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Case No. 10406/43

PATENT APPLICATION TRANSMITTAL LETTER

jc825 U.S. PTO
09/661222
09/13/00

To the Commissioner for Patents:

Transmitted herewith for filing is the patent application of: OVERTON ET AL. for : NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL. Enclosed are:

- ☒ 7 sheet(s) of informal drawings, 39 pages of application (including title page), and the following Appendices : Microfiche Appendix (2 sheets in sealed envelope).
- ☐ Declaration.
- ☐ Power of Attorney.
- ☐ Verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27.
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Claims as Filed	Col. 1	Col. 2	Small Entity			Other Than Small Entity	
For	No. Filed	No. Extra	Rate	Fee	or	Rate	Fee
Basic Fee				$ 345	or		$ 690
Total Claims	16-20	0	x$9=	$	or	x$18=	$
Indep. Claims	3-3	0	x$39=	$	or	x$78=	$
Multiple Dependent Claims Present			+$130=	$	or	+$260=	$
If the difference in col. 1 is less than zero, enter "0" in col. 2.			Total	$345	or	Total	$

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September 13, 2000
Date

Jonathan E. Retsky
BRINKS HOFER GILSON & LIONE
Registration No. 34,415

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Our Case No. 10406/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
APPLICATION FOR UNITED STATES LETTERS PATENT

INVENTORS:	JOHN K. OVERTON STEPHEN W. BAILEY
TITLE:	NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL
ATTORNEY:	JONATHAN E. RETSKY BRINKS HOFER GILSON & LIONE P.O. BOX 10395 CHICAGO, ILLINOIS 60610 (312) 321-4200

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NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

RELATED APPLICATIONS

This application claims priority to provisional patent application serial no. 60/153,709, entitled SIMPLE DATA TRANSPORT PROTOCOL METHOD AND APPARATUS, filed on September 13, 1999, and to regular patent application no. 09/111,896, entitled SYSTEM AND METHOD FOR ESTABLISHING AND RETREIVING DATA BASED ON GLOBAL INDICES, filed on July 8, 1998.

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FIELD OF THE INVENTION

This invention relates generally to the storage and retrieval of information, and in particular, to a protocol for dynamic and spontaneous global search and retrieval of information across a distributed network regardless of the data format.

BACKGROUND OF THE INVENTION

Data can reside in many different places. In existing retrieval systems and methods, a client seeking information sends a request to a server. Typically, only data that are statically associated with that server are returned. Disadvantageously, the search is also usually restricted to previously known systems. The search is thus conducted only where the server knows in advance to look.

Another disadvantage of known retrieval systems is the difficulty in accessing data in different forms. Known retrieval systems are typically

designed to search for data in limited forms. One example is where a client requests files based on a subject, like a person's name. In the search results, therefore, only text files of peoples' names may be retrieved. Another problem in current retrieval systems is that the client may receive text and image files in the search results, but could not seamlessly access the image files. Yet another problem in current retrieval systems is that video and sound files related to the request may not even be found in the search results. For example, a doctor might be able to retrieve medical records on a specific patient, but cannot view an MRI or X-Ray results associated with that record.

A distributed data collection is a system where data is stored and retrieved among multiple machines connected by a network. Typically, each machine in which some portion of the data in a distributed data collection may reside is called a "data repository machine", or simply a "data repository". One commonly asked question in a data repository environment is: Where is data associated with a particular entity in a distributed data collection? The data location is a key question when a distributed data collection has highly dynamic data distribution properties.

In networked environments where there are a large number of data repositories and any particular entity does not store data in all the repositories, a mechanism is needed that would permit queries to be directed only at data repositories with relevant information. It would also be beneficial to permit membership in the set of data repositories itself to be highly dynamic. Such a system would support on-the-fly addition and removal of data repositories from a distributed data collection seamlessly and without the need to reprogram the client and server participants.

BRIEF SUMMARY OF THE INVENTION

In view of the above, the invention provides a network distributed tracking wire transfer protocol, and a system and method for using the protocol in a networked environment. The network distributed tracking wire transfer protocol includes two basic components: identification strings for specifying the identity of an entity in the distributed data collection, and

location strings for specifying network locations of data associated with an entity. The protocol accommodates variable length identifier and location strings. Relationships between identification strings and location strings can be dynamically and spontaneously manipulated thus allowing the corresponding data relationships also to change dynamically, spontaneously, and efficiently. In addition, the network distributed tracking wire transfer protocol is application independent, organizationally independent, and geographically independent.

In another aspect of the invention, a system of components using the network distributed tracking protocol are provided for storing and identifying data with a distributed data collection. The components include (1) a data repository for storing data in the distributed data collection, (2) a client entity for manipulating data in the distributed data collection, and (3) a first server entity operative to locate data in the distributed data collection, which may be coupled to a client entity and/or data repository. In a network with these components, a client entity transmits an identifier string to the first server entity along with the client request, and the first server entity provides a set of location strings to the client entity in response thereto. The first server entity maps the identifier string received from the client entity to a set of location strings. The network may also include any number of additional server entities coupled to the first server entity.

According to yet another aspect of the invention, a method is provided for storing and retrieving tracking information over a network using a wire transfer protocol. A location string specifies the location of data associated with an entity in the distributed data collection and the identification string specifies the identification of an entity in a distributed data collection. A first data repository entity stores data by associating an identification string with each particular stored unit of data, and by mapping the identification string to a location string associated with the first data repository. The identification string and location string for the particular unit of data are at a first server entity coupled to the first data repository entity. A request is transmitted from a client entity to the first server entity to retrieve at least one location string

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associated with the stored unit of data in the distributed data collection. The request includes the identification string associated with the particular stored unit of data. The request is received at the first server entity, which responds to the client entity by providing at least one location string associated with the particular stored unit of data to the client entity.

The request may also be transmitted to a second server entity prior to responding to the client entity, where the second server entity is coupled to the first server entity and includes the mapping of the identification string and location strings for the particular units of data. In such case, the second server entity responds to the client entity by providing the at least one location string associated with the particular stored unit of data to the client entity.

The network distributed tracking protocol of the invention is a networking protocol that efficiently manages mappings from one or more identifier strings to zero or more location strings. The protocol permits client entities to add and remove identifier/location associations, and request the current set of locations for an identifier or identifiers from server entities that comply with the protocol.

The protocol is designed for use in the larger context of a distributed data collection. As such, it supports an architecture in which information about where data associated with particular application entities can be managed and obtained independently of the data itself. The protocol and its associated servers thus maintain a mapping between entity identifiers and data locations. The identifier/location mapping maintained by the servers is very dynamic. Regardless of the expected system context in a distributed data collection, the protocol can be used for any application in which one-to-one or one-to-many associations among strings are to be maintained and accessed on a network.

In any context, the protocol supports identifier and location strings of up to 2^{32}-4 bytes in length, but in most applications it is expected that the strings are typically short. String length is not fixed by the protocol, except by the upperbound. Accordingly, string formats are controlled at a local level and not dictated by the protocol.

These and other features and advantages of the invention will become apparent upon a review of the following detailed description of the presently preferred embodiments of the invention, when viewed in conjunction with the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an example of multiple outstanding protocol requests.

FIG. 2 is a layout of one presently preferred string format.

FIG. 3 is a layout of one presently preferred NDTP_GET message.

FIG. 4 is a layout of one presently preferred NDTP_GET_RSP message.

FIG. 5 is a layout of one presently preferred NDTP_PUT message.

FIG. 6 is a layout of one presently preferred NDTP_PUT_RSP message.

FIG. 7 is a layout of one presently preferred NDTP_DEL message.

FIG. 8 is a layout of one presently preferred NDTP_DEL_RSP message.

FIG. 9 is a layout of one presently preferred NDTP_RDR_RSP message, where FIG. 9(a) shows a server table layout, and FIG. 9(b) shows a redirection function layout.

FIG. 10 is a system block diagram showing a multi-server implementation environment of the network distributed tracking wire transfer protocol of the invention.

FIG. 11 is a system diagram showing an NDTP server constellation configuration.

FIG. 12 is a system diagram showing a client-centric constellation approach.

FIG. 13 is a system diagram showing a server-centric constellation approach.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS OF THE INVENTION

The following terms are used to describe the operation of the presently preferred network distributed tracking protocol (NDTP). An "identifier string" or an "identifier" is a unique string with which zero or more location strings are associated in an NDTP server. A "data location" or a "location" is a string that is a member of a set of strings associated with an identifier string in an NDTP server. An "NDTP client" or a "client" is a network-attached component that initiates update or lookup of identifier/location mappings from an NDTP server with NDTP request messages. An "NDTP server" or a "server" is a network-attached component that maintains a set of identifier/location mappings that are modified or returned in response to NDTP request messages from NDTP clients. The term "Network Byte Order" is the ordering of bytes that compose an integer of larger than a single byte as defined in the Internet Protocol (IP) suite. Preferably, Network Byte Order specifies a big-endian, or most significant byte first, representation of multibyte integers. In this specification a byte is preferably composed of eight bits.

Network Distributed Tracking Protocol (NDTP)

The Network Distributed Tracking Protocol (NDTP) efficiently tracks the location of data associated with an individual entity in a distributed data collection. NDTP is a transactional protocol, which means that each operation within NDTP consists of a request message from an NDTP client to an NDTP server, followed by an appropriate response message from the NDTP server to the NDTP client. NDTP defines an entity key (or "identifier") as a unique string used to refer to an entity about which a distributed query is performed.

The NDTP server treats the entity key as an unstructured stream of octets, which is assumed to be unique to a particular entity. The precise structure of the NDTP entity key and the mechanism for ensuring its uniqueness are a function of the application in which the NDTP server is used. In a customer oriented application, the NDTP entity key might be a unique customer identifier, for example, a Social Security Number, in either

printable or binary integer form, as is appropriate to the application. NDTP also defines a data location specifier as a string used to specify a data respository in which data associated with a particular entity may be found.

As with NDTP entity keys, the NDTP server treats NDTP data location specifiers as unstructured streams of octets. The structure of an NDTP data location specifier is a function of the application in which the NDTP server is used. For example, an NDTP data location specifier might be an Internet machine name, and a TCP/IP port number for a relational database server, or an HTTP Universal Resource Locator(URL), or some concatenation of multiple components.

The NDTP server efficiently maintains and dispenses one to zero or one to many relationships between entity keys and data location specifiers. In other words, an entity key may be associated with any number of data location specifiers. When data for a particular entity is added to a data repository, the NDTP server is updated to indicate an association between the entity key and the data repository's data location specifier. When a query is performed for an entity key, the NDTP server supplies the set of data repositories in which data may be found for that entity key.

General NDTP Mechanics

The protocol of the invention is designed to provide maximum transaction throughput from the NDTP server, associated clients, and associated data repositories when appropriate. The design goal is realized through two design principles:

1. NDTP messages should preferably be as short as possible to maximize the rate of NDTP transactions for a given network communication bandwidth.
2. NDTP messages should preferably be structured for efficient processing on existing machine architectures.

Design Optimizations.

Numerical fields of an NDTP message are preferably represented in binary integer format rather than ASCII or other printable format to minimize

host processing overhead and network utilization. Numerical fields of NDTP messages are also aligned on 32-bit boundaries to minimize the cost of manipulation on current machine architectures. Manipulating unaligned multibyte integer quantities on modern machine architectures usually incurs an extra cost ranging from mild to severe compared to manipulating the same quantities in aligned form.

In keeping with other network protocol standards including TCP/IP, multioctet integer quantities in NDTP are preferably encoded using the big endian integer interpretation convention, as set forth above.

To overcome network latency, NDTP is designed to support asynchronous operation, where many requests may be sent to an NDTP server before a response from any of them is received.

Each NDTP message is preceded by a fixed size, 12-octet header, using the preferred data structure:

```
typedef struct ndtp-hdr {
      uint8_T op;              /* opcode */
      uint8_t pad[3];
      uint32_t id;             /* transaction identifier */
      uint32_t size;           /* total request size
                                  following the header */
}ndtp_hdr_t;
```

where:

op:

NDTP message numerical operation code.

NDTP_GET:	get request
NDTP_GET_RSP:	get response
NDTP_PUT:	put request
NDTP_PUT_RSP:	put response
NDTP_DEL:	delete request
NDTP_DEL_RSP:	delete response
NDTP_RDR_RSP:	provide redirection

id:

Client supplied operation request used to distinguish responses from multiple outstanding NDTP asynchronous requests. Each "_RSP" message echoes the id field of the associated request.

size:

Size, in octets of the remainder of the NDTP message. The size field should always be a multiple of 4 octets.

Variably sized portions of NDTP messages are preferably defined with a size field rather than some other delimiter mechanism to facilitate efficient reading of NDTP messages. Requests may be made to the network layer to read the entire variably sized portion of an NDTP message, rather than reading small chunks while scanning for a delimiter. Furthermore, client and server resource management can be more efficient since the size of NDTP messages is known before reading.

The variably sized portions of NDTP messages are composed of zero or more NDTP stings:

```
typedef struct ndtp_str {
  uint32_t len;
  uint8_t data [];
{  ndtp_str_t;
```

Note that the C struct definitions in this document are schematic, and not necessarily fully compliant structures in the C programming language. Specifically, arrays denoted in this document with "[ ]" imply a dimension which is only known dynamically and this indefinite array size specifier is not allowed in C struct definitions. Note also the following:

len:

the number of significant octets of data following the len field in the data area.

data:

len octets of data, followed by up to 3 octets of padding, to ensure that the total length of the NDTP string structure is a multiple of 4 octets. The padding octets are not included in the len field.

Because variable sized portion NDTP messages are composed of zero or more NDTP stings and NDTP strings preferably occupy an even multiple of 4 octets, this ensures that the "size" field of NDTP message headers will preferably be a multiple of 4 octets.

Protocol Structure

An example of multiple outstanding NDTP requests and the use of request identifiers is shown in FIG. 1. NDTP preferably has a simple, stateless request/response structure. Each request message 10 sent by a client 12 has a corresponding response message 14 returned by the server 16. To maximize server 16 throughput and use of available network bandwidth, NDTP is asynchronous in nature. Many requests 10 from a single client 12 may be outstanding simultaneously, and responses 14 may or may not be returned from the server 16 in the order in which the requests 10 were issued. Each NDTP request 10 contains an NDTP request identifier 18 that is returned in the NDTP response 14 for the associated request 10. An NDTP client 12 uses a unique NDTP request identifier 18 for each NDTP request 10 that is outstanding at the same time to an NDTP server 16 if it wishes to correlate responses with requests.

There are four operations preferably supported by the protocol:

- Add a location association to an identifier.
- Delete a location association from an identifier.
- Get all locations associated with an identifier.
- Provide a redirect instruction to identify an alternative server.

The response to adding a location association to an identifier 18 is a simple acknowledgement. If the location is already associated with the identifier 18, adding the association has no effect, but the request 10 is still acknowledged appropriately. In other words, the NDTP add operation is idempotent. The response to deleting a location association from an identifier 18 is a simple acknowledgement. If the location is not currently associated with the identifier 18, deleting the association has no effect, but the request 10 is still acknowledged appropriately. In other words, the NDTP delete operation is idempotent. The response 14 to getting all locations associated

with an identifier 18 is a list of the locations presently associated with an identifier 18. If no locations are currently associated with an identifier 18, a list of length zero is returned.

Message Formats

NDTP messages 10, 14 preferably have a regular structure that consists of a message operation code, followed by a request identifier 18, followed by a string area length (in bytes) 20, followed by zero or more strings 22, as shown in FIG. 2. As those skilled in the art will appreciate, NDTP message formats are preferably independent of the network transport layer used to carry them. NDTP preferably defines mappings of these messages 10, 14 onto TCP and UDP transport layers (described in detail below), but other mappings could also be defined and it is likely that these NDTP message formats would not require change. For example, the notation ROUND4(x) means x, rounded up to the next multiple of 4.

Integer Format

Multibyte integers in NDTP messages are represented in network byte order; using the big-endian convention. In other words, the most significant byte of a multibyte integer is sent first, followed by the remainder of the bytes, in decreasing significance order.

String Format

Strings in NDTP are represented as counted strings, with a 32-bit length field 20, followed by the string data 22, followed by up to 3 bytes of padding 24 to make the total length of the string representation equal to ROUND4(length). This layout is shown diagrammatically in FIG. 2.

NDTP_GET Format

The `NDTP_GET` message has a message operation code 30 of 0, and a single NDTP string 32 which is the identifier string for which to get associated location strings. This layout is shown diagrammatically in FIG. 3.

NDTP_GET_RSP Format

The NDTP_GET_RSP message has a message operation code 40 of 1, and zero or more strings 42 that are the locations currently associated with the requested identifier. This layout is shown diagrammatically in FIG. 4.

NDTP_PUT Format

The NDTP_PUT message has a message operation code 50 of 2, and two NDTP strings 52, 54. The first string 52 is the identifier for which to add a location association, and the second string 54 is the location to add. This layout is shown diagrammatically in FIG. 5.

NDTP_PUT_RSP Format

The NDTP_PUT_RSP message has a message operation code 60 of 3, and zero NDTP strings. This layout is shown diagrammatically in FIG. 6.

NDTP_DEL Format

The NDTP_DEL message has a message operation code 70 of 4, and two NDTP strings 72, 74. The first string 72 is the identifier from which to delete a location association, and the second string 74 is the location to delete. This layout is shown diagrammatically in FIG. 7.

NDTP_DEL_RSP Format

The NDTP_DEL_RSP message has a message operation code 80 of 5, and zero NDTP strings. This layout is shown diagrammatically in FIG. 8.

NDTP_RDR_RSP Format

The NDTP_RDR_RSP message has a message operation code 90 of 6, and one or more NDTP strings 92, 94. Two layouts apply, which are shown diagrammatically in FIGS. 9(a) and 9(b).

A general description of the usage and operation of these protocol messages is provided below.

NDTP_GET Transaction

The NDTP_GET message contains a single NDTP string which is the entity key for which associated data locations are requested.

```
typedef struct ndtp_get {
  ndtp_hdr_t hdr;
  ndtp_str_t key;
} ndtp_get_t;
```

The NDTP_GET_RSP message contains zero or more NDTP strings which are the data location specifiers associated with the NDTP entity key:

```
typedef struct ndtp_get_rsp {
  ndtp_hdr_t hdr;
  uint32_t rsps;
  ndtp_str_t values[];
} ndtp_get_rsp_t;
```

NDTP_PUT Transaction

The NDTP_PUT messages contains two NDTP strings which are (1) the NDTP entity key and (2) the NDTP data location specifier which is to be associated with the NDTP entity key.

```
typedef struct ndtp_put {
  ndtp_hdr_t hdr;
  ndtp_str_t key;
  ndtp_str_t data;
} ndtp_put_t;
```

The NDTP_PUT_RSP message has no NDTP strings, and simply indicates that the requested entity key/data location specifier association was added:

```
typedef struct ndtp_put_rsp {
  ndtp_hdr_t hdr;
} ndtp_put_rsp_t;
```

The requested entity key/data location specifier association is added in addition to any other associations already maintained by the NDTP server. If

the requested entity key/data location specifier association is already in effect, the NDTP_PUT still succeeds and results in an NDTP_PUT_RSP message.

NDTP_DELETE Transaction

The NDTP_DEL message contains two NDTP strings which are (1) the NDTP entity key and (2) the NDTP data location specifier which is to be unassociated with the NDTP entity key:

```
typedef struct ndtp_del {
  ndtp_hdr_t hdr;
  ndtp_str_t key;
  ndtp_str_t data;
} ndtp_del_t;
```

The NDTP_DEL_RSP message has no NDTP strings, and simply indicates that the requested entity key/data location specifier association was deleted.

```
typedef struct ndtp_del_rsp {
  ndtp_hdr_t hdr;
} ndtp_del_rsp_t;
```

If the requested entity key/data location specifier association is not in effect, the NDTP_DEL still succeeds and results in an NDTP_DEL_RSP message.

NDTP_RDR_RSP Message

NDTP supports a distributed server implementation for which two principle redirection methods apply: (1) embedded redirection links, and (2) passed functions. The passed functions method in turn has two variants: (a) a well-known function, and (b) a communicated function. (These methods and variants are described in further detail below.)

Network Front End

The NDTP server network front end preferably maximizes NDTP transaction throughput including concurrent NDTP requests from a single client as well NDTP requests from multiple concurrent clients.

Network Communication Mechanism

NDTP defines a transaction oriented protocol, which can be carried over any of a variety of lower level network transport protocols. For example:

TCP/IP: TCP/IP provides a ubiquitously implemented transport which works effectively on both local area and wide area networks. An NDTP client using TCP/IP preferably connects with the NDTP server at an established TCP port number, and then simply writes NDTP request messages through the TCP/IP connection to the server, which then writes NDTP response messages back to the client through the same TCP/IP connection in the reverse direction. TCP/IP implementations perform buffering and aggregation of many small messages into larger datagrams, which are carried more efficiently through the network infrastructure. Running NDTP on top of TCP/IP will take advantage of this behavior when the NDTP client is performing many NDTP requests. For example, a data repository which is undergoing rapid addition of data records associated with various entities will perform many rapid NDTP_PUT operations to the NDTP server that can all be carried on the same NDTP TCP/IP connection.

UDP/IP: If an NDTP client only performs occasional, isolated NDTP operations, or there are a vast number of clients communicating with an NDTP server, TCP/IP will not offer the best possible performance because many traversals of the network are required to establish a TCP/IP connection, and yet more network traversals are required to transfer actual NDTP messages themselves. For such isolated NDTP transactions, depending upon the application and network infrastructure in use, it is beneficial to have the NDTP server employ UDP/IP, which is a widely available connectionless datagram protocol.

However, UDP/IP does not support reliable data transfer, or any congestion control mechanism. This means that NDTP clients using UDP/IP must implement reliability and congestion control maintaining transaction timeouts and performing exponential retry backoff timers, precisely analogous to the congestion control mechanism implemented by Ethernet, and other well known UDP protocols. Those skilled in the art will note that the NDTP

protocol is stateless from the standpoint of the NDTP server, which means that there is no congestion control or reliability burden on the server; it is all implemented in a distributed manner by the NDTP UDP/IP clients.

Still Higher Performance (ST): Both TCP/IP and to a lesser degree UDP/IP suffer from high host CPU overhead. Like the relatively long latency of TCP/IP, this host CPU consumption is considered just the "cost of doing business" where TCP/IP provides ubiquitous connectivity. If an NDTP server were running in a more constrained environment, where ubiquitous connectivity was not required, its absolute performance could be improved substantially by using a different protocol that is optimized to reduce CPU overhead and latency, such as the Scheduled Transfer (St) protocol.

None of these network implementation issues are particularly unique to NDTP, however. All similar protocols face similar tradeoffs, and what art exists to improve the performance of such protocols applies fully to NDTP as well.

NDTP Query Processing

Servicing NDTP query requests does not require high latency operations, such as disk I/O. Therefore, the NDTP server network front end preferably services NDTP query requests in a FIFO style by reading the NDTP_GET message, performing the lookup for the entity key in the NDTP server string store, and writing the NDTP_GET_RSP message. Each NDTP query is independent of any other NDTP transactions (other queries or updates), so it is possible to process multiple NDTP queries simultaneously on multiprocessor machines. The NDTP server permits this by not performing multiprocessor locking in the NDTP query processing path.

The current prototype NDTP server preferably does not create multiple read service threads per NDTP connection, so multiprocessing will only occur while processing queries from different NDTP connections. Nonetheless, the NDTP server could be extended to support multiprocessing of NDTP queries from a single NDTP connection if this turned out to be advantageous.

NDTP Update Processing

Unlike NDTP queries, processing NDTP updates requires the high latency operation of committing the change to nonvolatile storage. To maintain high performance on NDTP updates, the NDTP server network front end preferably supports multiple concurrent asynchronous update transactions. Also, each update is preferably performed atomically to avoid creating an inconsistent state in the string store. Currently, the string store supports only a single mutator thread, which means that all NDTP updates are serialized through the string store mutator critical code sections. As is traditional in transactional systems, the string store mutation mechanism is implemented as a split transaction.

When an NDTP update is processed, a call is made to the string store mutation function, which returns immediately indicating either that the mutation is complete, or that the completion will be signaled asynchronously through a callback mechanism. The mutator function might indicate an immediate completion on an NDTP_PUT operation if the entity key/data location specifier mapping was already present in the database. In this case, the network front end will immediately write the update response message back to the client.

For updates which are not immediately completed, the network front end maintains a queue of NDTP updates for which it is awaiting completion. When the completion callback is called by the string store log file update mechanism, the network front end writes the NDTP update response messages for all completed updates back to the clients. If no new NDTP update requests are arriving from NDTP clients, and there are some incomplete updates in the update queue, the network front end preferably calls the string store log buffer flush function to precipitate the completion of the incomplete updates in update queue.

Multiple Connection Handling

Handling multiple clients in a single server process requires that the server process not block waiting for events from a single client, such as newly

received data forming an NDTP request message, or clearing a network output buffer so an NDTP response message can be written. The NDTP server network front end may be conditionally compiled to use either of two standard synchronous I/O multiplexing mechanisms, select or poll, or to use threads to prevent blocking the server waiting for events on individual connections. The select and poll interfaces are basically similar in their nature, but different in the details. When compiled for synchronous I/O multiplexing, the NDTP server network front end maintains an input buffer for each connection. The multiplexing function is called to determine if any of the connections have input available, and if so, it is read into the connection's input buffer. Once a complete NDTP request is in the buffer, it is acted upon. Similarly, the network front end maintains an output buffer for each connection, and if there is still a portion of an NDTP response message to send, and the connection has some output buffer available, more of the NDTP response message is sent.

The threaded version of the NDTP server network front end preferably creates two threads for each NDTP connection, one for reading and one for writing. While individual threads may block as input data or output buffer is no longer available on a connection, the thread scheduling mechanism ensures that if any of the threads can run, they will. The threaded version of the NDTP server is most likely to offer best performance on modern operating systems, since it will permit multiple processors of a system to be used, and the thread scheduling algorithms tend to be more efficient than the synchronous I/O multiplexing interfaces. Nonetheless, the synchronous I/O multiplexing versions of NDTP server will permit it to run on operating systems with poor or nonexistent thread support.

A more detailed description of the mapping operation in both a TCP and UDP environment appears below.

TCP Mapping

As those skilled in the art will appreciate, the Transmission Control Protocol (TCP) is a connection-oriented protocol that is part of a universally

implemented subset of the Internet Protocol (IP) suite. TCP provides reliable, bi-directional stream data transfer. TCP also implements adaptive congestion avoidance to ensure data transfer across a heterogeneous network with various link speeds and traffic levels.

NDTP is preferably carried on TCP in the natural way. An NDTP/TCP client opens a connection with a server on a well-known port. (The well-known TCP (and UDP) port numbers can be selected arbitrarily by the initial NDTP implementer. Port numbers that do not conflict with existing protocols should preferably be chosen.) The client sends NDTP requests 10 to the server 16 on the TCP connection, and receives responses 14 back on the same connection. While it is permissible for a single client 12 to open multiple NDTP/TCP connections to the same server 16, this practice is discouraged to preserve relatively limited connection resources on the NDTP server 16. The asynchronous nature of NDTP should make it unnecessary for a client 12 to open multiple NDTP/TCP connections to a single server 16.

If protocol errors are detected on an NDTP/TCP connection, the NDTP/TCP connection should be closed immediately. If further NDTP/TCP communication is required after an error has occurred, a new NDTP/TCP connection should be opened. Some examples of detectable protocol errors include:

- Illegal NDTP message operation code;
- Nonzero String Area Length in `NDTP_PUT_RSP` or `NDTP_GET_RSP`;
- Inconsistent String Area Length and String Length(s) in `NDTP_GET`, `NDTP_GET_RSP`, `NDTP_PUT` or `NDTP_DEL`;
- Unexpected NDTP request identifier by client.

Due to the reliable nature of TCP, NDTP/TCP servers 16 and clients 12 need not maintain any additional form of operation timeout. The only transport errors that can occur will result in gross connection level errors. A client 12 should assume that any NDTP requests 10 for which it has not received responses 14 have not been completed. Incomplete operations may be retried. However, whether unacknowledged NDTP requests 10 have

actually been completed is implementation dependent. Any partially received NDTP messages should also be ignored.

UDP Mapping

As those skilled in the art will appreciate, the Unreliable Datagram Protocol (UDP) is a best-effort datagram protocol that, like TCP, is also part of the universally implemented subset of the IP suite. UDP provides connectionless, unacknowledged datagram transmission. The minimal protocol overhead associated with UDP can deliver extremely high performance if used properly.

NDTP/UDP clients 12 send UDP datagrams with NDTP request messages 10 to a well-known UDP port (see above). NDTP/UDP servers 16 return NDTP response messages 14 to the client 12 selected local UDP port indicated in the NDTP/UDP datagram containing the requests 10. NDTP/UDP does not require any form of connection or other association to be established in advance. An NDTP interchange begins simply with the client request message 10.

For efficiency, the mapping of NDTP on to UDP permits multiple NDTP messages to be sent in a single UDP datagram. UDP datagrams encode the length of their payload, so when a UDP datagram is received, the exact payload length is available. The recipient of an NDTP/UDP datagram will read NDTP messages from the beginning of the UDP datagram payload until the payload is exhausted. Thus, a sender of an NDTP/UDP datagram is free to pack as many NDTP messages as will fit in a UDP datagram.

The largest possible UDP datagram payload is presently slightly smaller than 64K bytes. In addition, there may be a performance penalty sending UDP datagrams that are larger than the maximum datagram size allowed by the physical network links between the sender and intended recipient. IP provides mechanisms for discovering this maximum transfer size, called the Path Maximum Transfer Unit (Path MTU), but a discussion of these mechanisms is beyond the scope of this specification. An

implementation of NDTP/UDP should preferably respect these datagram size limitations.

Unlike TCP, UDP does not provide reliable data delivery. Therefore, an NDTP/UDP client 12 implementation should implement a timeout mechanism to await the response for each outstanding NDTP request 10. The exact duration of this response timer is implementation dependent, and may be set adaptively as a client 12 receives responses from a server 16, but a reasonable default maximum value is preferably 60 seconds. If a response 14 is not received within the response timeout, the client 12 may retransmit the request 10. NDTP/UDP servers 16 need not maintain any timeout mechanisms.

Depending upon the exact timeout values selected, the client 12 retry mechanism may place some requirements on a client's 12 use of the NDTP request identifier 18 field. If the response timer is shorter than the maximum lifetime of a datagram in the network, it is possible that a delayed response will arrive after the response timer for the associated request has expired. An NDTP/UDP client 12 implementation should ensure that this delayed response is not mistaken for a response to a different active NDTP request 10. Distinguishing current responses from delayed ones is called *antialiasing*. One presently preferred way to perform antialiasing in NDTP/UDP is to ensure that NDTP request identifier 18 values are not reused more frequently than the maximum datagram lifetime.

NDTP/UDP client 12 implementations that use the NDTP request identifier 18 for antialiasing should ignore (i.e., skip) NDTP messages within a NDTP/UDP datagram with invalid NDTP request identifier 18 values. Client 12 or server 16 NDTP/UDP implementations detecting any other protocol error should also preferably discard the remainder of the current NDTP/UDP datagram without processing any further NDTP requests from that datagram. Some examples of such detectable errors include:

- Illegal NDTP message operation code;
- Nonzero String Area Length in `NDTP_PUT_RSP` or `NDTP_GET_RSP`;

- Inconsistent String Area Length and String Length(s) in `NDTP_GET`, `NDTP_GET_RSP`, `NDTP_PUT` or `NDTP_DEL`;
- Inconsistent NDTP message length and UDP datagram length.

Because NDTP/UDP messages are limited to the length of a single UDP datagram payload, NDTP/UDP cannot be used to transfer long NDTP messages. For example, it would be very difficult to send an `NDTP_GET` message with NDTP/UDP for a 64K byte identifier string. This case is avoidable by a client 12 realizing that an NDTP message is too long to send as a UDP datagram and using NDTP/TCP instead. However, a greater limitation is that NDTP currently provides no mechanism for an NDTP server 16 to indicate that a response is too large to fit in a UDP datagram. In this case, the NDTP server 16 should not send a response 14, and it may or may not chose to complete the request 10. The recovery mechanism in this case preferably is, after several unsuccessful attempts to use NDTP/UDP, a client 12 may try again with NDTP/TCP.

Because UDP does not provide any form of congestion avoidance it is possible that the simple retry strategy specified for NDTP/UDP can create network congestion. Network congestion can cause a severe degradation in the successful delivery of *all* network traffic (not just NDTP traffic, nor just the traffic from the particular client/server 12, 16 pair) through a congested network link. Congestion will occur when an NDTP/UDP implementation is sending datagrams faster than can be accommodated through a network link. Sending a large number of NDTP/UDP datagrams all at once is the most likely way to trigger such congestion. Sending a single NDTP/UDP datagram, assuming it is smaller than the Path MTU, and then waiting for a response 14 is unlikely to create congestion. Therefore, the use of NDTP/UDP should be confined to contexts where clients 12 send few outstanding requests at a time, or where network congestion is avoided through network engineering techniques.

Those skilled in the art will appreciate that network congestion is a highly dynamic property that is a function of network traffic from all sources through a network link and will vary over time over any given network path.

An NDTP/UDP client 12 implementation can recover from network congestion by switching to NDTP/TCP after several failed retries using NDTP/UPD. Failure due to network congestion may be indistinguishable from failure due to UDP packet size limitations, but since the recovery strategy is the same in both cases, there is no need to distinguish these cases.

NDTP/UDP Congestion Avoidance

Given the stateless, transactional nature of NDTP, NDTP/UDP generally performs much better than NDTP/TCP. This performance improvement is measurable both in terms of the maximum sustainable transaction rate of an NDTP server 16, and the latency of a single response to an NDTP client 12. In the same way as the Domain Name Service (DNS), NDTP fits naturally in the UDP model. It is a working assumption of NDTP (and DNS) that for every NDTP transfer, there will be an associated transfer of real data that is an order of magnitude or more greater in size than the NDTP protocol traffic. This property will naturally limit the amount of NDTP traffic on a network. However, in applications where NDTP traffic reaches high levels, particularly at network 'choke points' which are not within the control of network engineers, it may be desirable to support a congestion avoidance mechanism for NDTP/UDP.

However, those skilled in the art will appreciate that the other main future requirement of NDTP, security (described below), implies an existing, durable association between NDTP clients 12 and NDTP servers 16. This association is much like (and in the case of SSL, it is) a network connection. Therefore, depending upon what security technology is applied, developing a congestion avoidance mechanism for NDTP/UDP may be an irrelevant exercise.

Server Redirection Mechanism

NDTP provides two mechanisms for server redirection. The redirection mechanisms allow cluster and hierarchical topologies, and mixtures of such topologies (described in detail below). The first redirection mechanism supported by NDTP, embedded redirection links, uses an application specific

convention to return redirection pointers as NDTP data location strings. For example, if location strings are W3C URLs, a URL with the schema *ndtp:* could be a server indirection pointer. An NDTP_GET_RSP message may contain any mixture of real data location strings and NDTP server redirection pointers. In this case, the client must issue the same NDPT_GET query message to other NDTP servers indicated by the redirection pointers. The total set of data location strings associated with the supplied identifier string is the collection of all the data location strings returned from all the NDTP servers queried. The embedded redirection link technique does not require any specific NDTP protocol support. Therefore, it could be used within the NDTP protocol as is, and does not require further description in this specification.

The second redirection mechanism, which is specified as a future extension of NDTP, is having the server return an NDTP_RDR_RSP message in response to an NDTP request for which the NDTP server has no ownership of the supplied identifier string. Those skilled in the art will note that unlike the embedded redirection links mechanism, the NDTP_RDR_RSP mechanism applies to all NDTP requests, not just NDTP_GET.

As mentioned above, the second redirection mechanism has two variants. The first variant of the NDTP_RDR_RSP function mechanism specifies a well-known function that all NDTP server and client implementations know when they are programmed, and the NDTP_RDR_RSP message carries a table of NDTP server URLs. The format of the NDTP_RDR_RSP message with an NDTP server URL table is shown in FIG. 9(a).

The appropriate NDTP server is selected from the table in the NDTP_RDR_RSP message by applying a well-known function to the identifier string and using the function result as an index into the NDTP server table. The well-known function preferably applied is the *hashpjw* function presented by Aho, Sethi and Ullman in their text *Compilers, Principles, Techniques and Tools*:

```
uint32_t
hash (uint8_t *s, uint32_t slen, uint32_t size)
{
  uint32_t g;
  uint32_t i;
      unit32_t h = 0;
  uint8_t c;

  for (i = 0; i < slen; i++) {
    c = s[i];
    h = (h << 4) + c;
    g = (h & 0xf0000000);
    if (g) {
      h ^= g >> 24;
      h ^= g;
    }
  }
  return h % size;
}
```

In this case, the *size* parameter is the number of elements in the NDTP server URL table returned in the `NDTP_RDR_RSP` message. For the hashpjw function to behave correctly, the *size* parameter must be a prime number, therefore the NDTP server URL table must also have a prime number of elements. Those skilled in the art will appreciate that the same NDTP server may appear multiple times in the NDTP server URL table. For example, if the server URL table has 2039 elements, by putting one NDTP server URL in the first 1019 table elements, and a second NDTP server URL in the second 1020 table elements, the responsibility for the index string space will be split roughly in half.

The second variant of the `NDTP_RDR_RSP` function mechanism specifies that a general function description will be sent to the NDTP client in the NDTP_RDR_RSP message. The NDTP client will apply this function to

the identifier string and the output of the function will be the NDTP server URL to which to send NDTP requests for the particular identifier string. The advantage of this technique over the well-know function approach is that it allows application-specific partitions of the identifier string space. This can permit useful administrative control. For example, if General Electric manages all identifiers beginning with the prefix "GE", a general function can be used to make this selection appropriately. The disadvantage of using a general function is it may be less efficient to compute than a well-known function.

There are a variety of possible mechanisms for sending function descriptions. NDTP is expected to be applied in environments that make extensive use of the Java programming platform. Therefore the `NDTP_RDR_RSP` mechanism preferably uses a feature of the Java programming language called "serialized representation" to communicate generalized functions in the `NDTP_RDR_RSP` message. A serialized form of a Java object is a stream of bytes that represents the precise state of the object, including its executable methods. For example, the Java Remote Method Invocation (RMI) mechanism uses serialized objects to send executable code to a remote platform for execution. The NDTP_RDR_RSP message contains the serialized form of an object implementing this Java interface:

```
interface NDTPRedirectFunction {
    String selectServer(byte[] identifier);
}
```

The format of the NDTP_RDR_RSP message with a Java Serialized form of the NDTP redirection function is specifically identified in FIG. 9(b).

The NDTP server redirection mechanism also permits construction of NDTP server clusters (described below). It is expected that the identifier string hash function will be defined at the time NDTP is implemented, but the actual list of NDTP servers 90 will change from application to application and within a single application throughout the lifetime of the system. Therefore, it

is necessary for clients to be able to discover updated NDTP server lists, and any other relevant dynamic parameters of the server selection function as these inputs change.

Hierarchical Server Topology

While the NDTP server topology supported by the server redirection mechanism described above and shown in FIGS. 9(a) and 9(b) is an extremely powerful and general scaling technique, suitable for diverse topology deployments, some applications might still benefit from a specifically hierarchical server topology. An NDTP server hierarchy 100, such as that shown in FIG. 10, permits identifier/location association data to be owned and physically controlled by many different entities. An NDTP server cluster should be managed by a single administrative entity 102, and the distribution of data can be for performance and scaling purposes. Furthermore, a server hierarchy would provide some fault isolation so portions of the identifier/location association data can be accessed and updated in the presence of failures of some NDTP servers 104. Finally, an NDTP server hierarchy can localize NDTP update operations (`NDTP_PUT` and `NDTP_DEL`), which can improve performance and reduce network load.

A hierarchical NDTP server topology also allows organizations to maintain their own local NDTP server 104 or NDTP server cluster 102 that manages associations to data locations that are within the organizations' control. Upper tier NDTP servers 108 would be used to link the various leaf NDTP servers 104.

Server Constellations

The NDTP server organization also allows NDTP servers to be combined in various ways to build server constellations that offer arbitrary server performance scalability and administrative control of the location of portions of the identifier/data location relationship mappings. Figure 11 illustrates an NDTP server constellation 110 as it relates to a client 112 and a data repository 114. In FIG. 10, the client 112 and data repository 114 of FIG. 11 were merged into the single client entity 106 for ease of discussion.

Their distinction can now be separated and identified in order to illustrate the storage and retrieval of data in a distributed data collection.

As shown in FIG. 11, a client 112 consults the server constellation 110, which may be construed in either of two forms (see FIGS. 12 and 13), and which returns location strings in response to a client 112 request. Once the client 112 has the location string for a particular unit of data, the client 112 contacts and retrieves information directly from the data repository 114. In one embodiment, if the client 112 contains a data repository 114, internal application logic would facilitate this interaction. Those skilled in the art will appreciate that the term "data collection" is being employed rather than the term "database" because database frequently invokes images of Relational Database Systems (which is only one application of the protocol); an NDTP data collection could just as easily be routing tables as it could be files or records in a RDBS database.

NDTP server constellations 110 preferably have two basic organizational paradigms: Client-Centric and Server-Centric. NDTP supports both by design, and both approaches apply to all aspects of managing the relationships between identifiers and locations, such as data retrieval, index manipulation, and server redirection. Each will be discussed separately below.

Client-Centric Approach

The first basic pattern that NDTP supports is driven by the client 112, and can be called "client-centric". Referring to FIG. 12, a single client (not shown) asks a server 120a in the server constellation 110 for operations that the client desires executed (represented by arrow 1 in FIG. 12). If the client doesn't receive the data requested, it will receive a redirection response message (`NDTP_RDR_RSP`) from the contacted server 120a (arrow 2). The client then uses the information it receives to ask another server 120b for the operations the client wants to initiate (arrow 3). A successful response from the second server 120b is then sent to the client (arrow 4).

This design constructs operating patterns for (1) redirection, (2) index operations, and (3) hierarchical or cluster topologies. The important point is that the Network Distributed Tracking Protocol is designed to support highly configurable methods for processing index-related operations.

NDTP supports two specific redirection mechanisms, which are not mutually exclusive and may be combined in any way within a single NDTP server constellation 110. This formation may increase performance when many clients (not shown) participate, since client processing is emphasized rather than server processing. The first NDTP redirection mechanism uses a distinctively encoded location string for each NDTP server 120a,b that contains additional location strings associated with the identifier string supplied in the NDTP request 122a,b. This is an embedded redirection link. For example, if location strings are some form of HTTP URL, a URL with the schema specifier *ndtp:* would indicate a redirection. Using this scheme, the location strings associated with an identifier string may be spread among multiple NDTP servers 120a,b. In addition to redirection, in FIG. 12, all index manipulation operations continue to apply, but they are directed at the correct NDTP server 110b for which they apply: NDTP_GET, NDTP_PUT, NDTP_DEL.

The second NDTP redirection mechanism uses a NDTP_RDR_RSP message to indicate that the server 120a to which the NDTP request 122a was directed does not contain any of the location strings associated with the identifier string supplied in the NDTP request 122a. The NDTP_RDR_RSP message contains all the information required for the originator of the NDTP request 122a to reissue the original NDTP request 122b to a different NDTP server 120b that does have location strings associated with the identifier string supplied in the NDTP request 122b. This information may be an array of NDTP server hosts from which one is selected by applying a well-known function to the identifier string supplied in the NDTP request 122b, or the communicated function to apply as well as a list or other description of the NDTP server hosts from which to choose, as described above.

Figure 12 illustrates a cluster topology for client interaction with NDTP servers 120. A single client queries a first server 120a (Server0), learns of a new index location (Server1), and then contacts that server 120b (Server1) for the operations it wishes to execute on the index that the client identifies. The basic idea is that a client asks a server 120a to process an index operation. If the contacted server 120a does not have all the information, as for example in a redirect, then it passes the request to another server 120b. If the second server 120b is appropriate it responds appropriately, or it passes the request on to another server (not shown), and so on. Figure 12 could also illustrate a hierarchical topology if a client (not shown) contacted another client in a handoff as shown in FIG. 10, where a client 106 "asks up" to another client 106, and so on.

Behind the scenes, the server constellation 110 could also be using a hierarchical organization or a cluster organization for managing indices. The important point of this topology is pushing processing emphasis toward clients (not shown) rather than toward servers 120a,b. Such protocol design has scale implications as the number of participating machines/mechanisms increases, since it distributes aggregate processing.

Server-Centric Approach

The second basic pattern that the Network Distributed Tracking Protocol provides is a "Server-Centric Approach". Figure 13 shows the server constellation 110 characterizing "server-centric" functionality. In this figure, an NDTP server 130a (Server0) receives a request 132a from a client (not shown). The server 130a (Server0) passes the request to a second server 130b (Server1), which is an appropriate server for the process, and the second server 130b returns a response 134a to the first server 130a (Server0). If the second server 130a (Server1) was not appropriate, it could pass the request to another server (not shown), and so on. Each NDTP server 130a,b will combine the results of NDTP requests 132a,b it has performed of other NDTP servers 130a,b with whatever responses 134a,b it generates locally for the original NDTP request 132a, and the combined

response 134b will be the appropriate response for the original NDTP request 132a.

This design constructs operating patterns for (1) index operations and (2) hierarchical or cluster topologies. The important point is that the Network Distributed Tracking Protocol is designed to support highly configurable methods for processing index-related operations, but this method emphasizes server-processing rather than client-processing. In FIG. 13, all index manipulation operations continue to apply, but they are directed at the correct NDTP server 130a,b for which they apply: NDTP_GET, NDTP_PUT, NDTP_DEL.

Figure 13 illustrates an hierarchical topology for client interaction with NDTP servers 130. A single client queries a first server 130a (Server0), which is not appropriate, and so the first server 130a (not the client) itself contacts an appropriate server 130b (Server1) for operations it "passes through" to execute on the index that the client has identified. Alternatively, FIG. 13 could illustrate a cluster topology if a server 130a contacted another server 130b in a what is known as a "peer" handoff. The important point of this topology is that it pushes processing emphasis toward servers 130a,b rather than toward clients. Since index processing services can be centralized, administration of the indices can be administered more conveniently in certain cases.

The simplest NDTP server constellation 110 is a single server 130, and the protocol is designed to permit massive scale with a single or simple server constellation. Highly configurable installations are possible using "client-centric" or "server-centric" techniques. NDTP server constellations 110 composed of more than one NDTP server may use any combination of the two approaches for performance optimization and data ownership properties. Client-centric and server-centric approaches can be used to build NDTP server clusters, NDTP server trees, NDTP server trees of NDTP server clusters, or any other useful configuration.

NDTP design thus explicitly addresses the emerging "peer-to-peer" topologies called "pure" and "hybrid". The "pure" peer-to-peer approach

emphasizes symmetric communication among peers, and is achievable through the "server-centric" approach. The "hybrid" peer-to-peer approach emphasizes asymmetric communication among non-peer participants, and is achievable through the "client-centric" approach. Beyond the pure and hybrid approaches that NDTP allows, as described above, NDTP permits any additional mixtures between client-centric and server-centric approaches to provide superior configurability and performance tuning.

Security

NDTP preferably has no provisions for security. Three key features of security should therefore be provided:

- Data privacy (encryption)
- Client 12 authentication
- Client 12 authorization

NDTP/TCP will be extended using SSL/X.509 to support these security features in a straightforward, 'industry standard' way.

Adding security to NDTP/UDP also requires technology other than SSL. For example, IPSec supports securing all IP traffic, not just TCP between two endpoints. IPSec is a somewhat more heavyweight technology than SSL, and the rate of adoption in industry is somewhat slow. Nonetheless, it can provide the relevant capabilities to NDTP/UDP.

Additional Transport Layers

The early-adopter portion of the industry is in a state of turmoil regarding network transport protocols. On one hand, TCP has provided decades of solid service, and is so widely implemented that the mainstream computer industry could not imagine using another protocol to replace it. On the other hand, TCP lacks several features that may be necessary to enable the next step in network applications. In particular, the TCP design assumed pure software implementations by relatively powerful host computer computers. However, developments in network technology have increased the packet rate that a TCP implementation must handle to deliver full network speed beyond the capabilities of even increasingly powerful host computers.

To take the next step, much of the packet processing work must be off-loaded to hardware, and TCP's design makes this very difficult.

It is unclear whether it will become possible to implement the relevant portions of TCP in hardware in a timely fashion. If this does not happen, one of the many new transport layers currently under development (ST, SCTP, VI, etc.) may emerge as a market leader in high performance networking. In this case, a layering of NDTP on top of a new hardware accelerated transport would permit NDTP servers to deliver greatly increased transaction rates. Even with the use of a hardware accelerated transport layer, however, the only benefit to a typical NDTP client would be lower cost of service due to cheaper NDTP server platform requirements. On the flip side, NDTP clients could likely still use a cheaper software implementation of the new transport because of individual clients' modest performance demands.

As can be seen, the Network Distributed Tracking Protocol is a networking protocol that runs on top of any stream (e.g. TCP) or datagram (e.g. UDP) network transport layer. The goal of NDTP is to support a network service that efficiently manages mappings from each individual key string, an identifier, to an arbitrary set of strings, locations. NDTP permits protocol participating clients to add and remove identifier/location associations, and request the current set of locations for an identifier from protocol servers.

NDTP is designed for use in the larger context of a distributed data collection. As such, it supports an architecture, in which information about where data associated with particular application entities, can be managed and obtained independently of the data itself. One way to understand this is as a highly dynamic DNS for data. DNS maintains a mapping between names and machines. NDTP and its associated servers maintain a mapping between entity identifiers and data locations. The identifier/location mapping maintained by NDTP servers is much more dynamic (more frequent updates), than the domain name/IP address mapping maintained by DNS. NDTP is designed to support very fast, very diverse, and very large scale mapping manipulations.

Regardless of the expected system context of NDTP in a distributed data collection, those skilled in the art will appreciate that NDTP can be used for any application in which one-to-zero or one-to-many associations among strings are to be maintained and accessed on a network. In applications of NDTP other than distributed databases, the term identifier is likely to make sense in most cases, but the term location may not. In any context, however, although NDTP supports identifier and location strings of up to 2^{32}-4 bytes in length, it is a general assumption that the strings are typically short.

Those skilled in the art will note that the invention provides for the management and manipulation of indices and their associated relationships. Even more importantly, it is the manipulation of dynamic and spontaneous relationships between indices and locations, not the indices and locations, that is the core significance. The Network Distributed Tracking Protocol was written to manipulate these relationships, of which indices (identifiers) and locations are components of the aggregate solution.

It is to be understood that a wide range of changes and modifications to the embodiments described above will be apparent to those skilled in the art, and are contemplated. It is therefore intended that the foregoing detailed description be regarded as illustrative, rather than limiting, and that it be understood that it is the following claims, including all equivalents, that are intended to define the spirit and scope of the invention.

WE CLAIM:

1. A network distributed tracking wire transfer protocol comprising:

a variable length identification string, the identification string for specifying the identity of an entity in a distributed data collection; and

a variable length location string, the location string for specifying the network location of data associated with an entity in a distributed data collection;

wherein a relationship between the identification string and the location string can be spontaneously and dynamically created and modified.

2. The network distributed tracking wire transfer protocol defined in claim 1, wherein the protocol is application independent.

3. The network distributed tracking wire transfer protocol defined in claim 1, wherein the protocol is organizationally independent.

4. The network distributed tracking wire transfer protocol defined in claim 1, wherein the protocol is geographically independent.

5. A system having a network distributed tracking wire transfer protocol for storing and identifying data with a distributed data collection, comprising:

a data repository, the data repository for storing data in a distributed data collection;

a client entity, the client entity for manipulating data in the distributed data collection; and

a first server entity, the first server entity operative to locate data in the distributed data collection;

wherein the client entity transmits an identifier string to the first server entity along with a client request and the first server entity provides at least one location string to the client entity in response thereto.

6. The system defined in claim 5, further comprising a second server entity coupled to the first server entity.

7. The system defined in claim 5, wherein the first server entity maps the identifier string received from the client entity to the at least one location string.

8. The system defined in claim 7, wherein the mapping is performed using a hash operation.

9. The system defined in claim 6, wherein the first server entity transmits the client request to the second server entity if the first server entity cannot provide the at least one location string to the client entity.

10. The system defined in claim 9, wherein the second server entity maps the identifier string received from the first server entity to the at least one location string.

11. The system defined in claim 10, wherein the second server entity transmits the at least one location string to the first server entity for transmission to the client entity.

12. A method for storing and retrieving tracking information over a network using a wire transfer protocol, comprising the steps of:

providing a location string and an identification string, the location string for specifying the location of data associated with an entity in a distributed data collection and the identification string for specifying the identification of an entity in the distributed data collection;

storing information at a data repository entity by associating an identification string with each particular stored unit of information and by mapping the identification string to at least one location string associated with the data repository entity, the identification string and the at least one location

string for a particular unit of information being stored at a first server entity coupled to the data repository entity;

transmitting a request from a client entity to the first server entity to retrieve at least one location string associated with a particular stored unit of information, the request including the identification string associated with the particular stored unit of information; and

receiving the request at the first server entity and responding to the client entity by providing at least one location string associated with the particular stored unit of information to the client entity.

13. The method for storing and retrieving tracking information defined in claim 12, further comprising the step of transmitting the request to a second server entity prior to responding to the client entity, the second server entity coupled to the first server entity and having stored therewith the mapping of the identification string and the at least one location string for the particular unit of information.

14. The method for storing and retrieving tracking information defined in claim 13, wherein the second server entity responds to the client entity by providing the location string associated with the particular stored unit of information to the second client entity.

15. The method for storing and retrieving tracking information defined in claim 12, wherein the lengths of the identification string and the at least one location string are variable.

16. The method for storing and retrieving tracking information defined in claim 12, further comprising the step of spontaneously and dynamically manipulating the mapping of an identification string to a location string.

ABSTRACT OF THE DISCLOSURE

A network distributed tracking wire transfer protocol for storing and retrieving data across a distributed data collection. The protocol includes a location string for specifying the network location of data associated with an entity in the distributed data collection, and an identification string for specifying the identity of an entity in the distributed data collection. According to the protocol, the length of the location string and the length of the identification string are variable, and an association between an identification string and a location string can be spontaneously and dynamically changed. The network distributed tracking wire transfer protocol is application independent, organizationally independent, and geographically independent. A method for using the protocol in a distributed data collection environment and a system for implementing the protocol are also provided.

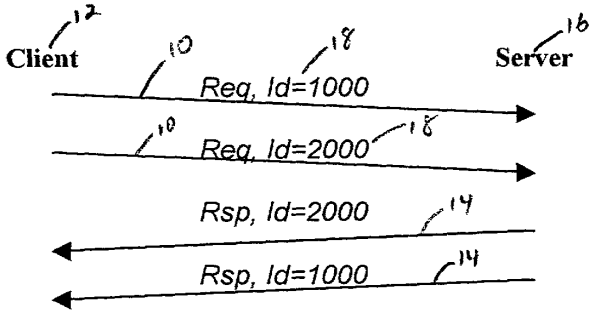


Figure 1 - Use Of Request Identifiers

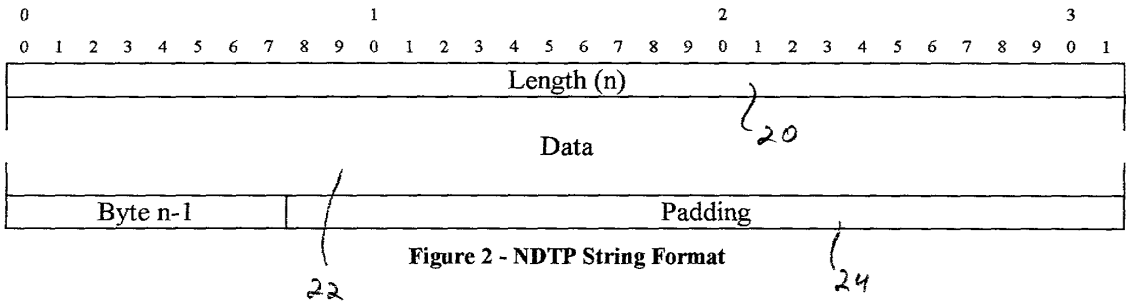


Figure 2 - NDTP String Format

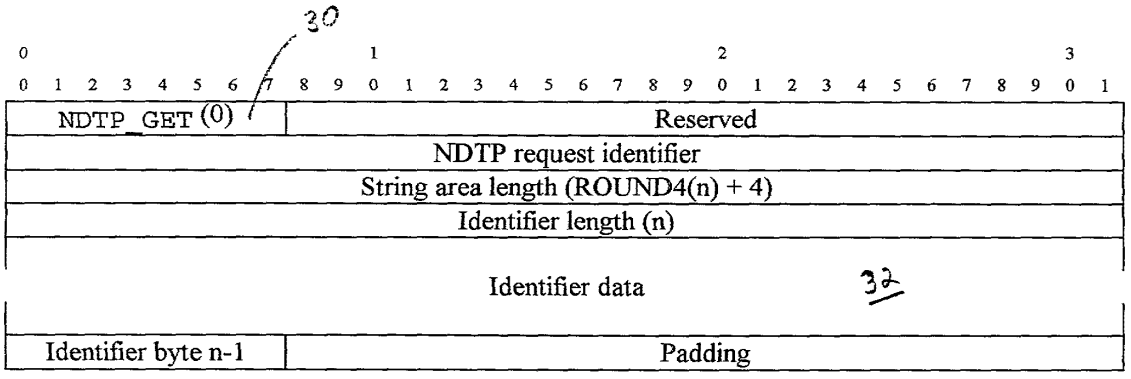


Figure 3 – NDTP_GET Format

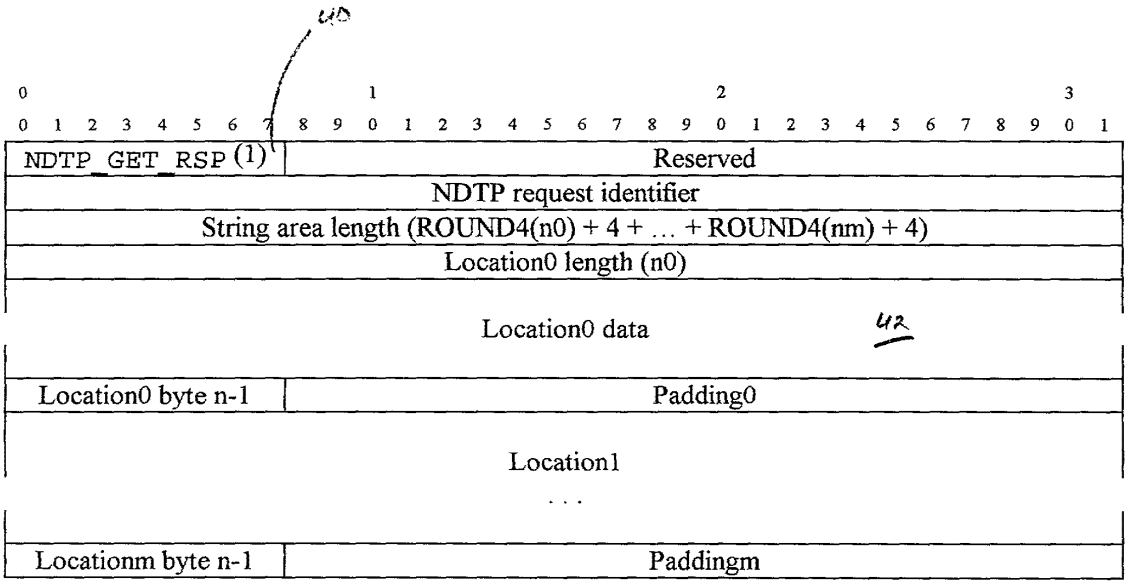


Figure 4 - NDTP_GET_RSP Format

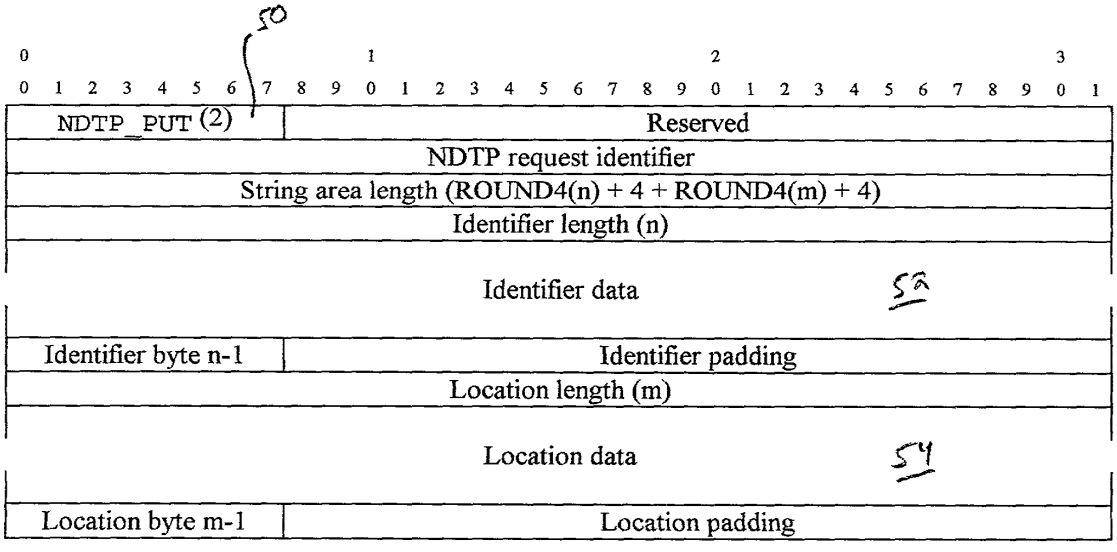


Figure 5 - NDTP_PUT Format

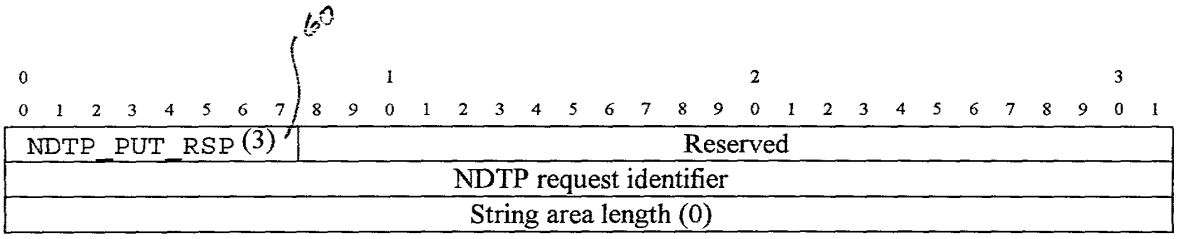


Figure 6 - NDTP_PUT_RSP Format

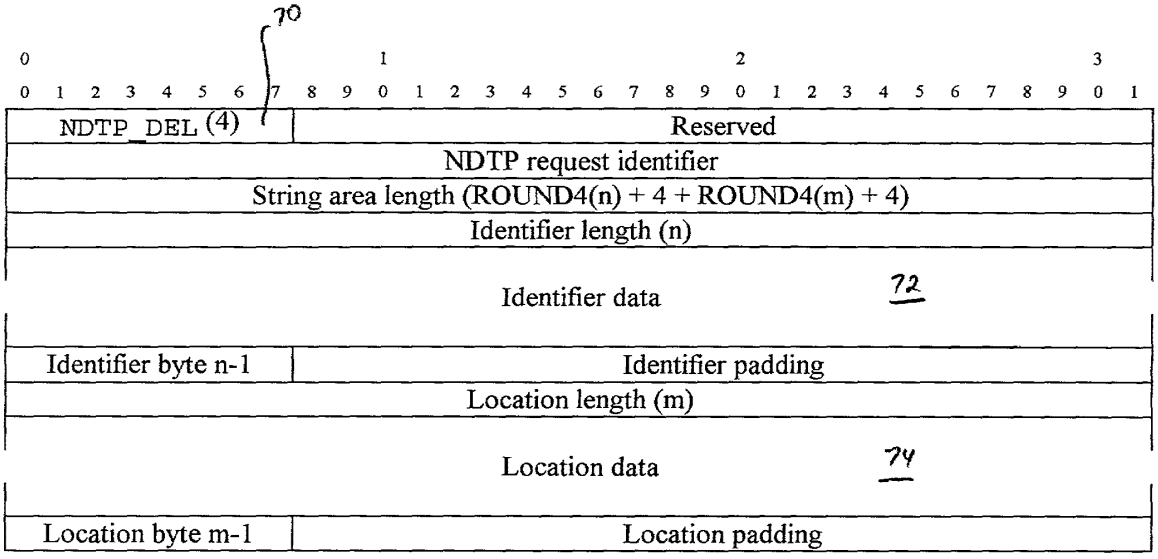


Figure 7 - NDTP_DEL Format

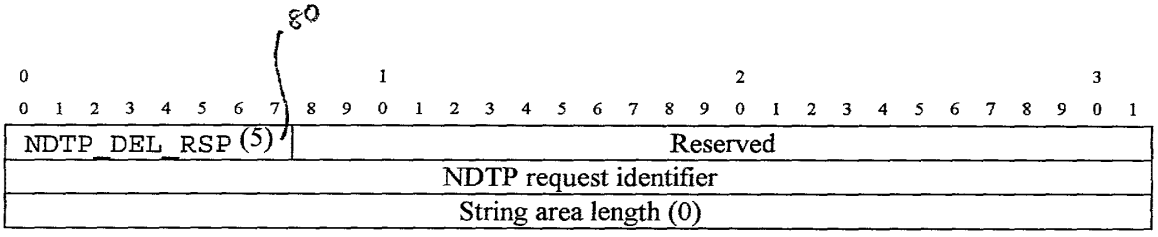


Figure 8 - NDTP_DEL_RSP Format

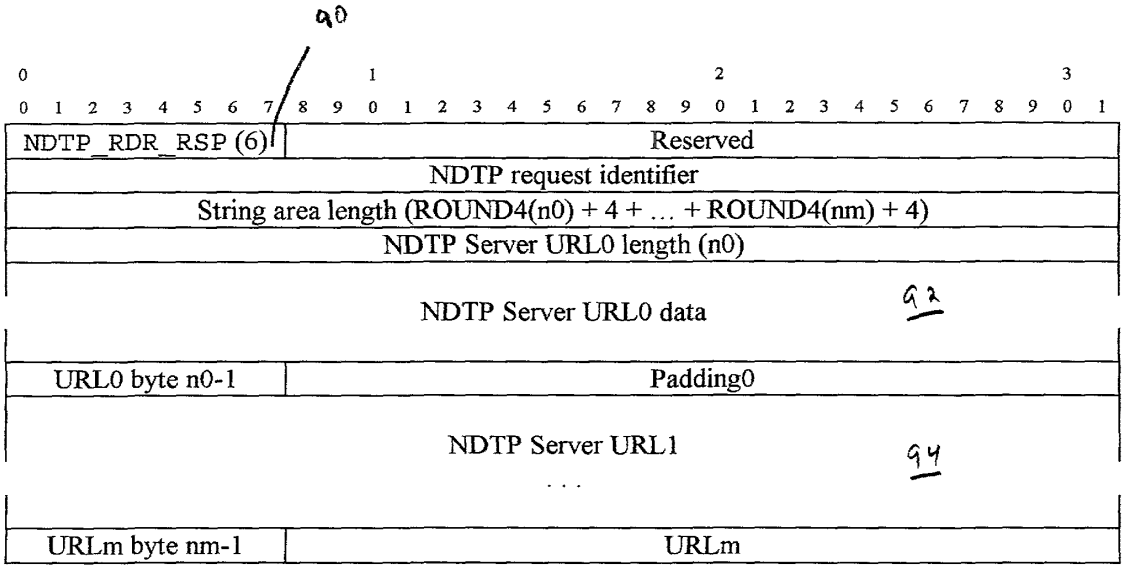


Figure 9(a) - NDTP_RDR_RSP With Server Table

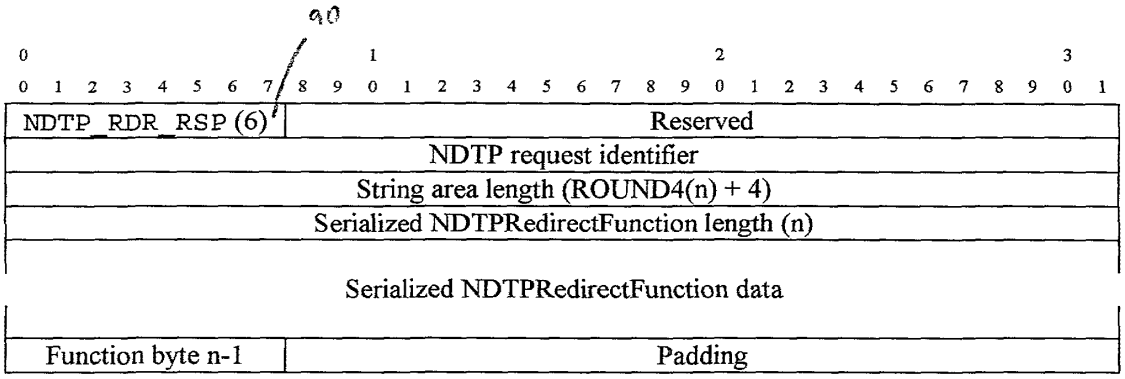


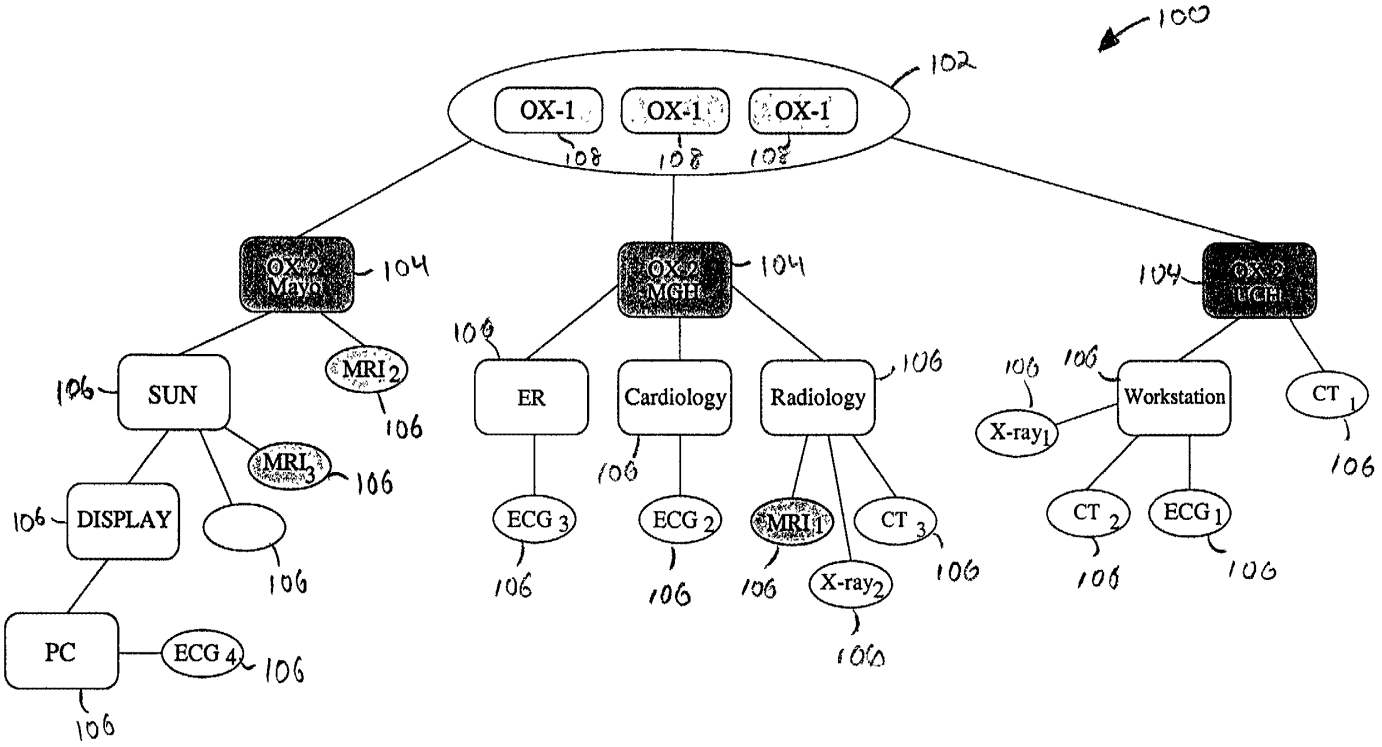
Figure 9(b) - NDTP_RDR_RSP With Redirection Function

DOCKET ALARM

Fig. 10

Network Distributed Tracking

Distributed Record Retrieval



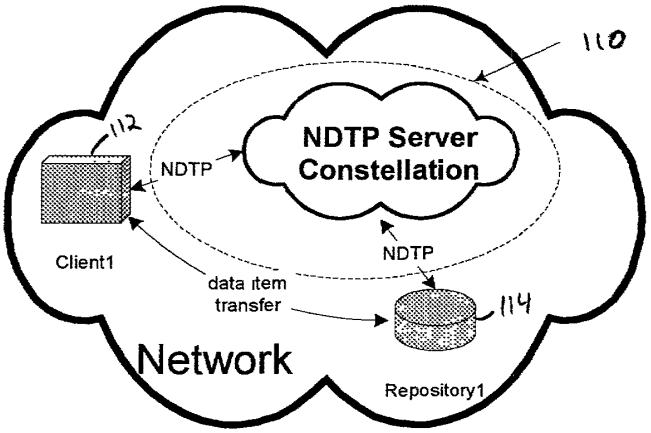


Figure 11 - NDTP Server Constellation Context

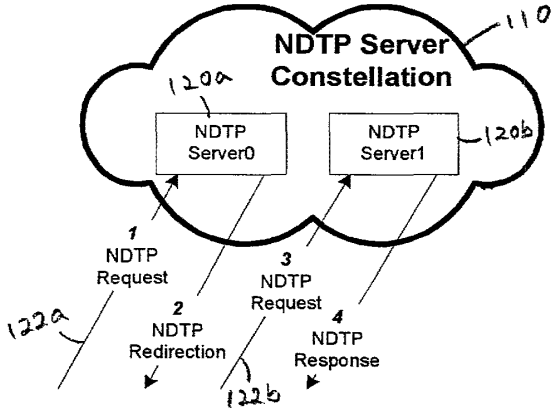


Figure 12 - NDTP Client-Centric Constellation

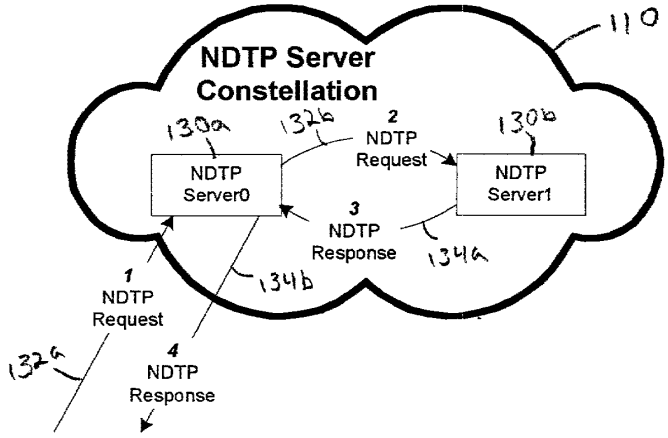


Figure 13 - NDTP Server-Centric Constellation

JC625 U.S. PTO
09/661222
09/13/00

Class	ISSUE CLASSIFICATION
14	

PATENT NUMBER

U.S. **UTILITY** Patent Application

O.I.P.E.	PATENT DATE
SCANNED NS4 Q.A. IA	

APPLICATION NO.	CONT/PRIOR	CLASS	SUBCLASS	ART UNIT	EXAMINER
09/661222	D	705	224	2144	karadia

APPLICANTS: John Overton
Stephen Bailey

TITLE: Network distributed tracking wire transfer protocol

PTO-2040
12/99

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ISSUING CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)	
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)
INTERNATIONAL CLASSIFICATION			
			Continued on Issue Slip Inside File Jacket

☐ TERMINAL DISCLAIMER	DRAWINGS			CLAIMS ALLOWED	
	Sheets Drwg.	Figs. Drwg.	Print Fig.	Total Claims	Print Claim for O.G.
The term of this patent subsequent to ____ (date) has been disclaimed.	(Assistant Examiner) (Date)			NOTICE OF ALLOWANCE MAILED	
The term of this patent shall not extend beyond the expiration date of U.S Patent. No. ____	(Primary Examiner) (Date)			ISSUE FEE	
				Amount Due	Date Paid
The terminal ____ months of this patent have been disclaimed.	(Legal Instruments Examiner) (Date)			ISSUE BATCH NUMBER	

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Microfiche Appendix
2 Microfiche
143 Pages

(FACE)

SEARCHED

Class	Sub.	Date	Exmr.
709	21-3 217-19, 230 (US only)	2/5/04	MSK
707	3,4,5, 7,10 (text search only)	2/5/04	MSK

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.

SEARCH NOTES
(INCLUDING SEARCH STRATEGY)

	Date	Exmr.
EIC PLUS (see attached)	2/5/04	MSK

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ISSUE SLIP STAPLE AREA (for additional cross references)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION	PM	10591	9/27
O.I.P.E. CLASSIFIER	RSD		9/27/00
FORMALITY REVIEW		71435	11/9/00
RESPONSE FORMALITY REVIEW			
			02/12/01

INDEX OF CLAIMS

✔	Rejected	N	Non-elected
=	Allowed	I	Interference
— (Through numeral)	Canceled	A	Appeal
:	Restricted	O	Objected

Claim		Date	Claim		Date	Claim		Date
Final	Original		Final	Original		Final	Original	
	1			51			101	
	2			52			102	
	3			53			103	
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Date of Deposit September 13,2000

jc912 U.S. PTO
09/13/00

Case No. 10406/43

PATENT APPLICATION TRANSMITTAL LETTER

jc825 U.S. PTO
09/661222
09/13/00

To the Commissioner for Patents:

Transmitted herewith for filing is the patent application of: OVERTON ET AL. for : NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL. Enclosed are:

☒ 7 sheet(s) of informal drawings, 39 pages of application (including title page), and the following Appendices : Microfiche Appendix (2 sheets in sealed envelope).

☐ Declaration.

☐ Power of Attorney.

☐ Verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27.

☐ Assignment transmittal letter and Assignment of the invention to : _____.

☒ Return postcard.

Claims as Filed For	Col. 1 No. Filed	Col. 2 No. Extra	Small Entity Rate	Small Entity Fee		Other Than Small Entity Rate	Other Than Small Entity Fee
Basic Fee	[redacted]	[redacted]	[redacted]	$ 345	or	[redacted]	$ 690
Total Claims	16-20	0	x$9=	$	or	x$18=	$
Indep. Claims	3-3	0	x$39=	$	or	x$78=	$
Multiple Dependent Claims Present			+$130=	$	or	+$260=	$
If the difference in col. 1 is less than zero, enter "0" in col. 2.			Total	$345	or	Total	$

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- ☐ Any filing fees under 37 CFR § 1.16 for presentation of extra claims.
- ☐ Any patent application processing fees under 37 CFR § 1.17.
- ☐ The issue fee set in 37 CFR § 1.18 at or before mailing of the Notice of Allowance, pursuant to 37 CFR § 1.311(b).

September 13, 2000
Date

Jonathan E. Retsky
BRINKS HOFER GILSON & LIONE
Registration No. 34,415

Rev. Nov-98
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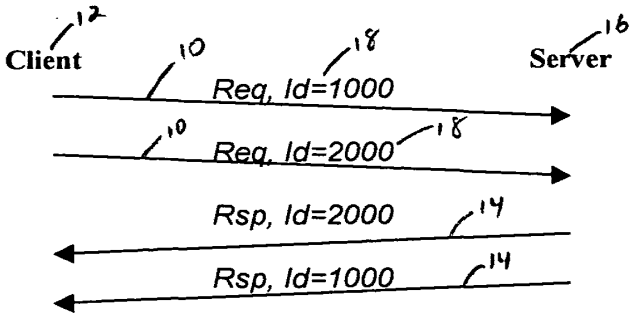


Figure 1 - Use Of Request Identifiers

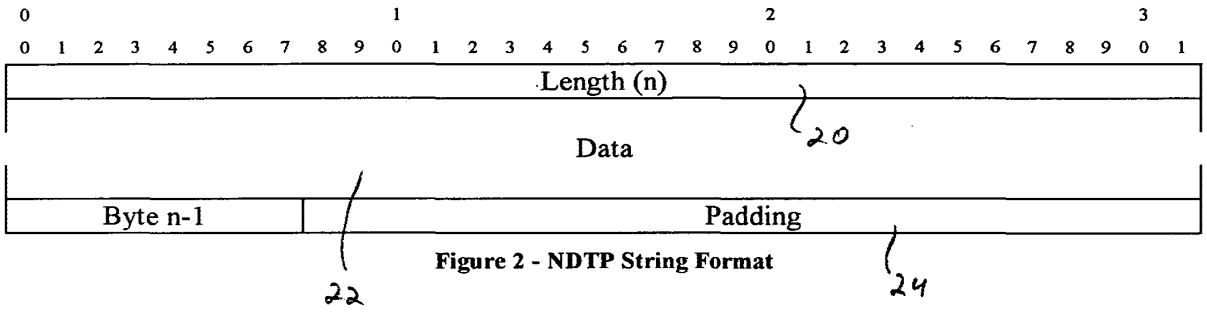


Figure 2 - NDTP String Format

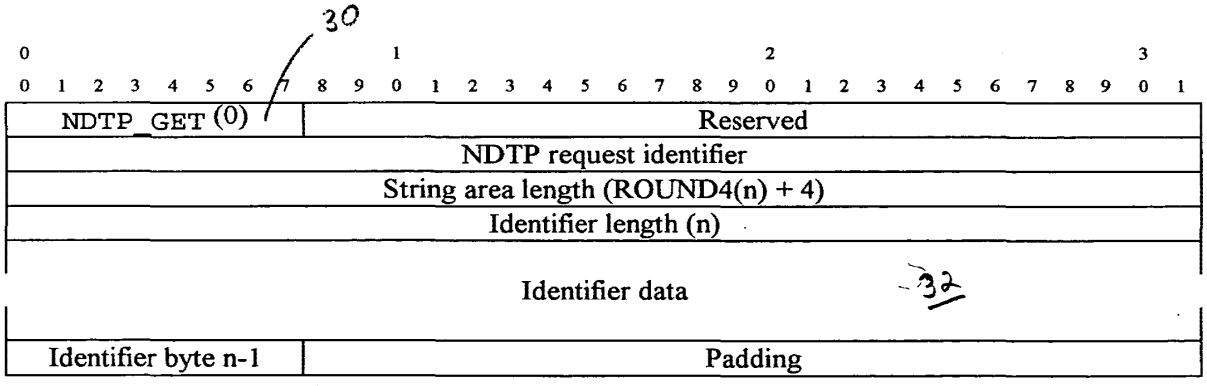


Figure 3 – NDTP_GET Format

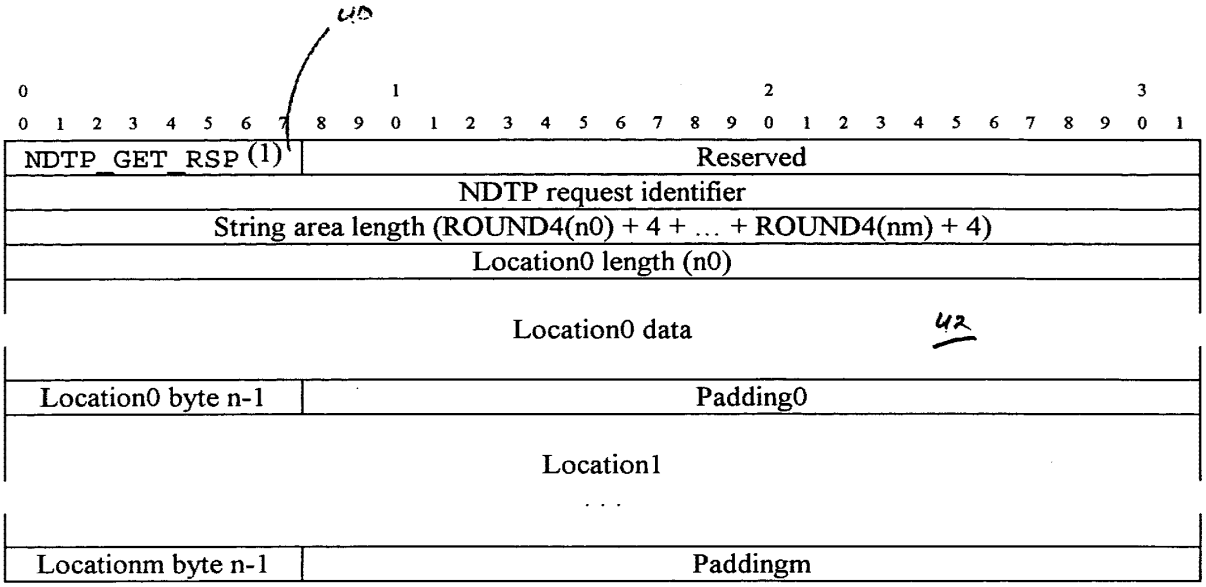


Figure 4 - NDTP_GET_RSP Format

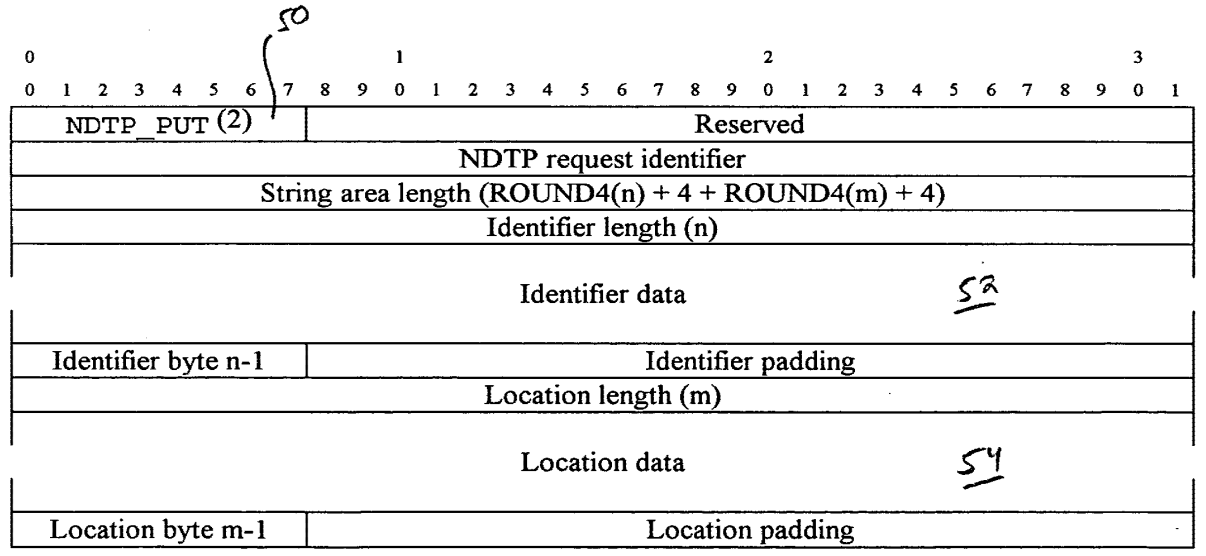


Figure 5 - NDTP_PUT Format

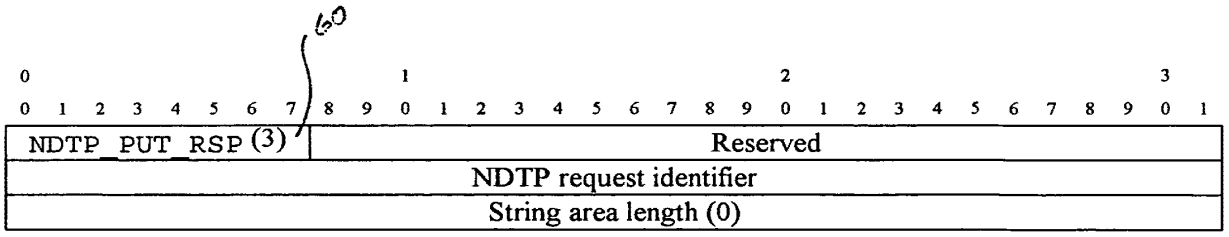


Figure 6 - NDTP_PUT_RSP Format

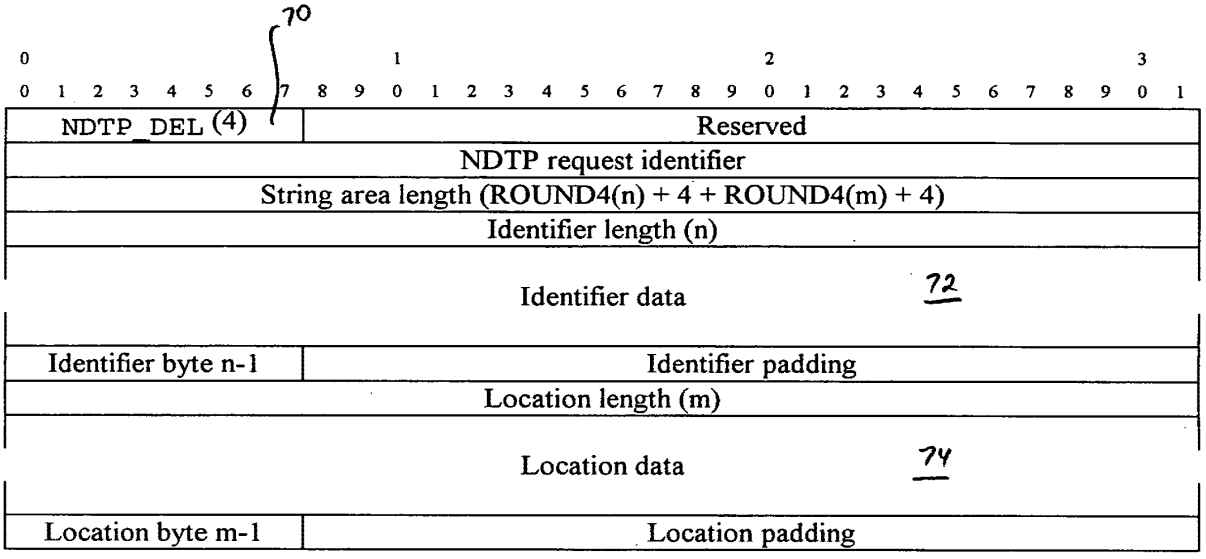


Figure 7 - NDTP_DEL Format

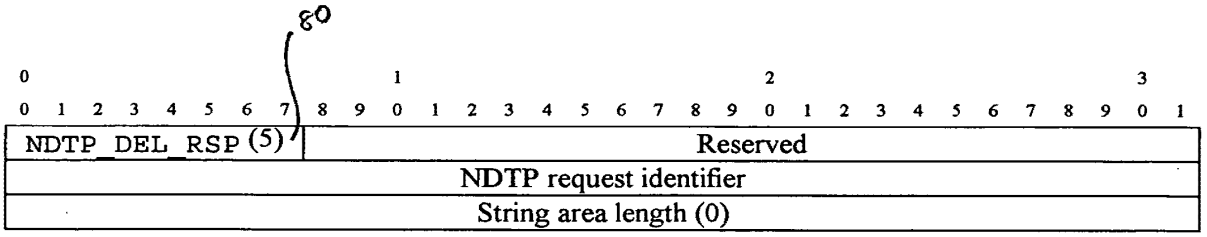


Figure 8 - NDTP_DEL_RSP Format

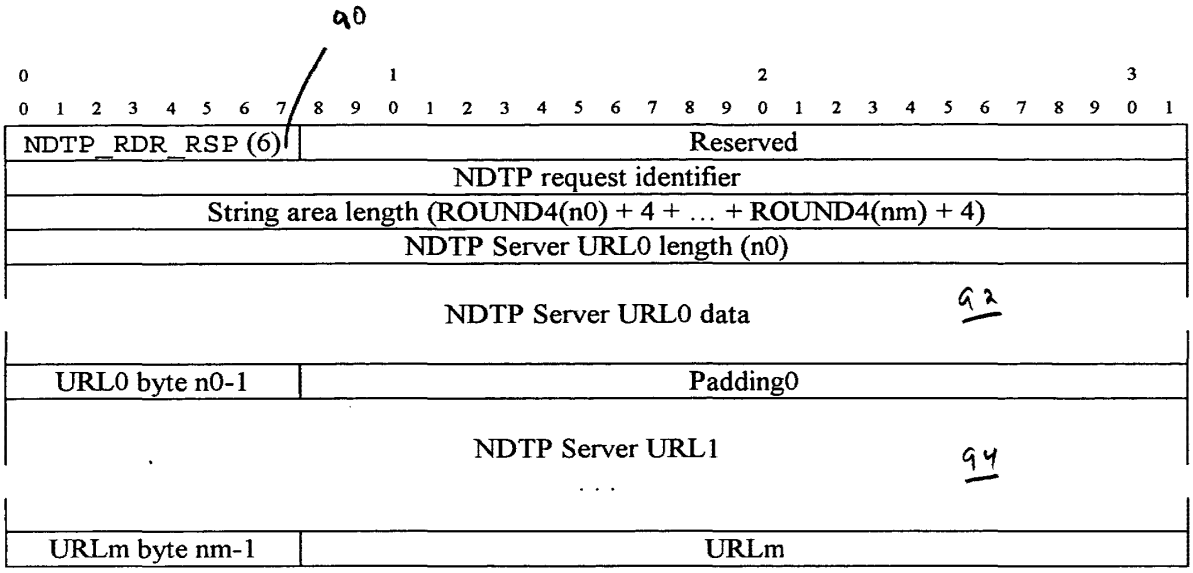


Figure 9(a) - NDTP_RDR_RSP With Server Table

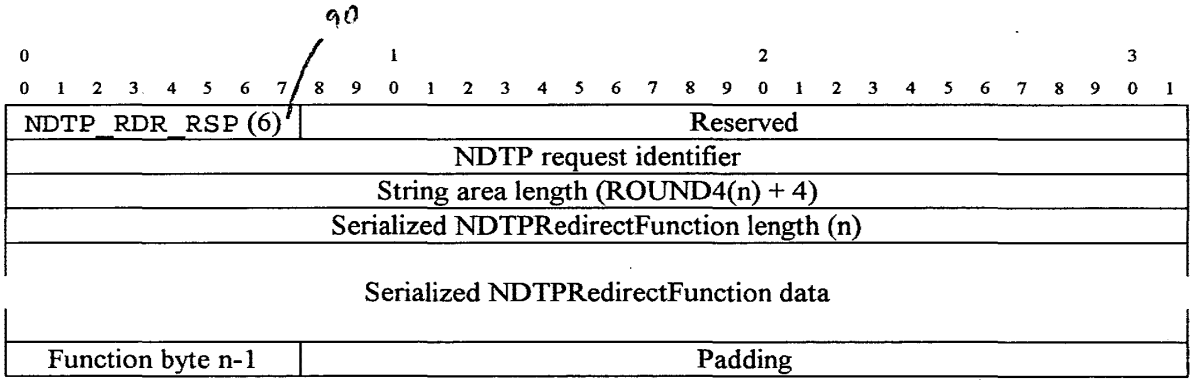


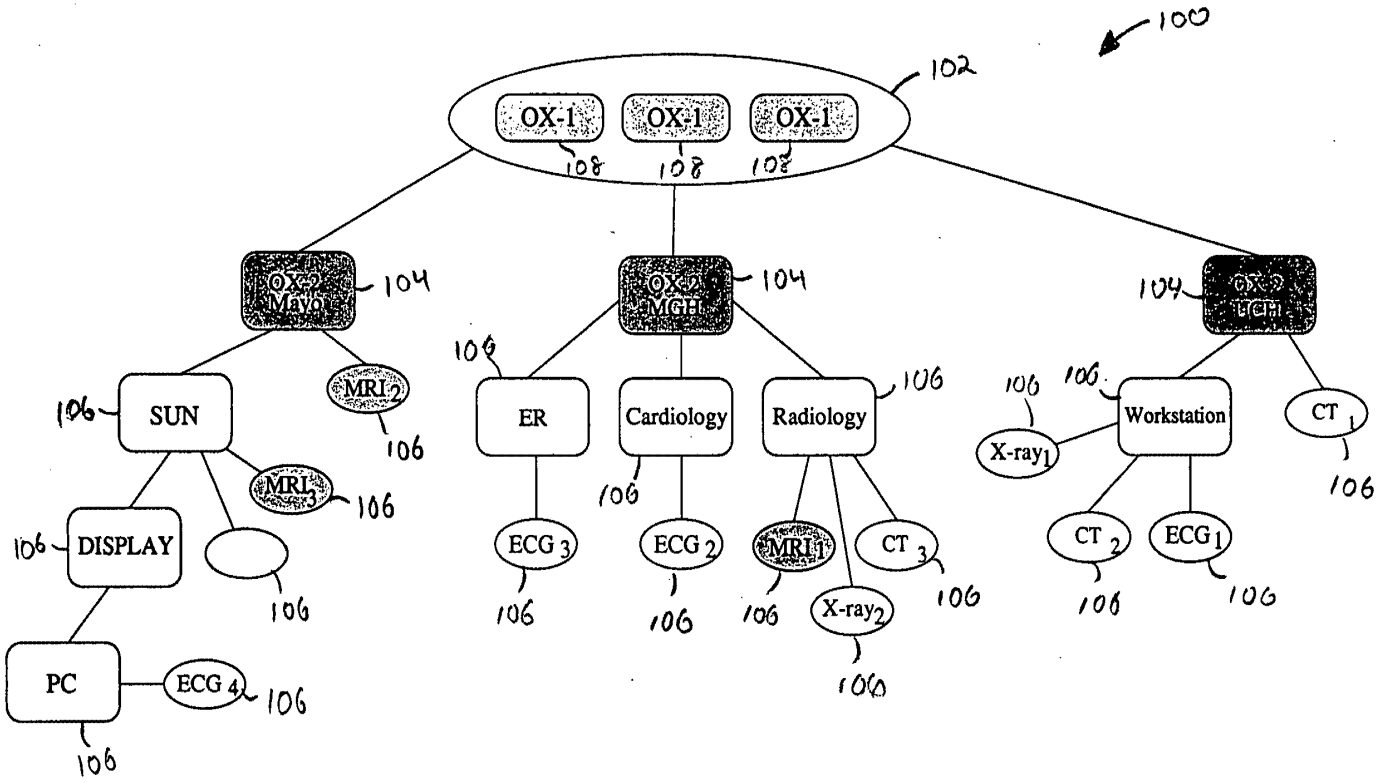
Figure 9(b) - NDTP_RDR_RSP With Redirection Function

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Fig. 10

Network Distributed Tracking

Distributed Record Retrieval



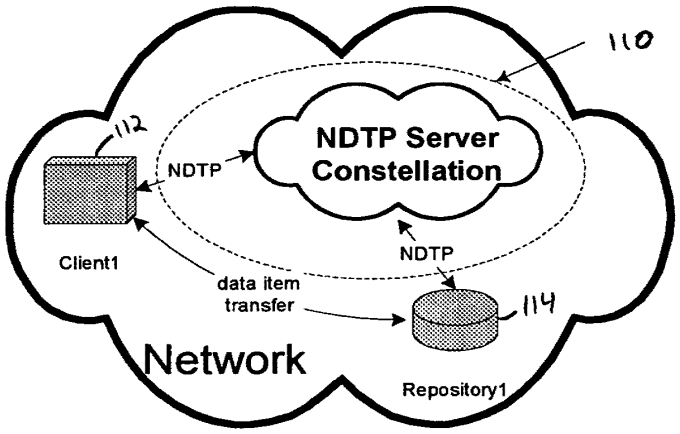


Figure 11 - NDTP Server Constellation Context

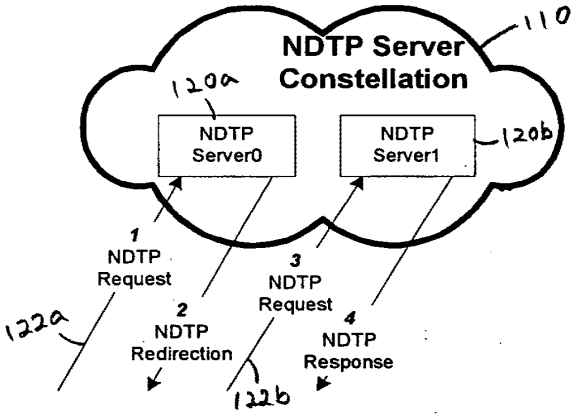


Figure 12 - NDTP Client-Centric Constellation

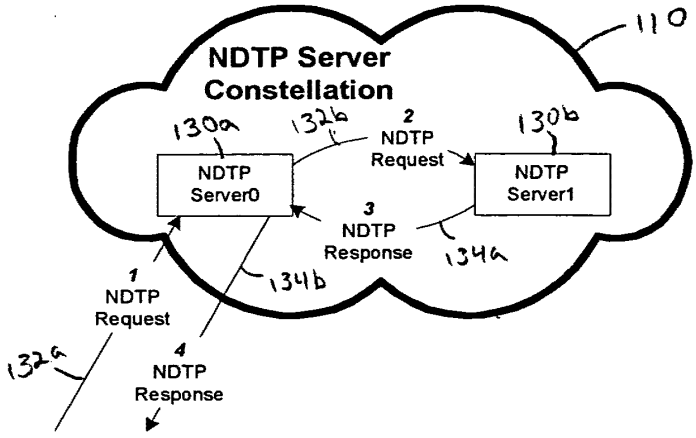


Figure 13 - NDTP Server-Centric Constellation

Google Exhibit 1015

"Express Mail" mailing label number EL500980142US

Date of Deposit: September 13, 2000

Our Case No. 10406/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
APPLICATION FOR UNITED STATES LETTERS PATENT

INVENTORS: JOHN K. OVERTON
STEPHEN W. BAILEY

TITLE: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

ATTORNEY: JONATHAN E. RETSKY
BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

09656520 v2 092600

NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

RELATED APPLICATIONS

This application claims priority to provisional patent application serial no. 60/153,709, entitled SIMPLE DATA TRANSPORT PROTOCOL METHOD AND APPARATUS, filed on September 13, 1999, and to regular patent application no. 09/111,896, entitled SYSTEM AND METHOD FOR ESTABLISHING AND RETREIVING DATA BASED ON GLOBAL INDICES, filed on July 8, 1998.

MICROFICHE/COPYRIGHT REFERENCE

A Microfiche Appendix (143 frames, 2 sheets) is included in this application that contains material which is subject to copyright protection. The copyright owner has no objection to the facsimile reproduction by anyone of the Microfiche Appendix, as it appears in the Patent and Trademark Office patent files or records, but otherwise reserves all copyright rights whatsoever.

FIELD OF THE INVENTION

This invention relates generally to the storage and retrieval of information, and in particular, to a protocol for dynamic and spontaneous global search and retrieval of information across a distributed network regardless of the data format.

BACKGROUND OF THE INVENTION

Data can reside in many different places. In existing retrieval systems and methods, a client seeking information sends a request to a server. Typically, only data that are statically associated with that server are returned. Disadvantageously, the search is also usually restricted to previously known systems. The search is thus conducted only where the server knows in advance to look.

Another disadvantage of known retrieval systems is the difficulty in accessing data in different forms. Known retrieval systems are typically

designed to search for data in limited forms. One example is where a client requests files based on a subject, like a person's name. In the search results, therefore, only text files of peoples' names may be retrieved. Another problem in current retrieval systems is that the client may receive text and image files in the search results, but could not seamlessly access the image files. Yet another problem in current retrieval systems is that video and sound files related to the request may not even be found in the search results. For example, a doctor might be able to retrieve medical records on a specific patient, but cannot view an MRI or X-Ray results associated with that record.

A distributed data collection is a system where data is stored and retrieved among multiple machines connected by a network. Typically, each machine in which some portion of the data in a distributed data collection may reside is called a "data repository machine", or simply a "data repository". One commonly asked question in a data repository environment is: Where is data associated with a particular entity in a distributed data collection? The data location is a key question when a distributed data collection has highly dynamic data distribution properties.

In networked environments where there are a large number of data repositories and any particular entity does not store data in all the repositories, a mechanism is needed that would permit queries to be directed only at data repositories with relevant information. It would also be beneficial to permit membership in the set of data repositories itself to be highly dynamic. Such a system would support on-the-fly addition and removal of data repositories from a distributed data collection seamlessly and without the need to reprogram the client and server participants.

BRIEF SUMMARY OF THE INVENTION

In view of the above, the invention provides a network distributed tracking wire transfer protocol, and a system and method for using the protocol in a networked environment. The network distributed tracking wire transfer protocol includes two basic components: identification strings for specifying the identity of an entity in the distributed data collection, and

location strings for specifying network locations of data associated with an entity. The protocol accommodates variable length identifier and location strings. Relationships between identification strings and location strings can be dynamically and spontaneously manipulated thus allowing the corresponding data relationships also to change dynamically, spontaneously, and efficiently. In addition, the network distributed tracking wire transfer protocol is application independent, organizationally independent, and geographically independent.

In another aspect of the invention, a system of components using the network distributed tracking protocol are provided for storing and identifying data with a distributed data collection. The components include (1) a data repository for storing data in the distributed data collection, (2) a client entity for manipulating data in the distributed data collection, and (3) a first server entity operative to locate data in the distributed data collection, which may be coupled to a client entity and/or data repository. In a network with these components, a client entity transmits an identifier string to the first server entity along with the client request, and the first server entity provides a set of location strings to the client entity in response thereto. The first server entity maps the identifier string received from the client entity to a set of location strings. The network may also include any number of additional server entities coupled to the first server entity.

According to yet another aspect of the invention, a method is provided for storing and retrieving tracking information over a network using a wire transfer protocol. A location string specifies the location of data associated with an entity in the distributed data collection and the identification string specifies the identification of an entity in a distributed data collection. A first data repository entity stores data by associating an identification string with each particular stored unit of data, and by mapping the identification string to a location string associated with the first data repository. The identification string and location string for the particular unit of data are at a first server entity coupled to the first data repository entity. A request is transmitted from a client entity to the first server entity to retrieve at least one location string

associated with the stored unit of data in the distributed data collection. The request includes the identification string associated with the particular stored unit of data. The request is received at the first server entity, which responds to the client entity by providing at least one location string associated with the particular stored unit of data to the client entity.

The request may also be transmitted to a second server entity prior to responding to the client entity, where the second server entity is coupled to the first server entity and includes the mapping of the identification string and location strings for the particular units of data. In such case, the second server entity responds to the client entity by providing the at least one location string associated with the particular stored unit of data to the client entity.

The network distributed tracking protocol of the invention is a networking protocol that efficiently manages mappings from one or more identifier strings to zero or more location strings. The protocol permits client entities to add and remove identifier/location associations, and request the current set of locations for an identifier or identifiers from server entities that comply with the protocol.

The protocol is designed for use in the larger context of a distributed data collection. As such, it supports an architecture in which information about where data associated with particular application entities can be managed and obtained independently of the data itself. The protocol and its associated servers thus maintain a mapping between entity identifiers and data locations. The identifier/location mapping maintained by the servers is very dynamic. Regardless of the expected system context in a distributed data collection, the protocol can be used for any application in which one-to-one or one-to-many associations among strings are to be maintained and accessed on a network.

In any context, the protocol supports identifier and location strings of up to 2^{32}-4 bytes in length, but in most applications it is expected that the strings are typically short. String length is not fixed by the protocol, except by the upperbound. Accordingly, string formats are controlled at a local level and not dictated by the protocol.

These and other features and advantages of the invention will become apparent upon a review of the following detailed description of the presently preferred embodiments of the invention, when viewed in conjunction with the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an example of multiple outstanding protocol requests.

FIG. 2 is a layout of one presently preferred string format.

FIG. 3 is a layout of one presently preferred NDTP_GET message.

FIG. 4 is a layout of one presently preferred NDTP_GET_RSP message.

FIG. 5 is a layout of one presently preferred NDTP_PUT message.

FIG. 6 is a layout of one presently preferred NDTP_PUT_RSP message.

FIG. 7 is a layout of one presently preferred NDTP_DEL message.

FIG. 8 is a layout of one presently preferred NDTP_DEL_RSP message.

FIG. 9 is a layout of one presently preferred NDTP_RDR_RSP message, where FIG. 9(a) shows a server table layout, and FIG. 9(b) shows a redirection function layout.

FIG. 10 is a system block diagram showing a multi-server implementation environment of the network distributed tracking wire transfer protocol of the invention.

FIG. 11 is a system diagram showing an NDTP server constellation configuration.

FIG. 12 is a system diagram showing a client-centric constellation approach.

FIG. 13 is a system diagram showing a server-centric constellation approach.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS OF THE INVENTION

The following terms are used to describe the operation of the presently preferred network distributed tracking protocol (NDTP). An "identifier string" or an "identifier" is a unique string with which zero or more location strings are associated in an NDTP server. A "data location" or a "location" is a string that is a member of a set of strings associated with an identifier string in an NDTP server. An "NDTP client" or a "client" is a network-attached component that initiates update or lookup of identifier/location mappings from an NDTP server with NDTP request messages. An "NDTP server" or a "server" is a network-attached component that maintains a set of identifier/location mappings that are modified or returned in response to NDTP request messages from NDTP clients. The term "Network Byte Order" is the ordering of bytes that compose an integer of larger than a single byte as defined in the Internet Protocol (IP) suite. Preferably, Network Byte Order specifies a big-endian, or most significant byte first, representation of multibyte integers. In this specification a byte is preferably composed of eight bits.

Network Distributed Tracking Protocol (NDTP)

The Network Distributed Tracking Protocol (NDTP) efficiently tracks the location of data associated with an individual entity in a distributed data collection. NDTP is a transactional protocol, which means that each operation within NDTP consists of a request message from an NDTP client to an NDTP server, followed by an appropriate response message from the NDTP server to the NDTP client. NDTP defines an entity key (or "identifier") as a unique string used to refer to an entity about which a distributed query is performed.

The NDTP server treats the entity key as an unstructured stream of octets, which is assumed to be unique to a particular entity. The precise structure of the NDTP entity key and the mechanism for ensuring its uniqueness are a function of the application in which the NDTP server is used. In a customer oriented application, the NDTP entity key might be a unique customer identifier, for example, a Social Security Number, in either

printable or binary integer form, as is appropriate to the application. NDTP also defines a data location specifier as a string used to specify a data respository in which data associated with a particular entity may be found.

As with NDTP entity keys, the NDTP server treats NDTP data location specifiers as unstructured streams of octets. The structure of an NDTP data location specifier is a function of the application in which the NDTP server is used. For example, an NDTP data location specifier might be an Internet machine name, and a TCP/IP port number for a relational database server, or an HTTP Universal Resource Locator(URL), or some concatenation of multiple components.

The NDTP server efficiently maintains and dispenses one to zero or one to many relationships between entity keys and data location specifiers. In other words, an entity key may be associated with any number of data location specifiers. When data for a particular entity is added to a data repository, the NDTP server is updated to indicate an association between the entity key and the data repository's data location specifier. When a query is performed for an entity key, the NDTP server supplies the set of data repositories in which data may be found for that entity key.

General NDTP Mechanics

The protocol of the invention is designed to provide maximum transaction throughput from the NDTP server, associated clients, and associated data repositories when appropriate. The design goal is realized through two design principles:

1. NDTP messages should preferably be as short as possible to maximize the rate of NDTP transactions for a given network communication bandwidth.
2. NDTP messages should preferably be structured for efficient processing on existing machine architectures.

Design Optimizations.

Numerical fields of an NDTP message are preferably represented in binary integer format rather than ASCII or other printable format to minimize

host processing overhead and network utilization. Numerical fields of NDTP messages are also aligned on 32-bit boundaries to minimize the cost of manipulation on current machine architectures. Manipulating unaligned multibyte integer quantities on modern machine architectures usually incurs an extra cost ranging from mild to severe compared to manipulating the same quantities in aligned form.

In keeping with other network protocol standards including TCP/IP, multioctet integer quantities in NDTP are preferably encoded using the big endian integer interpretation convention, as set forth above.

To overcome network latency, NDTP is designed to support asynchronous operation, where many requests may be sent to an NDTP server before a response from any of them is received.

Each NDTP message is preceded by a fixed size, 12-octet header, using the preferred data structure:

```
typedef struct ndtp-hdr {
      uint8_T op;              /* opcode */
      uint8_t pad[3];
      uint32_t id;             /* transaction identifier */
      uint32_t size;           /* total request size
                                  following the header */
}ndtp_hdr_t;
```

where:

op:

NDTP message numerical operation code.

NDTP_GET:	get request
NDTP_GET_RSP:	get response
NDTP_PUT:	put request
NDTP_PUT_RSP:	put response
NDTP_DEL:	delete request
NDTP_DEL_RSP:	delete response
NDTP_RDR_RSP:	provide redirection

id:

Client supplied operation request used to distinguish responses from multiple outstanding NDTP asynchronous requests. Each "_RSP" message echoes the id field of the associated request.

size:

Size, in octets of the remainder of the NDTP message. The size field should always be a multiple of 4 octets.

Variably sized portions of NDTP messages are preferably defined with a size field rather than some other delimiter mechanism to facilitate efficient reading of NDTP messages. Requests may be made to the network layer to read the entire variably sized portion of an NDTP message, rather than reading small chunks while scanning for a delimiter. Furthermore, client and server resource management can be more efficient since the size of NDTP messages is known before reading.

The variably sized portions of NDTP messages are composed of zero or more NDTP stings:

```
typedef struct ndtp_str {
  uint32_t len;
  uint8_t data [];
{  ndtp_str_t;
```

Note that the C struct definitions in this document are schematic, and not necessarily fully compliant structures in the C programming language. Specifically, arrays denoted in this document with "[ ]" imply a dimension which is only known dynamically and this indefinite array size specifier is not allowed in C struct definitions. Note also the following:

len:

the number of significant octets of data following the len field in the data area.

data:

len octets of data, followed by up to 3 octets of padding, to ensure that the total length of the NDTP string structure is a multiple of 4 octets. The padding octets are not included in the len field.

Because variable sized portion NDTP messages are composed of zero or more NDTP stings and NDTP strings preferably occupy an even multiple of 4 octets, this ensures that the "size" field of NDTP message headers will preferably be a multiple of 4 octets.

Protocol Structure

An example of multiple outstanding NDTP requests and the use of request identifiers is shown in FIG. 1. NDTP preferably has a simple, stateless request/response structure. Each request message 10 sent by a client 12 has a corresponding response message 14 returned by the server 16. To maximize server 16 throughput and use of available network bandwidth, NDTP is asynchronous in nature. Many requests 10 from a single client 12 may be outstanding simultaneously, and responses 14 may or may not be returned from the server 16 in the order in which the requests 10 were issued. Each NDTP request 10 contains an NDTP request identifier 18 that is returned in the NDTP response 14 for the associated request 10. An NDTP client 12 uses a unique NDTP request identifier 18 for each NDTP request 10 that is outstanding at the same time to an NDTP server 16 if it wishes to correlate responses with requests.

There are four operations preferably supported by the protocol:

- Add a location association to an identifier.
- Delete a location association from an identifier.
- Get all locations associated with an identifier.
- Provide a redirect instruction to identify an alternative server.

The response to adding a location association to an identifier 18 is a simple acknowledgement. If the location is already associated with the identifier 18, adding the association has no effect, but the request 10 is still acknowledged appropriately. In other words, the NDTP add operation is idempotent. The response to deleting a location association from an identifier 18 is a simple acknowledgement. If the location is not currently associated with the identifier 18, deleting the association has no effect, but the request 10 is still acknowledged appropriately. In other words, the NDTP delete operation is idempotent. The response 14 to getting all locations associated

with an identifier 18 is a list of the locations presently associated with an identifier 18. If no locations are currently associated with an identifier 18, a list of length zero is returned.

Message Formats

NDTP messages 10, 14 preferably have a regular structure that consists of a message operation code, followed by a request identifier 18, followed by a string area length (in bytes) 20, followed by zero or more strings 22, as shown in FIG. 2. As those skilled in the art will appreciate, NDTP message formats are preferably independent of the network transport layer used to carry them. NDTP preferably defines mappings of these messages 10, 14 onto TCP and UDP transport layers (described in detail below), but other mappings could also be defined and it is likely that these NDTP message formats would not require change. For example, the notation ROUND4(x) means x, rounded up to the next multiple of 4.

Integer Format

Multibyte integers in NDTP messages are represented in network byte order; using the big-endian convention. In other words, the most significant byte of a multibyte integer is sent first, followed by the remainder of the bytes, in decreasing significance order.

String Format

Strings in NDTP are represented as counted strings, with a 32-bit length field 20, followed by the string data 22, followed by up to 3 bytes of padding 24 to make the total length of the string representation equal to ROUND4(length). This layout is shown diagrammatically in FIG. 2.

NDTP_GET Format

The `NDTP_GET` message has a message operation code 30 of 0, and a single NDTP string 32 which is the identifier string for which to get associated location strings. This layout is shown diagrammatically in FIG. 3.

NDTP_GET_RSP Format

The NDTP_GET_RSP message has a message operation code 40 of 1, and zero or more strings 42 that are the locations currently associated with the requested identifier. This layout is shown diagrammatically in FIG. 4.

NDTP_PUT Format

The NDTP_PUT message has a message operation code 50 of 2, and two NDTP strings 52, 54. The first string 52 is the identifier for which to add a location association, and the second string 54 is the location to add. This layout is shown diagrammatically in FIG. 5.

NDTP_PUT_RSP Format

The NDTP_PUT_RSP message has a message operation code 60 of 3, and zero NDTP strings. This layout is shown diagrammatically in FIG. 6.

NDTP_DEL Format

The NDTP_DEL message has a message operation code 70 of 4, and two NDTP strings 72, 74. The first string 72 is the identifier from which to delete a location association, and the second string 74 is the location to delete. This layout is shown diagrammatically in FIG. 7.

NDTP_DEL_RSP Format

The NDTP_DEL_RSP message has a message operation code 80 of 5, and zero NDTP strings. This layout is shown diagrammatically in FIG. 8.

NDTP_RDR_RSP Format

The NDTP_RDR_RSP message has a message operation code 90 of 6, and one or more NDTP strings 92, 94. Two layouts apply, which are shown diagrammatically in FIGS. 9(a) and 9(b).

A general description of the usage and operation of these protocol messages is provided below.

NDTP_GET Transaction

The NDTP_GET message contains a single NDTP string which is the entity key for which associated data locations are requested.

```
typedef struct ndtp_get {
  ndtp_hdr_t hdr;
  ndtp_str_t key;
} ndtp_get_t;
```

The NDTP_GET_RSP message contains zero or more NDTP strings which are the data location specifiers associated with the NDTP entity key:

```
typedef struct ndtp_get_rsp {
  ndtp_hdr_t hdr;
  uint32_t rsps;
  ndtp_str_t values[];
} ndtp_get_rsp_t;
```

NDTP_PUT Transaction

The NDTP_PUT messages contains two NDTP strings which are (1) the NDTP entity key and (2) the NDTP data location specifier which is to be associated with the NDTP entity key.

```
typedef struct ndtp_put {
  ndtp_hdr_t hdr;
  ndtp_str_t key;
  ndtp_str_t data;
} ndtp_put_t;
```

The NDTP_PUT_RSP message has no NDTP strings, and simply indicates that the requested entity key/data location specifier association was added:

```
typedef struct ndtp_put_rsp {
  ndtp_hdr_t hdr;
} ndtp_put_rsp_t;
```

The requested entity key/data location specifier association is added in addition to any other associations already maintained by the NDTP server. If

the requested entity key/data location specifier association is already in effect, the NDTP_PUT still succeeds and results in an NDTP_PUT_RSP message.

NDTP_DELETE Transaction

The NDTP_DEL message contains two NDTP strings which are (1) the NDTP entity key and (2) the NDTP data location specifier which is to be unassociated with the NDTP entity key:

```
typedef struct ndtp_del {
  ndtp_hdr_t hdr;
  ndtp_str_t key;
  ndtp_str_t data;
} ndtp_del_t;
```

The NDTP_DEL_RSP message has no NDTP strings, and simply indicates that the requested entity key/data location specifier association was deleted.

```
typedef struct ndtp_del_rsp {
  ndtp_hdr_t hdr;
} ndtp_del_rsp_t;
```

If the requested entity key/data location specifier association is not in effect, the NDTP_DEL still succeeds and results in an NDTP_DEL_RSP message.

NDTP_RDR_RSP Message

NDTP supports a distributed server implementation for which two principle redirection methods apply: (1) embedded redirection links, and (2) passed functions. The passed functions method in turn has two variants: (a) a well-known function, and (b) a communicated function. (These methods and variants are described in further detail below.)

Network Front End

The NDTP server network front end preferably maximizes NDTP transaction throughput including concurrent NDTP requests from a single client as well NDTP requests from multiple concurrent clients.

Network Communication Mechanism

NDTP defines a transaction oriented protocol, which can be carried over any of a variety of lower level network transport protocols. For example:

TCP/IP: TCP/IP provides a ubiquitously implemented transport which works effectively on both local area and wide area networks. An NDTP client using TCP/IP preferably connects with the NDTP server at an established TCP port number, and then simply writes NDTP request messages through the TCP/IP connection to the server, which then writes NDTP response messages back to the client through the same TCP/IP connection in the reverse direction. TCP/IP implementations perform buffering and aggregation of many small messages into larger datagrams, which are carried more efficiently through the network infrastructure. Running NDTP on top of TCP/IP will take advantage of this behavior when the NDTP client is performing many NDTP requests. For example, a data repository which is undergoing rapid addition of data records associated with various entities will perform many rapid NDTP_PUT operations to the NDTP server that can all be carried on the same NDTP TCP/IP connection.

UDP/IP: If an NDTP client only performs occasional, isolated NDTP operations, or there are a vast number of clients communicating with an NDTP server, TCP/IP will not offer the best possible performance because many traversals of the network are required to establish a TCP/IP connection, and yet more network traversals are required to transfer actual NDTP messages themselves. For such isolated NDTP transactions, depending upon the application and network infrastructure in use, it is beneficial to have the NDTP server employ UDP/IP, which is a widely available connectionless datagram protocol.

However, UDP/IP does not support reliable data transfer, or any congestion control mechanism. This means that NDTP clients using UDP/IP must implement reliability and congestion control maintaining transaction timeouts and performing exponential retry backoff timers, precisely analogous to the congestion control mechanism implemented by Ethernet, and other well known UDP protocols. Those skilled in the art will note that the NDTP

protocol is stateless from the standpoint of the NDTP server, which means that there is no congestion control or reliability burden on the server; it is all implemented in a distributed manner by the NDTP UDP/IP clients.

Still Higher Performance (ST): Both TCP/IP and to a lesser degree UDP/IP suffer from high host CPU overhead. Like the relatively long latency of TCP/IP, this host CPU consumption is considered just the "cost of doing business" where TCP/IP provides ubiquitous connectivity. If an NDTP server were running in a more constrained environment, where ubiquitous connectivity was not required, its absolute performance could be improved substantially by using a different protocol that is optimized to reduce CPU overhead and latency, such as the Scheduled Transfer (St) protocol.

None of these network implementation issues are particularly unique to NDTP, however. All similar protocols face similar tradeoffs, and what art exists to improve the performance of such protocols applies fully to NDTP as well.

NDTP Query Processing

Servicing NDTP query requests does not require high latency operations, such as disk I/O. Therefore, the NDTP server network front end preferably services NDTP query requests in a FIFO style by reading the NDTP_GET message, performing the lookup for the entity key in the NDTP server string store, and writing the NDTP_GET_RSP message. Each NDTP query is independent of any other NDTP transactions (other queries or updates), so it is possible to process multiple NDTP queries simultaneously on multiprocessor machines. The NDTP server permits this by not performing multiprocessor locking in the NDTP query processing path.

The current prototype NDTP server preferably does not create multiple read service threads per NDTP connection, so multiprocessing will only occur while processing queries from different NDTP connections. Nonetheless, the NDTP server could be extended to support multiprocessing of NDTP queries from a single NDTP connection if this turned out to be advantageous.

NDTP Update Processing

Unlike NDTP queries, processing NDTP updates requires the high latency operation of committing the change to nonvolatile storage. To maintain high performance on NDTP updates, the NDTP server network front end preferably supports multiple concurrent asynchronous update transactions. Also, each update is preferably performed atomically to avoid creating an inconsistent state in the string store. Currently, the string store supports only a single mutator thread, which means that all NDTP updates are serialized through the string store mutator critical code sections. As is traditional in transactional systems, the string store mutation mechanism is implemented as a split transaction.

When an NDTP update is processed, a call is made to the string store mutation function, which returns immediately indicating either that the mutation is complete, or that the completion will be signaled asynchronously through a callback mechanism. The mutator function might indicate an immediate completion on an NDTP_PUT operation if the entity key/data location specifier mapping was already present in the database. In this case, the network front end will immediately write the update response message back to the client.

For updates which are not immediately completed, the network front end maintains a queue of NDTP updates for which it is awaiting completion. When the completion callback is called by the string store log file update mechanism, the network front end writes the NDTP update response messages for all completed updates back to the clients. If no new NDTP update requests are arriving from NDTP clients, and there are some incomplete updates in the update queue, the network front end preferably calls the string store log buffer flush function to precipitate the completion of the incomplete updates in update queue.

Multiple Connection Handling

Handling multiple clients in a single server process requires that the server process not block waiting for events from a single client, such as newly

received data forming an NDTP request message, or clearing a network output buffer so an NDTP response message can be written. The NDTP server network front end may be conditionally compiled to use either of two standard synchronous I/O multiplexing mechanisms, select or poll, or to use threads to prevent blocking the server waiting for events on individual connections. The select and poll interfaces are basically similar in their nature, but different in the details. When compiled for synchronous I/O multiplexing, the NDTP server network front end maintains an input buffer for each connection. The multiplexing function is called to determine if any of the connections have input available, and if so, it is read into the connection's input buffer. Once a complete NDTP request is in the buffer, it is acted upon. Similarly, the network front end maintains an output buffer for each connection, and if there is still a portion of an NDTP response message to send, and the connection has some output buffer available, more of the NDTP response message is sent.

The threaded version of the NDTP server network front end preferably creates two threads for each NDTP connection, one for reading and one for writing. While individual threads may block as input data or output buffer is no longer available on a connection, the thread scheduling mechanism ensures that if any of the threads can run, they will. The threaded version of the NDTP server is most likely to offer best performance on modern operating systems, since it will permit multiple processors of a system to be used, and the thread scheduling algorithms tend to be more efficient than the synchronous I/O multiplexing interfaces. Nonetheless, the synchronous I/O multiplexing versions of NDTP server will permit it to run on operating systems with poor or nonexistent thread support.

A more detailed description of the mapping operation in both a TCP and UDP environment appears below.

TCP Mapping

As those skilled in the art will appreciate, the Transmission Control Protocol (TCP) is a connection-oriented protocol that is part of a universally

implemented subset of the Internet Protocol (IP) suite. TCP provides reliable, bi-directional stream data transfer. TCP also implements adaptive congestion avoidance to ensure data transfer across a heterogeneous network with various link speeds and traffic levels.

NDTP is preferably carried on TCP in the natural way. An NDTP/TCP client opens a connection with a server on a well-known port. (The well-known TCP (and UDP) port numbers can be selected arbitrarily by the initial NDTP implementer. Port numbers that do not conflict with existing protocols should preferably be chosen.) The client sends NDTP requests 10 to the server 16 on the TCP connection, and receives responses 14 back on the same connection. While it is permissible for a single client 12 to open multiple NDTP/TCP connections to the same server 16, this practice is discouraged to preserve relatively limited connection resources on the NDTP server 16. The asynchronous nature of NDTP should make it unnecessary for a client 12 to open multiple NDTP/TCP connections to a single server 16.

If protocol errors are detected on an NDTP/TCP connection, the NDTP/TCP connection should be closed immediately. If further NDTP/TCP communication is required after an error has occurred, a new NDTP/TCP connection should be opened. Some examples of detectable protocol errors include:

- Illegal NDTP message operation code;
- Nonzero String Area Length in `NDTP_PUT_RSP` or `NDTP_GET_RSP`;
- Inconsistent String Area Length and String Length(s) in `NDTP_GET`, `NDTP_GET_RSP`, `NDTP_PUT` or `NDTP_DEL`;
- Unexpected NDTP request identifier by client.

Due to the reliable nature of TCP, NDTP/TCP servers 16 and clients 12 need not maintain any additional form of operation timeout. The only transport errors that can occur will result in gross connection level errors. A client 12 should assume that any NDTP requests 10 for which it has not received responses 14 have not been completed. Incomplete operations may be retried. However, whether unacknowledged NDTP requests 10 have

actually been completed is implementation dependent. Any partially received NDTP messages should also be ignored.

UDP Mapping

As those skilled in the art will appreciate, the Unreliable Datagram Protocol (UDP) is a best-effort datagram protocol that, like TCP, is also part of the universally implemented subset of the IP suite. UDP provides connectionless, unacknowledged datagram transmission. The minimal protocol overhead associated with UDP can deliver extremely high performance if used properly.

NDTP/UDP clients 12 send UDP datagrams with NDTP request messages 10 to a well-known UDP port (see above). NDTP/UDP servers 16 return NDTP response messages 14 to the client 12 selected local UDP port indicated in the NDTP/UDP datagram containing the requests 10. NDTP/UDP does not require any form of connection or other association to be established in advance. An NDTP interchange begins simply with the client request message 10.

For efficiency, the mapping of NDTP on to UDP permits multiple NDTP messages to be sent in a single UDP datagram. UDP datagrams encode the length of their payload, so when a UDP datagram is received, the exact payload length is available. The recipient of an NDTP/UDP datagram will read NDTP messages from the beginning of the UDP datagram payload until the payload is exhausted. Thus, a sender of an NDTP/UDP datagram is free to pack as many NDTP messages as will fit in a UDP datagram.

The largest possible UDP datagram payload is presently slightly smaller than 64K bytes. In addition, there may be a performance penalty sending UDP datagrams that are larger than the maximum datagram size allowed by the physical network links between the sender and intended recipient. IP provides mechanisms for discovering this maximum transfer size, called the Path Maximum Transfer Unit (Path MTU), but a discussion of these mechanisms is beyond the scope of this specification. An

implementation of NDTP/UDP should preferably respect these datagram size limitations.

Unlike TCP, UDP does not provide reliable data delivery. Therefore, an NDTP/UDP client 12 implementation should implement a timeout mechanism to await the response for each outstanding NDTP request 10. The exact duration of this response timer is implementation dependent, and may be set adaptively as a client 12 receives responses from a server 16, but a reasonable default maximum value is preferably 60 seconds. If a response 14 is not received within the response timeout, the client 12 may retransmit the request 10. NDTP/UDP servers 16 need not maintain any timeout mechanisms.

Depending upon the exact timeout values selected, the client 12 retry mechanism may place some requirements on a client's 12 use of the NDTP request identifier 18 field. If the response timer is shorter than the maximum lifetime of a datagram in the network, it is possible that a delayed response will arrive after the response timer for the associated request has expired. An NDTP/UDP client 12 implementation should ensure that this delayed response is not mistaken for a response to a different active NDTP request 10. Distinguishing current responses from delayed ones is called *antialiasing*. One presently preferred way to perform antialiasing in NDTP/UDP is to ensure that NDTP request identifier 18 values are not reused more frequently than the maximum datagram lifetime.

NDTP/UDP client 12 implementations that use the NDTP request identifier 18 for antialiasing should ignore (i.e., skip) NDTP messages within a NDTP/UDP datagram with invalid NDTP request identifier 18 values. Client 12 or server 16 NDTP/UDP implementations detecting any other protocol error should also preferably discard the remainder of the current NDTP/UDP datagram without processing any further NDTP requests from that datagram. Some examples of such detectable errors include:

- Illegal NDTP message operation code;
- Nonzero String Area Length in `NDTP_PUT_RSP` or `NDTP_GET_RSP`;

- Inconsistent String Area Length and String Length(s) in `NDTP_GET`, `NDTP_GET_RSP`, `NDTP_PUT` or `NDTP_DEL`;
- Inconsistent NDTP message length and UDP datagram length.

Because NDTP/UDP messages are limited to the length of a single UDP datagram payload, NDTP/UDP cannot be used to transfer long NDTP messages. For example, it would be very difficult to send an `NDTP_GET` message with NDTP/UDP for a 64K byte identifier string. This case is avoidable by a client 12 realizing that an NDTP message is too long to send as a UDP datagram and using NDTP/TCP instead. However, a greater limitation is that NDTP currently provides no mechanism for an NDTP server 16 to indicate that a response is too large to fit in a UDP datagram. In this case, the NDTP server 16 should not send a response 14, and it may or may not chose to complete the request 10. The recovery mechanism in this case preferably is, after several unsuccessful attempts to use NDTP/UDP, a client 12 may try again with NDTP/TCP.

Because UDP does not provide any form of congestion avoidance it is possible that the simple retry strategy specified for NDTP/UDP can create network congestion. Network congestion can cause a severe degradation in the successful delivery of *all* network traffic (not just NDTP traffic, nor just the traffic from the particular client/server 12, 16 pair) through a congested network link. Congestion will occur when an NDTP/UDP implementation is sending datagrams faster than can be accommodated through a network link. Sending a large number of NDTP/UDP datagrams all at once is the most likely way to trigger such congestion. Sending a single NDTP/UDP datagram, assuming it is smaller than the Path MTU, and then waiting for a response 14 is unlikely to create congestion. Therefore, the use of NDTP/UDP should be confined to contexts where clients 12 send few outstanding requests at a time, or where network congestion is avoided through network engineering techniques.

Those skilled in the art will appreciate that network congestion is a highly dynamic property that is a function of network traffic from all sources through a network link and will vary over time over any given network path.

An NDTP/UDP client 12 implementation can recover from network congestion by switching to NDTP/TCP after several failed retries using NDTP/UPD. Failure due to network congestion may be indistinguishable from failure due to UDP packet size limitations, but since the recovery strategy is the same in both cases, there is no need to distinguish these cases.

NDTP/UDP Congestion Avoidance

Given the stateless, transactional nature of NDTP, NDTP/UDP generally performs much better than NDTP/TCP. This performance improvement is measurable both in terms of the maximum sustainable transaction rate of an NDTP server 16, and the latency of a single response to an NDTP client 12. In the same way as the Domain Name Service (DNS), NDTP fits naturally in the UDP model. It is a working assumption of NDTP (and DNS) that for every NDTP transfer, there will be an associated transfer of real data that is an order of magnitude or more greater in size than the NDTP protocol traffic. This property will naturally limit the amount of NDTP traffic on a network. However, in applications where NDTP traffic reaches high levels, particularly at network 'choke points' which are not within the control of network engineers, it may be desirable to support a congestion avoidance mechanism for NDTP/UDP.

However, those skilled in the art will appreciate that the other main future requirement of NDTP, security (described below), implies an existing, durable association between NDTP clients 12 and NDTP servers 16. This association is much like (and in the case of SSL, it is) a network connection. Therefore, depending upon what security technology is applied, developing a congestion avoidance mechanism for NDTP/UDP may be an irrelevant exercise.

Server Redirection Mechanism

NDTP provides two mechanisms for server redirection. The redirection mechanisms allow cluster and hierarchical topologies, and mixtures of such topologies (described in detail below). The first redirection mechanism supported by NDTP, embedded redirection links, uses an application specific

convention to return redirection pointers as NDTP data location strings. For example, if location strings are W3C URLs, a URL with the schema *ndtp:* could be a server indirection pointer. An NDTP_GET_RSP message may contain any mixture of real data location strings and NDTP server redirection pointers. In this case, the client must issue the same NDPT_GET query message to other NDTP servers indicated by the redirection pointers. The total set of data location strings associated with the supplied identifier string is the collection of all the data location strings returned from all the NDTP servers queried. The embedded redirection link technique does not require any specific NDTP protocol support. Therefore, it could be used within the NDTP protocol as is, and does not require further description in this specification.

The second redirection mechanism, which is specified as a future extension of NDTP, is having the server return an NDTP_RDR_RSP message in response to an NDTP request for which the NDTP server has no ownership of the supplied identifier string. Those skilled in the art will note that unlike the embedded redirection links mechanism, the NDTP_RDR_RSP mechanism applies to all NDTP requests, not just NDTP_GET.

As mentioned above, the second redirection mechanism has two variants. The first variant of the NDTP_RDR_RSP function mechanism specifies a well-known function that all NDTP server and client implementations know when they are programmed, and the NDTP_RDR_RSP message carries a table of NDTP server URLs. The format of the NDTP_RDR_RSP message with an NDTP server URL table is shown in FIG. 9(a).

The appropriate NDTP server is selected from the table in the NDTP_RDR_RSP message by applying a well-known function to the identifier string and using the function result as an index into the NDTP server table. The well-known function preferably applied is the *hashpjw* function presented by Aho, Sethi and Ullman in their text *Compilers, Principles, Techniques and Tools*:

```
uint32_t
hash (uint8_t *s, uint32_t slen, uint32_t size)
{
  uint32_t g;
  uint32_t i;
      unit32_t h = 0;
  uint8_t c;

  for (i = 0; i < slen; i++) {
    c = s[i];
    h = (h << 4) + c;
    g = (h & 0xf0000000);
    if (g) {
      h ^= g >> 24;
      h ^= g;
    }
  }
  return h % size;
}
```

In this case, the *size* parameter is the number of elements in the NDTP server URL table returned in the NDTP_RDR_RSP message. For the hashpjw function to behave correctly, the *size* parameter must be a prime number, therefore the NDTP server URL table must also have a prime number of elements. Those skilled in the art will appreciate that the same NDTP server may appear multiple times in the NDTP server URL table. For example, if the server URL table has 2039 elements, by putting one NDTP server URL in the first 1019 table elements, and a second NDTP server URL in the second 1020 table elements, the responsibility for the index string space will be split roughly in half.

The second variant of the NDTP_RDR_RSP function mechanism specifies that a general function description will be sent to the NDTP client in the NDTP_RDR_RSP message. The NDTP client will apply this function to

the identifier string and the output of the function will be the NDTP server URL to which to send NDTP requests for the particular identifier string. The advantage of this technique over the well-know function approach is that it allows application-specific partitions of the identifier string space. This can permit useful administrative control. For example, if General Electric manages all identifiers beginning with the prefix "GE", a general function can be used to make this selection appropriately. The disadvantage of using a general function is it may be less efficient to compute than a well-known function.

There are a variety of possible mechanisms for sending function descriptions. NDTP is expected to be applied in environments that make extensive use of the Java programming platform. Therefore the `NDTP_RDR_RSP` mechanism preferably uses a feature of the Java programming language called "serialized representation" to communicate generalized functions in the `NDTP_RDR_RSP` message. A serialized form of a Java object is a stream of bytes that represents the precise state of the object, including its executable methods. For example, the Java Remote Method Invocation (RMI) mechanism uses serialized objects to send executable code to a remote platform for execution. The NDTP_RDR_RSP message contains the serialized form of an object implementing this Java interface:

```
interface NDTPRedirectFunction {
    String selectServer(byte[] identifier);
}
```

The format of the NDTP_RDR_RSP message with a Java Serialized form of the NDTP redirection function is specifically identified in FIG. 9(b).

The NDTP server redirection mechanism also permits construction of NDTP server clusters (described below). It is expected that the identifier string hash function will be defined at the time NDTP is implemented, but the actual list of NDTP servers 90 will change from application to application and within a single application throughout the lifetime of the system. Therefore, it

is necessary for clients to be able to discover updated NDTP server lists, and any other relevant dynamic parameters of the server selection function as these inputs change.

Hierarchical Server Topology

While the NDTP server topology supported by the server redirection mechanism described above and shown in FIGS. 9(a) and 9(b) is an extremely powerful and general scaling technique, suitable for diverse topology deployments, some applications might still benefit from a specifically hierarchical server topology. An NDTP server hierarchy 100, such as that shown in FIG. 10, permits identifier/location association data to be owned and physically controlled by many different entities. An NDTP server cluster should be managed by a single administrative entity 102, and the distribution of data can be for performance and scaling purposes. Furthermore, a server hierarchy would provide some fault isolation so portions of the identifier/location association data can be accessed and updated in the presence of failures of some NDTP servers 104. Finally, an NDTP server hierarchy can localize NDTP update operations (`NDTP_PUT` and `NDTP_DEL`), which can improve performance and reduce network load.

A hierarchical NDTP server topology also allows organizations to maintain their own local NDTP server 104 or NDTP server cluster 102 that manages associations to data locations that are within the organizations' control. Upper tier NDTP servers 108 would be used to link the various leaf NDTP servers 104.

Server Constellations

The NDTP server organization also allows NDTP servers to be combined in various ways to build server constellations that offer arbitrary server performance scalability and administrative control of the location of portions of the identifier/data location relationship mappings. Figure 11 illustrates an NDTP server constellation 110 as it relates to a client 112 and a data repository 114. In FIG. 10, the client 112 and data repository 114 of FIG. 11 were merged into the single client entity 106 for ease of discussion.

Their distinction can now be separated and identified in order to illustrate the storage and retrieval of data in a distributed data collection.

As shown in FIG. 11, a client 112 consults the server constellation 110, which may be construed in either of two forms (see FIGS. 12 and 13), and which returns location strings in response to a client 112 request. Once the client 112 has the location string for a particular unit of data, the client 112 contacts and retrieves information directly from the data repository 114. In one embodiment, if the client 112 contains a data repository 114, internal application logic would facilitate this interaction. Those skilled in the art will appreciate that the term "data collection" is being employed rather than the term "database" because database frequently invokes images of Relational Database Systems (which is only one application of the protocol); an NDTP data collection could just as easily be routing tables as it could be files or records in a RDBS database.

NDTP server constellations 110 preferably have two basic organizational paradigms: Client-Centric and Server-Centric. NDTP supports both by design, and both approaches apply to all aspects of managing the relationships between identifiers and locations, such as data retrieval, index manipulation, and server redirection. Each will be discussed separately below.

Client-Centric Approach

The first basic pattern that NDTP supports is driven by the client 112, and can be called "client-centric". Referring to FIG. 12, a single client (not shown) asks a server 120a in the server constellation 110 for operations that the client desires executed (represented by arrow 1 in FIG. 12). If the client doesn't receive the data requested, it will receive a redirection response message (`NDTP_RDR_RSP`) from the contacted server 120a (arrow 2). The client then uses the information it receives to ask another server 120b for the operations the client wants to initiate (arrow 3). A successful response from the second server 120b is then sent to the client (arrow 4).

This design constructs operating patterns for (1) redirection, (2) index operations, and (3) hierarchical or cluster topologies. The important point is that the Network Distributed Tracking Protocol is designed to support highly configurable methods for processing index-related operations.

NDTP supports two specific redirection mechanisms, which are not mutually exclusive and may be combined in any way within a single NDTP server constellation 110. This formation may increase performance when many clients (not shown) participate, since client processing is emphasized rather than server processing. The first NDTP redirection mechanism uses a distinctively encoded location string for each NDTP server 120a,b that contains additional location strings associated with the identifier string supplied in the NDTP request 122a,b. This is an embedded redirection link. For example, if location strings are some form of HTTP URL, a URL with the schema specifier *ndtp:* would indicate a redirection. Using this scheme, the location strings associated with an identifier string may be spread among multiple NDTP servers 120a,b. In addition to redirection, in FIG. 12, all index manipulation operations continue to apply, but they are directed at the correct NDTP server 110b for which they apply: NDTP_GET, NDTP_PUT, NDTP_DEL.

The second NDTP redirection mechanism uses a NDTP_RDR_RSP message to indicate that the server 120a to which the NDTP request 122a was directed does not contain any of the location strings associated with the identifier string supplied in the NDTP request 122a. The NDTP_RDR_RSP message contains all the information required for the originator of the NDTP request 122a to reissue the original NDTP request 122b to a different NDTP server 120b that does have location strings associated with the identifier string supplied in the NDTP request 122b. This information may be an array of NDTP server hosts from which one is selected by applying a well-known function to the identifier string supplied in the NDTP request 122b, or the communicated function to apply as well as a list or other description of the NDTP server hosts from which to choose, as described above.

Figure 12 illustrates a cluster topology for client interaction with NDTP servers 120. A single client queries a first server 120a (Server0), learns of a new index location (Server1), and then contacts that server 120b (Server1) for the operations it wishes to execute on the index that the client identifies. The basic idea is that a client asks a server 120a to process an index operation. If the contacted server 120a does not have all the information, as for example in a redirect, then it passes the request to another server 120b. If the second server 120b is appropriate it responds appropriately, or it passes the request on to another server (not shown), and so on. Figure 12 could also illustrate a hierarchical topology if a client (not shown) contacted another client in a handoff as shown in FIG. 10, where a client 106 "asks up" to another client 106, and so on.

Behind the scenes, the server constellation 110 could also be using a hierarchical organization or a cluster organization for managing indices. The important point of this topology is pushing processing emphasis toward clients (not shown) rather than toward servers 120a,b. Such protocol design has scale implications as the number of participating machines/mechanisms increases, since it distributes aggregate processing.

Server-Centric Approach

The second basic pattern that the Network Distributed Tracking Protocol provides is a "Server-Centric Approach". Figure 13 shows the server constellation 110 characterizing "server-centric" functionality. In this figure, an NDTP server 130a (Server0) receives a request 132a from a client (not shown). The server 130a (Server0) passes the request to a second server 130b (Server1), which is an appropriate server for the process, and the second server 130b returns a response 134a to the first server 130a (Server0). If the second server 130a (Server1) was not appropriate, it could pass the request to another server (not shown), and so on. Each NDTP server 130a,b will combine the results of NDTP requests 132a,b it has performed of other NDTP servers 130a,b with whatever responses 134a,b it generates locally for the original NDTP request 132a, and the combined

response 134b will be the appropriate response for the original NDTP request 132a.

This design constructs operating patterns for (1) index operations and (2) hierarchical or cluster topologies. The important point is that the Network Distributed Tracking Protocol is designed to support highly configurable methods for processing index-related operations, but this method emphasizes server-processing rather than client-processing. In FIG. 13, all index manipulation operations continue to apply, but they are directed at the correct NDTP server 130a,b for which they apply: NDTP_GET, NDTP_PUT, NDTP_DEL.

Figure 13 illustrates an hierarchical topology for client interaction with NDTP servers 130. A single client queries a first server 130a (Server0), which is not appropriate, and so the first server 130a (not the client) itself contacts an appropriate server 130b (Server1) for operations it "passes through" to execute on the index that the client has identified. Alternatively, FIG. 13 could illustrate a cluster topology if a server 130a contacted another server 130b in a what is known as a "peer" handoff. The important point of this topology is that it pushes processing emphasis toward servers 130a,b rather than toward clients. Since index processing services can be centralized, administration of the indices can be administered more conveniently in certain cases.

The simplest NDTP server constellation 110 is a single server 130, and the protocol is designed to permit massive scale with a single or simple server constellation. Highly configurable installations are possible using "client-centric" or "server-centric" techniques. NDTP server constellations 110 composed of more than one NDTP server may use any combination of the two approaches for performance optimization and data ownership properties. Client-centric and server-centric approaches can be used to build NDTP server clusters, NDTP server trees, NDTP server trees of NDTP server clusters, or any other useful configuration.

NDTP design thus explicitly addresses the emerging "peer-to-peer" topologies called "pure" and "hybrid". The "pure" peer-to-peer approach

emphasizes symmetric communication among peers, and is achievable through the "server-centric" approach. The "hybrid" peer-to-peer approach emphasizes asymmetric communication among non-peer participants, and is achievable through the "client-centric" approach. Beyond the pure and hybrid approaches that NDTP allows, as described above, NDTP permits any additional mixtures between client-centric and server-centric approaches to provide superior configurability and performance tuning.

Security

NDTP preferably has no provisions for security. Three key features of security should therefore be provided:

- Data privacy (encryption)
- Client 12 authentication
- Client 12 authorization

NDTP/TCP will be extended using SSL/X.509 to support these security features in a straightforward, 'industry standard' way.

Adding security to NDTP/UDP also requires technology other than SSL. For example, IPSec supports securing all IP traffic, not just TCP between two endpoints. IPSec is a somewhat more heavyweight technology than SSL, and the rate of adoption in industry is somewhat slow. Nonetheless, it can provide the relevant capabilities to NDTP/UDP.

Additional Transport Layers

The early-adopter portion of the industry is in a state of turmoil regarding network transport protocols. On one hand, TCP has provided decades of solid service, and is so widely implemented that the mainstream computer industry could not imagine using another protocol to replace it. On the other hand, TCP lacks several features that may be necessary to enable the next step in network applications. In particular, the TCP design assumed pure software implementations by relatively powerful host computer computers. However, developments in network technology have increased the packet rate that a TCP implementation must handle to deliver full network speed beyond the capabilities of even increasingly powerful host computers.

To take the next step, much of the packet processing work must be off-loaded to hardware, and TCP's design makes this very difficult.

It is unclear whether it will become possible to implement the relevant portions of TCP in hardware in a timely fashion. If this does not happen, one of the many new transport layers currently under development (ST, SCTP, VI, etc.) may emerge as a market leader in high performance networking. In this case, a layering of NDTP on top of a new hardware accelerated transport would permit NDTP servers to deliver greatly increased transaction rates. Even with the use of a hardware accelerated transport layer, however, the only benefit to a typical NDTP client would be lower cost of service due to cheaper NDTP server platform requirements. On the flip side, NDTP clients could likely still use a cheaper software implementation of the new transport because of individual clients' modest performance demands.

As can be seen, the Network Distributed Tracking Protocol is a networking protocol that runs on top of any stream (e.g. TCP) or datagram (e.g. UDP) network transport layer. The goal of NDTP is to support a network service that efficiently manages mappings from each individual key string, an identifier, to an arbitrary set of strings, locations. NDTP permits protocol participating clients to add and remove identifier/location associations, and request the current set of locations for an identifier from protocol servers.

NDTP is designed for use in the larger context of a distributed data collection. As such, it supports an architecture, in which information about where data associated with particular application entities, can be managed and obtained independently of the data itself. One way to understand this is as a highly dynamic DNS for data. DNS maintains a mapping between names and machines. NDTP and its associated servers maintain a mapping between entity identifiers and data locations. The identifier/location mapping maintained by NDTP servers is much more dynamic (more frequent updates), than the domain name/IP address mapping maintained by DNS. NDTP is designed to support very fast, very diverse, and very large scale mapping manipulations.

Regardless of the expected system context of NDTP in a distributed data collection, those skilled in the art will appreciate that NDTP can be used for any application in which one-to-zero or one-to-many associations among strings are to be maintained and accessed on a network. In applications of NDTP other than distributed databases, the term identifier is likely to make sense in most cases, but the term location may not. In any context, however, although NDTP supports identifier and location strings of up to 2^{32}-4 bytes in length, it is a general assumption that the strings are typically short.

Those skilled in the art will note that the invention provides for the management and manipulation of indices and their associated relationships. Even more importantly, it is the manipulation of dynamic and spontaneous relationships between indices and locations, not the indices and locations, that is the core significance. The Network Distributed Tracking Protocol was written to manipulate these relationships, of which indices (identifiers) and locations are components of the aggregate solution.

It is to be understood that a wide range of changes and modifications to the embodiments described above will be apparent to those skilled in the art, and are contemplated. It is therefore intended that the foregoing detailed description be regarded as illustrative, rather than limiting, and that it be understood that it is the following claims, including all equivalents, that are intended to define the spirit and scope of the invention.

WE CLAIM:

1. A network distributed tracking wire transfer protocol comprising:

a variable length identification string, the identification string for specifying the identity of an entity in a distributed data collection; and

a variable length location string, the location string for specifying the network location of data associated with an entity in a distributed data collection;

wherein a relationship between the identification string and the location string can be spontaneously and dynamically created and modified.

2. The network distributed tracking wire transfer protocol defined in claim 1, wherein the protocol is application independent.

3. The network distributed tracking wire transfer protocol defined in claim 1, wherein the protocol is organizationally independent.

4. The network distributed tracking wire transfer protocol defined in claim 1, wherein the protocol is geographically independent.

5. A system having a network distributed tracking wire transfer protocol for storing and identifying data with a distributed data collection, comprising:

a data repository, the data repository for storing data in a distributed data collection;

a client entity, the client entity for manipulating data in the distributed data collection; and

a first server entity, the first server entity operative to locate data in the distributed data collection;

wherein the client entity transmits an identifier string to the first server entity along with a client request and the first server entity provides at least one location string to the client entity in response thereto.

6. The system defined in claim 5, further comprising a second server entity coupled to the first server entity.

7. The system defined in claim 5, wherein the first server entity maps the identifier string received from the client entity to the at least one location string.

8. The system defined in claim 7, wherein the mapping is performed using a hash operation.

9. The system defined in claim 6, wherein the first server entity transmits the client request to the second server entity if the first server entity cannot provide the at least one location string to the client entity.

10. The system defined in claim 9, wherein the second server entity maps the identifier string received from the first server entity to the at least one location string.

11. The system defined in claim 10, wherein the second server entity transmits the at least one location string to the first server entity for transmission to the client entity.

12. A method for storing and retrieving tracking information over a network using a wire transfer protocol, comprising the steps of:

providing a location string and an identification string, the location string for specifying the location of data associated with an entity in a distributed data collection and the identification string for specifying the identification of an entity in the distributed data collection;

storing information at a data repository entity by associating an identification string with each particular stored unit of information and by mapping the identification string to at least one location string associated with the data repository entity, the identification string and the at least one location

string for a particular unit of information being stored at a first server entity coupled to the data repository entity;

transmitting a request from a client entity to the first server entity to retrieve at least one location string associated with a particular stored unit of information, the request including the identification string associated with the particular stored unit of information; and

receiving the request at the first server entity and responding to the client entity by providing at least one location string associated with the particular stored unit of information to the client entity.

13. The method for storing and retrieving tracking information defined in claim 12, further comprising the step of transmitting the request to a second server entity prior to responding to the client entity, the second server entity coupled to the first server entity and having stored therewith the mapping of the identification string and the at least one location string for the particular unit of information.

14. The method for storing and retrieving tracking information defined in claim 13, wherein the second server entity responds to the client entity by providing the location string associated with the particular stored unit of information to the second client entity.

15. The method for storing and retrieving tracking information defined in claim 12, wherein the lengths of the identification string and the at least one location string are variable.

16. The method for storing and retrieving tracking information defined in claim 12, further comprising the step of spontaneously and dynamically manipulating the mapping of an identification string to a location string.

ABSTRACT OF THE DISCLOSURE

A network distributed tracking wire transfer protocol for storing and retrieving data across a distributed data collection. The protocol includes a location string for specifying the network location of data associated with an entity in the distributed data collection, and an identification string for specifying the identity of an entity in the distributed data collection. According to the protocol, the length of the location string and the length of the identification string are variable, and an association between an identification string and a location string can be spontaneously and dynamically changed. The network distributed tracking wire transfer protocol is application independent, organizationally independent, and geographically independent. A method for using the protocol in a distributed data collection environment and a system for implementing the protocol are also provided.

doc-1650-20020605

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Bib Data Sheet

CONFIRMATION NO. 7777

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/661,222	09/13/2000 RULE	~~705~~ 709	2144 ~~2152~~	10406/43

APPLICANTS

John K. Overton, Chicago, IL;
Stephen W. Bailey, Chicago, IL;

**** CONTINUING DATA ***************************

THIS APPLN CLAIMS BENEFIT OF 60/153,709 09/14/1999

**** FOREIGN APPLICATIONS *********************

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 11/09/2000

** SMALL ENTITY **

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☒ no 35 USC 119 (a-d) conditions met ☐ yes ☒ no ☐ Met after Allowance Verified and Acknowledged Examiner's Signature Initials	IL	7	16	3

ADDRESS

757

TITLE

Network distributed tracking wire transfer protocol

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
410	No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
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FEE RECORD SHEET

09/25/2000 KHARLING 00000116 09661222
01 FC:201 345.00 OP

PTO-1556
(5/87)

*U.S. GPO: 1999-459-082/19144

PATENT APPLICATION FEE DETERMINATION RECORD
Effective December 29, 1999

Application or Docket Number: 09/466,220

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)	SMALL ENTITY TYPE ☑		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE	FEE		RATE	FEE
BASIC FEE	Provisional			345.00	OR		690.00
TOTAL CLAIMS	16 minus 20=	*	X$ 9=		OR	X$18=	
INDEPENDENT CLAIMS	3 minus 3 =	*	X39=		OR	X78=	
MULTIPLE DEPENDENT CLAIM PRESENT			+130=		OR	+260=	
			TOTAL	345	OR	TOTAL	1035

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X39=		OR	X78=	
+130=		OR	+260=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X39=		OR	X78=	
+130=		OR	+260=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X39=		OR	X78=	
+130=		OR	+260=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875
(Rev. 12/99)

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Example: 59 123 456 PA, 59 123 456 PB, 59 123 456 ZA, 59 123 456 ZB

09/661222 FA

Indicate quantity of a single type of artifact received but not scanned. Create individual artifact folder/ box and artifact number for each Artifact Type.

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Pages of specification and / or sequence listing and /or table
Doc Code: Artifact
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Doc Code: Artifact
☐ Artifact Type Code: S

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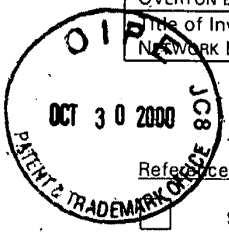
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☐ Other, description: _____
Doc Code: Artifact Artifact Type Code: Z

0230

TRANSMITTAL LETTER			Case No. 10406/43
Serial No. 09/661,222	Filing Date September 13, 2000	Examiner	Group Art Unit
Inventor(s) OVERTON ET AL.			
Title of Invention NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL			



TO THE COMMISSIONER FOR PATENTS

☐ Transmitted herewith is a Information Disclosure Statement (2 pages); Form PTO-1449 (2 pages); 51 U.S. References; 6 Foreign References; 5 Other Art References; Postcard Receipt.

☐ Small entity status of this application under 37 CFR § 1.27 has been established by verified statement previously submitted.

☐ A verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27 is enclosed.

☐ Petition for a _____month extension of time.

☐ No additional fee is required.

☐ The fee has been calculated as shown below:

	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Small Entity Rate	Small Entity Add'l Fee	or	Other Than Small Entity Rate	Other Than Small Entity Add'l Fee
Total		Minus			x $9 =			x $18 =	
Indep.		Minus			x 40 =			x $80 =	
First Presentation of Multiple Dep. Claim					+ $135 =			+ $270 =	
					Total add'l fee	$		Total add'l fee	$

☐ Please charge Deposit Account No. 23-1925 (BRINKS HOFER GILSON & LIONE) in the amount of $_____. A duplicate copy of this sheet is enclosed.

☐ A check in the amount of $_____ to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this communication or credit any overpayment to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

☒ I hereby petition under 37 CFR § 1.136(a) for any extension of time required to ensure that this paper is timely filed. Please charge any associated fees which have not otherwise been paid to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Joseph F. Hetz
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

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Joseph F. Hetz - Reg. No. 41,070
Name of Applicant, Assignee or Registered Representative

Signature



Patent
Our Case No. 10406-43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		)
	Overton et al.	)
		)
Serial No.:	09/661,222	)
		)
Filed:	September 13, 2000	)
		)
For:	Network Distributed Tracking Wire Transfer Protocol	)

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Pursuant to the obligation under 37 C.F.R. § 1.56 and in conformance with 37 C.F.R. §§ 1.97-1.99, Applicants hereby submit documents A1-A62 listed on the attached form PTO-1449 for consideration by the Examiner. Copies of the documents are enclosed herewith. Applicants respectfully request that the Examiner review the entire disclosure of these documents and make them of record.

Applicants also would like to bring the Examiner's attention to the following three pending U.S. patent applications:

U.S. patent application serial number 09/503,441; filed February 14, 2000; titled "Automated System for Image Archiving"

U.S. patent application serial number 09/111,896; filed July 8, 1998; titled "System and Method for Establishing and Retrieving Data Based on Global Indices"

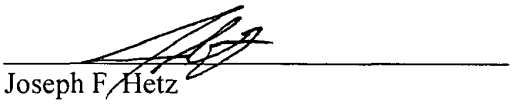
U.S. patent application serial number 09/367,461; filed August 13, 1999; titled "Automated Image Archiving System"

Also, Applicants note that document A52 is a published PCT application corresponding to the '461 patent application and that document A53 is a published PCT application corresponding to the '896 patent application.

The filing of this Information Disclosure Statement does not constitute an admission that the information cited herein is, or is considered to be, material to patentability as defined in 37 C.F.R. § 1.56(b). Further, Applicants reserve the right to contest that these documents are prior art against the present application.

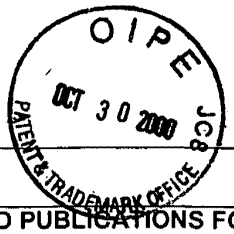
Dated: October 26, 2000

Respectfully submitted,



Joseph F. Hetz
Reg. No. 41,070
Attorney for Applicants

BRINKS HOFER
GILSON & LIONE
P.O. Box 10395
Chicago, Illinois 60610
(312) 321-4719



FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 10406/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT
(use several sheets if necessary)	APPLICANT(S): OVERTON ET AL.	

REFERENCE DESIGNATION **U.S. PATENT DOCUMENTS**

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
	A1	5,384,643	01/24/95	INGA ET AL.		
	A2	5,208,623	05/04/93	TAKAHASHI		
	A3	5,124,814	06/23/92	TAKAHASHI ET AL.		
	A4	4,553,261	11/12/85	FROESSL		
	A5	5,008,700	04/16/91	OKAMOTO		
	A6	5,193,185	03/09/93	LANTER		
	A7	5,579,067	11/26/96	WAKABAYASHI		
	A8	5,455,648	10/03/95	KAZAMI		
	A9	5,649,247	07/15/97	ITOH ET AL.		
	A10	5,319,401	06/07/94	HICKS		
	A11	4,728,978	03/01/88	INOUE ET AL.		
	A12	5,669,029	09/16/97	FYSON ET AL.		
	A13	5,875,302	02/23/99	OBHAN		
	A14	5,872,973	02/16/99	MITCHELL ET AL.		
	A15	5,848,246	12/08/98	GISH		
	A16	5,813,006	09/22/98	POLNEROW ET AL.		
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	A18	5,802,518	09/01/98	KARAEV ET AL.		
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	A33	5,961,610	10/05/99	KELLY ET AL.		
	A34	5,995,965	11/30/99	EXPERTON		
	A35	5,940,844	08/17/99	CAHILL ET AL.		
	A36	4,800,488	01/24/89	AGRAWAL ET AL.		
	A37	4,825,406	04/25/89	BEAN ET AL.		

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 10406/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT
(use several sheets if necessary)	APPLICANT(S): Overton ET AL.	

REFERENCE DESIGNATION **U.S. PATENT DOCUMENTS**

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
	A38	4,914,571	04/03/90	BARATZ ET AL.		
	A39	5,414,841	05/09/95	BINGHAM ET AL.		
	A40	5,522,077	05/28/96	CUTHBERT ET AL.		
	A41	5,537,547	07/16/96	CHAN ET AL.		
	A42	5,557,790	09/17/96	BINGHAM ET AL.		
	A43	5,560,005	09/24/96	HOOVER ET AL.		
	A44	5,625,841	04/29/97	DAWKINS ET AL.		
	A45	5,809,331	09/15/98	STAATS ET AL.		
	A46	5,907,837	05/25/99	FERREL ET AL.		
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	A48	5,978,773	11/02/99	HUDETZ ET AL.		
	A49	6,032,175	02/29/00	FLETCHER ET AL.		
	A50	6,047,332	04/04/00	VISWANATHAN ET AL.		
	A51	6,055,544	04/25/00	DEROSE ET AL.		

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EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS/ SUBCLASS	TRANSLATION YES	NO
	A52	WO 98/31138	07/16/98	PCT			
	A53	WO 00/03526	01/20/00	PCT			
	A54	EPO 568 161 A1	03/11/93	EPO			
	A55	WO 86/05610	09/25/86	PCT			
	A56	0 889 422 A2	01/07/99	EPO			
	A57	WO 98/15910	04/16/98	PCT			

EXAMINER INITIAL		OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)
	A58	Callaghan V L et al: "Structures and Metrics for Image Storage and Interchange" Journal of Electronic Imaging, vol. 2, no. 2, 1 april 1993, pages 126-137.
	A59	Bourke D G et al: "Programmable Module and Circuit for Machine-Readable Unique Serial Number" IBM Technical Disclosure Bulletin, vol. 27, no. 4A, 1 September 1984 pages 1942-1944.
	A60	Kleinholz L et al: "Supporting Cooperative Medicine: The Bermed Project" IEEE Multimedia, vol. 1, no. 4, 21 December 1994 pages 44-53.
	A61	"Method for Network Naming and Routing" IBM Technical Disclosure Bulletin, vol. 37, no. 9, 1 September 1994 page 255.
	A62	"Minimizing Locking To Access Global Shared Data", IBM Technical Disclosure Bulletin, pp 619-622, February 1995.

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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(71) Applicant: **Sun Microsystems, Inc.**
Palo Alto, California 94303-0900 (US)

(72) Inventors:
- **Viswanathan,Srinivasan**
  Fremont California 94536 (US)
- **Nazari Siamak**
  Arcadia California 91006 (US)
- **Swaroop ,Anil**
  Loma Linda California 92354 (US)
- **Khalidi,Yousef**
  Sunnyvale California 94086 (US)

(74) Representative: **Harris, Ian Richard et al**
D. Young & Co.,
21 New Fetter Lane
London EC4A 1DA (GB)

(54) Global file system-based system and method for rendering devices on a cluster globally visible

(57) A system and method are disclosed for rendering devices on a cluster globally visible, wherein the cluster includes a plurality of nodes on which the devices are attached. The system establishes for each of the devices in the cluster at least one globally unique identifier enabling global access to the device. The system includes a device registrar that creates the identifiers and a global file system. The identifiers include a globally unique logical name by which users of the cluster identify the device and a globally unique physical name by which the global file system identifies the device. The registrar creates a one-to-one mapping between the logical name and the physical name for each of the devices. The system also includes a device information (dev_info) data structure maintained by the device registrar that represents physical associations of the devices within the cluster. Each association corresponds to the physical name of a device file maintained by the global file system. The device registrar determines for an attached device a globally unique, device type (dev_t) value; creates dev_info data structure entry and a corresponding physical name; generates a logical name based on the dev_t value and the physical name; and associates the dev_t value with the device file representing the attached device. Given this framework, a user of the cluster can access any of the devices by issuing the global file system an access request identifying the device to be accessed by its logical name.

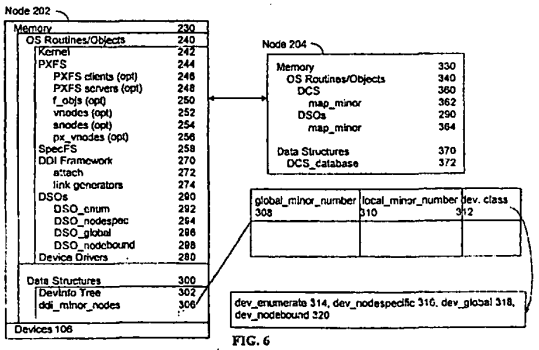


FIG. 6

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Description

The present invention relates generally to systems and methods that provide device access through a file system and, particularly, to systems and methods for rendering devices on a cluster globally visible.

BACKGROUND OF THE INVENTION

It has become increasingly common for Unix-based computer applications to be hosted on a cluster that includes a plurality of computers. It is a goal of cluster operating systems to render operation of the cluster as transparent to applications/users as if it were a single computer. For example, a cluster typically provides a global file system that enables a user to view and access all conventional files on the cluster no matter where the files are hosted. This transparency does not, however, extend to device access on a cluster.

Typically, device access on Unix-based systems is provided through a special file system (e.g., SpecFS) that treats devices as files. This special file system operates only on a single node. That is, it only allows a user of a particular node to view and access devices on that node, which runs counter to the goal of global device visibility on a cluster. These limitations are due to the lack of coordination between the special file systems running on the various nodes as well as a lack of a device naming strategy to accommodate global visibility of devices. These aspects of a prior art device access system are now described with reference to FIGS. 1-4.

Referring to FIG. 1, there is shown a block diagram of a conventional computer system 100 that includes a central processing unit (CPU) 102, a high speed memory 104, a plurality of physical devices 106 and a group of physical device interfaces 108 (e.g., busses or other electronic interfaces) that enable the CPU 102 to control and exchange data with the memory 102 and the physical devices 106. The memory 102 can be a random access memory (RAM) or a cache memory.

The physical devices 106 can include but are not limited to high availability devices 112, printers 114, kernel memory 116, communications devices 118 and storage devices 120 (e.g., disk drives). Printers 114 and storage devices 120 are well-known. High availability devices 112 include devices such as storage units or printers that have associated secondary devices. Such devices are highly available as the secondary devices can fill in for their respective primary device upon the primary's failure. The kernel memory 116 is a programmed region of the memory 102 that includes accumulating and reporting system performance statistics. The communications devices 118 include modems, ISDN interface cards, network interface cards and other types of communication devices. The devices 106 can also include pseudo devices 122, which are software devices not associated with an actual physical device.

The memory 104 of the computer 100 can store an operating system 130, application programs 150 and data structures 160. The operating system 130 executes in the CPU 102 as long as the computer 100 is operational and provides system services for the processor 102 and applications 150 being executed in the CPU 102. The operating system 130, which is modeled on v. 2.6. of the Solaris™ operating system employed on Sun® workstations, includes a kernel 132, a file system 134, device drivers 140 and a device driver interface (DDI) framework 142. Solaris and Sun are trademarks and registered trademarks, respectively, of Sun Microsystems, Inc. The kernel 116 handles system calls from the applications 150, such as requests to access the memory 104, the file system 134 or the devices 106. The file system 134 and its relationship to the devices 106 and the device drivers 140 is described with reference to FIGS. 2A and 2B.

Referring to FIG. 2A, there is shown a high-level representation of the file system 134 employed by v. 2.6 and previous versions of the Solaris operating system. In Solaris, the file system 134 is the medium by which all files, devices 106 and network interfaces (assuming the computer 100 is networked) are accessed. These three different types of accesses are provided respectively by three components of the file system 134: a Unix file system 138u (UFS), a special file system 138s (SpecFS) and a network file system 138n (NFS).

In Solaris, an application 150 initially accesses a file, device or network interface (all referred to herein as a target) by issuing an open request for the target to the file system 134 via the kernel 132. The file system 134 then relays the request to the UFS 138u, SpecFS 138s or NFS 138n, as appropriate. If the target is successfully opened, the UFS, SpecFS or NFS returns to the file system 134 a vnode object 136 that is mapped to the requested file, device or network node. The file system 134 then maps the vnode object 136 to a file descriptor 174, which is returned to the application 150 via the kernel 132. The requesting application subsequently uses the file descriptor 174 to access the corresponding file, device or network node associated with the returned vnode object 136.

The vnode objects 136 provide a generic set of file system services in accordance with a vnodeNFS interface or layer (VFS) 172 that serves as the interface between the kernel 132 and the file system 134. Solaris also provides inode, snode and mode objects 136i, 136s, 136r that inherit from the vnode objects 136 and also include methods and data structures customized for the types of targets associated with the UFS, SpecFS and NFS, respectively. These classes 136i, 136s and 136r form the low level interfaces between the vnodes 136 and their respective targets. Thus, when the UFS, SpecFS or NFS returns a vnode object, that object is associated with a corresponding inode, snode or

rnode that performs the actual target operations. Having discussed the general nature of the Solaris file system, the focus of the present discussion will now shift to the file-based device access methods employed by Solaris.

Referring to FIG. 2B, Solaris applications 150 typically issue device access requests to the file system 134 (via the kernel 132) using the logical name 166 of the device they need opened. For example, an application 150 might request access to a SCSI device with the command: *open(/dev/dsk/disk_logical_address).* The logical name, */dev/dsk/disk_logical_address,* indicates that the device to be opened is a disk at a particular logical address. In Solaris, the logical address for a SCSI disk might be "c0t0d0sx", where "c0" represents SCSI controller 0, t0 represents target 0, d0 represents disk 0, and sx represents the xth slice for the particular disk (a SCSI disk drive can have as many as eight slices).

The logical name is assigned by one of the link generators 144, which are user-space extensions of the DDI framework 142, and is based on information supplied by the device's driver 140 upon attachment of the device and a corresponding physical name for the device generated by the DDI framework 142. When an instance of a particular device driver 140 is attached to the node 100, the DDI framework 142 calls the attach routine of that driver 140. The driver 140 then assigns a unique local identifier to and calls the ddi_create_minor_nodes method 146 of the DDI framework 142 for each device that can be associated with that instance. Typically, the unique local identifier constitutes a minor name (e.g., "a") and a minor number (e.g., "2"). Each time it is called, the ddi_create_minor_nodes method 146 creates a leaf node in the DevInfo tree 162 that represents a given device. For example, because a SCSI drive (i.e., instance) can have up to eight slices (i.e., devices), the local SCSI driver 140 assigns unique local identifiers to each of the eight slices and calls the ddi_create_minor_nodes method 146 with the local identifiers up to eight times.

Also associated with each device 106 is a UFS file 170 that provides configuration information for the target device 106. The name of a particular UFS file 170i is the same as a physical name 168i derived from the physical location of the device on the computer. For example, a SCSI device might have the following physical name 168, */devices/iommu/sbus/esp1/sd@addr:minor_name,* where *addr is* the address of the device driver sd and *minor_name* is the minor name of the device instance, which is assigned by the device driver sd. How physical names are derived is described below in reference to FIG. 3.

To enable it to open a target device given the target device's logical name, the file system 134 employs a logical name space data structure 164 that maps logical file names 166 to physical file names 168. The physical names of devices 106 are derived from the location of the device in a device information (DevInfo) tree 140 (shown in FIG. 1), which represents the hierarchy of device types, bus connections, controllers, drivers and devices associated with the computer system 100. Each file 170 identified by a physical name 168 includes in its attributes an identifier, or dev_t (short for device type), which is uniquely associated with the target device. This dev_t value is employed by the file system 134 to access the correct target device via the SpecFS 138s. It is now described with reference to FIG. 3 how dev_t values are assigned and the DevInfo tree 140 maintained by the DDI framework 142.

Referring to FIG. 3, there is shown an illustration of a hypothetical DevInfo tree 162 for the computer system 100. Each node of the DevInfo tree 162 corresponds to a physical component of the device system associated with the computer 100. Different levels correspond to different levels of the device hierarchy. Nodes that are directly connected to a higher node represent objects that are instances of the higher level object. Consequently, the root node of the DevInfo tree is always the "/" node, under which the entire device hierarchy resides. The intermediate nodes (i.e., nodes other than the leaf and leaf-parent nodes) are referred to as nexus devices and correspond to intermediate structures, such as controllers, busses and ports. At the next to bottom level of the DevInfo tree are the device drivers, each of which can export, or manage, one or more devices. At the leaf level are the actual devices, each of which can export a number of device instances, depending on the device type. For example, a SCSI device can have up to seven instances.

The hypothetical DevInfo tree 162 shown in FIG. 3 represents a computer system 100 that includes an input/output (i/o) controller for memory mapped i/o devices (iommu) at a physical address *addr0.* The iommu manages the CPU's interactions with i/o devices connected to a system bus (sbus) at address *addr1* and a high speed bus, such as a PCI bus, at address *addr2.* Two SCSI controllers (esp1 and esp2) at respective addresses *addr3* and *addr4* are coupled to the sbus along with an asynchronous transfer mode (ATM) controller at address *addr5.* The first SCSI controller esp1 is associated with a SCSI device driver (sd) at address 0 (represented as @0) that manages four SCSI device instances (dev0, dev1, dev2, dev3). Each of these device instances corresponds to a respective slice of a single, physical device 106. The first SCSI controller esp1 is also associated with a SCSI device driver (sd) at address 1 that manages plural SCSI device instances (not shown) of another physical device 106.

Each type of device driver that can be employed with the computer system 100 is assigned a predetermined, unique major number. For example, the SCSI device driver sd is assigned the major number 32. Each device is associated with a minor number that, within the group of devices managed by a single device driver, is unique. For example, the devices dev0, dev1, dev2 and dev3 associated with the driver sd at address 0 have minor numbers 0, 1, 2 and 3 and minor names a, b, c, d, respectively. Similarly, the devices managed by the driver sd at address 1 would have minor numbers distinct from those associated with the devices dev0-dev3 (e.g., four such might have minor numbers

4-7). The minor numbers and names are assigned by the parent device driver 140 (FIG. 1) for each new device instance (recall that a SCSI instance might be a particular SCSI drive and a SCSI device a particular slice of that drive). This ensures that each device exported by a given device driver has a unique minor number and name. That is, a driver manages a minor number-name space.

Each minor number, when combined with the major number of its parent driver, forms a dev_t value that uniquely identifies each device. For example, the devices dev0, dev1, dev2 and dev3 managed by the driver sb at address 0 have respective dev_t values of (32,0), (32,1), (32,3) and (32,3). The SpecFS 138s maintains a mapping of dev_t values to their corresponding devices. As a result, all device open requests to the SpecFS identify the device to be opened using its unique dev_t value.

The DevTree path to a device provides that device's physical name. For example, the physical name of the device dev0 is given by the string:
/device/iommu@addr0/sbus@addr1/esp1@addr3/sd@0:a, where *sd@0:a* refers to the device managed by the sd driver at address 0 whose minor name is a; i.e., the device dev0. The physical name identifies the special file 170 (shown in FIG. 2) (corresponding to an snode) that holds all of the information necessary to access the corresponding device. Among other things, the attributes of each special file 170 hold the dev_t value associated with the corresponding device.

As mentioned above, a link_generator 144 generates a device's logical name from the device's physical name according to a set of rules applicable to the devices managed by that link generator. For example, in the case of the device dev0 managed by the driver sd at address 0, a link generator for SCSI devices could generate the following logical name, */dev/dsk/c0t0d0s0,* where cO refers to the controller esp1@addr3, *t0* refers to the target id the physical disk managed by the sd@0 driver, d0 refers to the sd@0 driver and *s0* designates the slice with minor name a and minor number 0. The device dev0 associated with the sd@1 driver could be assigned the logical name, *dev/dsk/c0t1d1s4,* by the same link generator 144. Note that the two dev0 devices have logical names distinguished by differences in the target, disk and slice values. It is now described with reference to FIG. 4 how this infrastructure is presently employed in Solaris to enable an application to open a particular device residing on the computer 100.

Referring to FIG. 4, there is shown a flow diagram of operations performed in the memory 104 of the computer 100 by various operating system components in the course of opening a device as requested by an application 150. The memory 104 is divided into a user space 104U in which the applications 150 execute and a kernel space 104K in which the operating system components execute. This diagram shows with a set of labeled arrows the order in which the operations occur and the devices that are the originators or targets of each operation. Where applicable, dashed lines indicate an object to which a reference is being passed. Alongside the representation of the memory 104, each operation associated with a labeled arrow is defined. The operations are defined as messages, or function calls, where the message name is followed by the data to be operated on or being returned by the receiving entity. For example, the message (4-1), "open(logical_name)," is the message issued by the application 150 asking the kernel 132 to open the device represented in the user space 104U by "logical_name". In this particular example, the application is seeking to open the device dev2.

After receiving the open message (4-1), the kernel 132 issues the message (4-2), "get_vnode(logical_name)," to the file system 134. This message asks the file system 134 to return the vnode of the device dev2, which the kernel 132 needs to complete the open operation. In response, the file system 134 converts the logical name 166 to the corresponding physical name 168 using the logical name space 164. The file system 134 then locates the file designated by the physical name and determines the dev_t value of the corresponding device from that file's attributes. Once it has acquired the dev_t value, the file system 134 issues the message (4-3), "get_vnode(dev_t)," to the SpecFS 138s. This message asks the SpecFS 138s to return a reference to a vnode linked to the device dev2. Upon receiving the message (4-3) the SpecFS 138s creates the requested vnode 136 and an snode 136s, which links the vnode 136 to the device dev2, and returns the reference to the vnode 136 (4-4) to the file system 134. The file system 134 then returns the vnode reference to the kernel (4-5).

Once it has the vnode reference, the kernel 132 issues a request (4-6) to the SpecFS 138s to open the device dev2 associated with the vnode 136. The SpecFS 138s attempts to satisfy this request by issuing an open command (4-7) to driver 2, which the SpecFS knows manages the device dev2. If driver 2 is able to open the device dev2, it returns an open_status message (4-8) indicating that the open operation was successful. Otherwise, driver 2 returns a failure indication in the same message (4-8). The SpecFS 138s then returns a similar status message (4-9) directly to the kernel 132. Assuming that "success" was returned in message (4-9), the kernel 132 returns a file descriptor to the application 150 that is a user space representation of the vnode 136 linked to the device dev2 (4-10). The application 150, once in possession of the file descriptor, can access the device dev2 via the kernel 132 and the file system 134 using file system operations. For example, the application 150 performs inputs data from the device dev2 by issuing read requests directed to the returned file descriptor. These file system commands are then transformed into actual device commands by the SpecFS 136s and the vnode and snode objects 136, 136s that manage the device dev2.

Consequently, Solaris enables users of a computer system 100 to access devices on that system 100 with relative

ease. However, the methods employed by Solaris do not permit users to transparently access devices across computers, even when the different computers are configured as part of a cluster. That is, an application running on a first computer cannot, using Solaris, transparently open a device on a second computer.

The reason that the current version of Solaris cannot provide transparent device access in the multi-computer situation has to do with the way the dev_t and minor numbers are currently assigned when devices are attached. Referring again to FIG. 3, each time a device is attached to the computer 100 the device's associated driver assigns that device a minor number that is unique within the set of devices controlled by that driver and therefore can be mapped to a unique dev_t value for the computer 100 when combined with the driver's major number. However, if the same devices and driver were provided on a second computer, the driver and devices would be assigned a similar, if not identical, set of major and minor numbers and dev_t values. For example, if both computers had a SCSI driver sd (major num = 32) and four SCSI device instances managed by the SCSI driver sd, each-driver sd would allocate the same set of minor numbers to their local set of SCSI devices (e.g., both sets would have minor numbers between 0 and 3). Consequently, keeping in mind that a device is accessed according to its dev_t value, if a first node application wanted to open a SCSI disk on the second node, that application would not be able to unambiguously identify the SCSI disk to the SpecFS on either computer system.

Therefore, there is a need for a file-based device access system that enables applications, wherever they are executing, to transparently access devices resident on any node of a computer cluster.

SUMMARY OF THE INVENTION

Particular and preferred aspects of the invention are set out in the accompanying independent and dependent claims. Features of the dependent claims may be combined with those of the independent claims as appropriate and in combinations other than those explicitly set out in the claims.

In summary, the present invention is a system and method for use in a cluster that maps local device names to globally unique, logical names that enable an application running on any of the cluster nodes to access a device located on a different cluster node.

In particular, a preferred embodiment includes a global file system for the cluster, a device driver interface and a device information tree. The DDI determines for at least the instances associated with a subset of predetermined device classes whether the local device name is globally unique. If the local device name is not globally unique, the DDI determines a globally unique identifier for the respective local instance. The device information tree, which is maintained by the device driver interface, represents physical associations of the devices within the cluster. Each path between a root node and a leaf node of the device information tree corresponds to the physical name of a device file maintained by the global file system that represents a respective one of the device instances. The link generator generates for each instance a logical name based on the globally unique identifer that is mapped to that instance's corresponding physical name and associates the globally unique identifier of a particular instance with the device file representing that particular instance.

Given this framework, a user of the cluster can access any of the devices by issuing the global file system an access request identifying the device to be accessed by its logical name. The global file system resolves the access request by converting the logical name to the corresponding physical name, accessing the globally unique identifier of the device via the device file identified by the physical name, and then accessing the device identified by its globally unique identifier.

In a preferred embodiment, the global file system might be hosted on only one of the network nodes and each of the nodes hosts instances respectively of the device driver interface and the device information tree. In this embodiment the links between the global file system and the respective device driver interfaces is provided by a proxy file system. The preferred embodiment can also include a plurality of device drivers for managing the devices, each of which can assign the local device names to the instances. These device drivers are co-located with the various device driver interfaces.

A preferred set of the predetermined device classes include:

"dev_enumerate," which designates devices with at least one instance managed by a particular driver, each of the instances managed by the particular driver on a particular node being individually enumerated;
"dev_nodespecific," which designates devices available on each node that are typically accessed only locally and have a 1-1 relationship with their managing driver on each node;
"dev_global," which designates devices that can be accessed from drivers on any node; and
"dev_nodebound," which designates devices that are typically accessed only by a driver on a particular node and have a 1-1 relationship with that driver.

An aspect of the invention is the definition of a set of rules for converting the local device names of instances of

the respective device classes to the corresponding globally unique identifier and logical name. In particular, the local device name of a dev_enumerate device comprises a combination of the device name and a local minor number that is locally unique, the globally unique identifier comprises a global minor number, and the logical name comprises a combination of the device name and the global minor number. Similarly, each of the local device name and logical name of a dev_nodespecific device is formed from the device name, and each of the local device name and logical name of a dev_global device is formed from the device name.

An embodiment of the invention also incorporates a device configuration system (DCS) hosted on one of the cluster nodes that maintains a persistent DCS database listing for each device in the cluster the device name, a major number of the device driver that manages the logical device, the global minor number and a hostid of the node hosting the logical device. The DDI generates the globally unique identifier, the logical name and the physical name for each logical device based on the assistance of the DCS, which, using the DCS database, generates the global minor numbers for each of the devices on behalf of the DDI.

An embodiment of the invention can also be a system for rendering devices on a cluster globaly visible, wherein the cluster includes a plurality of nodes on which the devices are attached. A preferred system comprises a device registrar that establishes for each of the devices at least one globally unique identifier enabling that device to be accessed from any of the nodes. This sytem can include a global file system running on the cluster wherein the at least one globally unique identifier includes a globally unique logical name by which users of the cluster identify the device and a globally unique physical name by which the global file system identifies the device. In a preferred embodiment, there is a one-to-one mapping between the logical name and the physical name for each of the devices, which is established by the device registrar.

An embodiment of the invention can also include a device information (dev_info) data structure maintained by the device registrar representing physical associations of the devices within the cluster, each of the physical associations corresponding to a physical name of a device file maintained by the global file system that represents a respective one of the devices. Given this framework, a preferred embodiment of the device registrar determines for an attached device a globally unique, device type (dev_t) value; creates an entry in the dev_info data structure and a corresponding physical name for the attached device; generates for the attached device a logical name based on the dev_t value and the corresponding physical name; and associates the dev_t value of the attached device with the device file representing the attached device.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the invention are described hereinafter, by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a block diagram of a prior art computer system showing components used to provide access to devices on a single computer;

FIG. 2 is a block diagram showing the relationships in the prior art between applications, the operating system kernel, the file system and the devices;

FIG. 2B is a block diagram showing the relationships in the prior art between device logical names, physical names, the file system, device type identifiers (dev_t) and devices.

FIG. 3 is a diagram of an exemplary device information tree (DevInfo Tree) consistent with those employed in the prior art.

FIG. 4 is a flow diagram of operations performed in the memory 104 of the prior art computer system 100 in the course of opening a device as requested by an application 150;

FIG. 5 is a block diagram of a computer cluster in which the present invention can be implemented;

FIG. 6 is a block diagram of memory programs and data structures composing the present invention as implemented in representative nodes 202 and 204 of the cluster of FIG. 5;

FIG. 7A is a flow diagram that illustrates the operations by which the device driver interface (DDI) Framework and the device configuration system (DCS) establish an appropriate dev_t value, logical name and physical name for a device being attached to the node 202;

FIG. 7B illustrates the relationship between the local minor name/number, physical name and logical name established by the present invention; and

FIGS. 8A and 8B are flow diagrams that illustrate the steps performed by the present invention in response to a request from an application 150 executing on a node 202-1 to access (open) a device that resides on a node 202-3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Figure 5, there is shown a block diagram of a computer cluster 210 in which the present invention can be implemented. The cluster 201 includes a plurality of nodes 202 with associated devices 106 and applications 150. As in FIG. 1, the devices 106 can include high availability devices 112, printers 114, kernel memory 116, communication devices 118 and storage devices 120. For the purposes of the present discussion a global file system 206, which maintains a single, global file space for all files stored on the cluster 201, runs on one of the nodes 202. The global file system 206 supports at least two representations of the devices 106. The physical name space (PNS) representation 305 is accessible from kernel space and corresponds to the physical arrangement of the device 106 on the respective nodes 202. The logical name space (LNS) representation 304 is a user space version of the physical name space 305; i.e., each entry in the logical name space 304 maps to a corresponding entry in the physical name space 305. The present invention modifies many aspects of this global file system 206 to allow transparent, global access to the devices 106 by the applications 150. The cluster 201 also includes a node 204 that hosts a device configuration system (DCS) 208 that is a key component of an embodiment of the invention.

In other embodiments there might be any number of global file systems 206, each of which maintains its own physical and logical name spaces. In such an environment a particular device is accessed through only of the global file systems 206 and its associated physical and logical name spaces.

As described above in reference to FIGS. 1-4, the prior Solaris device access system allows transparent device access only within a single computer system. Certain aspects of the way in which the prior art generates the logical names that are mapped by the file system to the dev_t value of the device to be accessed are not compatible with extending the current device access system to a cluster. For example, assuming that the sets of devices 106-1, 106-2 each included four SCSI disk drives, the logical naming system presently employed would result in different drives on the different nodes 106-1, 106-2 having the same dev_t value. This would make it impossible for an application 150-1 to access transparently a specific one of the disk drives on the node 202-2. It is now described how an embodiment of the invention provides such transparent, global device access.

Referring to FIG. 6, there are shown additional details of a representative one of the nodes 202 and the node 204, which hosts the DCS 208. The file system 206 is not shown in this figure as it resides only on one particular node 202-2. Each node 202 includes a memory 230 in which operating system (OS) routines/objects 240 and data structures 300 are defined. The OS routines 240 include an operating system kernel 242, a proxy file system (PxFS) 244, a special file system 258, a device driver framework (DDI) 270, a set of device server objects (DSO) and device drivers 280.

As described above, the kernel 242 handles system calls from the applications 150, such as requests to access the memory 230, the file system 206 or the devices 106. The kernel 242 differs from the kernel 132 (FIG. 1) as it has been modified by the present invention to support global device access. The proxy file system (PxFS) 244 is based on the Solaris PxFS file system but, like the kernel 242, is modified herein to support global device access. The PxFS 244 includes a collection of objects that enable an application 150-i in one node 202-i to interact seamlessly with the file system 206 across different nodes 202. The PxFS objects include PxFS clients 246, PxFS servers 248, f_objs (file objects) 250, vnodes (virtual file nodes) 252, snodes (special file nodes) 254 and px_vnodes (proxy vnodes) 256. Each of these objects is labeled in FIG. 6 as optional (opt) as they are created as needed by the PxFS 244 in response to operations of the file system 206.

The DDI framework 270 (hereinafter referred to as the DDI) is also similar to the DDI framework 142 described in reference to the prior art (FIG. 1). However, the DDI framework 270 is modified in an embodiment of the invention to interact with the DCS 360 and to generate physical and logical names that are compatible with devices 106 that can be accessed on and from different nodes 202. The DDI 270 includes an attach method 272 that is called every time a new device is attached to the local node 202. In contrast to the prior attach method, the attach method 272 is configured to employ the services of the DCS 360 to create a globally consistent physical name for each and every attached device. The DDI framework 270 also includes a collection of link generators 274 that generate unique logical names from corresponding the physical names. There is different type of link generator for each different type of device 106. Thus, the attach routine 272 and the link generators 274 respectively build the physical and logical name spaces that render the devices 106 globally visible at the kernel and user levels, respectively.

An embodiment of the invention includes a set of DSOs 290 on each node of the cluster 200, each of which manages a particular class 312 of devices 106. The respective device classes are a new aspect of the present invention that capture the particularity with which a user's request to open a particular device 106 must be satisfied by the

transparent, global device access system, generally, and the DCS 372, in particular. In the preferred embodiment there are four device classes: dev_enumerate 314, dev_node_specific 316, dev_global 318 and dev_nodebound 320; and four corresponding DSOs 290: DSO_enum 292, DSO_nodespec 294, DSO_global 296 and DSO_nodebound 298.

The dev_enumerate class 314 is associated with devices 106 that can have multiple instances at a particular node 202 that are enumerated by their associated driver 280 when each device is attached (e.g., multiple storage devices 120). The dev_nodespecific class 316 is associated with devices 106 of which there is only one instance per node (e. g., the kernel memory 116) and, as a result, are not enumerated by their drivers 280. The dev_global class 318 is for those devices 106 that can be accessed either locally or remotely using a driver that is resident on each node (e.g., communication devices 118). The dev_nodebound class is used for devices that can only be accessed using a driver on a particular node (e.g., HA devices 112).

The drivers 280 are similar to the drivers 140 except they report additional configuration information including, when available, the device class information 312 for each object being attached.

The data structures 300 include a DevInfo tree 302 and a ddi_minor_nodes table 306. Like many of the OS routines 240, the data structures 300 are similar to like-named data structures 160 used by the prior art (FIG. 1). Each, however, embodies important differences over the prior art that enable operation of the present invention. In particular, the DevInfo tree 302 includes additional intermediate nodes required to locate devices of selected classes within the cluster 200. As a result of changes to the physical name space 305, which is represented by the DevInfo tree, the logical name space 304 is also different from the prior art logical name space 164. Finally, the ddi_minor_nodes table 306 includes additional fields as compared to the ddi_minor_nodes table employed by the prior art. For example, the present ddi_minor nodes table includes global_minor_number, local_minor_number and (device) class fields 308, 310 and 312 (described above); the prior art ddi_minor_nodes table did not include either of the fields 308 or 312.

The node 204 includes a memory 330 in which are defined OS routines/objects 340 and data structures 370. The OS routines/objects 340 include the device configuration system (DCS) 360, a map_minor method 362 on the DCS and a set of DSOs 290 identical to those already described. The data structures 370 include a DCS database 372.

The DCS 360, for which there is no analog in the prior art, serves at least two important functions. First, the DCS 360 works with the DDIs 270 to assign global minor numbers to newly attached devices that allow those devices to be globally and transparently accessible. Second, the DCS 360 works with the file system 206 and PxFS 244 to enable applications 150 to access transparently the attached devices 106. The DCS_database 372 holds in persistent storage all important results generated by the DCS 372. The two aspects of the DCS 360 are now described below in reference to FIGS. 7A-B and 8A-B, respectively.

Referring to FIG. 7A, there is shown a flow diagram that illustrates the operations by which the DDI Framework in a node 202 and the DCS 360 in the node 204 establish an appropriate dev_t value, logical name and physical name for a device 380 being attached to the node 202. Collectively, the DDIs 270, the link generators 274, the DCS 360, and extensions thereof act as a device registrar for the cluster 200. The operations and messages are indicated in the same manner as in FIG. 4A. Before describing the operations represented in the flow diagram, the relationship between some of the name spaces managed by an embodiment of the invention is described with reference to FIG. 7B.

Referring to FIG. 7B, there is shown a conceptual diagram of the minor name/number space 307, physical name space 305 and logical name space 304 employed in an embodiment of the invention for an exemplary cluster including two nodes 202-1,202-2. As is described below, each time a device 106 is attached to a node 202 its driver assigns it a local minor number 307_num and name 307_name. The DDI 270 uses this information to generate a globally unique minor number and to form a globally unique physical name 305_name for the device 106. The physical-name 305_name locates the device in the cluster's device hierarchy. The link generators 274 then map the physical name 305_name to a globally unique logical name 304_name. Note that the DDIs 270-1, 270-2 and the link generators 274-1, 274-2 jointly generate common global physical and logical name spaces 305, 304, respectively. In contrast, each driver generates a minor name/number space only for its node 202. Thus, the embodiment maps local minor names/numbers to global physical and logical names. These global name spaces are a part of the file system 206. Consequently, an application 150 on any node 202 can employ the file system 206 to view and access all of the devices 106 on the cluster 200 as if they were situated on a single computer. Having described the name spaces that form its framework, an embodiment of the invention is now described with reference to FIG. 7B.

Referring to FIG. 7B, when the device 106 is attached to the node 202 the DDI 270 issues an attach message (7-1a) to the driver 280. In return the driver 280 issues a create_ddi_minor_nodes message (7-1b) to the DDI 270 for each device associated with the just attached instance. The create_ddi_minor_nodes message (7-1b) indicates the configuration of the device 380, including a local minor number (minor_num) 382 and minor_name 384 assigned by the appropriate device driver 280 and a device_class 386 selected from one of the classes 312. For example, if the device were the third SCSI disk drive attached to the node 202, the minor_num, minor_name and class might be "3",, "a" (indicating that it is the first slice on that device) and "dev_enumerate", respectively.

In response to the create_minor_nodes message (7-1b) the DDI 270 updates the ddi_minor_nodes table 380 by setting the local_minor_num field 310 equal to the minor_num value 382 (7-2). The DDI 270 then issues a

dc_map_minor message (7-3) to the DCS 360 asking the DCS 360 to return an appropriate global minor number 388 for the device 380. What is meant in the previous sentence by "appropriate" depends on the device class. That is, dev_enumerate and dev_nodebound devices require unique global minor numbers 388 and dev_global and dev_nodespecific devices do not. The dc_map_minor message (7-3) has three fields: (1) "gminor", which is a return field for the global minor number 388 generated by the DC-S 360; (2) "lminof", which holds the local minor number 384 generated by the device driver 280; and (3) "class", which holds the device class 386 generated by the device driver 280. In response to the map_minor message (7-3) the DCS 360 issues a similar ds_map_minor message (7-4) to the local DSO 290 for the class identified in the message (7-3).

The DSO 290, among other things, determines the global minor (gmin) number 388 that should be assigned to the device being attached. How the gmin number is assigned depends on the class 386 of the device. For example, the DSO 292 for the dev_enumerate class 314 assigns each dev_enumerate device a gmin number 388 that is unique across the cluster because each enumerated device must be accessed at a specific node. In contrast, the DSO 296 for the dev_global class 318 assigns each dev_global device the same gmin number as it is immaterial at which node such devices are accessed. As for the other classes, the DSO 294 for the dev_node specific class 316 assigns each device of that class the same, non-null gmin number and the DSO 298 for the dev_nodebound class 320 assigns each device of that class a gmin number that is unique across the cluster.

The DSOs 292, 298 assign global minor numbers by first consulting the DCS database 372 to determine which global minor numbers are still available.

The DCS database 372 is held in persistent storage and includes, for all devices 106 in the cluster 200, fields for major number 390, global minor number 388, internal (or local) minor number 382 and device server id 392 (comprising server class 386 and numerical value 394). The minor name, major number, global minor number and local minor number have already been described. The numerical value 394 identifies the node 202 that is the server for the device being attached. This information is optional for dev_global and dev_nodespecific devices as the identity of a server for the first class is irrelevant and, for the second case, is the same as the location of whatever node wishes to access the device. An example of the DCS database 272 is shown in Table 1.

TABLE 1

device (not a field)	major 390	global minor 388	internal minor 382	device server id 392:	
				server class 386	numerical value 394
tcp	42	0	0	dev_global	0
kmem	13	12	12	dev_node_spec	0
disk c2t0d0s0	32	24	24	dev_enum	node id
kmem	13	1	12	dev_enum	node 0 id
kmem	13	2	12	dev_enum	node 1 id
kmem	13	3	12	dev_enum	node 2 id
kmem	13	4	12	dev_enum	node 3 id
HA devices	M	X1	X1	dev_nodeb ound	id

The first line of Table 1 shows an entry for a tcp interface. A tcp interface is a dev_global device as it can be accessed from every node 202 in the cluster 200. The tcp device has a major number of 42, which is the value associated with all tcp drivers. Note that its global and local minimum values 388, 382 and server numerical value 394 (i.e., node_id) are set to 0. This is because it is immaterial from what node the tcp interface is accessed. Consequently, there is only one tcp entry in the DCS database for the entire cluster 200. The second entry in Table 1 is for a kernel memory device, which, by default, is accessed locally. For this reason, it is of the dev_nodespecific class. The major number 13 is associated with the kmem device driver. The kmem device has a null numerical value 394 as kmem devices are not accessed at any particular server and identical, non-null global and local minimum numbers (12). This is the case as, for dev_nodespecific devices the DCS 360 simply assigns a global minor number that is identical to the local minor number. In the present example, there is only one kmem entry of the dev_nodespecific variety in the DCS database 372 as there is no need to distinguish between the kmem devices located on respective nodes 202.

The third entry is for a SCSI disk c0t0d0t0 whose SCSI driver has major number 32. The DCS 360 has assigned the SCSI device a global minor number 388 that is identical to its local minor number 382 (24) as there are no other SCSI devices represented in the DCS database 372. However, if another SCSI device c0t0d0t0 were registered at a

different node with the same local number (24), the DCS 360 would assign that SCSI a different global number, perhaps 25. To distinguish SCSI devices with the same local numbers, the DCS database 372 includes complete server information. In this case the numerical value 394 is set to the hostid of the server 202.

Entries four through seven are for four kernel memory devices that are registered as dev_enumerate devices. In the preferred embodiment, each time a dev_nodespecific device is registered, additional entries can be created in the DCS database 372 for all of the nodes 202 in the kernel, which allows a user to access a dev_nodespecific device on other than the local node. Consequently, assuming there are four nodes 202-1, 202-2, 202-3 and 202-4 , the DCS 260 can register a kernel memory device of the dev_enumerate class for each of those nodes. As with other dev_enumerate devices, each kmem device is assigned a unique global number. The dev_enumerate information would not be used when a user issues a generic request to open a kernel memory device (e.g., *open(/devices/kmem))*. The dev_enumerate information would be used when a user issues a specific request to open a kernel memory device. For example, the request *open(/devices/kmem0)* allows a user to open the kmem device on node 0.

The final entry shows how a generic high availability (HA) device is represented in the DCS database 372. The major number 390, global minor number, and local minor number are taken from the values M, X1 and X1 provided in the map_minor nodes message. The numerical value 394 is set to the id of the device, which is bound to a particular node. This "id" is not a node id. Rather, the id is created uniquely for the cluster 200 for each HA service.

Once the global minor number 388 is determined for the device 380, the appropriate DSO 290 updates the DCS database 372 with the new information (7-5) and returns the global minor number 388 to the DCS 360 (7-6). The DCS 372 then returns the global minor number 388 to the DDI 270 (7-7), which updates the ddi_minor_nodes table 306 (7-9), the logical name space 304, the physical name space 305 and the dev_info tree 302 (7-9). The DDI 270 updates the ddi_minor nodes table 306 by writing therein the new global minor number 388. The update to the name spaces 304/305 is more complex and is now described.

First, the DDI 270 adds a new leaf node to the DevInfo tree 302, the structure of which is changed from that previously described in reference to FIG. 3 to include, just below the "/devices" node, an additional level of "/hostid" nodes to represent the cluster sites where dev_enumerate are attached. Note that each node 202 has its own DevInfo tree 270 that represents the devices on that node. However, as represented by the physical name space the collection of DevInfo trees is merged into a single representation with the additional /hostid nodes. (e.g., a typical physical name might start out with the string, */devices/hostid/...*). Each device is also associated at the leaf level with its global minor number 388, not its local minor number 382. Where relevant (i.e., for dev_enumerate devices) the dev_t value of each leaf node of the DevInfo tree 302 is derived from the corresponding device's global minor number 388 and its driver's major number 390. For example, the physical path to a SCSI disk on a node 202-x with a global minor number GN, minor name MN, and driver sd@addry is represented in the present invention as:
/devices/node_202-x/iommu@addr/sbus@addr/esp@addr/sd@addry:MN.

This physical name corresponds to the physical name of the UFS file 170 (FIG. 2B) that includes configuration information for the given device including, in its attributes, the dev_t value derived from the major and global minor numbers.

The link generators 274 of the present invention derive a logical name for the device (and for the corresponding UFS) from at least a portion of the DevInfo path and the minor name provided by the driver modified in accordance with the global minor number returned by the DCS.

For example, assume that the node 202-1 has one SCSI disk with four slices originally assigned by its driver minor names a-d and minor numbers 0-3 and the node 202-2 has one SCSI disk with six slices assigned the minor names a-f and minor numbers 0-5. Assume that, when these devices are attached, the DCS 360 returns for the first SCSI disk global minor numbers of 0-3 and for the second SCSI disk global minor numbers of 4-9. Using these global minor numbers, the DDIs 270 create physical names (described below) and the link generators 274 use the DDIs 270 to create logical names that map to the physical names as follows::

minor name from driver 280	logical name from link generators 274
a (node 202-1)	/dev/dsk/c0t0d0s0
b (node 202-1)	/dev/dsk/c0t0d0s1
c (node 202-1)	/dev/dsk/c0t0d0s2
d (node 202-1)	/dev/dsk/c0t0d0s3
a (node 202-2)	/dev/dsk/c1t0d0s0
b (node 202-2)	/dev/dsk/c1t0d0s1
...	
f (node 202-2)	/dev/dsk/c1t0d0s5

The logical names assigned to the node 202-1 and 202-2 devices have different cluster values (the *cx* part of the logical name string *cxt0d0sy*, where "x" and "y" are variables). This is because the logical names map to device physical names and, in a cluster, devices on different nodes are associated with different controllers. For example, the node 202-1 controller is represented as *c0* and the node 202-2 controller as *c1*.

The DDIs 270 generate the physical name space 305 using the same gmin information and produce a map between logical names and physical names identifying files whose attributes contain the dev_t values for the corresponding devices. For the above example, the logical name space 304 and the logical name space to physical name space map is updated as follows (note that *addr* substitutes for any address):

logical name	physical name from DevInfo tree 302
/dev/dsk/c0t0d0s0	/devices/node_202-1/iommu@addr/sbus@addr/es p1@addr/sd@0:a
/dev/dsk/c0t0d0s1	" /esp1@addr/sd@0:b
/dev/dsk/c0t0d0s2	" /esp1@addr/sd@0:c
/dev/dsk/c0t0d0s3	" /esp1@addr/sd@0:d
/dev/dsk/c1t0d0s0	/devices/node_202-2/iommu@addr/sbus@addr/es p1@addr/sd@0:minor
/dev/dsk/c1t0d0s1	" /esp1@addr/sd@0:e
/dev/dsk/c1t0d0s2	" /esp1@addr/sd@0:f
...	
/dev/dsk/c0t0d0s5	" /esp1@addr/sd@0:i

The example just presented shows the DDIs 270 generate logical and physical names for dev_enumerate devices, of which class SCSI devices are a member. Briefly summarized, the rules for naming dev_enumerate devices require that each instance enumerated by a particular driver (e.g., sd) must have a unique global minor number, which, when combined with its driver's major number forms a corresponding, unique dev_t value. These rules also specify that the physical name associated with each instance must include the hostid of that instance and the instance's global minor number in addition to other traditional physical path information. The rules for naming the other devices from the other classes are similar to those described above for the dev_enumerate class.

In particular, the DDI 270 assigns a dev_nodespecific device a logical name of the form */dev/device_name* and physical name of the form:

/devices/pseudo/driver@gmin:device_name,

where *device_name* is the name 384, pseudo indicates that devices of this type are pseudo devices, *driver* is the id of the corresponding driver and *@gmin.device_name* indicates the global number 388 and device name 384 of the dev_nodespecific device. For example, the logical and physical names of a kernel memory device could be */dev/kmem* and *devices/pseudo/mm@12:kmem,* respectively. As mentioned above, a kmem device can also be given a logical name that enables it to be accessed on a specific node. For example, the DDI 270 can map the logical name */dev/kmem0* to the physical name */devices/hostid0/pseudo/mm@0:kmem.*

For the dev_global class each logical name generated by the DDI identifies a common physical path that will be resolved to any device in the cluster 200 by the file system. Logical names for these devices are of the form */dev/device_name* and are mapped to physical names of the form:

/devices/pseudo/clone@gmin:device_name,

where *device_name* is the name 384, which is specific to the driver, *pseudo* indicates that devices of this type are pseudo devices, clone indicates that the device is cloneable and *@gmin:device_name* indicates the global number 388 and device name 384 of the dev_global device. For example, the tcp device from Table 1 might have a logical name of */dev/tcp* and a physical name of */devices/pseudo/clone@0.tcp.* Note that the embodiment of the invention does not allow any of dev_global devices to be made distinguishable, as in the case of the kmem devices, described above. That is, all dev_global devices are indistinguishable.

An advantage of the class-based naming system of an embodiment of the invention is that it is compatible with legacy software designed for prior versions of Solaris. For example, a legacy program might issue an *open(/dev/kmem)* request, in which case a version of Solaris embodying the present invention returns a handle to the local kmem device. Similar results are provided for dev_global and dev_enumerate devices. There was no conception in the prior art for dev_nodebound devices.

Having described how the DDI 270 and the DCS 360 form a consistent global name space in which different classes of devices can be accessed on different nodes of the cluster 200, the steps employed by an embodiment of the invention to respond to an open request for a device on another node is now described in reference to FIGS. 8A and 9B.

Referring to FIGS. 8A and 8B, there are shown flow diagrams of the steps performed by an embodiment of the invention in response to a request (8-1) from an application 150 executing on a node 202-1 to access (open) a device

106-2 (FIG. 9B) that resides on a node 202-3. In this example, the file system 206 and the DCS 360 reside on the nodes 202-2 and 204, respectively. The application 150 issues the open request to the local 242 on the device's logical name. The kernel 242 then queries the file system 206 to determine the device's dev_t value. Because the file system is on a different node from the kernel 242, this is a multistep process that involves the use of a proxy file system PxFS, most aspects of which are already defined by current versions of Solaris. However, the embodiment modifies such proxy file system elements as PxFS clients 246 and PxFS servers 248 to support interactions with the DCS 360, for which there is no analog in prior versions of Solaris. The interactions between the PxFS client 246, PxFS server 248 and the file system 206 are now briefly described.

An object such as the kernel 242 that needs to access the file system 206 first issues the access request to its local PxFS client 246. The PxFS client holds a reference to the PxFS server 248 co-located with the file system 206. This reference enables the PxFS client 246 to communicate the kernel's request to the file system 206 via the PxFS server 248. The file system 206 performs the requested access, creates a vnode object 252 representing the requested file and returns a reference to vnode object 252 to the PxFS server 248. Because the nodes 202-1 and 202-2 are different address spaces, the reference to the vnode 252 is useless to the PxFS client 246 and kernel 242 in the node 202-1. Consequently, the PxFS server 248 creates a file transport object (f_obj) 250 linked to the vnode 252 and returns a reference to the f_obj 150 to the PxFS client 246. Upon receiving the f_obj reference the PxFS client 246 creates a proxy vnode (px_vnode) 256 that is linked to the f_obj 250. The kernel 242 can then access the file information represented by the vnode 252 by simply accessing the local px_vnode 256.

Using this mechanism, the kernel 242 issues a lookup message (8-2) on the logical name of the device to be opened to the PxFS client 246, which relays a similar lookup message (8-3) to the PxFS sever 248. The PxFS server 248 issues the file system 206 a lookup(logical_name), get_vnode message (8-4), which asks the file system 206 to map the logical_name to the corresponding physical_name via a logical symbolic link return a reference to a v_node 252 representing the UFS file identified by that physical_name. When the physical_name refers to a device as in the present example, the attributes of the device include the unique dev_t of the device. As described above, the file system 206 then returns the vnode to the PxFS server 248 (8-5) and the PxFS server 248 creates a corresponding f_obj 250 and returns the f_obj 250 reference to the PxFS client 246 (8-6). The PxFS client 246 then creates a px_vnode 256 whose attributes include the dev_t information for the requested device and passes the px_vnode 256 reference to the kernel 242 (8-7). At this point, the kernel 242 issues an open message (8-8) to the PxFS client 246 for the px_vnode 246. Upon receiving this message, the PxFS client 246 determines from the px_vnode's attributes, which include a dev_t value, that the corresponding vnode 252 represents a device and therefore the open message must be handled by the DCS 360. If the px_vnode 256 did not contain a dev_t value, the PxFS client 246 would satisfy the open request (8-8) through other channels. As implemented in prior versions of Solaris, the PxFS client does not perform any testing for dev_t values as devices are only locally accessible.

Because the px_vnode 256 includes a dev_t value 430, the PxFS client 246 issues a resolve message (8-9) to the DCS 360 for the device corresponding to the dev_t. How the DCS 360 handles this request is now described in reference to FIG. 9B.

Referring to FIG. 8B, in response to the resolve(dev_t) message (8-9) the DCS 360 performs a lookup in the DCS database 372 to determine the location and identity of the device that corresponds to that dev_t value. Consistent with the preceding discussions of the device classes 312, devices of the dev_enumerate or dev_nodebound classes are accessed on a particular node whose location is specified in the numerical value field 394 of the DCS database 372. In contrast, devices of the dev_global or dev_nodespecific classes are accessed on the local node of the requesting application. Once it has determined the location of the device to be opened, the DCS 360 returns (8-10) to the PxFS client 246 a reference (DSO_ref) to the DSO 290 that manages the device class to which the requested device belongs and is local to the node that hosts the requested object. In the present example, assuming that the requested device 106-2 is of the dev_enumerate class and is hosted on the node 202-3, the returned DSO_ref would be to the DSO_enum object 292 on the node 202-3.

After receiving the message (8-10) the PxFS client 246 issues a get_device_fobj request for the device 106-2 to the referenced DSO 292 (8-11). In response, the DSO 292 issues a create_specvp() message (8-12) asking the SpecFS 410 on the node 202-3 to create and return (8-13) the snode for the device 106-2. The DSO 292 then requests (8-14a) the f_obj reference to the snode from the PxFS server 248-2, which returns the requested f_obj (8-14b). The DSO 292 then returns the fobj reference to the snode to the PxFS client 246 (8-15). The client 246 then issues an open request (8-16) on this fobj that goes to the SpecFS 410 via the PxFS server 248-2 (8-17).

The SpecFS 410 then attempts to open the device 106-2. Depending on the outcome of the open operation the SpecFS 410 returns a status message (8-18) indicating either success or failure. If the open was successful, the status message (8-18) also includes a reference to the opened snode 432. Upon receiving "success" in the status message (8-18) the PxFS server 248-2 creates the f_obj 250-2 for the opened v_node 252-2 and returns it back to the PxFS client 246 (8-19), which creates a px_vnode 256-2 that is linked across nodes to the f_obj 250-2. As the final step in the device open operation the PxFS client returns the px_vnode 256-2 to the kernel 242 (8-20), which creates a cor-

responding user space file descriptor (fd) 434. The kernel 242 returns this file descriptor to the application 150-1 (8-21), which can then use the file descriptor 434 to interact directly (i.e., via the kernel 242, PxFS client 246 and px_vnode) with the device 106-2.

While the present invention has been described with reference to a few specific embodiments, the description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications may occur to those skilled in the art without departing from the scope of the invention.

Claims

1. A system for rendering devices on a cluster globally visible, wherein the cluster includes a plurality of nodes on which the devices are attached, the system comprising a device registrar configured to establish for each of the devices at least one globally unique identifier enabling that device to be accessed from any of the nodes.

2. The system of claim 1, further comprising:

   a global file system running on the cluster;
   wherein the at least one globally unique identifier comprises:

      a globally unique logical name by which users of the cluster identify the device; and
      a globally unique physical name by which the global file system identifies the device.

3. The system of claim 1, further comprising:

   a global file system running on the cluster; and
   a device information (dev_info) data structure maintained by the device registrar representing physical associations of the devices within the cluster, each of the physical associations corresponding to a physical name of a device file maintained by the global file system that represents a respective one of the devices;
   wherein the device registrar is configured to:

      determine for an attached device a globally unique, device type (dev_t)value;
      create an entry in the dev_info data structure and a corresponding physical name for the attached device;
      generate for the attached device a logical name based on the dev_t value and the corresponding physical name; and
      associate the dev_t value of the attached device with the device file representing the attached device.

4. The system of claim 3, further comprising a plurality of device drivers for managing the devices, each driver being configured to assign to each attached, local device it manages a local minor number, each of the drivers being associated with a globally unique, major number.

5. The system of claim 4, wherein the device registrar comprises a device driver interface (DDI) configured to determine whether the local minor number is globally unique.

6. The system of claim 3, wherein the device registrar comprises:

   a device driver interface configured to map the globally unique dev_t values to the physical names; and
   a link generator configured to map the physical names to the logical names.

7. The system of claim 6, wherein the devices are classified in predetermined device classes that include at least one of:

   "dev_enumerate," for designating devices with at least one occurrence managed by a particular driver, each of the occurrence managed by the particular driver on a node being individually enumerated;
   "dev_nodespecific," for designating devices available on each node that are accessed locally and have a one-to-one relationship with the managing driver on each node;
   "dev_global," for designating devices for access from drivers on any such node; and
   "dev_nodebound," for designating devices for access by a driver on a particular node and having a one-to-one relationship with the driver.

8. The system of claim 7, further comprising a device configuration system (DCS) hosted on one of the cluster nodes that maintains a persistent DCS database comprising for each device in the cluster a major number of the device driver that manages the device, the local minor number, the global minor number and an id of the node hosting the device;
wherein the DDI generates the globally unique identifier by request to the DCS and the DCS database.

9. A method for use in a cluster including a plurality of nodes, at least a subset of which have associated devices, for converting a local device name associated with a device instance on a particular node to an object handle that allows a user of any of the nodes to access the device instance.

10. The method of claim 9, comprising the steps of:

determining for at least the instances associated with a subset of predetermined device classes whether the local device name is globally unique and, if not, to determine a globally unique identifier for the respective local instance;
forming a device information tree representing physical associations of the devices within the cluster, each path between a root node and a leaf node of the tree corresponding to a physical name of a device file maintained by a global file system that represents a respective one of the device instances;
generating for each instance a logical name based on the globally unique identifer that is mapped to that instance's corresponding physical name; and
associating the globally unique identifier of a particular instance with the device file representing that particular instance;
such that a user of the cluster can access any the devices by issuing the global file system a request to access the device identified by its logical name.

11. The method of claim 10, further comprising the steps of:

maintaining a persistent database comprising for each logical device in the cluster the local device name, a major number of a device driver that manages the logical device, a local minor number assigned by the device driver to the logical device, a global minor number corresponding to the local minor number and a hostid of the node hosting the logical device; and
generating the globally unique identifier, the logical name and the physical name for the logical device using the persistent database.

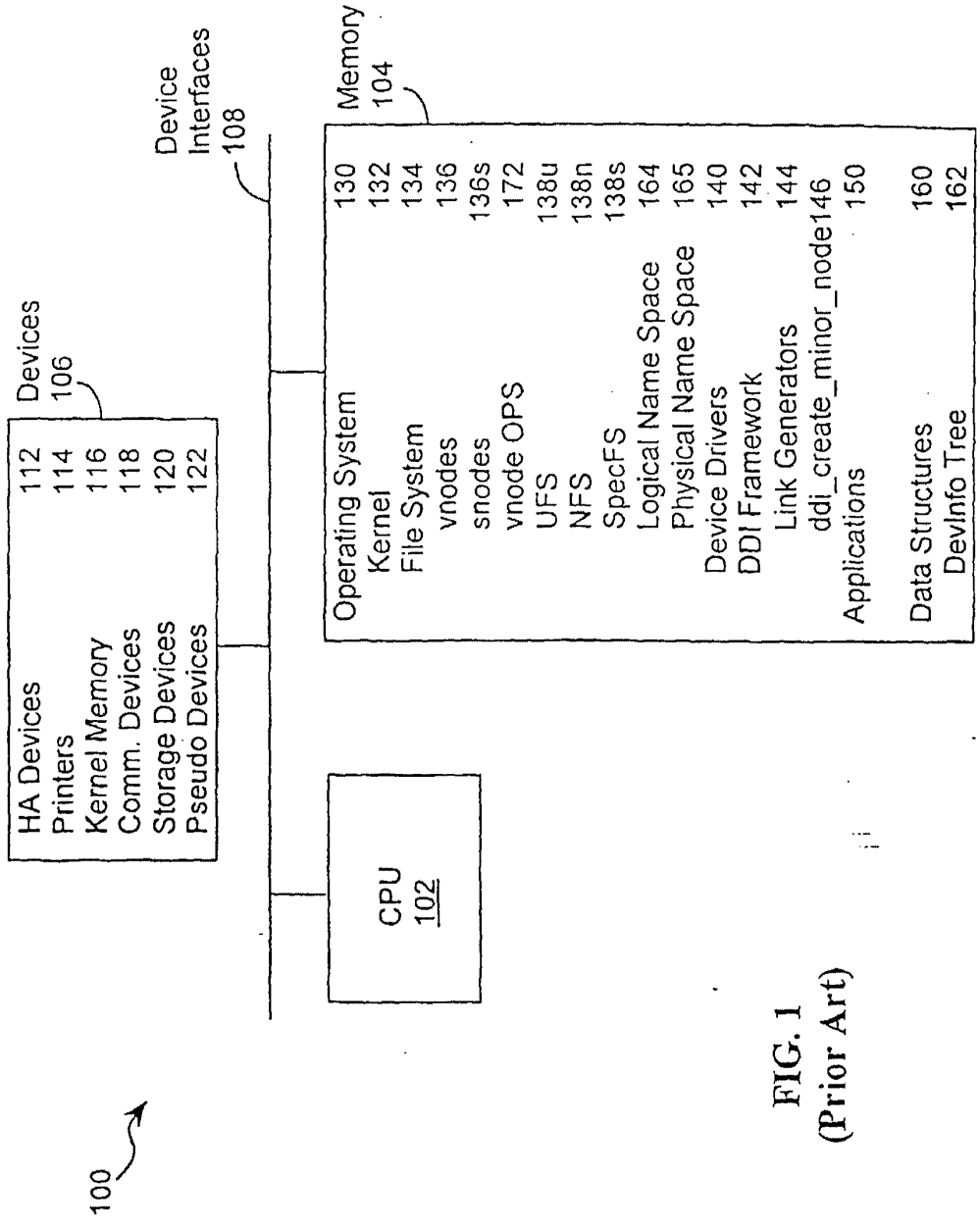


FIG. 1
(Prior Art)

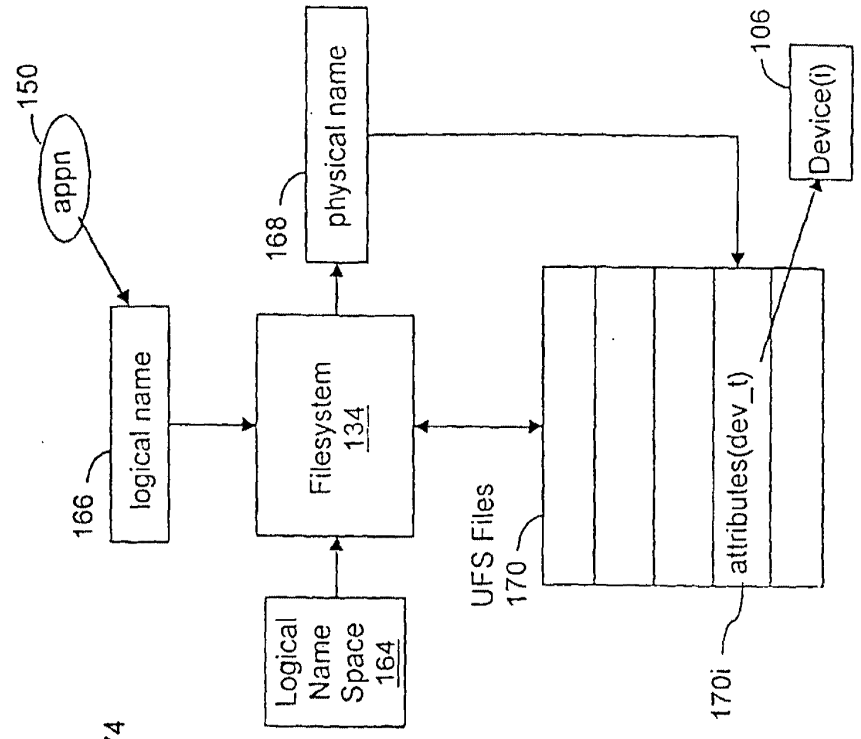


FIG. 2B
(Prior Art)

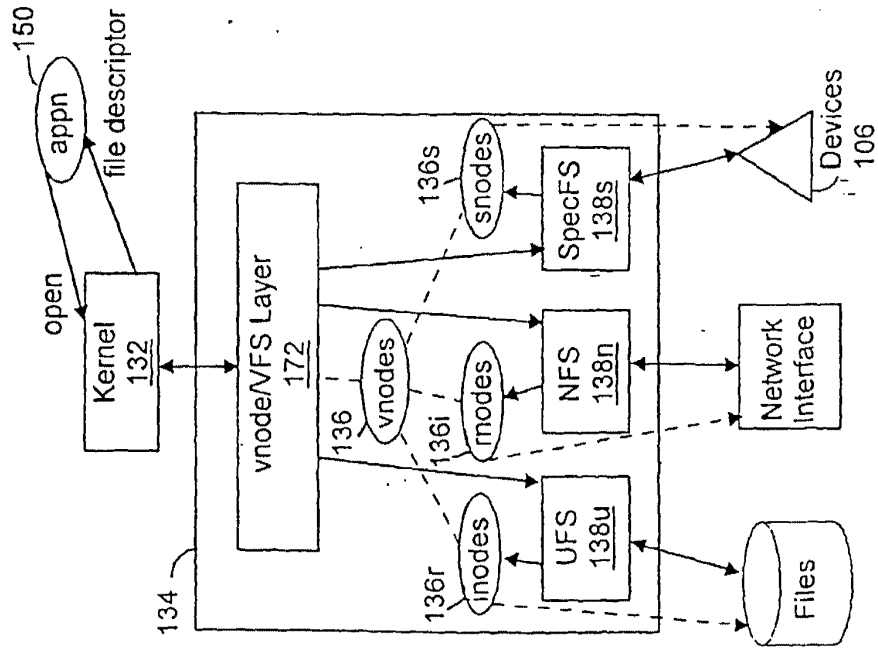


FIG. 2A
(Prior Art)

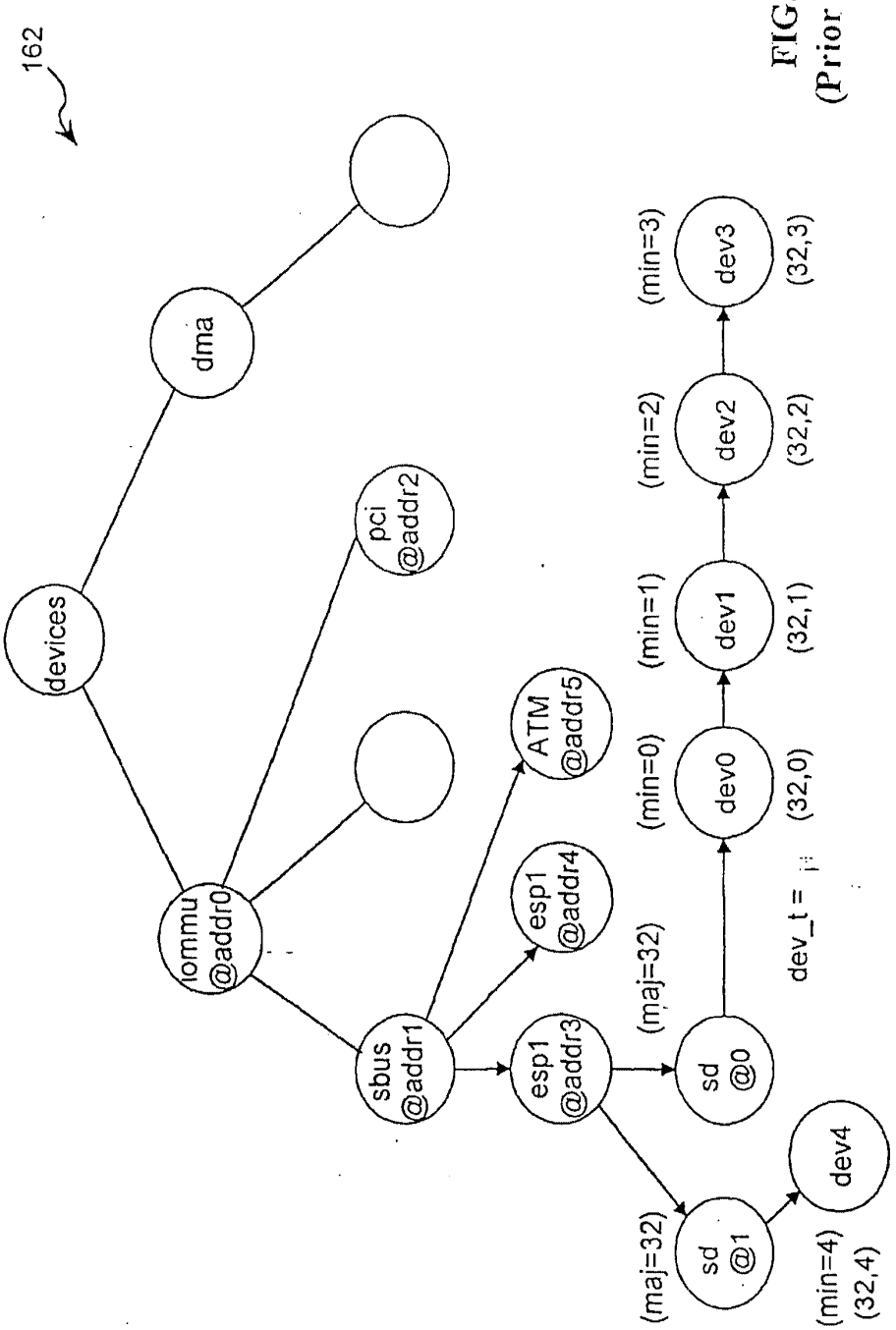


FIG. 3
(Prior Art)

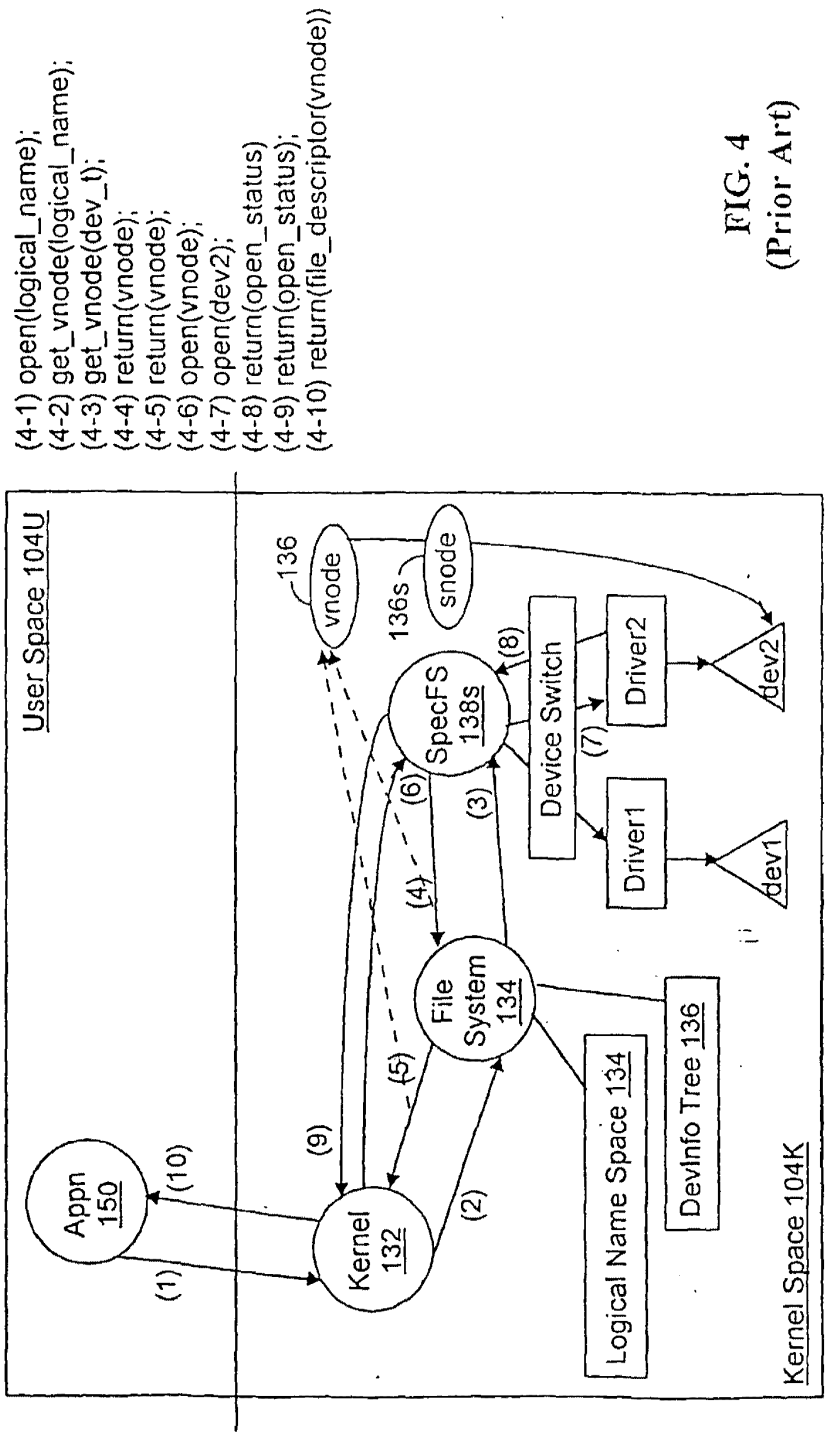


FIG. 4
(Prior Art)

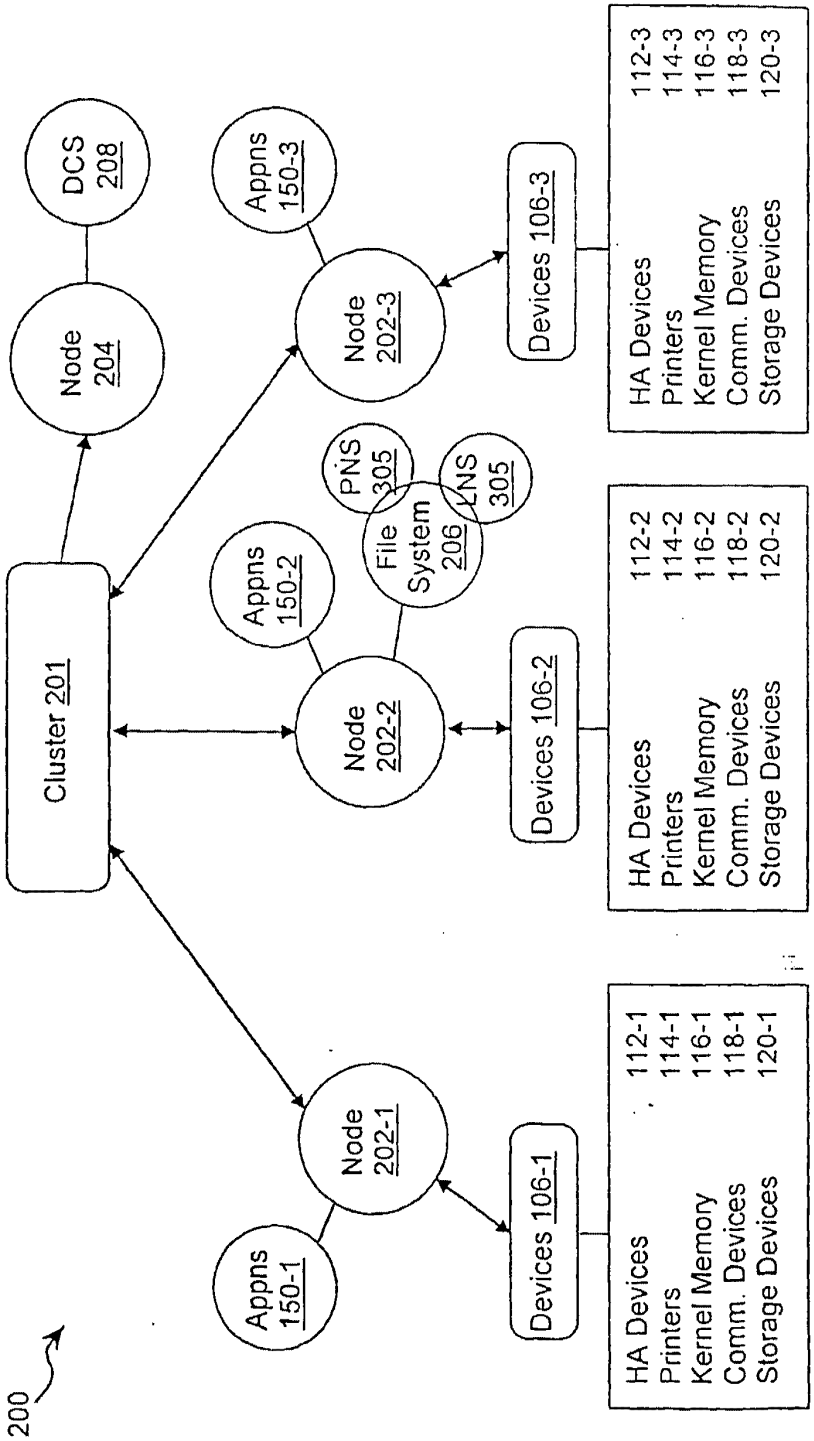

200
Cluster 201
DCS 208
Node 204
Node 202-1
Node 202-2
Node 202-3
Appns 150-1
Appns 150-2
Appns 150-3
PNS 305
File System 206
LNS 305
Devices 106-1
Devices 106-2
Devices 106-3
HA Devices 112-1
Printers 114-1
Kernel Memory 116-1
Comm. Devices 118-1
Storage Devices 120-1
HA Devices 112-2
Printers 114-2
Kernel Memory 116-2
Comm. Devices 118-2
Storage Devices 120-2
HA Devices 112-3
Printers 114-3
Kernel Memory 116-3
Comm. Devices 118-3
Storage Devices 120-3

FIG. 5

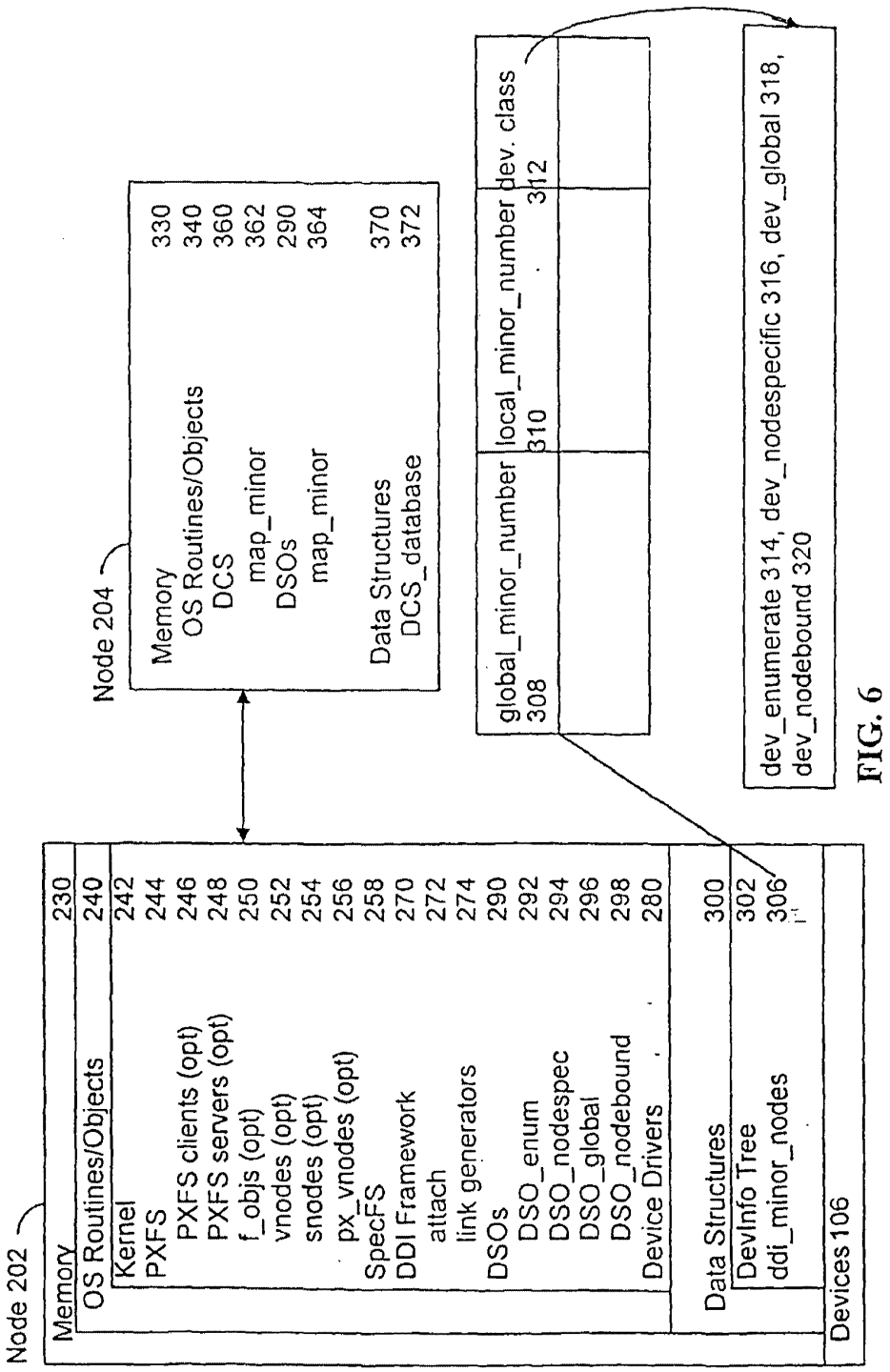

Node 202
Memory 230
OS Routines/Objects 240
Kernel 242
PXFS 244
PXFS clients (opt) 246
PXFS servers (opt) 248
f_objs (opt) 250
vnodes (opt) 252
snodes (opt) 254
px_vnodes (opt) 256
SpecFS 258
DDI Framework 270
attach 272
link generators 274
DSOs 290
DSO_enum 292
DSO_nodespec 294
DSO_global 296
DSO_nodebound 298
Device Drivers 280
Data Structures 300
DevInfo Tree 302
ddi_minor_nodes 306
Devices 106
Node 204
Memory 330
OS Routines/Objects 340
DCS 360
map_minor 362
DSOs 290
map_minor 364
Data Structures 370
DCS_database 372
global_minor_number 308
local_minor_number 310
dev. class 312
dev_enumerate 314, dev_nodespecific 316, dev_global 318,
dev_nodebound 320

FIG. 6

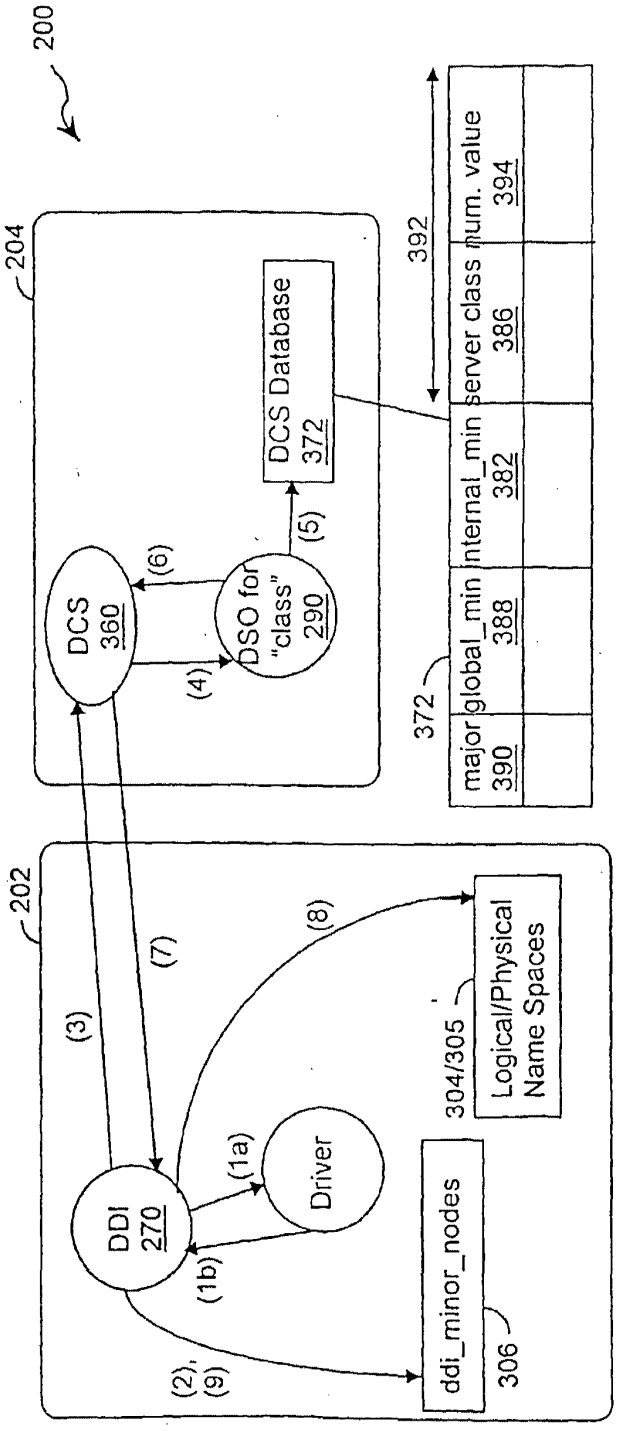


FIG. 7A

(7-1a) attach();
(7-1b) ddi_create_minor_nodes (minor_num 382, minor_name 384, class 386);
(7-2),(7-9) update ddi_minor_nodes (gminor, lminor, class);
(7-3) dc_map_minor (major, lminor, gminor, class);
(7-4) ds_map_minor (major, lminor, gminor);
(7-5) return (gminor);
(7-6) update_DCS_database (major, lminor, gminor, DS_type, DS_num_val);
(7-7) return (gminor);
(7-8) update filesystem;

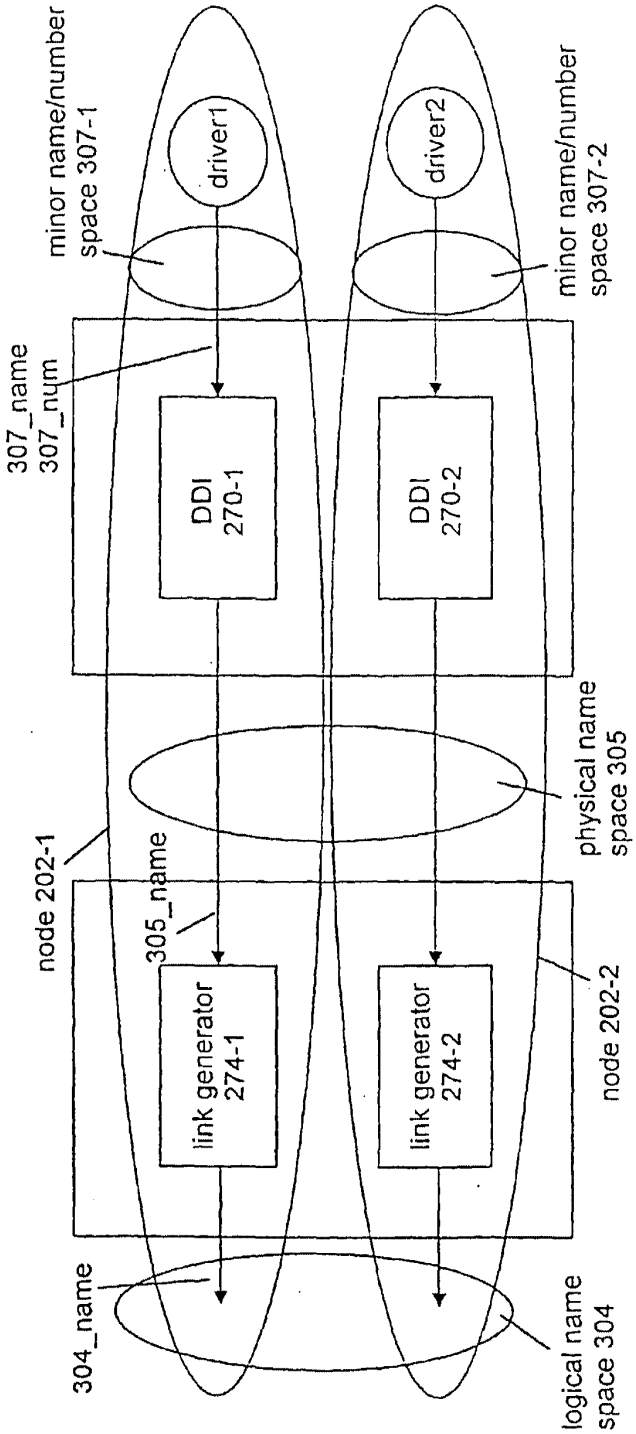

minor name/number space 307-1
driver1
driver2
minor name/number space 307-2
307_name
307_num
DDI 270-1
DDI 270-2
physical name space 305
node 202-1
305_name
link generator 274-1
link generator 274-2
node 202-2
304_name
logical name space 304

FIG. 7B

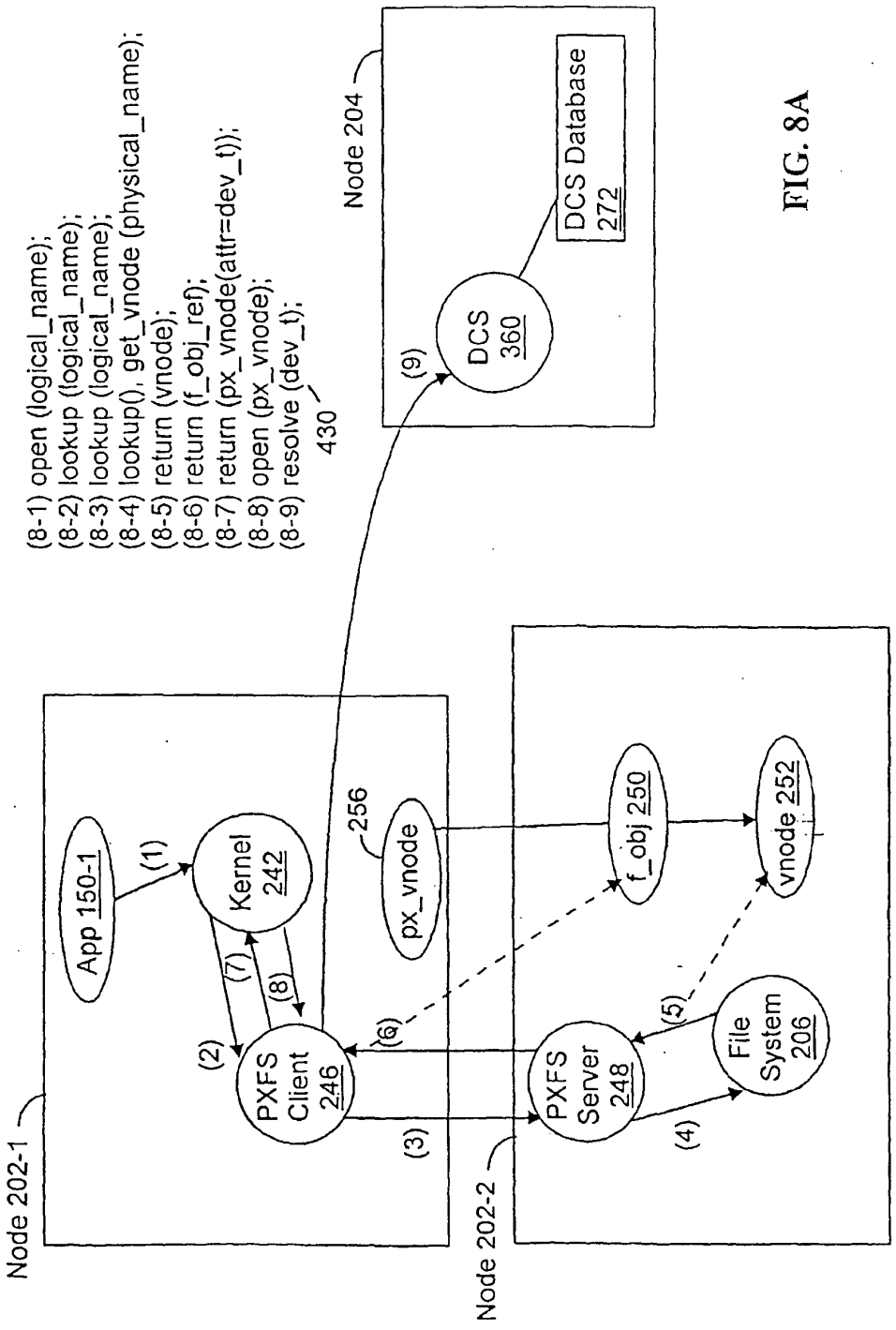

(8-1) open (logical_name);
(8-2) lookup (logical_name);
(8-3) lookup (logical_name);
(8-4) lookup(), get_vnode (physical_name);
(8-5) return (vnode);
(8-6) return (f_obj_ref);
(8-7) return (px_vnode(attr=dev_t));
(8-8) open (px_vnode);
(8-9) resolve (dev_t);
430
Node 204
DCS Database 272
DCS 360
(9)
Node 202-1
App 150-1
(1)
Kernel 242
256
px_vnode
f_obj 250
vnode 252
(7)
(8)
(2)
PXFS Client 246
(6)
(5)
File System 206
PXFS Server 248
(3)
(4)
Node 202-2

FIG. 8A

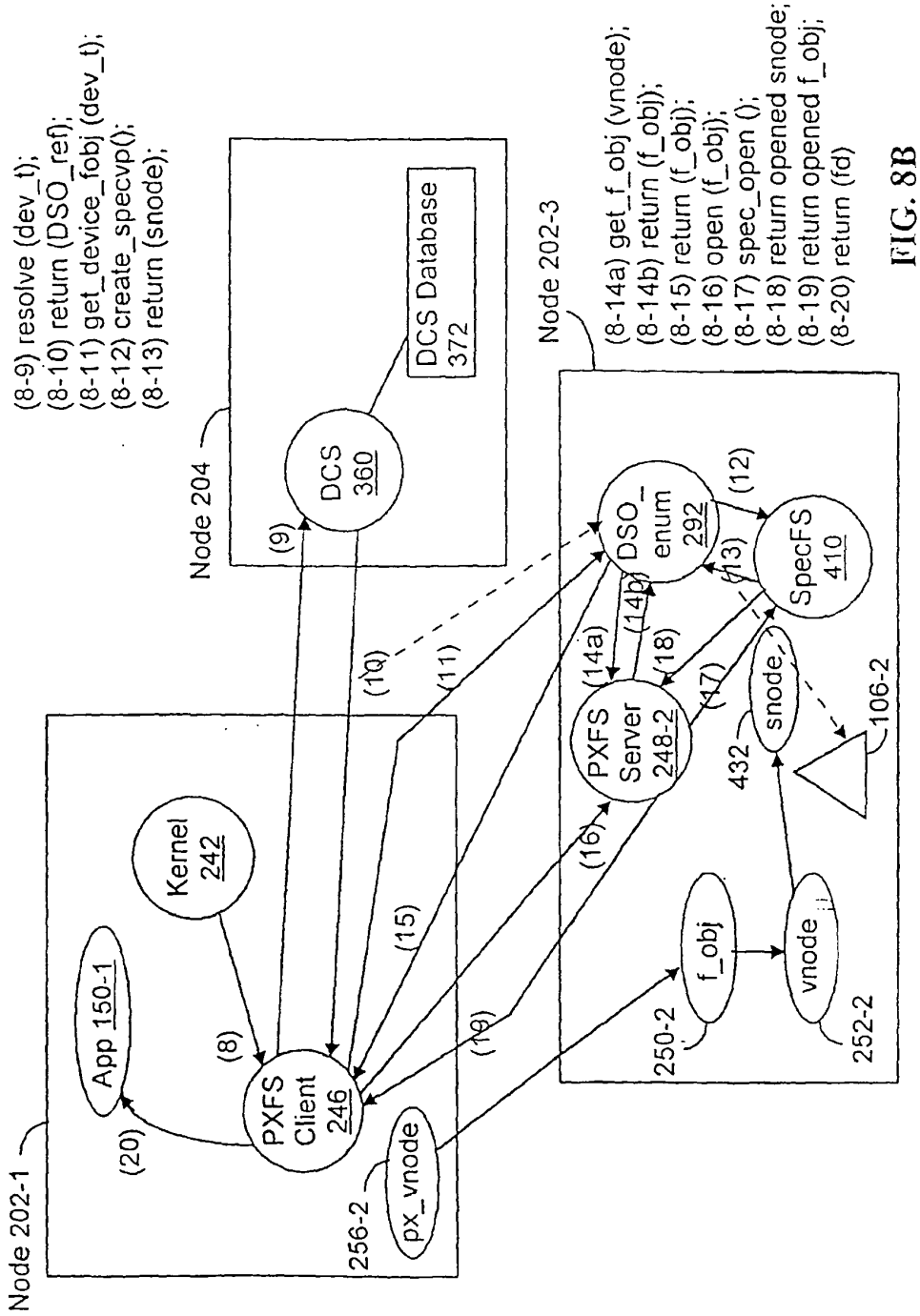

(8-9) resolve (dev_t);
(8-10) return (DSO_ref);
(8-11) get_device_fobj (dev_t);
(8-12) create_specvp();
(8-13) return (snode);
Node 204
DCS 360
DCS Database 372
(9)
(10)
(11)
Node 202-1
App 150-1
Kernel 242
(8)
PXFS Client 246
(20)
(15)
(19)
256-2
px_vnode
Node 202-3
(8-14a) get_f_obj (vnode);
(8-14b) return (f_obj);
(8-15) return (f_obj);
(8-16) open (f_obj);
(8-17) spec_open ();
(8-18) return opened snode;
(8-19) return opened f_obj;
(8-20) return (fd)
DSO_ enum 292
(12)
(13)
SpecFS 410
(14a)
(14b)
(18)
PXFS Server 248-2
(17)
(16)
snode
432
106-2
f_obj
250-2
vnode
252-2

FIG. 8B

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(71)(72) Applicant and Inventor: OVERTON, John [US/US]; 5825 S. Blackstone, Chicago, IL 60637 (US).

(74) Agent: ROBERTS, Jon, L.; Roberts & Brownell, L.L.C., Suite 212, 8381 Old Courthouse Road, Vienna, VA 22182 (US).

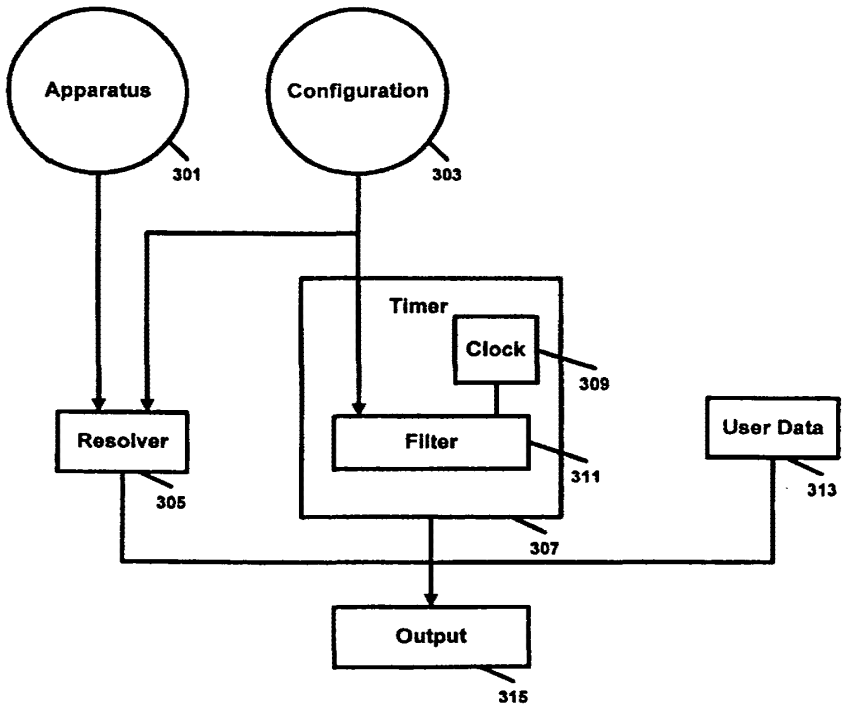
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(54) Title: AUTOMATED SYSTEM FOR IMAGE ARCHIVING

(57) Abstract

A method for producing universal image tracking implementations. This invention provides a functional implementation, from which any image–producing device can construct automatically generated archival enumerations. This implementation uses an encoding schemata based on location numbers, image numbers, and parent numbers, anticipated by the formal specifications. Location numbers encode information about logical sequence in the archive, image numbers encode information about the physical attributes of an image, and parent numbers record the conception date and time of a given image's parent. Parent–child relations are algorithmically derivable from location and parent number relationships, thus providing fully recoverable, cumulative image lineage information. Encoding schemata are optimized for use with all current and arriving barcode symbologies to facilitate data transportation across disparate technologies (e.g., negatives to prints to computers). The implemented system is seamlessly compatible with traditional database "key–driven" recovery systems, as well as with portable decoding systems capable of reading self–contained databases directly from images.



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Title: Automated System for Image Archiving

Reference to Related Application

This application claims the benefit of U.S. Provisional Application No. 60/035,485 filed January 13, 1997 entitled "Automated Image Archiving System."

Field of Invention

This invention relates generally to archive and documentation of data. More particularly this invention is a universal image tracking system wherein generations of images can be related one to another and to original images that contributed to a final image without significant user intervention.

Background of the Invention

Increasingly, images of various types are being used in a wide variety of industrial, digital, medical, and consumer uses. In the medical field, telemedicine has made tremendous advances that now allow a digital image from some medical sensor to be transmitted to specialists who have the requisite expertise to diagnose injury and disease at locations remote from where the patient lies. However, it can be extremely important for a physician, or indeed any other person to understand how the image came to appear as it does. This involves a knowledge of how the image was processed in order to reach the rendition being examined. In certain scientific applications, it may be important to "back out" the effect of

a particular type of processing in order to more precisely understand the appearance of the image when first made.

Varieties of mechanisms facilitate storage and retrieval of archival information relating to images. However, these archival numbering and documentation schemes suffer from certain limitations. For example, classificatory schemata are used to facilitate machine sorting of information about a subject ("subject information") according to categories into which certain subjects fit. Additionally tracking information, that is, information concerning where the image has been or how the image was processed, is also used together with classificatory schemata.

However, relying on categorizing schemata is inefficient and ineffective. On the one hand, category schemata that are limited in size (i.e. number of categories) are convenient to use but insufficiently comprehensive for large-scale applications, such as libraries and national archives. Alternatively if the classificatory schemata is sufficiently comprehensive for large-scale applications, it may well be far too complicated, and therefore inappropriate for small scale applications, such as individual or corporate collections of image data.

It is also an approach to provide customizable enumeration strategies to narrow the complexity of large-scale systems and make them discipline specific. Various archiving schemes are developed to suit a particular niche or may be

Certain classification approaches assume single device input. Thus, multiple devices must be tracked in separate archives, or are tracked as archive exceptions. This makes archiving maintenance more time consuming and inefficient. For example, disciplines that use multiple cameras concurrently, such as sports photography and photo-journalism, confront this limitation.

Yet other archive approaches support particular media formats, but not multiple media formats simultaneously occurring in the archive. For example, an archive scheme may support conventional silver halide negatives but not video or digital media within the same archive.

Thus, this approach fails when tracking the same image across different media formats, such as tracking negative, transparency, digital, and print representation of the same image.

Yet another archive approach may apply to a particular state of the image, as the initial or final format, but does not apply to the full life-cycle of all image. For example, some cameras time- and date-stamp negatives, while database software creates tracking information after processing. While possibly overlapping, the enumeration on the negatives differs from the enumeration created for archiving. In another example, one encoding may track images on negatives and another encoding may track images on prints. However, such a state-specific approach makes it difficult automatically to

customizable for a niche. This is necessitated by the fact that no single solution universally applies to all disciplines, as noted above. However, the resulting customized archival implementation will differ from, for example, a medical image to a laboratory or botanical image archive. The resulting customized image archive strategy may be very easy to use for that application but will not easily translate to other application areas.

Thus, the utility provided by market niche image archiving software simultaneously makes the resulting applications not useful to a wide spectrum of applications. For example, tracking schemata that describes art history categories might not apply to high-tech advertising.

Another type of archival mechanism is equipment-specific archiving. In this implementation a particular type of image device, such as a still camera, a video camera, a digital scanner, or other form of imaging means has its own scheme for imprinting or recording archival information relating to the image that is recorded.

Thus, using different image-producing devices in the image production chain can cause major problems. For example, mixing traditional photography (with its archive notation) with digital touch-up processing(with its own different archive notation). Further, equipment-specific archive schemes do not automate well, since multiple devices within the same archive may use incompatible enumeration schemata.

track image histories and lineages across all phases of an image's life-cycle, such as creation, processing, editing, production, and presentation.

Thus, tracking information that uses different encoding for different image states is not particularly effective since maintaining multiple enumeration strategies creates potential archival error, or at a minimum, will not translate well from one image form to another.

Some inventions that deal with recording information about images have been the subject of U.S. patents in the past. U.S. Patent No. 5579067 to *Wakabayashi* describes a "Camera Capable of Recording Information." This system provides a camera which records information into an information recording area provided on the film that is loaded in the camera. If information does not change from frame to frame, no information is recorded. However, this invention does not deal with recording information on subsequent processing.

U.S. Patent No. 5455648 to *Kazami* was granted for a "Film Holder or for Storing Processed Photographic Film." This invention relates to a film holder which also includes an information holding section on the film holder itself. This information recording section holds electrical, magnetic, or optical representations of film information. However, once the information is recorded, it is to used for purposes other than to identify the original image.

U.S. Patent No. 5649247 to *Itoh* was issued for an "Apparatus for Recording Information of Camera Capable of Optical Data Recording and Magnetic Data Recording." This patent provides for both optical recording and magnetic recording onto film. This invention is an electrical circuit that is resident in a camera system which records such information as aperture value, shutter time, photo metric value, exposure information, and other related information when an image is first photographed. This patent does not relate to recording of subsequent operations relating to the image.

U.S. Patent 5319401 to *Hicks* was granted for a "Control System for Photographic Equipment." This invention deals with a method for controlling automated photographic equipment such as printers, color analyzers, film cutters. This patent allows for a variety of information to be recorded after the images are first made. It mainly teaches methods for production of pictures and for recording of information relating to that production. For example, if a photographer consistently creates a series of photographs which are off center, information can be recorded to offset the negative by a pre-determined amount during printing. Thus the information does not accompany the film being processed but it does relate to the film and is stored in a separate database. The information stored is therefore not helpful for another laboratory that must deal with the image that is created.

U.S. Patent 5193185 to *Lanter* was issued for a "Method and Means for Lineage Tracing of a Spatial Information Processing and Database System." This Patent relates to geographic information systems. It provides for "parent" and "child" links that relate to the production of layers of information in a database system. Thus while the this patent relates to computer-generated data about maps, it does not deal with how best too transmit that information along a chain of image production.

U.S. Patent No. 5008700 to *Okamoto* was granted for a "Color Image Recording Apparatus using Intermediate Image Sheet." This patent describes a system, where a bar code is printed on the image production media which can then be read by an optical reader. This patent does not deal with subsequent processing of images which can take place or recording of information that relates to that subsequent processing.

U.S. Patent No. 4728978 was granted to *Inoue* for a "Photographic Camera." This patent describes a photographic camera which records information about exposure or development on an integrated circuit card which has a semiconductor memory. This card records a great deal of different types of information and records that information onto film. The information which is recorded includes color temperature information, exposure reference information, the date and time, shutter speed, aperture value, information concerning

use of a flash, exposure information, type of camera, film type, filter type, and other similar information. The patent claims a camera that records such information with information being recorded on the integrated circuit court. There is no provision for changing the information or recording subsequent information about the processing of the image nor is there described a way to convey that information through many generations of images.

Thus a need exists to provide a uniform tracking mechanism for any type of image, using any type of image-producing device, which can describe the full life-cycle of an image and which can translate between one image state and another and between one image forming mechanism and another.

Summary of the Invention

It is therefore an object of the present invention to create an archival tracking method that includes relations, descriptions, procedures, and implementations for universally tracking images.

It is a further object of the present invention to create an encoding schemata that can describe and catalogue any image produced on any media, by any image producing device, that can apply to all image producing disciplines.

It is a further object of the present invention to implement to archival scheme on automated data processing means that exist within image producing equipment.

It is a further object of the present invention to apply

to all image-producing devices.

It is a further object of the present invention to support simultaneous use of multiple types of image-producing devices.

It is a further object of the present invention to support simultaneous use of multiple image-producing devices of the same type.

It is a further object of the present invention to provide automatic parent-child encoding.

It is a further object of the present invention to track image lineages and family trees.

It is a further object of the present invention to provide a serial and chronological sequencing scheme that uniquely identifies all images in an archive.

It is a further object of present invention to provide an identification schemata that describes physical attributes of all images in an archive.

It is a further object of the present invention to separate classificatory information from tracking information.

It is a further object of the present invention to provide an enumeration schemata applicable to an unlimited set of media formats used in producing images.

It is a further object of the present invention to apply the archival scheme to all stages of an image's life-cycle, from initial formation to final form.

It is a further object of the present invention to create

self-generating archives, through easy assimilation into any image-producing device.

It is a further object of the present invention to create variable levels of tracking that are easily represented by current and arriving barcode symbologies, to automate data transmission across different technologies (e.g., negative to digital to print).

These and other objects of the present invention will become clear to those skilled in the art from the description that follows.

Brief Description of the Invention

The present invention is a universal image tracking method and apparatus for tracking and documenting images through their complete life-cycle, regardless of the device, media, size, resolution, etc., used in producing them.

Specifically, the automated system for image archiving ("ASIA") encodes, processes, and decodes numbers that characterize images and image related data. Encoding and decoding takes the form of a 3-number association: 1) location number (serial and chronological location), 2) image number (physical attributes), and 3) parent number (parent-child relations).

Brief Description of the Drawings

Figure 1. Invention

Figure 1A. Overview of original image input

Figure 1B. Overview of lineage information generation

Figure 2. Formal specification

Figure 3 Encoding

Figure 4 Decoding

Figure 5 Implementation

Figure 6 Parent-child tree

Figure 7 ASIA

Detailed Description of the Invention

The present invention is a method and apparatus for formally specifying relations for constructing image tracking mechanisms, and providing an implementation that includes an encoding schemata for images regardless of form or the equipment on which the image is produced.

Referring to Figure 1 an overview of the present invention is shown. This figure provides the highest-level characterization of the invention. Figure 1 itself represents all components and relations of the ASIA.

Reference conventions. Since Figure 1 organizes all high-level discussion of the invention, this document introduces the following conventions of reference.

- Whenever the text refers to "the invention" or to the, *"Automated System for Image Archiving"*, it refers to the aggregate components and relations identified in Figure 1.
- Parenthesized numbers to the left of the image in Figure 1 **Invention** represent **layers** of the invention. For example, 'Formal specification'

represents the "first layer" of the invention.

In Figure 1 **Invention**, each box is a hierarchically derived sub-component of the box above it. 'ASIA' is a sub-component of 'Formal objects', which is a sub-component of 'Formal specification'. By implication, thus, ASIA is also hierarchically dependent upon 'Formal specification.' The following descriptions apply.

Formal specification 1. This represents (a) the formal specification governing the creation of systems of automatic image enumeration, and (b) all derived components and relations of the invention's implementation.

Formal objects 2. This represents implied or stated implementations of the invention.

ASIA 3. This is the invention's implementation software offering.

It is useful to discuss an overview of the present invention as a framework for the more detailed aspects of the invention that follow. Referring first to figure 1A an overview of the original image input process according to the present invention is shown. The user first inputs information to the system to provide information on location, author, and other record information. Alternatively, it is considered to be within the scope of the present invention for the equipment that the user is using to input the required information. In this manner, data is entered with minimum user interaction.

This information will typically be in the format of the equipment doing the imaging. The system of the present invention simply converts the data via a configuration algorithm, to the form needed by the system for further processing. The encoding/decoding engine 12 receives the user input information, processes into, and determines the appropriate classification and archive information to be in coded 14. The system next creates the appropriate representation 16 of the input information and attaches the information to the image in question 18. Thereafter the final image is output 20, and comprises both the image data as well as the appropriate representation of the classification or archive information. Such archive information could be in electronic form seamlessly embedded in a digital image or such information could be in the form of a barcode or other graphical code that is printed together with the image on some form of hard copy medium.

Referring to figure 1B the operation of the system on an already existing image is described. The system first receives the image and reads the existing archival barcode information 30. This information is input to the encoding/decoding engine 32. New input information is provided 36 in order to update the classification and archival information concerning the image in question. This information will be provided in most cases without additional user intervention. Thereafter the encoding/decoding engine

determines the contents of the original barcoded information and arrives at the appropriate encoded data and lineage information 34. This data and lineage information is then used by the encoding/decoding engine to determine the new information that is to accompany the image 38 that is to be presented together with the image in question. Thereafter the system attaches the new information to the image 40 and outputs the new image together with the new image related information 42. In this fashion, the new image contains new image related information concerning new input data as well as lineage information of the image in question. Again, such archive information could be in electronic form as would be the case for a digital image or such information could be in the form of a barcode or other graphical code that is printed together with the image on some form of hard copy medium.

Referring to Figure 2 the formal relations governing encoding **4**, decoding **5**, and implementation of the relations **6** are shown. Encoding and decoding are the operations needed to create and interpret the information on which the present invention relies. These operations in conjunction with the implementation of the generation of the lineage information give rise to the present invention. These elements are more fully explained below.

Encoding

Introduction. This section specifies the formal relations characterizing all encoding of the invention, as identified in

Figure 2 **Formal specification.**

Rather than using a "decision tree" model (e.g., a flow chart), Figure 3 uses an analog circuit diagram. Such a diagram implies the traversal of all paths, rather than discrete paths, which best describes the invention's, encoding relations.

Component descriptions. Descriptions of each component in Figure 3 **Encoding** follow.

Apparatus input **301** generates raw, unprocessed image data, such as from devices or software. Apparatus input could be derived from image data, for example, the digital image from a scanner or the negative from a camera system.

Configuration input **303** specifies finite bounds that determine encoding processes, such as length definitions or syntax specifications.

The resolver **305** produces characterizations of images. It processes apparatus and configuration input, and produces values for variables required by the invention.

Using configuration input, the timer 307 produces time stamps. Time-stamping occurs in 2 parts:

The clock **309** generates time units from a mechanism. The filter **311** processes clock output according to specifications from the configuration input. Thus the filter creates the output of the clock in a particular format that can be used later in an automated fashion. Thus the output from the clock is passed through the filter to produce a time-stamp.

User data processing **313** processes user specified information such as author or device definitions, any other information that the user deems essential for identifying the image produced, or a set of features generally governing the production of images.

Output processing **315** is the aggregate processing that takes all of the information from the resolver, timer and user data and produces the final encoding that represents the image of interest.

Decoding

Referring to Figure 4 the relationships that characterize all decoding of encoded information of the present invention are shown. The decoding scheme shown in Figure 4 specifies the highest level abstraction of the formal grammar characterizing encoding. The set of possible numbers (the "language") is specified to provide the greatest freedom for expressing characteristics of the image in question, ease of decoding, and compactness of representation. This set of numbers is a regular language (i.e., recognizable by a finite state machine) for maximal ease of implementations and computational speed. This language maximizes the invention's applicability for a variety of image forming, manipulation and production environments and hence its robustness.

Decoding has three parts: location, image, and parent. The "location" number expresses an identity for an image through use of the following variables.

	generation	Generation depth in tree structures.
	sequence	Serial sequencing of collections or lots of images.
	time-stamp	Date and time recording for chronological sequencing.
	author	Creating agent.
	device	Device differentiation, to name, identify, and distinguish currently used devices within logical space.
	locationRes	Reserved storage for indeterminate future encoding.
	locationCus	Reserved storage for indeterminate user customization.

The "image" number expresses certain physical attributes of an image through the following variables.

category	The manner of embodying or "fixing" a representation, e.g., "still" or "motion".
size	Representation dimensionality.
bit-or-push	Bit depth (digital dynamic range) or push status of representation.
set	Organization corresponding to a collection of tabular specifiers, e.g. a "Hewlett Packard package of media tables.
media	Physical media on which representation occurs.
resolution	Resolution of embodiment on media.

stain	Category of fixation-type onto media, e.g. "color".
format	Physical form of image, e.g. facsimile, video, digital, etc.
imageRes	Reserved storage for indeterminate future encoding.
imageCus	Reserved storage for user customization.

The "parent" number expresses predecessor image identity through the following variables.

time-stamp	Date, and time recording for chronological sequencing.
parentRes	Reserved storage, for indeterminate future encoding.
parentCus	Reserved storage, for indeterminate user customization.

Any person creating an image using "location," "image," and "parent" numbers automatically constructs a representational space in which any image-object is uniquely identified, related to, and distinguished from, any other image-object in the constructed representational space.

Implementation

Referring to figure 5, the formal relations characterizing all implementations of the invention are shown. Three components and two primary relations characterize any implementation of the encoding and decoding components of the present invention. Several definitions of terms are apply.

"**schemata" 51** are encoding rules and notations.

"**engine " 53** refers to the procedure or procedures for processing data specified in a schemata.

"**interface" 55** refers to the structured mechanism for interacting with an engine.

The engine and interface have interdependent relations, and combined are hierarchically subordinate to schemata. The engine and interface are hierarchically dependent upon schemata.

Formal objects

The present invention supports the representation of (1) parent-child relations, (2) barcoding, and (3) encoding schemata. While these specific representations are supported, the description is not limited to these representations but may also be used broadly in other schemes of classification and means of graphically representing the classification data.

Parent-child implementation

Parent-child relations implement the 'schemata' and 'engine' components noted above. The following terms are used in conjunction with the parent child implementation of the present invention:

"conception date" means the creation date/time of image.

"originating image" means an image having no preceding conception date.

"tree" refers to all of the parent-child relations descending from an originating image.

"**node**" refers to any item in a tree.

"**parent**" means any predecessor node, for a given node.

"**parent identifier**" means an abbreviation identifying the conception date of an image's parent.

"**child**" means a descendent node, from a given node.

"**lineage**" means all of the relationships ascending from a given node, through parents, back to the originating image.

"**family relations**" means any set of lineage relations, or any set of nodal relations.

A conventional tree structure describes image relations.

Encoding

Database software can trace parent-child information, but does not provide convenient, universal transmission of these relationships across all devices, media, and technologies that might be used to produce images that rely on such information. ASIA provides for transmission of parent-child information both (1) inside of electronic media, directly; and (2) across discrete media and devices, through barcoding.

This flexibility implies important implementational decisions involving time granularity and device production speed.

Time granularity & number collision. This invention identifies serial order of children (and thus parents) through date- and time-stamping. Since device production speeds for various image forming devices vary across applications, e.g.

from seconds to microseconds, time granularity that is to be recorded must at least match device production speed. For example, a process that takes merely tenths of a second must be time stamped in at least tenths of a second.

In the present invention any component of an image forming system may read and use the time stamp of any other component. However, applications implementing time-stamping granularities that are slower than device production speeds may create output collisions, that is, two devices may produce identical numbers for different images. Consider an example in which multiple devices would process and reprocess a given image during a given month. If all devices used year-month stamping, they could reproduce the same numbers over and over again.

The present invention solves this problem by deferring decisions of time granularity to the implementation. Implementation must use time granularity capable of capturing device output speed. Doing this eliminates all possible instances of the same number being generated to identify the image in question. In the present invention, it is recommended to use time intervals beginning at second granularity, however this is not meant to be a limitation but merely a starting point to assure definiteness to the encoding scheme. In certain operations, tenths of a second (or yet smaller units) may be more appropriate in order to match device production speed.

Specification

All images have parents, except for the originating image which has a null ('0') parent. Parent information is recorded through (1) a generation depth identifier derivable from the *generation* field of the location number, and (2) a parent conception date, stored in the parent number. Two equations describe parent processing. The first equation generates a parent identifier for a given image and is shown below.

Equation 1: Parent identifiers. A given image's parent identifier is calculated by decrementing the location number's *generation* value (i.e. the generation value of the given image), and concatenating that value with the parent number's parent value. Equation 1 summarizes this:

$$parent\ identifier = prev(generation) \cdot parent \qquad (1)$$

To illustrate parent-child encoding, consider an image identified in a given archive by the following key:

B0106-19960713T195913JSA:1-19 S135F-OFCP@0100S:2T-0123 19960613T121133

In this example the letter "B" refers to a second generation. The letter "C" would mean a third generation and so forth. The numbers "19960713" refers to the day and year of creation, in this case July 13, 1996. The numbers following the "T" refers to the time of creation to a granularity of seconds, in this case 19:59:13 (using a 24 hour clock). The date and time for the production of the parent image on which the example image relies is 19960613T121133, or June 13, 1996

at 12:11:33.

Equation 1 constructs the parent identifier:

parent identifier = *prev(generation)* • *parent*

or,

parent identifier = prev(B) • (19960613T121133)

= A • 19960613T121133

= A19960613T121133

The location number identifies a B (or "2nd") generation image. Decrementing this value identifies the parent to be from the **A** (or "1st") generation. The parent number identifies the *parent* conception date and time, (19960613T121133). Combining these, yields the parent identifier A19960613T121133, which uniquely identifies the parent to be generation A, created on 13 June 1996 at 12:11:13PM (T121133).

Equation 2 evaluates the number of characters needed to describe a given image lineage.

Equation 2: Lineage lengths. Equation 2 calculates the number of characters required to represent any given generation depth and is shown below:

$$\begin{matrix} \textit{lineage} \\ \textit{length} \end{matrix} = \textit{len(key)} + (\textit{generation} - 1) * \textit{len}\begin{pmatrix} \textit{parent} \\ \textit{depth} \end{pmatrix} \begin{matrix} \\ (\textit{identifier}) \end{matrix} \quad (2)$$

Example: 26 generations, 10^{79} family relations. Providing a 26 generation depth requires a **1** character long definition for *generation* (i.e. A-Z). Providing 1000 possible transformations for each image requires millisecond time

encoding, which in turn requires a **16** character long *parent* definition (i.e. gen. 1-digit, year-4 digit, month 2-digit, day 2-digit, hour 2-digit, min. 2-digit, milliseconds 3-digit). A 1 character long *generation* and 16 character long *parent* yield a 17 character long parent identifier.

Referring to Figure 6, the parent child encoding of the present invention is shown in an example form. The figure describes each node in the tree, illustrating the present invention's parent-child support.

601 is a 1st generation original color transparency.

603 is a 2nd generation 3x5 inch color print, made from parent 601.

605 is a 2nd generation 4x6 inch color print, made from parent 601.

607 is a 2nd generation 8x10 inch color internegative, made from parent 601.

609 is a 3rd generation 16x20 inch color print, made from parent 607.

611 is a 3rd generation 16x20 inch color print, 1 second after 609, made from parent 607.

613 is a 3rd generation 8x10 inch color negative, made from parent 607.

615 is a 4th generation computer 32x32 pixel RGB "thumbnail" (digital), made from parent 611.

617 is a 4th generation computer 1280x1280 pixel RGB screen dump (digital), 1 millisecond after 615, made

from parent 611.

619 is a 4th generation 8.5x11 inch CYMK print, from parent 611.

This tree (Figure 6) shows how date- and time-stamping of different granularities (e.g., nodes 601,615, and 617) distinguish images and mark parents. Thus, computer screen-dumps could use millisecond accuracy (e.g., 615,617), while a hand-held automatic camera might use second granularity (e.g., 601). Such variable date,- and time-stamping guarantees (a) unique enumeration and (b) seamless operation of multiple devices within the same archive.

Applications

The design of parent-child encoding encompasses several specific applications. For example, such encoding can provide full lineage disclosure, and partial data disclosure.

Application 1: Full lineage disclosure, partial data disclosure

Parent-child encoding compacts lineage information into parent identifiers. Parent identifiers disclose parent-child tracking data, but do not disclose other location or image data. In the following example a given lineage is described by (1) a fully specified key (location, image, and parent association), and (2) parent identifiers for all previous parents of the given key. Examples illustrates this design feature.

Example 1: 26 generations, 10^{79} family relations.

Providing a 26 generation depth requires a **1** character long definition for *generation*. Providing 1000 possible transformations for each image requires millisecond time encoding, which in turn requires a **16** character long *parent* definition. A 1 character long *generation* and 16 character long *parent* yield a 17 character long parent identifier (equation 1).

Documenting all possible family relations requires calculating the sum of all possible nodes. This is a geometric sum increasing by a factor of 1000 over 26 *generations*. The geometric sum is calculated by the following equation:

$$sum = \frac{factor^{(generations+1)} - 1}{factor - 1} \qquad (3)$$

or,

$$sum = \frac{1000^{(26+1)} - 1}{1000 - 1}$$

$$= \frac{10^{81} - 1}{999}$$

$$= 1.00 \cdot 10^{79}$$

For 26 generations, having 1000 transformations per image, the geometric sum yields 10^{79} possible family relations. To evaluate the number of characters needed to represent a maximum lineage encoded at millisecond accuracy across 26 generations, the following equation is used (noted earlier):

```
1          lineage = len(key) + (generation) -1 * len(   parent )
2          length               (  depth    )          (identifier)
3
4           or,
```

$$\text{lineage length} = (100) + (26 - 1) * (17) = 525$$

Thus, the present invention uses **525 characters** to encode the maximum lineage in an archive having 26 generations and 1000 possible transformations for each image, in a possible total of 10^{79} family relations.

Example 2: 216 generations, 10^{649} family relations. The upper bound for current 2D symbologies (e.g., PDF417, Data Matrix, etc.) is approximately 4000 alphanumeric characters per symbol. The numbers used in this example illustrate, the density of information that can be encoded onto an internally sized 2D symbol.

Providing a 216 generation depth requires a **2** character long definition for *generation*. Providing 1000 possible transformations for each image requires millisecond time encoding, which in turn requires a 16 character long *parent* definition. A 2 character long *generation* and 16 character long *parent* yield an 18 character long parent identifier. To evaluate the number of characters needed to represent a maximal lineage encoded at millisecond accuracy across 216 generations, we recall equation 2:

$$\text{lineage length} = \text{len(key)} + (\text{generation depth}) - 1 * \text{len}(\text{parent identifier})$$

or,

lineage = (100) + (216-1) * (18)
length
= 3970

In an archive having 216 generations and 1000 possible modifications for each image, a maximal lineage encoding requires **3970 characters**.

Documenting all possible family relations requires calculating the sum of all possible nodes. This is a geometric sum increasing by a *factor* of 1000 over 216 *generations*. To calculate the geometric sum, we recall equation 3:

$$sum = \frac{factor^{(generations+1)} - 1}{factor - 1}$$

or,

$$sum = \frac{1000^{(216+1)} - 1}{1000 - 1}$$

$$= \frac{10^{651} - 1}{999}$$

$$= 1.00 \cdot 10^{649}$$

For 216 generations, having 1000 transformations per image, the geometric sum yields **10^{641} possible family relations**. Thus, this invention uses **3970 characters** to encode a maximal lineage, in an archive having 216 generations and 1000 possible transformations for each image, in a possible total of 10^{649} family relations.

Conclusion. The encoding design illustrated in **Application 1: Full lineage disclosure, partial data disclosure** permits exact lineage tracking. Such tracking discloses full data for a given image, and parent identifier data for a given image's ascendent family. Such design protects proprietary information while providing full data recovery for any lineage by the proprietor.

A 216 generation depth is a practical maximum for 4000 character barcode symbols, and supports numbers large enough for most conceivable applications. Generation depth beyond 216 requires compression and/or additional barcodes or the use of multidimensional barcodes. Furthermore, site restrictions may be extended independently of the invention's apparati. Simple compression techniques, such as representing numbers with 128 characters rather than with 41 characters as currently done, will support 282 generation depth and 10^{850} possible relations.

Application 2: Full lineage disclosure, full data disclosure In direct electronic data transmission, the encoding permits full transmission of all image information without restriction, of any archive size and generation depth. Using 2D+ barcode symbologies, the encoding design permits full lineage tracking to a 40 generation depth in a single symbol, based on a 100 character key and a theoretical upper bound of 4000 alphanumeric characters per 2D symbol. Additional barcode symbols can be used when additional generation depth

is needed.

Application 3: Non-tree-structured disclosure

The encoding scheme of the present invention has extensibility to support non-tree-structured, arbitrary descent relations. Such relations include images using multiple sources already present in the database, such as occurring in image overlays.

Conclusion

Degrees of data disclosure. The invention's design supports degrees of data disclosure determined by the application requirements. In practicable measures the encoding supports:

1. Full and partial disclosure of image data;
2. Lineage tracking to any generation depth, using direct electronic data transmission;
3. Lineage tracking to restricted generation depth, using barcode symbologies, limited only by symbology size restrictions.

Further, ASIA supports parent-child tracking through time-stamped parent-child encoding. No encoding restrictions exist for electronic space. Physical boundaries within 2D symbology space promote theoretical encoding guidelines, although the numbers are sufficiently large so as to have little bearing on application of the invention. In all cases, the invention provides customizable degrees of data disclosure appropriate for application in commercial, industrial, scientific, medical, etc., domains.

Barcoding implementation

Introduction. The invention's encoding system supports archival and classifications schemes for all image-producing devices, some of which do not include direct electronic data transmission. Thus, this invention's design is optimized to support 1D-3D+ barcode symbologies for data transmission across disparate media and technologies.

1D symbology

Consumer applications may desire tracking and retrieval based on 1 dimensional (1D) linear symbologies, such as Code 39. Table 5 shows a configuration example which illustrates a plausible encoding configuration suitable for consumer applications.

The configuration characterized in Table 5 yields a maximal archive size of 989,901 images (or 19,798 images a year for 50 years), using a 4 digit *sequence* and 2 digit *unit*. This encoding creates 13 character keys and 15 character long, Code 39 compliant labels. A database holds full location, image, and parent number associations, and prints convenient location number labels, for which database queries can be made.

<generation>	=	1 character
<sequence>	=	4 digits
<date>	=	6 digits
<unit>	=	2 digits
constants	=	2 characters
Total	=	15 characters

Table 5: Configuration example

With such a configuration, a conventional 10 mil, Code 39 font, yields a 1.5 inch label. Such a label conveniently fits onto a 2x2 inch slide, 3x5 inch prints, etc. Note, that this encoding configuration supports records and parent-child relations through a conventional "database key" mechanism, not through barcode processing.

Conclusion. The ASIA implementation provides native 1D symbology support sufficient for many consumer applications. However, 2D symbology support is preferred since it guarantees data integrity. 2D symbology also provides greater capacity and so can support a richer set of functionality provided by the ASIA.

2D symbology

Comprehensive tracking suitable for commercial, industrial, and scientific applications is achievable electronically, and/or through 2 dimensional (2D), stacked matrix or full matrix symbologies, such as PDF417, Data Matrix, etc. These symbologies have adequate capacity to support complex implementations of the various archival and classification schemes presented.

Example application. 2D symbology can support a rich set of the present invention's encoding. The following examples present some of the possibilities.

1. **Parent-child tracking**. 2D symbology can support significant parent-child encoding including parent-child relations, lineage, tracking mechanisms, and derivative

applications.

2. **Copyright protection**. Combined with certification programs, 2D image encodings of this invention can enhance copyright protection. Referential tracking to production source can be provided on any image, which can include partial or full disclosure of image data. Encryption technologies can further enhance authentication control.

3. **Migration paths**. 2D symbology also includes important potential migration paths for encoding schemata in commercial and industrial image management. 2D applications may include arbitrary encryption; variable sizing; Reed-Solomon error correction (e.g., providing full data recovery with 50% symbol loss); printability through ink, invisible ink, etching, embossing, exposing (e.g., onto negatives or transparencies); and efficient scan rates suitable for automated film processing equipment.

In summary, 2D symbology can facilitate universal data transmission, regardless of the producing technology; or data transmission *from* any form of image-producing device *to* any other form of image-producing device.

Further, the present invention provides viable 1D symbology support at the implementation layer, and a specific implementation with the ASIA software. However, with 1D symbology the same number or classification being assigned to

different images is, in a 1D implementation, theoretically possible.

Use of 2D symbology barcoding eliminates the possibility of ambiguity resulting from the same classification or archive identifiers being assigned to the same image and is therefore preferred. The use of 2D symbology together with the classification and archiving scheme of the present invention can protect any granularity of proprietary image data; provide unobtrusive labeling on prints or print description plates; expose archival encoding directly onto media at exposure, processing, and/or development time; and yield rapid data collection through sorting machines for media, such as transparencies, prints, etc. ASIA provides native support of 2D Data Matrix to facilitate such application development.

3D+ (holographic) symbologies will permit tracking greater lineage depths in single symbols. Supporting this 3D implementation requires no additional complexity to the system.

Schemata

This section describes the invention's schemata, characterized through the tables that follow. Tables 6 and 7, provide a guide to the organization of schemata of the present invention. Tables 9-17 describe the conventions, syntax, and semantics of *location numbers*, *image numbers*, and *parent numbers*. Tables 19-26 fully expand the semantics listed in Table 13 entitled "Image semantics."

Table 6 (following) lists all tables that specify the classification scheme of the present invention. In this table, exact table names are identified together with a brief description of each table which describes the contents of that table.

Tables	Description
Table 9 Conventions	Conventions for all tables
Table 10 Syntax	Syntactic summaries
Table 11 Size/res. syntax	"
Table 12 Locations semantics	Semantic summaries
Table 13 Image semantics	"
Table 14 Parent semantics	"
Table 15 Measure semantics	"
Table 15 Software Packages	"
Table 16 Format semantics	"
Table 17 Size examples	Illustrations of *size*
Table 18 Resolution examples	"
Table 19 Reserved media slots	Specifics for Table 13
Table 20 Color transparency film	"
Table 21 Color negative film	"
Table 22 Black & White film	"
Table 23 Duplicating & internegative film	"
Table 24 Facsimile	"
Table 25 Prints	"
Table 26 Digital	"

Table 6: Schemata tables

Similarly, Table 7 (following) entitled **"Table groupings"** further groups the specification table by the categories in which they are discussed in the following pages.

Title	**Table No.**
Conventions:	Table 9
Syntax:	Tables 10-11
Semantics:	Tables 12-16
Examples:	Tables 17-18
Media:	Tables 19-26

Table 7: Table groupings

Conventions: Table 9

Table 9 entitled **"Conventions"** fully specifies the conventions governing all tabular information in the archival and classification scheme of the present invention. In Table

9, the column **Form** lists the conventions governing syntactic items for all tables in of the present invention. Specific conventions are the following.

- *Emphasized* words indicate variables.
- ROMAN words indicate constant or literal values.
- Angle-brackets <> indicate required material.
- Brackets [] indicate optional material.
- Parentheses () indicate logical groupings.
- Braces {} indicate regular expression modifiers.
- The bar '|' character indicates an alternative.
- The star '*' character indicates "0 or more".
- The plus '+' character indicates "1 or more".

The columns **Variables** comprehensively lists all variables used in Appendix **Schemata**. Each variable represents a single length character, so *n* represents any single digit (not any number of any digit). Specific variables are:

- '*l*' indicates any alphabetical character a-z
- '*n*' indicates any number 0-9
- '*c*' indicates any alphabetical character a-z, or a number 0-9
- '*y*' indicates a digit used to construct the year
- '*m*' indicates a digit used to construct the month
- '*d*' indicates a digit used to construct the day
- '*h*' indicates a digit used to construct the

hour

- 't' indicates a digit used to construct the minute
- 's' indicates a digit used to construct the second
- 'i' indicates a digit used to construct a fractional second.

Table 9: Conventions

Form	Description	Variables	Description
emphasis	variable	*l*	letter
ROMAN	constant	*n*	number
< >	required	*c*	class *ln*
[ ]	optional		
( )	grouping	*y*	year
{ }	modifier	*m*	month
|	alteration	*d*	day
*	0 or more	*h*	hour
+	1 or more	*t*	minute
		s	second
		i	fractional second

Syntax: Tables 10-11

Tables 10-11 strictly conform to the syntactic rules of Table 9 **Conventions** (above). Specifics are described according to two logical divisions:

1. ¶**Location, image, & parent syntax**. This is described in Table 10 entitled "Syntax." Table 10 Syntax

provides a compact summary of the present invention's functionality.

2. ¶**Size & resolution syntax**. This is described in Table 11 entitled "Size/res. syntax." Table 11 **Size/res. syntax** expands the syntax rules for the variable *size* and *resolution*, introduced in Table 10.

Location, image & parent syntax. In Table 10 **Syntax**, the *rows* assigned to **Location, Image** and **Parent** respectively provide:

1. An example of a number ('Example'), showing small and large illustrations of the schemata.
2. The names of each field used by a number ('Names').
3. The specific syntactic rules governing a number('Syntax').

The *columns* identify the type of number ('#'), category, and row illustration.

The association of a *location number* and *image number* guarantees a unique identification of every image in an archive. The association of a *location number, image number,* and *parent number* guarantees unique identification and fully recoverable patent-child relations.

Location numbers track serial and chronological location. Specific fields are (a) required entries *generation, sequence,* and *date*; and (b) optional entries *time, author, device, unit, locationRes,* and *locationCus*. The required entries guarantee minimal tracking information and data consistency for basic electronic sorting, while the optional entries provide

additional granularity for high volume tracking (there are no theoretical size limitations).

Image numbers track primarily physical attributes of images across devices, media types, and storage conditions. Specific fields are (a) required entries *category size, media, push* **or** *bit, resolution, stain,* and *format;* and (b) optional entries, *imageRes* and *imageCus*. Either *push* or *bit* is always required, but both are never permissible. The *format* field determines whether *push* or *bit* is used: *bit* is used when *format* is digitally related, otherwise *push* is used.

Parent numbers track the date and time of parent conception, and optional data. Specific fields are (a) the required entry *parent*, and (b) optional entries *parentRes* and *parentCus*. The required entry encodes parent information for a given child image, while the optional entries provide specification extension and user customization.

Table 10: Syntax

#	Category	Illustration
Location	Example:	small: A1040-199609; large: A1011-19920417T053656599CPG@2-12345:A1.Z2
	Names:	*<generation>* *<sequence>* *<date>* *[time]* *[author]* *[device]* *[unit]* *[locationRes]* *[locationCus]*
	Syntax:	*<l{+}>* *<n{+}>* *<yyyymm[dd]* [T *hhmf*[*ss*[*i*{+}]]] [/{+}] [@*c*{+}] [-*n*{+}] [.*c*{+}] [:*c*{+}]
	⋮	
Image	Example:	small: S135+1KCAM@0200S:2T; large: S135F-024GIF8@HP@0300DI:6D:1A2B.5E
	Names:	*<category>* *<size>* *<[push]>*	*[bit]* *<media>* *[set]* *<resolution>* *<stain>* *<format>* *[imageRes]* *[imageCus]*
	Syntax:	*<l{+}>* *<nc{*}>* *<[-] n {+}]*	[-*n*{+}]> *<c{*}>* [@ *c*{+}] @<*c*{+}> :<*n*{+}> <*a*{+}> [: *c*{+}] [. *c*{+}]
	⋮	
Parent	Example:	19961231T235959; large: 19961231T235959999
	Names:	*<parent>* *<parentRes>* *<parentCus>*
	Syntax:	*<yyyymm[dd]*>[T *hhmf*[*ss*[*i*{+}]]] [: *c*{+}] [. *c*{+}]
	⋮	

NB: Second accuracy is minimally recommended for parent-child encoding. Both (a) *parent* and (b) **Location's** *date* and *time* should use the same specification when possible.

Size & resolution syntax. Table 11 **Size/res. syntax** specifies syntactic rules governing the variables *size* and *resolution*, previously introduced in Table 10. Table 11 describes how the variables *size* and *resolution* express (a) dimension and (b) units of measure.

The row 'Names' indicates variable names, such as '<*measure*>' for the unit of measure. 'Syntax 1' and 'Syntax 2' are the canonical syntaxes.

Table 11: Size/res. syntax

Category	Illustration			
Names	<*dimension*>			<*measure*>
Syntax 1	<*c*{+}>			<*lc*{*}>
Names	<*X-dimension*>	X	<*Y-dimension*>	<*measure*>
Syntax 2	<*n*{+}>	X	<*n*{+}>	<*lc*{*}>

NB: Variables *size* and *resolution* use either syntax form. Table 15 **Measure Semantics** lists *measure* values. Table 17 **Size examples** and 18 **Resolution examples** provide illustrations.

Semantics: Tables 12-16

Introduction. Tables 12-16 describe semantic conventions, and fully specify the syntactic rules of Tables 10-11. Values for all variables are *case insensitive*. Tables 12-16 describe the meanings of syntactic names, literal values, descriptions of syntactic elements, and lengths of all fields. Specifics are described according to the following conceptual divisions.

Location semantics	Table 12
Image semantics	Table 13
Parent semantics	Table 14

Measure semantics Table 15

Format semantics Table 16

Location semantics. In Table 12 **Location semantics**, **Location** indicates the location number classification. The column **Name** indicates the name of a given location number *field*, while the column **Description,** describes what a *field* means. For example, the field <*date*> within the classification **Location**, describes the date when the lot was made.

In the next column of Table 12, **Syntax,** Table 10's row **Syntax** is relisted in vertical form. The column **Literal** lists the corresponding values or ranges of permissible values. For example, the **Syntax** '*-yyyy*' for the field <*date*> literally expands into a permissible range of 0000-9,999 years. The next column **Description**, describes what the legal value means. For example, '*yyyy*' is the year.

Finally, the column **Length** indicates the permissible length of a given argument. For example, in the <*date*> field, a minimum of 7 characters is required, and a maximum of 9 characters is permissible.

Table 12: Location semantics

				Legal Values			
	#	Name	Description	Syntax	Literal	Description	Length
Location		*<generation>*	Lot generation	*l*{+}	A-Z	A =1st	1+
					AA-ZZ	AA = 27th	
					..	etc.	
		<sequence>	Sequence in	*n*{+}	0-9	Lot number	1+
			archive		0000-9999		
					..	etc.	
		<date>	Date made	*-yyyy*	0000-9999	Year	7 [9]
			(ISO 8601:1988	*mm*	01-12	Month	
			compliant)	[*dd*]	01-31	Day	
		[*time*]	Time made	[T *hh*	00-23	Hour	[5+]
			(ISO 8601:1988	*tt*	00-59	Minute	
			compliant, plus	[*ss*	00-59	Second	
			any fractional	[*i*{+}]]]	0-9	Fractional	
			second)			second	
		[*author*]	Author	[*lc*{*}]	a-zA-Z	Author's name	[1+]
					..	etc.	
		[*device*]	Device used	[@*c*{+}]	0-9	Device number	[2+]
					..	etc.	
		[*unit*]	Image in Lot	[-*n*{+}]	0-9	Image number	
					0000-9999		
					..	etc.	[2+]
		[*locationRes*]	Unspecified	[:*c*{+}]	a-zA-Z0-9	Future use	[2+]
		[*locationCus*]	Unspecified	[.*c*{+}]	a-zA-Z0-9	User Customization	[2+]
						Total	**9 [-25+]**

Image semantics. In Table 13 **Image semantics**, **Image** indicates the image number classification. The column **Name** indicates the name of a given image number *field*, while the column **Description** describes what a *field* means. For example, the field <*category*> describes the category of the image number.

In the next column of Table 13, **Syntax**, Table 10's row **Syntax** is relisted in vertical form. The next column **Literal**, lists the corresponding values or ranges of permissible values. The next column **Description**, describes what the **Literal** value means. Finally, the column **Length** indicates the permissible length of a given argument. For example, the <*size*> field uses 1 or more characters.

Table 13: Image semantics

				Legal Values		
#	Name	Description	Syntax	Literal	Description	Length
Image	<*category*>	Category	*l*{+}	S	Single Frame	1+
				M	Motion Picture	
	<*size*>	Image or film size	*nc*{*}	(See Table 11	Size/res. syntax)	1+
				(See Table 15	Measure semantics)	
				(See Table 18	Size examples)	
	<*push* |	Exposure	<(-|+)*n*{+} |	0	No push ('+' = up)	<2+|
				3	3 stops ('-' = down)	
				..	etc.	
	bit>	Dynamic range	-*n*{+}>	0-9	E.g, 8=8 bit	2+>
		("bit depth")		..	etc.	

	#	Name	Description	Syntax	Literal	Description	Length
1		*<media>*	Image media	*lc{*}*	(See Table 20	Reserved)	
2					(See Table 21	Slides)	2+
3					(See Table 22	Negatives)	
4					(See Table 23	B&W)	
5					(See Table 24	Dups & Internegs	
6					(See Table 25	Facsimiles)	
7					(See Table 26	Prints)	
					(See Table 27	Digital)	
8		[*set*]	Package	[@c{+}]	(See Table 17	Packages)	
9		*<resolution>*	Resolution	*@c{+}*	(See Table 11	Size/res. syntax	2+
10					(See Table 15	Measure semantics	
					(See Table 19	Resolution examples	
11		*<stain>*	Presentation	*:n{+}*	0	Black & White	1+
12			form		1	Gray scale	
13					2	Color	
14					3	RGB (Red,Grn,Blu)	
15					4	YIQ (RGB TV	
16						variant)	
17					5	CYMK	
18						(Cyn,Yel,Mag,BlK)	
19					6	HSB (Hue, Sat,	
20						Bright)	
21			("bit depth")		7	CIE (Commission	
22						de l'Eclairage)	
23					8	LAB	
24						etc.	
25							
26		*</format>*	Image form	*lc{*}*	(See Table 16	Format sematics)	1+

#	Name	Description	Syntax	Literal	Description	Length
1	[*imageRes*]	Unspecified	[:c{+}]	a-zA-Z0-9	Future use	[2+]
	[*imageCus*]	Unspecified	[.c{+}]	a-zA-Z0-9	User customization	[2+]
2					Total 10[-16+]	

3

4 **Parent semantics.** In Table 14 Parent semantics, **Parent**
5 indicates the parent number classification. The column **Name**
6 indicates the name of a given parent number field, while the
7 column **Description** describes what a given *field* means. For
8 example, the field <*parentRes*> is a reserved field for future
9 use.

10 In the next column of Table 14, **Syntax,** Table 10's row
11 **Syntax** is relisted in vertical form. The next column **Literal**,
12 lists the corresponding values or ranges of permissible
13 values. The next column **Description**, describes what the
14 **Literal** value means. Finally, the column **Length** indicates the
15 permissible length of a given argument. For example, the
16 <*parent*> field uses 6 or more characters.
17 **Measure semantics**. Table 15 **Measure semantics** specifies legal
18 values for the variables *size* and *resolution*, previously
19 described by the rules in Table 11 **Size/res. syntax**.

Table 14: Parent semantics

#	Name	Description	Syntax	Legal Values: Literal	Desription	Length
Parent	*<parent>*	Parent	*yyyymm*[*dd*] [*Thhtt*[*ss*[*i*{+}]]]	0-9 0-9T0-9	Date/time	6+
	[*parentRes*]	Unspecified	[*:c*{+}]	a-zA-Z0-9	Future use	[1+]
	[*parentCus*]	Unspecified	[*.c*{+}]	a-zA-Z0-9	User customization	[1+]
						Total
	6 [-8+]					

The column **Category** identifies which values are shared by *size* and *resolution* and which are unique. The column **Literal** lists the abbreviations used in *size* and *resolution* values. The column **Description** expands the abbreviations into their corresponding names.

Table 15: Measure semantics

Category	Literal	Description	
Shared	DI	Dots per inch	(dpi)
	DE	Dots per foot	(dpe)
	DY	Dots per yard	(dpy)
	DC	Dots per centimeter	(dpc)
	DM	Dots per millimeter	(dpm)
	DP	Dots per pixel	(dpp)
	DT	Dots per meter	(dpt)
	M	Millimeters	
	C	Centimeters	
	T	Meters	
	I	Inches	
	E	Feet	
	Y	Yard	
	P	Pixel	
	L	Lines	
	R	Rows	
	O	Columns	
	B	Columns & Rows	
	. .	etc.	
Size	F	Format	
Unique	. .	etc.	
Res. Unique	S	ISO	
	. .	etc.	

Format semantics. Table 16 Format semantics specifies legal values for the variable *format*, previously described in Table 13 Image semantics. The **Literal** column lists legal values and

the **Description** column expands the abbreviations into their corresponding names.

Table 16: Format semantics

Literal	Description
A	Audio-visual
C	Photocopy
D	Digital
F	Facsimile
L	Plotter
M	MRI
N	Negative
P	Print
R	Vector graphics
T	Transparency
V	Video
X	X-radiographic
..	etc.

Table 17: Packages

Literal	Description
3C	3Com
3M	3M
AD	Adobe
AG	AGFA
AIM	AIMS Labs
ALS	Alesis
APP	Apollo
APL	Apple
ARM	Art Media
ARL	Artel
AVM	Aver Media Technologies
ATT	AT&T
BR	Bronica
BOR	Borland
CN	Canon
CAS	Casio
CO	Contax
CR	Corel
DN	Deneba
DL	DeLorme
DI	Diamond
DG	Digital
DIG	Digitech

1	EP	Epson
2	FOS	Fostex
3	FU	Fuji
4	HAS	Hasselblad
5	HP	Hewlett Packard
6	HTI	Hitachi
7	IL	Ilford
8	IDX	IDX
9	IY	Iiyama
10	JVC	JVC
11	KDS	KDS
12	KK	Kodak
13	KN	Konica
14	IBM	IBM
15	ING	Intergraph
16	LEI	Leica
17	LEX	Lexmark
18	LUC	Lucent
19	LOT	Lotus
20	MAM	Mamiya
21	MAC	Mackie
22	MAG	MAG Innovision
23	MAT	Matrox Graphics
24	MET	MetaCreations
25	MS	Microsoft
26	MT	Microtech
27	MK	Microtek
28	MIN	Minolta
29	MTS	Mitsubishi
30	MCX	Micrografx
31	NEC	NEC
32	NTS	Netscape
33	NTK	NewTek
34	NK	Nikon
35	NS	Nixdorf-Siemens
36	OLY	Olympus
37	OPC	Opcode
38	OR	O'Reilly
39	PAN	Panasonic
40	PNC	Pinnacle
41	PNX	Pentax
42	PO	Polaroid
43	PRC	Princeton Graphics
44	QT	Quicktime
45	ROL	Roland
46	RO	Rollei
47	RIC	Ricoh
48	SAM	Samsung
49	SAN	SANYO
50	SHA	Sharp
51	SHI	Shin Ho
52	SK	Softkey
53	SN	Sony
54	SUN	SUN
55	TAS	Tascam
56	TEAC	TEAC

TKX	Tektronix
TOS	Toshiba
ULS	Ulead systems
UMX	UMAX
VWS	ViewSonic
VID	Videonics
WG	Wang
XX	Unknown
XE	Xerox
YAS	Yashica
YAM	Yamaha

Table 18: Size examples

Literal	Dimension	Measure	
Syntax 1	135F	35mm	format
	120F	Medium	format
	220F	Full	format
	4X5F	4x5	format
	..	..	etc.
Syntax 2	9X14C	9x14	centimeter
	3X5I	3x5	inch
	4X6I	4x6	inch
	5X7I	5x7	inch
	8X10I	8x10	inch
	11X14I	11x14	inch
	16X20I	16x20	inch
	20X24I	20x24	inch
	24X32I	24x32	inch
	24X36I	24x36	inch
	32X40I	32x40	inch
	40X50I	40x50	inch
	50X50I	50x50	inch
	40X50P	40X50	pixels
	100X238P	100X238	pixels
	1024X1280P	1024X1280	pixels
	A4S	210x297mm	sheet
	A5S	148x210mm	sheet
	JIS B5S	182x257mm	sheet
	LETTERS	8.5x11in	sheet
	LEGALS	8.5x14in	sheet
	EXECUTIVES	7.25x10.5in	sheet
	..	..	etc.

Examples: Tables 18-19

Size & resolution examples. Table 18 **Size examples** illustrates typical *size* values, and Table 19 **Resolution examples** illustrates typical *resolution* values.

Values in these tables represent limited defaults since

size and *resolution* are algorithmically generated from the rules contained in Table 11 **Size/res. syntax**, and from the values contained in Table 15 **Measure semantics**. See ¶**Size & resolution syntax** for details.

Table 19: Resolution examples

Literal	Dimension	Measure	
Syntax 1	50S	50	ISO
	200S	200	ISO
	300DC	600	dpc
	1200DI	1200	dpi
	..	..	etc.
Syntax 2	640X768P	640X768	pixels
	1024X1280P	1024X1280	pixels
	1280X1600P	1024X1280	pixels
	..	..	etc.

Media: Tables 20-27

Table 20-27 specify the supported *media* listed in Table 13 **Image semantics**. Values of *media* are tied to values of *format*, so any *format* value may have its own *media* table. Since *format* is unlimited in size, *media* support is also unlimited.

Tables 20-24: Film Media. In Tables 20-24, the first character represents film manufacturers in the following ways:

- 'A' represents Agfa
- 'F' represents Fuji
- 'I' represents Ilford
- 'C' represents Konica
- 'K' represents Kodak
- 'P' represents Polaroid

- 'S' represents Seattle Film Works
- 'T' represents 3M
- 'X' represents an unknown film manufacturer

This leaves 17 slots for additional major film manufacturers, before a single first letter prefix must represent multiple manufacturers, or before additional letters must be added. Any number of film media may be supported, but 223 defaults are provided in the preferred embodiment of the present invention.

Table 20: Reserved media slots

Reserved For	Literal	Description
Unknown	XXXX	Unknown film
User	UX0	Customization
	UX1	"
	UX2	"
	UX3	"
	UX4	"
	UX5	"
	UX6	"
	UX7	"
	UX8	"
	UX9	"
Specification	UR0	For future use
	UR1	"
	UR2	"
	UR3	"
	UR4	"
	UR5	"
	UR6	"
	UR7	"
	UR8	"
	UR9	"

Table 21: Color Transparency film

Company	Literal	Description
Agfa	AASC	Agfa Agfapan Scala Reversal (B&W)
	ACRS	Agfa Agfachrome RS
	ACTX	Agfa Agfachrome CTX
	ARSX	Agfa Agfacolor Professional RSX Reversal
Fuji	FCRTP	Fuji Fujichrome RTP
	FCSE	Fuji Fujichrome Sensia
	FRAP	Fuji Fujichrome Astia
	FRDP	Fuji Fujichrome Provia Professional 100
	FRPH	Fuji Fujichrome Provia Professional 400
	FRSP	Fuji Fujichrome Provia Professional 1600
	FRTP	Fuji Fujichrome Professional Tungsten
	FRVP	Fuji Fujichrome Velvia Professional
Ilford	IICC	Ilford Ilfochrome
	IICD	Ilford Ilfochrome Display
	IICM	Ilford Ilfochrome Micrographic
Konica	CAPS	Konica APS JX
	CCSP	Konica Color Super SR Professional
Kodak	K5302	Kodak Eastman Fine Grain Release Positive Film 5302
	K7302	Kodak Fine Grain Positive Film 7302
	KA2443	Kodak Aerochrome Infrared Film 2443
	KA2448	Kodak Aerochrome II MS Film 2448
	KE100SW	Kodak Ektachrome Professional E100SW Film

	KE100S	Kodak Ektachrome Professional E100S Film
	KE200	Kodak Ektachrome Professional E200 Film
	KEEE	Kodak Ektachrome Elite
	KEEO100	Kodak Ektachrome Electronic Output Film 100
	KEEO200	Kodak Ektachrome Electronic Output Film
	KEEO64T	Kodak Ektachrome Electronic Output Film 64T
	KEEP	Kodak Ektachrome E Professional
	KEES	Kodak Ektachrome ES
	KEEW	Kodak Ektachrome EW
	KEIR	Kodak Ektachrome Professional Infrared EIR Film
	KEK	Kodak Ektachrome
	KELL	Kodak Ektachrome Lumiere Professional
	KELX	Kodak Ektachrome Lumiere X Professional
	KEPD	Kodak Ektachrome 200 Professional Film
	KEPF	Kodak Ektachrome Professional
	KEPH	Kodak Ektachrome Professional P1600 Film
	KEPJ	Kodak Ektachrome 320T Professional Film, Tungsten
	KEPL400	Kodak Ektachrome Professional 400X Film
	KEPL	Kodak Ektachrome 200 Professional Film
	KEPL	Kodak Ektachrome Plus Professional
	KEPN	Kodak Ektachrome 100 Professional Film
	KEPO	Kodak Ektachrome P Professional
	KEPR	Kodak Ektachrome 64 Professional
	KEPT	Kodak Ektachrome 160T Professional Film, Tungsten
	KEPY	Kodak Ektachrome 64T Professional Film, Tungsten
	KETP	Kodak Ektachrome T Professional
	KETT	Kodak Ektachrome T
	KEXP	Kodak Ektachrome X Professional
	KCCR	Kodak Kodachrome
	KPKA	Kodak Kodachrome Professional 64 Film
	KPKL	Kodak Kodachrome Professional 200 Film
	KPKM	Kodak Kodachrome Professional 25
	KVSSO279	Kodak Film Vericolor Slide Film SO-279
	KVS	Kodak Vericolor Slide Film
Polaroid	PPCP	Polaroid Professional High Contrast Polychrome
Reserved	--	See Table 20
Seattle Film Works	SFWS	Seattle Film Works
3M	TSCS	3M ScotchColor Slide
	TSCT	3M ScotchColor T slide

Table 22: Color negative film

Company	Literal	Description
Agfa	ACOP	Agfa Agfacolor Optima
	AHDC	Agfa Agfacolor HDC
	APOT	Agfa Agfacolor Triade Optima Professional
	APO	Agfa Agfacolor Professional Optima
	APP	Agfa Agfacolor Professional Portraita
	APU	Agfa Agfacolor Professional Ultra
	APXPS	Agfa Agfacolor Professional Portrait XPS
	ATPT	Agfa Agfacolor Triade Portraita Professional
	ATUT	Agfa Agfacolor Triade Ultra Professional
Fuji	FHGP	Fuji Fujicolor HG Professional

1		FHG	Fuji Fujicolor HG
2		FNHG	Fuji Fujicolor NHG Professional
3		FNPH	Fuji Fujicolor NPH Professional
4		FNPL	Fuji Fujicolor NPL Professional
5		FNPS	Fuji Fujicolor NPS Professional
6		FPI	Fuji Fujicolor Print
7		FPL	Fuji Fujicolor Professional, Type L
8		FPO	Fuji Fujicolor Positive
9		FRG	Fuji Fujicolor Reala G
10		FR	Fujicolor Reala
11		FSGP	Fuji Fujicolor Super G Plus
12		FSG	Fuji Fujicolor Super G
13		FSHG	Fuji Fujicolor Super HG 1600
14		FS	Fuji Fujicolor Super
15	Kodak	K5079	Kodak Motion Picture 5079
16		K5090	Kodak CF1000 5090
17		K5093	Kodak Motion Picture 5093
18		K5094	Kodak Motion Picture 5094
19		KA2445	Kodak Aerocolor II Negative Film 2445
20		KAPB	Advantix Professional Film
21		KCPT	Kodak Kodacolor Print
22		KEKA	Kodak Ektar Amateur
23		KEPG	Ektapress Gold
24		KEPPR	Kodak Ektapress Plus Professional
25		KGOP	Kodak Gold Plus
26		KGO	Kodak Gold
27		KGPX	Kodak Ektacolor Professional GPX
28		KGTX	Kodak Ektacolor Professional GTX
29		KPCN	Kodak Professional 400 PCN Film
30		KPHR	Kodak Ektar Professional Film
31		KPJAM	Kodak Ektapress Multispeed
32		KPJA	Kodak Ektapress 100
33		KPJC	Kodak Ektapress Plus 1600 Profession
34		KPMC	Kodak Pro 400 MC Film
35		KPMZ	Kodak Pro 1000 Film
36		KPPF	Kodak Pro 400 Film
37		KPRMC	Kodak Pro MC
38		KPRN	Kodak Pro
39		KPRT	Kodak Pro T
40		KRGD	Kodak Royal Gold
41		KVPS2L	Kodak Vericolor II Professional Type L
42		KVPS3S	Kodak Vericolor III Professional Type S
43		KVP	Kodak Vericolor Print Film
44	Konica	CCIP	Konica Color Impresa Professional
45		CIFR	Konica Infrared 750
46		CCSR	Konica SRG
47	Polaroid	POCP	Polaroid OneFilm Color Print
48	Reserved	--	See Table 20
49			
50			

Table 23: Black & white film

Company	Literal	Description
Agfa	AAOR	Agfa Agfapan Ortho
	AAPX	Agfa Agfapan APX
	APAN	Agfa Agfapan
Ilford	IDEL	Ilford Delta Professional
	IFP4	Ilford FP4 Pl
	IHP5	Ilford HP5 Plus
	IPFP	Ilford PanF Plus
	IPSF	Ilford SFX750 Infrared
	IUNI	Ilford Universal
	IXPP	Ilford XP2 Plus
Fuji	FNPN	Fuji Neopan
Kodak	K2147T	Kodak PLUS-X Pan Professional 2147, ESTAR Thick Base
	K2147	Kodak PLUS-X Pan Professional 2147, ESTAR Base
	K4154	Kodak Contrast Process Ortho Film 4154, ESTAR Thick Base
	K4570	Kodak Pan Masking Film 4570, ESTAR Thick Base
	K5063	Kodak TRI-X 5063
	KA2405	Kodak Double-X Aerographic Film 2405
	KAI2424	Kodak Infrared Aerographic Film 2424
	KAP2402	Kodak PLUS-X Aerographic II Film 2402, ESTAR Base
	KAP2412	Kodak Panatomic-X Aerographic II Film 2412, ESTAR Base
	KEHC	Kodak Ektagraphic HC
	KEKP	Kodak Ektapan
	KH13101	Kodak High Speed Holographic Plate, Type 131-01
	KH13102	Kodak High Speed Holographic Plate, Type 131-02
	KHSIET	Kodak High Speed Infrared, ESTAR Thick Base
	KHSIE	Kodak High Speedo nfrared, ESTAR Base
	KHSI	Kodak High Speed Infrared
	KHSO253	Kodak High Speed Holographic Film, ESTAR Base SO-253
	KLPD4	Kodak Professional Precision Line Film LPD4
	KO2556	Kodak Professional Kodalith Ortho Film 2556
	KO6556	Kodak Professional Kodalith Ortho Film 6556, Type 3
	KPMF3	Kodak Professional Personal Monitoring Film, Type 3
	KPNMFA	Kodak Professional Personal Neutron Monitor Film, Type A
	KPXE	Kodak PLUS-X Pan Professional, Retouching Surface, Emulsion & Base
	KPXP	Kodak PLUS-X Pan Professional, Retouching Surface, Emulsion
	KPXT	Kodak PLUS-X Pan Professional, Retouching Surface, Emulsion & Base
	KPXX	Kodak Plus-X
	KPX	Kodak PLUS-X Pan Film
	KREC	Kodak Recording 2475
	KSAF1	Kodak Spectrum Analysis Film, No. 1
	KSAP1	Kodak Spectrum Analysis Plate, No. 1
	KSAP3	Kodak Spectrum Analysis Plate, No. 3
	KSWRP	Kodak Short Wave Radiation Plate
	KTMXCN	Kodak Professional T-MAX Black and White Film CN
	KTMY	Kodak Professional T-MAX
	KTMZ	Kodak Professional T-MAX P3200 Film
	KTP2415	Kodak Technical Pan Film 2415, ESTAR-AH Base
	KTPKTRP	KodakKTechnicaloPandFilmak TRI-Pan Professional
	KTRXPT	Kodak TRI-X Pan Professional 4164, ESTAR Thick Base
	KTRXP	Kodak TRI-Pan Professional

	KTXP	Kodak TRI-X Professional, Interior Tungsten
	KTXT	Kodak TRI-X Professional, Interior Tungsten
	KTX	Kodak TRI-X Professional
	KVCP	Kodak Verichrome Pan
Konica	CIFR	Kodak Infrared 750
Polaroid	PPGH	Konica Polagraph HC
	PPLB	Polaroid Polablue BN
	PPPN	Polaroid Polapan CT
Reserved	--	See Table 20

Table 24: Duplicating & Internegative Film

Company	Literal	Description
Agfa	ACRD	Agfa Agfachrome Duplication Film CRD
Fuji	FCDU	Fuji Fujichrome CDU Duplicating
	FCDU1	Fujichrome CDU Duplicating, Type I
	FCDU2	Fuji Fujichrome CDU Duplicating, Type II
	FITN	Fuji Fujicolor Internegative IT-N
Kodak	K1571	Kodak 1571 Internegative
	K2475RE	Kodak Recording Film 2475
	K4111	Kodak 4111
	KC4125	Kodak Professional Professional Copy Film 4125
	K6121	Kodak 6121
	KA2405	Kodak Double-X Aerographic Film 2405
	KA2422	Kodak Aerographic Direct Duplicating Film 2422
	KA2447	Kodak Aerochrome II Duplicating Film 2447
	KAR	Kodak Aerographic RA Duplicating Film 2425, ESTAR Base
	KARA4425	Kodak Aerographic RA Duplicating Film 4425, ESTAR Thick Base
	KARA	Kodak Aerographic RA Duplicating Film
	KCIN	Kodak Commercial Internegative Film
	KE5071	Kodak Ektachrome Slide Duplicating Film 5071
	KE5072	Kodak Ektachrome Slide Duplicating Film 5072
	KE6121	Kodak Ektachrome Slide Duplicating Film 6121
	KE7121K	Kodak Ektachrome Duplicating Film 7121, Type K
	KESO366	Kodak Ektachrome SE Duplicating Film SO -366
	KS0279	Kodak S0279
	KS0366	Kodak S0366
	KSO132	Kodak Professional B/W Duplicating Film SO-132
	KV4325	Kodak Vericolor Internegative 4325
	KVIN	Kodak Vericolor Internegative Film
Reserved	--	See Table 20

Table 24: Facsimile. Table 24 **Facsimile** lists supported file formats used in facsimile imaging. All digital formats are supported, plus G1-G5, for a total of 159 supported formats. Any number of facsimile media are permissible.

Table 25: Facsimile

Category	Literal	Description
Digital Facsimile	--	See Table 27
	DFAXH	DigiBoard, DigiFAX Format, Hi-Res
	DFAXL	DigiBoard, DigiFAX Format, Normal-Res
	G1	Group 1 Facsimile
	G2	Group 2 Facsimile
	G3	Group 3 Facsimile
	G32D	Group 3 Facsimile, 2D
	G4	Group 4 Facsimile
	G42D	Group 4 Facsimile, 2D
	G5	Group 4 Facsimile
	G52D	Group 4 Facsimile, 2D
	TIFFG3	TIFF Group 3 Facsimile
	TIFFG3C	TIFF Group 3 Facsimile, CCITT RLE 1D
	TIFFG32D	TIFF Group 3 Facsimile, 2D
	TIFFG4	TIFF Group 4 Facsimile
	TIFFG42D	TIFF Group 4 Facsimile, 2D
	TIFFG5	TIFF Group 5 Facsimile
	TIFFG52D	TIFF Group 5 Facsimile, 2D
Reserved	--	See Table 20

Table 26: Prints. Table 26 **Prints** lists supported file formats used in print imaging, such as paper prints for display. 230 defaults are provided; any number of print media are permissible.

Table 26: Prints

Company	Literal	Description
Agfa	ACR	Agfacolor RC
	ABF	Agfa Brovira, fiber, B&W
	ABSRC	Agfa Brovira-speed RC, B&W
	APF	Agfa Portriga, fiber, B&W
	APSRC	Agfa Portriga-speed RC, B&W
	ARRF	Agfa Record-rapid, fiber, B&W
	ACHD	Agfacolor HDC
	AMCC111FB	Agfacolor Multicontrast Classic MC C 111 FB, double weight, glossy surface
	AMCC118FB	Agfacolor Multicontrast Classic MC C 118 FB, double weight, fine grained matt surface
	AMCC1FB	Agfacolor Multicontrast Classic MC C 1FB, single weight, glossy surface

1		AMCP310RC	Agfacolor Multicontrast Premium RC 310, glossy surface
2		AMCP312RC	Agfacolor Multicontrast Premium RC 312, semi-matt surface
3		APORG	Agfacolor Professional Portrait Paper, glossy surface CN310
4		APORL	Agfacolor Professional Portrait Paper, semi-matt surface
5			CN312
6		APORM	Agfacolor Professional Portrait Paper, lustre surface CN319
7		ASIGG	Agfacolor Professional Signum Paper, glossy surface CN310
8		ASIGM	Agfacolor Professional Signum Paper, matt surface CN312
9	Konica	CCOL	Konica Color
10	Fuji	FCHPFCPI	FujicolorFHGuProfessionaljicolor Print
11		FCSP	Fujicolor Super G Plus Print
12		FCT35	Fujichrome paper, Type 35, glossy surface
13		FCT35HG	Fujichrome reversal copy paper, Type 35, glossy surface
14		FCT35HL	Fujichrome reversal copy paper, Type 35, lustre surface
15		FCT35HM	Fujichrome reversal copy paper, Type 35, matt surface
16		FCT35L	Fujichrome paper, Type 35, lustre surface
17		FCT35M	Fujichrome paper, Type 35, matt surface
18		FCT35PG	Fujichrome Type535, polyester, super glossly surface
19		FSFA5G	Fujicolor paper super FA, Type 5, glossy SFA5 surface
20		FSFA5L	Fujicolor paper super FA, Type 5, lustre SFA5 surface
21		FSFA5M	Fujicolor paper super FA, Type 5, matt SFA5 surface
22		FSFASCG	Fujicolor paper super FA5, Type C, glossy surface
23		FSFA5SL	Fujicolor paper super FA5, Type C, lustre surface
24		FSFA5SM	Fujicolor paper super FA5, Type C, matt surface
25		FSFA5SPG	Fujicolor paper super FA, Type 5P, glossy SFA P surface
26		FSFA5SPL	Fujicolor paper super FA, Type 5P, lustre SFA P surface
27		FSFA5SPM	Fujicolor paper super FA, Type 5P, matt SFA P surface
28		FSFAG	Fujicolor paper super FA, Type 5, glossy surface
29		FSFAL	Fujicolor paper super FA, Type 5, lustre surface
30		FSFAM	Fujicolor paper super FA, Type 5, matt surface
31		FSFAS5PG	Fujicolor paper super FA, Type P, glossy SFA 5P surface
32		FSFAS5PL	Fujicolor paper super FA, Type P, lustre SFA 5P surface
33		FSFAS5PM	Fujicolor paper super FA, Type P, matt SFA 5P surface
34		FSFASCG	Fujicolor paper super FA, Type C, glossy surface
35		FSFASCL	Fujicolor paper super FA, Type C, lustre surface
36		FSFASCM	Fujicolor paper super FA, Type C, matt surface
37		FTRSFA	Fujitrans super FA
38		FXSFA	Fujiflex super FA polyester (super gloss), Fujiflex SFA
39			surface
40	Ilford	ICF1K	Ilfochrome Classic Deluxe Glossy Low Contrast
41		ICLM1K	Ilfochrome Classic Deluxe Glossy Medium Contrast
42		ICPM1M	Ilfochrome Classic RC Glossy
43		ICPM44M	Ilfochrome Classic RC Pearl
44		ICPS1K	Ilfochrome Classic Deluxe Glossy
45		IGFB	Ilfochrome Galerie FB
46		IILRA1K	Ilfocolor Deluxe
47		IIPRAM	Ilfocolor RC
48		IMG1FDW	Ilford Multigrade Fiber, Double Weight
49		IMG1FW	Ilford Multigrade Fiber Warmtone
50		IMG1RCDLX	Ilford Multigrade RC DLX

1		IMG1RCPDW	Ilford Multigrade RC Portfolio, Double Weight
2		IMG1RCR	Ilford Multigrade RC Rapid
3		IMG2FDW	Ilford Multigrade II Fiber, Double Weight
4		IMG2FW	Ilford Multigrade II Fiber Warmtone
5		IMG2RCDLX	Ilford Multigrade II RC
6		IMG1RCPDW	Ilford Multigrade II RC Portfolio, Double Weight
7		IMG2RCR	Ilford Multigrade II RC Rapid
8		IMG3FDW	Ilford Multigrade III Fiber, Double Weight
9		IMG3FW	Ilford Multigrade III Fiber Warmtone
10		IMG3RCDLX	Ilford Multigrade III RC DLX
11		IMG3RCPDW	Ilford Multigrade III RC Portfolio, Double Weight
12		IMG3RCR	Ilford Multigrade III RC Rapid
13		IMG4FDW	Ilford Multigrade IV Fiber, Double Weight
14		IMG4FW	Ilford Multigrade IV Fiber Warmtone
15		IMG4RCDLX	Ilford Multigrade IV RC DLX
16		IMG4RCPDW	Ilford Multigrade IV RC Portfolio, Double Weight
17		IMGFSWG	Ilford Multigrade Fiber, Single Weight, glossy
18		IPFP	Ilford PanF Plus
19		ISRCD	Ilfospeed RC, Deluxe
20	Kodak		B&W Selective Contrast Papers
21		KPC1RCE	Kodak Polycontrast RC, medium weight, fine-grained, lustre
22		KPC1RCF	Kodak Polycontrast RC, medium weight, smooth, glossy
23		KPC1RCN	Kodak Polycontrast RC, medium weight, smooth, semi-matt
24		KPC2RCE	Kodak Polycontrast II RC, medium weight, fine-grained, lustre
25		KPC2RCF	Kodak Polycontrast II RC, medium weight, smooth, glossy
26		KPC2RCN	Kodak Polycontrast II RC, medium weight, smooth, semi-matt
27		KPCRCE	Kodak Polycontrast III RC, medium weight, fine-grained,
28			lustre
29		KPC3RCF	Kodak Polycontrast III RC, medium weight, smooth, glossy
30		KPC3RCN	Kodak Polycontrast III RC, medium weight, smooth,
31			semi-matt
32		KPMFF	Kodak Polymax Fiber, single weight, smooth, glossy
33		KPMFN	Kodak Polymax Fiber, single weight, smooth, semi-matt
34		KPMFE	Kodak Polymax Fiber, single weight, fine-grained, lustre
35		KPM1RCF	Kodak Polymax RC, single weight, smooth, glossy
36		KPM1RCE	Kodak Polymax RC, single weight, fine-grained, lustre
37		KPM1RCN	Kodak Polymax RC, single weight, smooth, semi-matt
38		KPM2RCF	Kodak Polymax II RC, single weight, smooth, glossy
39		KPM2RCE	Kodak Polymax II RC, single weight, fine-grained, lustre
40		KPM2RCN	Kodak Polymax II RC, single weight, smooth, semi-matt
41		KPMFAF	Kodak Polymax Fine-Art, double weight, smooth, glossy
42		KPMFAN	Kodak Polymax Fine-Art, double weight, smooth, semi-matt
43		KPPFM	Kodak Polyprint RC, medium weight, smooth, glossy
44		KPPNM	Kodak Polyprint RC, medium weight, smooth, semi-matt
45		KPPEM	Kodak Polyprint RC, medium weight, fine-grained, lustre
46		KPFFS	Kodak Polyfiber, single weight, smooth, glossy
47		KPFND	Kodak Polyfiber, double weight, smooth, semi-matt
48		KPFGL	Kodak Polyfiber, light weight, smooth,lustre
49		KPFNS	Kodak Polyfiber, smooth, single weight, semi-matt
50		KPFND	Kodak Polyfiber, double weight, smooth, semi-matt

KPFGD	Kodak Polyfiber, double weight, fine-grained, lustre
	B&W Continuous Tone Papers
KAZOF	Kodak AZO, fine-grained, lustre
KB1RCF	Kodak Kodabrome RC Paper, smooth, glossy
KB1RCG1	Kodak Kodabrome RC, premium weight (extra heavy) 1, fine-grained, lustre
KB1RCN	Kodak_Kodabrome_RC_Paper,_smooth,_semi-matt
KB2RCF	Kodak Kodabrome II RC Paper, smooth, glossy
KB2RCG1	Kodak Kodabrome II RC, premium weight (extra heavy) 1, fine-grained, lustre
KB2RCN	Kodak Kodabrome II RC Paper, smooth, semi-matt
KBR	Kodak Kodabromide, single weight, smooth, glossy
KEKLG	Kodak Ektalure, double weight, fine-grained, lustre
KEKMSCF	Kodak Ektamatic SC single weight, smooth, glossy
KEKMSCN	Kodak Ektamatic SC, single weight, smooth, semi-matt
KEKMXRALF	Kodak Ektamax RA Professional L, smooth, glossy
KEKMXRALN	Kodak Ektamax RA Professional L, smooth, semi-matt
KEKMXRAMF	Kodak Ektamax RA Professional M, smooth, glossy
KEKMXRAMN	Kodak Ektamax RA Professional M, smooth, smooth, semi-matt
KELFA1	Kodak Elite Fine-Art, premium weight (extra heavy) 1, ultra-smooth, high-lustre
KELFA2	Kodak Elite Fine-Art, premium weight (xtra heavy) 2, ultra-smooth, high-lustre
KELFA3	Kodak Elite Fine-Art, premium weight (xtra heavy) 3, ultra-smooth, high-lustre
KELFA4	Kodak Elite Fine-Art, premium weight (xtra heavy) 4, ultra-smooth, high-lustre
KK1RCG1	Kodak Kodabrome RC, premium weight (extra heavy) 1, fine-grained, lustre
KK1RCG2	Kodak Kodabrome RC, premium weight (extra heavy) 2, fine-grained, lustre
KK1RCG3	Kodak Kodabrome RC, premium weight (extra heavy) 3, fine-grained, lustre
KK1RCG4	Kodak Kodabrome RC, premium weight (extra heavy) 4, fine-grained, lustre
KK1RCG5	Kodak Kodabrome RC, premium weight (extra heavy) 5, fine-grained, lustre
KK2RCG1	Kodak Kodabrome II RC, premium weight (extra heavy) 1, fine-grained, lustre
KK2RCG2	Kodak Kodabrome II RC, premium weight (extra heavy) 2, fine-grained, lustre
KK2RCG3	Kodak Kodabrome II RC, premium weight (extra heavy) 3, fine-grained, lustre
KK2RCG4	Kodak Kodabrome II RC, premium weight (extra heavy) 4, fine-grained, lustre
KK2RCG5	Kodak Kodabrome II RC, premium weight (extra

		heavy) 5, fine-grained, lustre
	KPMARCW1	Kodak P-Max Art RC, double weight 1, suede double-matt
	KPMARCW2	Kodak P-Max Art RC, double weight 2, suede double-matt
	KPMARCW3	Kodak P-Max Art RC, double weight 3, suede double-matt
		B&W Panchromatic Papers
	KPSRCH	Kodak Panalure Select RC, H grade, medium weight, smooth, glossy
	KPSRCL	Kodak Panalure Select RC, L grade, medium weight, smooth, glossy
	KPSRCM	Kodak Panalure Select RC, M grade, medium weight, smooth, glossy
		Color Reversal Papers
	KER1F	Kodak Ektachrome Radiance Paper, smooth, glossy
	KER1N	Kodak Ektachrome Radiance Paper, smooth, semi-matt
	KER1SF	Kodak Ektachrome Radiance Select Material, smooth, glossy
	KER2F	Kodak Ektachrome Radiance II Paper, smooth, glossy
	KER2N	Kodak Ektachrome Radiance II Paper, smooth, semi-matt
	KER2SF	Kodak Ektachrome Radiance II Select Material, smooth, glossy
	KER3F	Kodak Ektachrome Radiance III Paper, smooth, glossy
	KER3N	Kodak Ektachrome Radiance III Paper, smooth, semi-matt
	KER3SF	Kodak Ektachrome Radiance III Select Material, smooth, glossy
	KERCHCF	Kodak Ektachrome Radiance HC Copy Paper, smooth, glossy
	KERCHCN	Kodak Ektachrome Radiance HC Copy Paper, smooth, semi-matt
	KERCN	Kodak Ektachrome Radiance Copy Paper, smooth, semi-matt
	KERCTF	Kodak Ektachrome Radiance Thin Copy Paper, smooth, glossy
	KERCTN	Kodak Ektachrome Radiance Thin Copy Paper, smooth, semi-matt
	KEROM	Kodak Ektachrome Radiance Overhead Material, transparent ESTAR Thick Base
		Color Negative Papers & Transparency Materials
	KD2976E	Kodak Digital Paper, Type 2976, fine-grained, lustre
	KD2976F	Kodak Digital Paper, Type 2976, smooth, glossy
	KD2976N	Kodak Digital Paper, Type 2976, smooth, semi-matt
	KDCRA	Kodak Duraclear RA Display Material, clear

KDFRAF	Kodak Duraflex RA Print Material, smooth, glossy
KDT2	Kodak Duratrans Display Material, translucent
KDTRA	Kodak Duratrans RA Display Material, translucent
KECC	Kodak Ektacolor, Type C
KECE	Kodak Ektacolor Professional Paper, fine-graned, lustre
KECF	Kodak Ektacolor Professional Paper, smooth, glossy
KECN	Kodak Ektacolor Professional Paper, smooth, semi-matt
KEC	Kodak Ektacolor
KEP2E	Kodak Ektacolor Portra II Paper, Type 2839, fine-grained, lustre
KEP2F	Kodak Ektacolor Portra II Paper, Type 2839, smooth, glossy
KEP2N	Kodak Ektacolor Portra II Paper, Type 2839, smooth, semi-matt
KEP3E	Kodak Ektacolor Portra III Paper, fine-grained, lustre
KEP3F	Kodak Ektacolor Portra III Paper, smooth, glossy
KEP3N	Kodak Ektacolor Portra III Paper, smooth, semi-matt
KES2E	Kodak Ektacolor Supra II Paper, fine-grained, lustre
KES2F	Kodak Ektacolor Supra II Paper, smooth, glossy
KES2N	Kodak Ektacolor Supra II Paper, smooth, semi-matt
KES3E	Kodak Ektacolor Supra III Paper, fine-grained, lustre
KES3F	Kodak Ektacolor Supra III Paper, smooth, glossy
KES3N	Kodak Ektacolor Supra III Paper, smooth, semi-matt
KESE	Kodak Ektacolor Supra Paper, fine-grained, lustre
KESF	Kodak Ektacolor Supra Paper, smooth, glossy
KESN	Kodak Ektacolor Supra Paper, smooth, semi-matt
KET1	Kodak Ektatrans RA Display Material, smooth, semi-matt
KEU2E	Kodak Ektacolor Ultra II Paper, fine-grained, lustre
KEU2F	Kodak Ektacolor Ultra II Paper, smooth, glossy
KEU2N	Kodak Ektacolor Ultra II Paper, smooth, semi-matt
KEU3E	Kodak Ektacolor Ultra III Paper, fine-grained, lustre
KEU3F	Kodak Ektacolor Ultra III Paper, smooth, glossy
KEU3N	Kodak Ektacolor Ultra III Paper, smooth, semi-matt
KEUE	Kodak Ektacolor Ultra Paper, fine-grained, lustre
KEUF	Kodak Ektacolor Ultra Paper, smooth, glossy
KEUN	Kodak Ektacolor Ultra Paper, smooth, semi-matt
	Inkjet Papers & Films
KEJFC50HG	Kodak Ektajet 50 Clear Film LW4, Polyester Base, clear
KEJFLFSG	Kodak Ektajet Film, Type LF, semi-gloss
KEJFW50HG	Kodak Ektajet 50 White Film, Polyester Base, high gloss
KEJP50SG	Kodak Ektajet 50 Paper, RC Base, semi-gloss
KEJPC	Kodak Ektajet Coated Paper
KEJPCHW	Kodak Ektajet Heavy Weight Coated Paper
KEJPEFSG	Kodak Ektajet Paper, Type EF, semi-gloss

	KEJPLFSG	Kodak Ektajet Paper, Type LF, semi-gloss
Polaroid	POCP	Polaroid OneFilm Color Print
	PPCP	Polaroid Professional High Contrast Polychrome
	PPGH	Polaroid Polygraph HC
	PPLB	Polaroid Polablue BN
	PPPN	Polapan CT
Reserved	--	See Table 20

Table 26: Digital Formats. Table 26 **Digital** lists supported file formats used in digital imaging. 159 default values are provided in the preferred embodiment although any number of digital media are permissible.

Table 27: Digital

Category	Literal	Description
Digital	ACAD	AutoCAD database or slide
	ASCI	ASCII graphics
	ATK	Andrew Toolkit raster object
	AVI	Microsoft video
	AVS	AVS X image
	BIO	Biorad confocal file
	BMP	Microsoft Windows bitmap image
	BMPM	Microsoft Windows bitmap image, monochrome
	BPGM	Bentleyized Portable Graymap Format
	BRUS	Doodle brush file
	CGM	CGM
	CDR	Corel Draw
	CIF	CIF file format for VLSI
	CGOG	Compressed GraphOn graphics
	CMUW	CMU window manager bitmap
	CMX	Corel Vector
	CMYK	Raw cyan, magenta, yellow, and black bytes
	CQT	Cinepak Quicktime
	DVI	Typesetter DeVice Independent format
	EPS	Adobe Encapsulated PostScript
	EPSF	Adobe Encapsulated PostScript file format
	EPSI	Adobe Encapsulated PostScript Interchange format

1	FIG	Xfig image format
2	FIT	Flexible Image Transport System
3	FLC	FLC movie file
4	FLI	FLI movie file
5	FST	Usenix FaceSaver(tm) file
6	G10X	Gemini 10X printer graphics
7	GEM	GEM image file
8	GIF	CompuServe Graphics image
9	GIF8	CompuServe Graphics image (version 87a)
10	GOUL	Gould scanner file
11	GRA	Raw gray bytes
12	HDF	Hierarchical Data Format
13	HIPS	HIPSIfile
14	HIS	Image Histogram
15	HPLJ	Hewlett Packard LaserJet format
16	HPPJ	Hewlett Packard PaintJet
17	HTM	Hypertext Markup Language
18	HTM2	Hypertext Markup Language, level 2
19	HTM3	Hypertext Markup Language, level 3
20	HTM4	Hypertext Markup Language, level 4
21	ICON	Sun icon
22	ICR	NCSA Telnet Interactive Color Raster graphic format
23	IFF	Electronic Arts
24	ILBM	Amiga ILBM file
25	IMG	Img-whatnot file
26	JBG	Joint Bi-level image experts Group file interchange format
27	JPG	Joint Photographic experts Group file interchange format
28	LISP	Lisp machine bitmap file
29	MACP	Apple MacPaint file
30	MAP	Colormap intensities and indices
31	MAT	Raw matt bytes
32	MCI	MCI format
33	MGR	MGR bitmap
34	MID	MID format
35	MIF	ImageMagick format
36	MITS	Mitsubishi S340-10 Color sublimation
37	MMM	MMM movie file
38	MOV	Movie format
39	MP2	Motion Picture Experts Group (MPEG) interchange format, level
40		2
41	MP3	Motion Picture Experts Group (MPEG) interchange format, level
42		3
43	MPG	Motion Picture Experts Group (MPEG) interchange format, level
44		1
45	MSP	Microsoft Paint
46	MTV	MTV ray tracer image
47	NKN	Nikon format
48	NUL	NULL image
49	PBM	Portable BitMap
50	PCD	Kodak Photo-CD

1	PCX	Zsoft IBM PC Paintbrush
2	PDF	Portable Document Format table
3	PGM	Portable GrayMap format
4	PGN	Portable GrayMap format
5	PI1	Atari Degas .pi1 Format
6	PI3	Atari Degas .pi3 Format
7	PIC	Apple Macintosh QuickDraw/PICT
8	PLOT	Unix Plot(5) format
9	PNG	Portable Network Graphics
10	PNM	Portable anymap
11	PPM	Portable pixmap
12	PPT	Powerpoint
13	PRT	PRT ray tracer image
14	PS1	Adobe PostScript, level 1
15	PS2	Adobe PostScript, level 2
16	PSD	Adobe Photoshop
17	QRT	QRT ray tracer
18	RAD	Radiance image
19	RAS	CMU raster image format
20	RGB	Raw red, green, and blue bytes
21	RGBA	Raw red, green, blue, and matt bytes
22	RLE	Utah Run length encoded image
23	SGI	Silicon Graphics
24	SIR	Solitaire file format
25	SIXL	DEC sixel color format
26	SLD	AutoCADA slide filea
27	SPC	Atari compressed Spectrum file
28	SPOT	SPOT satelite images
29	SUN	SUN Rasterfile
30	TGA	Targa True Vision
31	TIF	Tagged Image Format
32	TIL	Tile image with a texture
33	TXT	Raw text
34	UIL	Motif UIL icon file
35	UPC	Universal Product Code bitmap
36	UYVY	YUV bit/pixel interleaved (AccomWSD)
37	VIC	Video Image Communication and Retrieval (VICAR)
38	VID	Visual Image Directory
39	VIF	Khoros Visualization image
40	WRL	Virtual reality modeling language
41	X1BM	X10 bitmap
42	XBM	X11 bitmap
43	XCC	Constant image of X server color
44	XIM	XIM file
45	XPM	X11 pixmap
46	XWD	X Window system window Dump
47	XXX	Image from X server screen
48	YBM	Bennet Yee ``face'' file
49	YUV	Abekas Y- and U- and Y-file
50	YUV3	Abekas Y- and U- and Y-file, 3

		ZEIS	Zeiss confocal file
		ZINC	Zinc bitmap
	Facsimile	--	See Table 25
	Reserved	--	See Table 20

Conclusion

This invention supports an indefinite number of formal objects. At the current time, supported objects are parent-child encoding, 1D and 2D barcoding, and a reasonably sized schemata. The invention's means of classification and archive notation is sufficiently flexible to be used in a variety of imaging situations shown. The examples given are meant to provide illustrations only and not to be limiting with respect to the types of imaging situations to which the present invention might apply.

The rules and notations specified in the preceding tables provide a basis for universal image enumeration encoding, decoding, and processing suitable for development of diverse implementations of the invention.

ASIA

The present invention is implemented in a variety of hardware embodiments. Common to these embodiments is the ability of the equipment to process information(i.e. a CPU of some type is required, a means for entering data satisfying the require syntax is necessary (i.e. some form of user data entry in the form of a keyboard, optical reader, voice entry, point-and-click, or other data entry means), a built-in encoding mechanism or some form of data storage means to hold, at least

temporarily the data input by the user, a data recording means in order to process the information and output a barcode or other graphical representation of data.

Processing flow

Referring to Figure 7 the processing flow of ASIA is shown.

Command 701 is a function call that accesses the processing to be performed by ASIA

Input format 703 is the data format arriving to ASIA. For example, data formats from Nikon, Hewlett Packard, Xerox, Kodak, etc., are input formats.

ILF (705,707, and 709) are the Input Language Filter libraries that process input formats into ASIA-specific format, for further processing. For example, an ILF might convert a Nikon file format into an ASIA processing format. ASIA supports an unlimited number of ILFs.

Configuration 711 applies configuration to ILF results. Configuration represents specifications for an application, such as length parameters, syntax specifications, names of component tables, etc.

CPF (713,715, and 717) are Configuration Processing Filters which are libraries that specify finite bounds for processing, such pre-processing instructions applicable to implementations of specific devices. ASIA supports an unlimited number of CPFs. Processing 719 computes output, such as data converted into numbers.

Output format 721 is a structured output used to return

processing results.

OLF (723, 725, 727) are Output Language Filters which are libraries that produce formatted output, such as barcode symbols, DBF, Excel, HTML, LaTeX, tab delimited text, WordPerfect, etc. ASIA supports an unlimited number of OLFs.

Output format driver 729 produces and/or delivers data to an Output Format Filter. OFF (731, 733, 735) are Output Format Filters which are libraries that organize content and presentation of output, such as outputting camera shooting data, database key numbers, data and database key numbers, data dumps, device supported options, decoded number values, etc. ASIA supports an unlimited number of OLFs.

Numeric ranges

ASIA uses indefinite numeric ranges for all of its variables except date, which supports years 0000-9999. ASIA provides default values for the numeric ranges, which represent a preferred embodiment, and are not meant to be limiting. Indeed the present invention can accommodate additional values depending upon the implementation selected. And the current ranges and values can be easily extended, depending upong the needs of specific implementation.

Location numbers. Location numbers track any number of generation, any number of lots, and date to the day. Optionally, location numbers track time to any granularity of accuracy, any number of concurrent authors, any number of devices, any number of images in an archive, any number of

additional data for future extensibility, and any number of additional data for user customization.

Image numbers. Image numbers track any number of imaging categories (2 defaults), any number of media sizes (47 defaults); any number of push settings or any number of dynamic range ("bit depth") settings, keyed by format; any number of transparency media types (60 defaults), any number of negative media types (115 defaults), any number of print media types (209 defaults), any number of packages (90 defaults), and any number of digital formats (159 defaults); any unit of resolution; any number of stain (presentation) forms (9 defaults); and any number of image formats (12 defaults). Finally, image numbers optionally support any number of additional data for future extensibility, and any number of additional data for user customization.

Parent numbers. Parent numbers track parent conception date. Since an archive can have any number of images, an archive also contains any number of parents. Parent numbers optionally support any unit of additional data for future extensibility, and any unit of additional data for user customization.

All variables use unbounded value ranges except for the variable *date*, which supports years 0000-9999. Table 8 **Variables with unbounded ranges** specifically identifies unbounded variables, organized by type of number **(Number)**, category of functionality **(Category)**, and corresponding variable **(Variable)**.

Syntactic rules guarantee consistency across all implementations; see **Syntax: Tables 10-11** above. No matter how differently implementations are customized, all implementations that are compliant with the encoding scheme described herein will exchange data.

Number	Category	Variable
location	number of generations	*generation*
location	number of lots in an archive	*sequence*
location	number of units in a lot	*unit*
location	number of authors	*author*
location	number of devices	*device*
location	granularity of time accuracy	*time*
location	specification extensibility	*locationRes*
location	user customization	*locationCus*
image	number of categories	*category*
image	number of media	*media*
image	number of software packages	*set*
image	number of stains	*stain*
image	number of formats	*format*
image	range of push settings	*push*
image	range of bit depth	*bit*
image	range of size	*size*
image	range of resolution	*resolution*
image	specification extensibility	*imageRes*
image	user customization	*imageCus*
parent	granularity of time accuracy	*parent*
parent	specification extensibility	*parentRes*
parent	user customization	*parentCus*

Table 8: Variables with unbounded ranges

Examples. More specifically, 4 examples will illustrate ASIA's interoperability. All of these examples use a 4 digit *sequence* definition (i.e., supporting 9,999 lots), but each example adjusts the *unit* definition and employs the optional variables *device* and/or *author*. Values of *device* and *author* are adjusted irregularly across the examples.

Example. Using 36 unit lots, useful for traditional 35mm

photography, this creates an upper bound of 359,964 images per archive (or 7,199 images a year for 50 years). 1 digit device encoding is used supporting up to 10 concurrently used devices.

Example. Using 99 unit lots, useful for digital imaging, this creates an upper bound of 989,901 images per archive (or 19,798 images a year for 50 years). 2 digit device encoding is used supporting up to 100 concurrently used devices.

Example. Using 9,999 unit lots, useful for photocopy imaging, this creates an upper bound of 100 million (99,980,001) images per archive (or 2 million [1,999,600] images a year for 50 years). 3 character author encoding is used supporting up to 676 concurrent authors in the archive, device is unspecified.

Example. Using 999,999 unit lots, suitable for motion imaging, this creates an upper bound of 9,998,990,001 (10 trillion) images per archive (or 200 million [199,979,800] images a year for 50 years). 4 character author encoding is used supporting up to 456,976 concurrent authors; and 3 digit device encoding is used supporting up to 1000 concurrently used devices per author.

Data from all of the above example can be seamlessly shared using the encoding scheme of the present invention.

Parent-child Processing

Implementation. ASIA provides native support of parent

decoding and is written to support parent encoding. However, since parent-child encoding functionality must operate directly with resolvers (see Figure 3) multi-generation encoding is left to device specific implementations.

ASIA implements parent-child support through the 'schemata' and 'engine' components of the Figure 5 **Implementation** through extensive use of OLF's (See Figure 7 ASIA).

Barcode Processing

Implementation. ASIA natively supports 1D Code 39 and 2D Data Matrix barcodes. ASIA implements barcoding through the 'engine' component of the implementation.

Code Instantiation

The ASIA engine library specifically implements the invention's formal requirements for classification and archival notation and in this sense provides a reference implementation of the invention's relations.

ASIA is written in ANSI C++, with flexibility and performance improving extensions for Win32 and SVID compliant UNIXes. It has been developed to work as a library for inclusion into other software, or as a core engine to which interfaces are written. ASIA is modularized into small, convenient encoding and decoding filters (libraries): ILFs, CPFs, OLFs, and OFFs. To create a full implementation, a developer often needs only to write 1 filter of each variety. These filters are simple, sometimes a few lines of code each.

Such extensibility is designed to permit rapid porting of ASIA to diverse applications. For example, with minimal effort, a programmer may port ASIA to a new device or software package. With little or no customization, the ASIA engine library may plug into pre-existing applications, serve as a back-end for newly written interfaces, or be included directly into chips with tabular information maintained through Flash ROM upgrades, etc. ASIA illustrates all 3 layers of the invention, as characterized in Figure 1. Specifically, ASIA provides a robust set of native functionality in a core code offering. The core code has been developed for extreme, rapid, and convenient extensibility. ASIA's extensibility provides theoretically unlimited interoperability with devices, mechanisms, and software, while requiring absolutely minimal development effort and time.

It is expected that ASIA subsumes the functionality needed by most applications for which the Automated System for Image Archiving applies, but ASIA itself merely is one implementation of the invention's formal specifications presented in §4.2.

Utility

For the author, devices that implement this invention can provide a convenient, accurate, and flexible tracking system that builds cumulatively and automatically into a comprehensive, rationally organized archival system that required no archival knowledge whatsoever to use. This can

reduce many administrative needs facing those who use image-producing devices. Similarly, after a user initializes the systems, the system will work without user intervention.

For example, the need for photographic assistants could be curtailed in professional photography. Using a device constructs an archive without human intervention, and clicking a barcode reader on an image displays image data.

For the archivist, mechanisms implementing this invention can automate exact and rapid tacking of every image in a given archive, for inventory/sales, author identification, historical record, etc. For example, an advertising agency could recall client information and image production facts from a click of a barcode reader. A newspaper could process, identify, and track images from its photographic staff through automated slide sorting machines. Museums could automate collection and inventory services as a matter of course in receiving new materials.

For the manufacturer, implementations of this invention can provide devices with automated encoding, decoding, and processing systems, included in chips or accompanying software. A device can produce self-identifying enumeration which interoperates with other devices by the same manufacturer, or with other devices from other manufacturers.

For example, a manufacturer could provide consumers with a seamless mechanism to track image evolutions, from film developing to digital editing to paper production. Or

hospitals could automatically track patient x-rays and MRI scans as a matter of course in using the equipment. The equipment could be manufactured by one or different manufacturers, and the system would work seamlessly for the end-user.

I Claim:

1. A system for universal image tracking comprising:
An image forming apparatus;
A CPU integral to the image forming apparatus;
User input means connected to the CPU for receiving user input;
Logic stored in the CPU for receiving user input and creating archive data based upon the user input; and
A Graphic code producer responsive to the CPU for producing graphic codes representative of the archive data.

2. The system for universal image tracking of claim 1 wherein the image forming apparatus is a film based camera.

3. The system for universal image tracking of claim 1 wherein the image forming apparatus is a digital based camera.

4. The system for universal image tracking of claim 1 wherein the image forming apparatus is a video camera.

5. The system for universal image tracking of claim 1 wherein the image forming apparatus is a digital image processor.

6. The system for universal image tracking of claim 1 wherein the image forming apparatus is a medical image sensor.

7. The system for universal image tracking of claim 6 wherein the medical image sensor is a magnetic resonance imager.

8. The system for universal image tracking of claim 6 wherein the medical image sensor is an X-ray imager.

9. The system for universal image tracking of claim 6 wherein

the medical image sensor is a CAT scan imager.

10. The system for universal image tracking of claim 1 wherein the user input means is a push button input.

11. The system for universal image tracking of claim 1 wherein the user input means is a keyboard.

12. The system for universal image tracking of claim 1 wherein the user input means is voice recognition equipment.

13. The system for universal image tracking of claim 1 wherein the graphic codes are one-dimensional.

14. The system for universal image tracking of claim 1 wherein the graphic codes are two-dimensional.

15. The system for universal image tracking of claim 1 wherein the graphic codes are three-dimensional.

16. The system for universal image tracking of claim 1 wherein the logic comprises configuration input processing for determining bounds for the archive data generation based on configuration input;

a resolver for determining the correct value of archive data representing the image forming apparatus and the configuration input; and

a timer for creating date/time stamps.

17. The system for universal image tracking of claim 16 wherein the timer further comprises a filter for processing the time stamp according to configuration input rules.

18. The system for universal image tracking of claim 16

wherein the configuration input comprises at least generation, sequence, data, unit, and constants information.

19. The system for universal image tracking of claim 1 further comprising a graphic code reader connected to the CPU for reading a graphic code on an image representing archive information; and

A decoder for decoding the archive information represented by the graphic code.

20. The system for universal image tracking of claim 19 wherein the logic further comprises:

logic for receiving a second user input and creating lineage archive information relating to the image based upon the archive information and the second user input; and

logic for producing graphic code representative of the lineage archive data.

21. The system for universal image tracking of claim 1 wherein the archive data comprises location attributes of an image.

22. The system for universal image tracking of claim 1 wherein the archive data comprises physical attribute of an image.

23. The system for universal image tracking of claim 1 wherein each image in an image archive has unique archive data associated with each image.

24. The system for universal image tracking of claim 21

wherein the location data comprises at least:
image generation depth;
serial sequence of lot within an archive;
serial sequence of unit within a lot;
date location of a lot within an archive;
date location of an image within an archive;
author of the image; and
device producing the image.

25. The system for universal image tracking of claim 16 wherein the timer tracks year in the range of from 0000 to 9999.

26. The system for universal image tracking of claim 16 wherein the timer tracks all 12 months of the year.

27. The system for universal image tracking of claim 16 wherein the timer tracks time in at least hours and minutes.

28. The system for universal image tracking of claim 16 wherein the timer tracks time in fractions of a second.

29. The system for universal image tracking of claim 16 wherein the system is ISO 8601:1988 compliant.

30. The system for universal image tracking of claim 22 wherein the physical attributes comprise at least:
image category;
image size;
push status;
digital dynamic range;

image medium;

image resolution;

image stain; and

image format.

31. The system for universal image tracking of claim 20 wherein the lineage archive information comprises a parent number.

32. The system for universal image tracking of claim 31 wherein the parent number comprises at least:

a parent conception date; and

a parent conception time.

33. A method for universally tracking images comprising:

inputting raw image data to an image forming apparatus;

inputting image-related data; creating first archive data based upon the image-related data; and translating the first archive data into a form that can be attached to the raw image data.

34. The method for universally tracking images of claim 33 wherein the raw image data is from a film based camera.

35. The method for universally tracking images of claim 33 wherein the raw image data is from a digital camera.

36. The method for universally tracking images of claim 33 wherein the raw image data is from a video camera.

37. The method for universally tracking images of claim 33 wherein the raw image data is from a digital image processor.

38. The method for universally tracking images of claim 33 wherein the raw image data is from a medical image sensor.

39. The method for universally tracking images of claim 38 wherein the medical image sensor is a magnetic resonance imager.

40. The method for universally tracking images of claim 38 wherein the raw image data is from an X-ray imager.

41. The method for universally tracking images of claim 38 wherein the raw image data is from a CAT scan imager.

42. The method for universally tracking images of claim 33 wherein the inputting image related data occurs without user intervention.

43. The method for universally tracking images of claim 33 wherein the inputting of image related data occurs via push button input.

44. The method for universally tracking images of claim 33 wherein the inputting of image related data occurs via voice recognition equipment.

45. The method for universally tracking images of claim 33 wherein the inputting of image related data occurs via a keyboard.

46. The method for universally tracking images of claim 33 wherein the form of the translated archive data is an electronic file.

47. The method for universally tracking images of claim 33 wherein the form of the translated data is a graphic code.

48. The method for universally tracking images of claim 47 wherein the graphic code is one dimensional.

49. The method for universally tracking images of claim 47 wherein the graphic code is two dimensional.

50. The method for universally tracking images of claim 47 wherein the graphic code is three dimensional.

51. The method for universally tracking images of claim 33 wherein the image data comprises image data and second archive data.

52. The method for universally tracking images of claim 33 further comprising reading the second archive data; and creating lineage archive information relating to the image based upon the first archive information and second archive information.

53. The method for universally tracking images of claim 33 wherein the inputting of image related data comprises configuration input processing for determining bounds for the archive data generation based upon configured input; determining the correct value of archive data representing the image forming apparatus and configuration input; and date/time stamping the image related data.

54. The method for universally tracking images of claim 53 wherein date/time stamping is filtered according to configuration input rules.

55. The method for universally tracking images of claim 33 wherein the configuration input comprises at least



generation, sequence, data, unit, and constants information.

56. The method for universally tracking images of claim 33 wherein the first archive data comprises location attributes of an image.

57. The method for universally tracking images of claim 33 wherein the first archive data comprises physical attributes of an image.

58. The method for universally tracking images of claim 56 wherein the location attributes comprise at least:
image generation depth;
serial sequence of lot within an archive;
serial sequence of unit within a lot;
date location of a lot within an archive;
date location of an image within an archive;
author of the image; and
device producing the image.

59. The method for universally tracking images of claim 57 wherein the physical attributes of an image comprise at least:
image category;
image size;
push status;
digital dynamic range;
image medium;
software set;

image resolution;

image stain; and

image format.

60. The method for universally tracking images of claim 52 wherein the lineage archive information comprises a parent number.

61. The method for universally tracking images of claim 52 wherein the parent number comprises at least:

a parent conception date; and

a parent conception time.

62. The system for universal image tracking of claim 1 wherein the input means comprises a magnetic card reader.

63. The system for universal image tracking of claim 1 wherein the input means comprises a laser scanner.

64. The system for universal image tracking of claim 31 wherein the physical attributes further comprise;

imageRes; and

imageCus.

65. The method for universally tracking images of claim 33 wherein the inputting image related data is via a magnetic card reader.

66. The method for universally tracking images of claim 33 wherein the inputting of image related data is via a laser scanner.

67. The method of universally tracking images of claim 33 wherein the inputting of image related data is via an

optical reader.

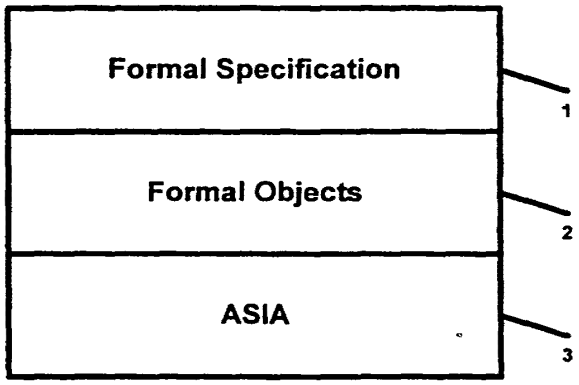


Figure 1

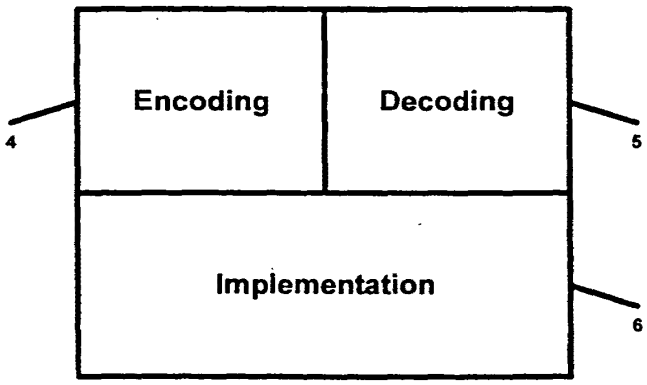


Figure 2

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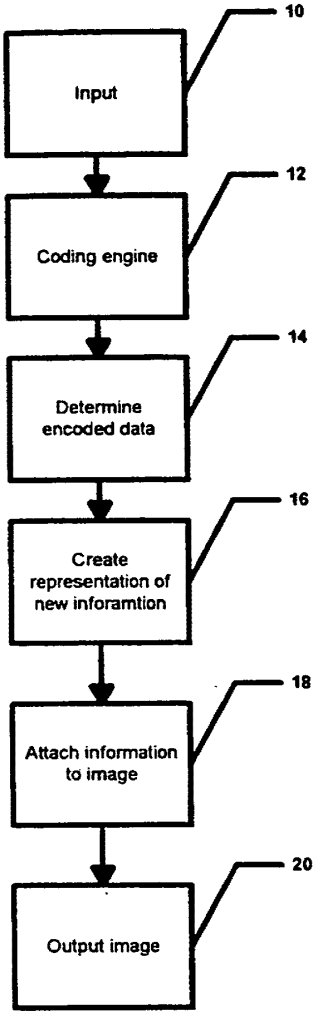


Figure 1A

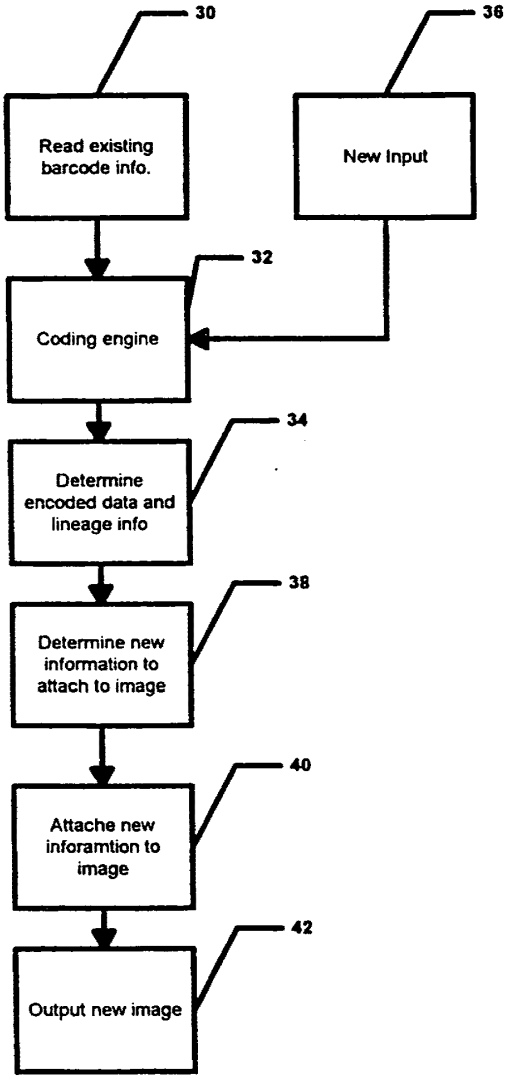


Figure 1B

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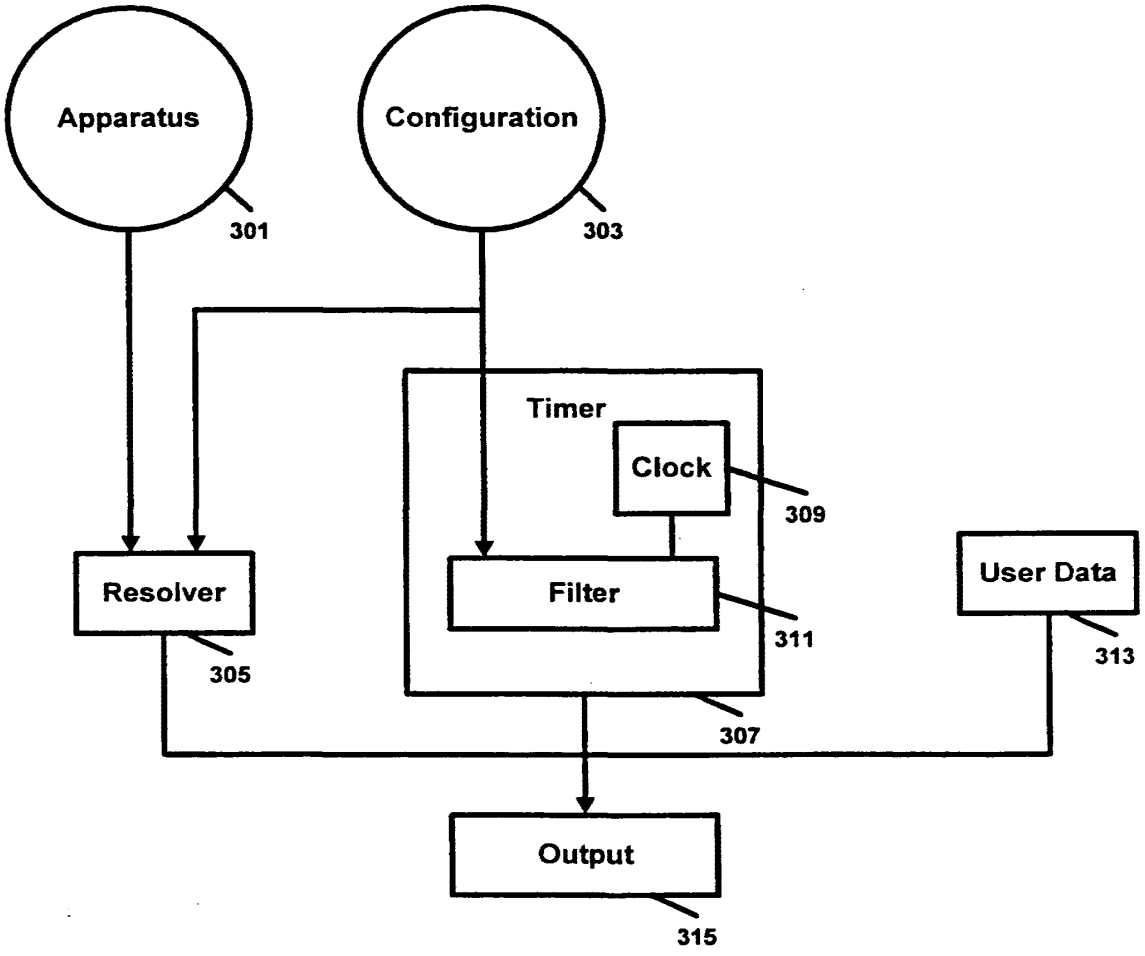

Apparatus
301
Configuration
303
Timer
Clock
309
Resolver
305
Filter
311
User Data
313
307
Output
315

Figure 3

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```
// Location identifying information
location      →   generation sequence time-stamp author device locationRes locationCus

// Physical attribute information
image         →   category size bit-or-push media set resolution stain format imageRes imageCus

// Parent identifying information
parent        →   time-stamp parentRes parentCus
```

Figure 4

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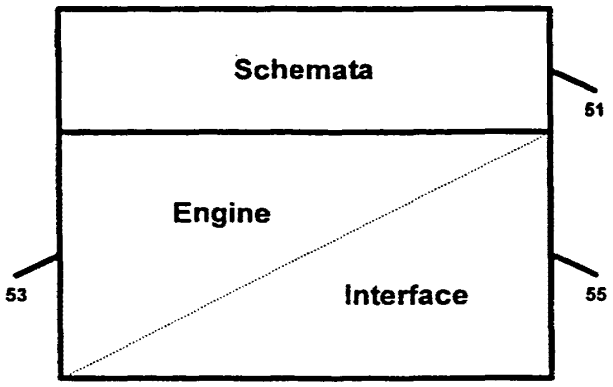


Figure 5

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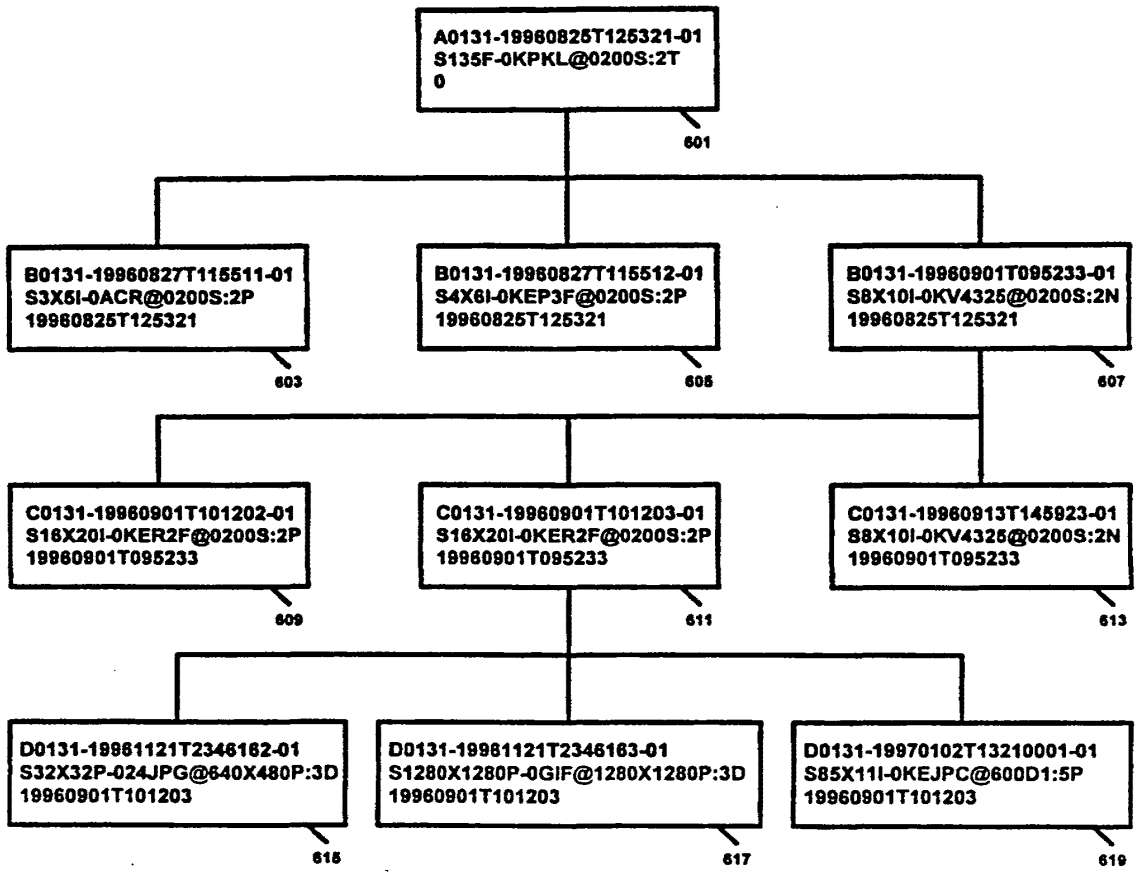

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19960825T125321
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C0131-19960901T101202-01
S16X20I-0KER2F@0200S:2P
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19960901T101203
617
D0131-19970102T13210001-01
S85X11I-0KEJPC@600D1:5P
19960901T101203
619

Figure 6

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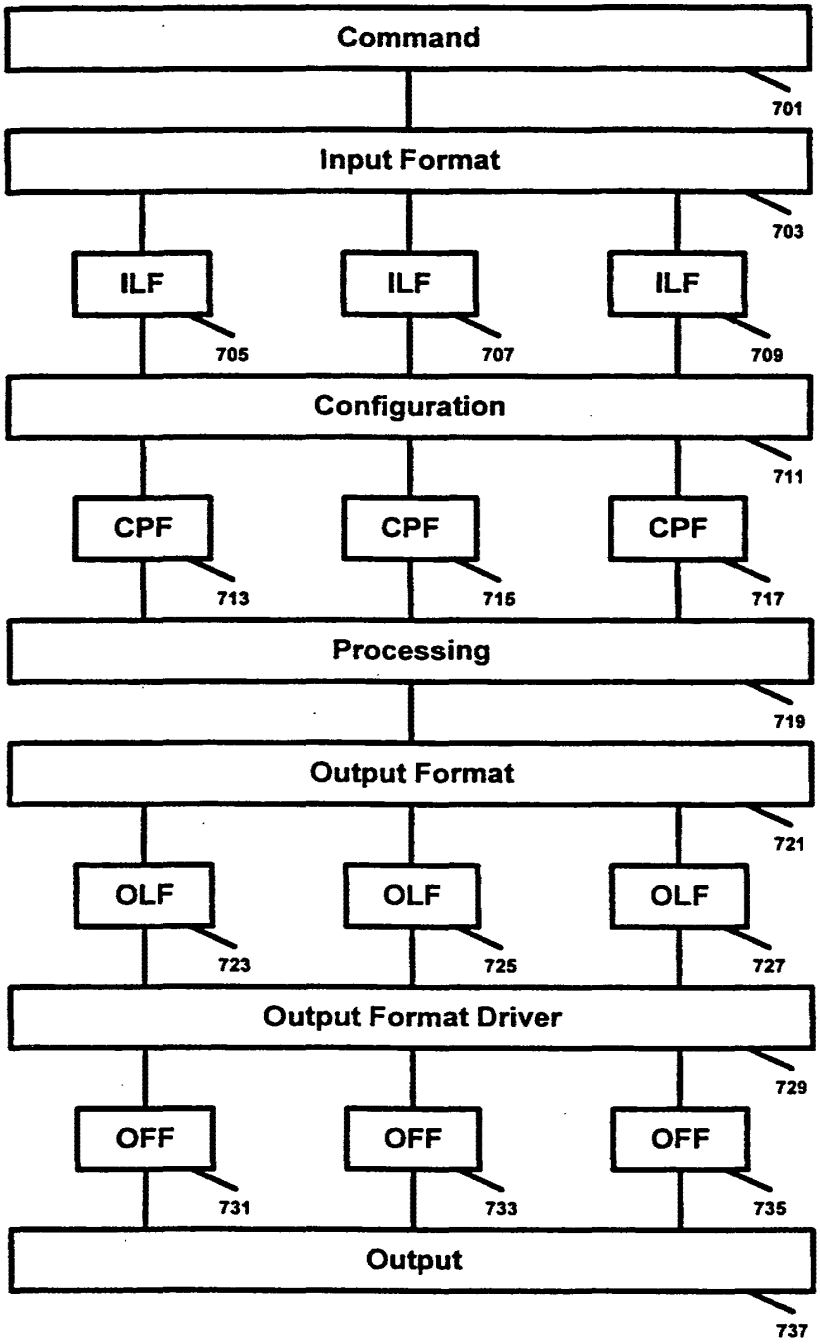

Command
701
Input Format
703
ILF
ILF
ILF
705
707
709
Configuration
711
CPF
CPF
CPF
713
715
717
Processing
719
Output Format
721
OLF
OLF
OLF
723
725
727
Output Format Driver
729
OFF
OFF
OFF
731
733
735
Output
737

Figure 7

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INTERNATIONAL SEARCH REPORT

Ir ational Application No
PCT/US 98/00624

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N1/21

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 568 161 A (XEROX CORP) 3 November 1993	1,33
A	see the whole document	1,16,23, 53

Y	US 5 008 700 A (OKAMOTO TSUGIO) 16 April 1991 cited in the application	1,33
A	see abstract	47

A	US 5 193 185 A (LANTER DAVID) 9 March 1993 cited in the application see abstract	1,33

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[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
12 May 1998	25/05/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Hazel, J

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 98/00624

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	CALLAGHAN V L ET AL: "STRUCTURES AND METRICS FOR IMAGE STORAGE AND INTERCHANGE" JOURNAL OF ELECTRONIC IMAGING, vol. 2, no. 2, 1 April 1993, pages 126-137, XP000369378 see Section 2.2 ---	1,22,23, 30,33, 46,53, 57,59
A	WO 86 05610 A (ALPHAREL INC) 25 September 1986 see abstract -----	1,23,33

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Ir ational Application No
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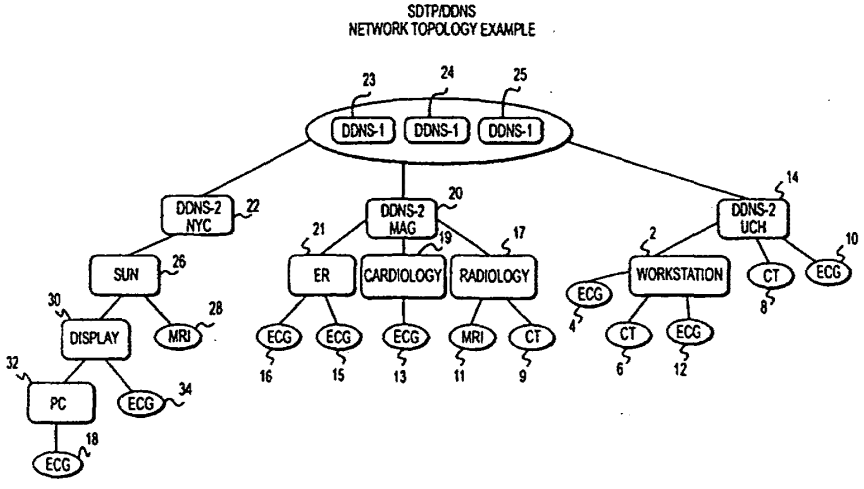
(71)(72) Applicants and Inventors: OVERTON, John [US/US]; 5825 S. Blackstone, Chicago, IL 60637 (US). ROIZEN, Michael, F. [US/US]; 5622 South Woodlawn, Chicago, IL 60637 (US).

(74) Agents: ROBERTS, Jon, L. et al.; Roberts Abokhair & Mardula, LLC, Suite 1000, 11800 Sunrise Valley Drive, Reston, VA 20191 (US).

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(54) Title: SYSTEM AND METHOD FOR ESTABLISHING AND RETRIEVING DATA BASED ON GLOBAL INDICES



(57) Abstract

A system and method for establishing and retrieving data based upon global indices established on the date of first use by a user. The system uses a distributed data name service (DDNS) which uniquely identifies users of the system based upon the unique ID of devices on the system combined with the date and time of first use by the user. Both the unique device ID and the unique user ID's are stored on servers of the system. This unique user ID generated is used for all subsequent uses of the system by the user. Searching for data generated by devices of the system relating to a particular user is accomplished by searching for instances of the user ID on servers of the system rather than by searching for the data itself. A simplified data transport protocol allows for the transfer of data from one location to another after the data is located.

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Title: System and Method for Establishing and Retrieving Data Based on Global Indices

Field of the invention

This invention relates generally to storage to data and retrieval of records. More particularly this invention relates to a universal method for generating an index of medical records at the time services are rendered and retrieving medical records based upon the automated indexing performed.

Background of the invention

Medical records can reside in many different places. As a patient sees different doctors and is treated for different conditions, individual records relating to the patient are created in each individual location. Therefore a medical record could exist at a general practitioner where the patient goes for annual physicals. At another time a medical record could be created for the patient at an immediate care facility where emergency room services are rendered. In a similar fashion a medical record for the same patient could be created at a particular specialist's office who treats the patient for a particular condition. All of these medical records may be critical to the treatment of the patient in any particular circumstance. If the total medical record for individual patient is not available, certain diagnoses may be overlooked or erroneously made.

Several systems have addressed the issue of how to create universal medical records. In general these systems create medical records by the creation of a file in some central storage area. Thereafter the central storage area may be accessed by individual practitioners by accessing the central storage of the medical record. Such systems use a "root registration" system wherein medical records and identities are registered centrally. Such systems generally are not fully automated leading to the potential for errors. Further only "registered"

records are available to remote users. Thus if a patient's medical record is not centrally registered, it is simply not available to the practitioner.

Another disadvantage of the central registration process is that, at the present time, no single format is universal. Thus many different medical organizations have different formats which cannot be accessed among different medical institutions. Even if such access is granted, format translation programs must be used which could cause additional errors in translation.

One example of a system which attempts to obtain a master index of patient identification information is the telemed system in use at Los Alamos labs. That system maintains a master index of patient ID's thus tracking patient ID as a master reference. The master ID is then used to determine where to find data related to a particular patient. Telemed system deals with topological information normally characterizing patient records. Further, the system relies upon "middleware" to resolve differences between database systems that possess a particular patient's record. Thus a translation mechanism is necessary. Further, the telemed system still requires a master patient index as a form of central registration.

In contrast to the systems noted above, the present invention does not rely on a root registration or a central registration of client information. Rather, the present invention establishes an identity for a patient at the time of service, based on the identity of a given device. This identity is established at the location of the device and not at any central location. This identity is designated, however, in a universal fashion such that, for patient's whose identity is established by the system, information relating to that particular patient can be looked up in a convenient manner. Further, the present invention comprises the data transfer protocol to allow for global addressing and retrieval of information from sites remote

from the location at which the patient is present. In this matter, all information concerning a particular patient maybe retrieved by the location treating the patient.

Brief description of the invention

It is therefore and objective of the present invention to be able to locate information by searching for indices of that information rather than for the information itself.

It is a further objective of the present invention to establish device driven unique identifiers that identify a person using the system.

It is a further objective of the present invention to establish device driven unique identifiers that identify a objects that are the subject of transactions using the system.

It is yet another objective of the present information to establish a global identifier for a user of the present invention the first time that a user uses the present invention.

It is yet another objective of the present information to establish a persistent identifier for a user of the present invention the first time that a user uses the present invention.

It is a further objective of the present invention to uniquely identify a particular device connected to the system.

It is yet another objective of the present invention to establish device identification the first time that a device is activated on the system.

It is a further objective of the present invention to make data universally available as soon as that data is created on the system.

It is another objective of the present invention to make data available at sites remote from the location at which the data is created as soon as the data is created.

It is yet another objective of the present invention to be able to search for data of interest without knowledge of the format in which the data was originally created.

It is a further objective of the present invention to allow local sites where data is

created to establish their own formatting and storage policies without such formatting and storage polices being dictated by a central facility.

It is yet another objective of the present invention to establish security for a users records by separating the user records from the identification card issues to a user.

The present invention uses a device-based paradigm to avoid the confusion and restrictions associated with root registration systems. For example, a particular manufacturer would register its company for participation with the present invention. Identification numbers are assigned by the manufacturer and used to designate the equipment in question. Thus equipment from a particular manufacturer which is used by a particular practitioner or health care provider has a unique ID. A date/time stamp is also added to this equipment ID to designate the source and when the equipment is used.

The present invention also comprises a simple network transport up protocol, defined in this application as the Simple Data Transfer Protocol or SDTP. The SDTP provides Internet wide sharing of data and database systems through a client/server, transaction based model of data interaction and management. The SDTP allows for the transmission, reception, and recovery of data from disparate locations.

The present invention also provides a network delivery mechanism for addressing where to find requested information. This subsystem known as the distributed data name service or DDN S is the reference system by which SDTP operates. This is not meant however as a limitation. Once the location of information is established by the DDNS, retrieval of information could occur equally as well by any protocol once that protocol knows the location of the desired information.

Various universal encoding systems are also used in the present invention so that individual devices and users of those devices can be encoded in a universal fashion.

It should be noted that the preferred embodiment illustrated in this specification is that of a medical device and data retrieval system. However, the present invention should not be construed as being so limited. For example the architectures and topology of the present invention is equally well suited to commercial transactions such as point of sale transactions, the generation of ATM cards and other commercial ventures. It can also be sued as a form of identification for employees of large organizations where security and access to facilities in disparate locations must be tightly controlled. Thus while the medical application will be elucidated below, those skilled in the art will appreciate that the system and method described can be applied in many disparate situations.

Using the present invention, device manufacturers register their own unique names with the system. For example Hewlett-Packard may register the name "HP" to be used with all of its device ID numbers whereas another manufacturer such as Phillips might register another different name "PH." When a medical device is first used on the system, its own identification (manufacturer, and device ID number) is automatically registered with the system. A patient receives an ID number, the first time the patient receives an ECG or is x-rayed by equipment that is registered with the system of the present invention. Thus the first time a patient is examined via medical equipment of the present invention, a universal record of not only the equipment, but also the patient is automatically created.

The present invention also comprises a user identification token or barcode label placed on any card of any variety which may be in the form of a credit card, smart card or other token card which is generated at the time of the first use of any device registered with the system. From that point on, the patient identification card is "registered" within the system. Further, the health care provider simply uses the imaging equipment available based upon the patient identification card, the universal encoding of the system, and images

recorded with appropriate patient identification information and image information. In addition, the image created is universally available immediately after creation.

After recording information, the present invention tracks indices to locations of information. If the location of the device changes, that information could be tracked by the DDNS level 1 server so that queries could be automatically rerouted to the location at which the device is currently housed. Thus the information can change as necessary while the index to access that information does not. The present invention also does not require standardized formatting of information. Thus, local sites format and store their own information as they desire without having to adhere to a particular dictated format. Thus local sites do not have equipment, staffing, administration, and other matters imposed upon them.

The system of the present invention transports, sends, delivers, receives, and processes information objects. No middleware is required. Transmission of request for information and the receiving of that information is done, using the simplified data transfer protocol. In addition, existing systems can be included within the present invention since any kind of document or object can fit within the present invention as an object. Only namespaces as addresses are necessary for the present invention in order to find the location of desired information and retrieve that information.

In summary, the present invention is a device driven addressing system rather than a top-down addressing system. Individual devices create the namespace address necessary to retrieve information created by the individual device. Thus the present invention allows the minimal set of possible information at the top-level, which is used for routing requests for information, with actual information created by individual devices or sites stored and located at those devices or sites.

The present invention comprises a Simple Data Transport Protocol (SDTP),

Distributed Data Name Service (DDNS) software implementation, and a paradigm for automated indexing of global databases.

The DDNS design is similar in function to the domain name service which supports all Internet addresses. The domain name service for the Internet allows a single address to be used by any user regardless of that user's location to find another user on the Internet. In a similar fashion the DDNS of the present invention supports such a lookup service. However DDNS is generalized and optimized for resolving database locations and database service locations.

The DDNS exists in a series of servers in a tree structure whereby medical diagnostic equipment are connected to servers. These lower level servers are in turn connected to higher level servers in a tree structure or parent-child relationship. There is no practical limit to the level of servers in the tree structure. It is only required that there be sufficient levles of servers to satisfy the query needs of the organizations connected to the DDNS network.

Using the DDNS of the present invention, if a client machine requires information it does not have, it sends a query to a parent server concerning where to find the record information. In this application, the parent server is referred to as a DDNS Level 2 server or DDNS-2 server. This situation can exist in the medical sense if a patient, having a medical ID card of the present invention, visits an emergency room in other than the patient's home city. In that situation the patient may use the patient ID card which will not be recognized by the local medical diagnostic equipment. In that case the medical diagnostic equipment will query the next higher server regarding where to find information on the patient.

If the server being queried has the necessary information, and answers the requesting client, the Interaction stops. If the server does not have the information, it in turn, asks its parent server, and so on up a tree structure of parent-child DDNS servers until the requested

information is found. Once the patient index information is found, it is passed back down to the originating client which receives address/index information for a direct site to site request. At this point a peer-to-peer connection can be made whereby the client receives the desired medical information directly from the medical diagnostic equipment or database possessing that information.

The Simplified Data Transport Protocol (SDTP)

Once the source of the desired information is located it becomes necessary to transfer the desired information from one location to another. The Simplified Data Transport Protocol (SDTP) of the present invention has this task. SDTP provides Internet-wide sharing of data and database systems through a client-server, transaction-based model of data interaction and management. SDTP structures transmission, reception, and recovery of data.

Brief Description of the Figures

Figure 1 illustrates the DDNS server nodes

Figure 2 illustrates a DDNS network topology

Figure 3 illustrates a specific example of an instance of use of the DDNS network topology

Detailed Description of the Preferred Embodiment

As noted earlier, the present invention comprises a Distributed Domain Name Service (DDNS) software implementation whereby devices and users are uniquely identified and registered on servers of the system the first time the devices are used and the first time that users use the devices, a Simple Data Transport Protocol (SDTP) whereby once data of interest is located, that data can be transported from location to location with ease, and a paradigm for automated indexing of global databases.

Distributed Data Name Service (DDNS)

Distributed Data Name Service (DDNS) provides a name lookup service for the

indexing of global databases. It is designed to work in between a transfer protocol such as SDTP, and an encoding scheme for naming objects uniquely.

The DDNS implementation is similar to DNS (Domain Name Service), which supports all Internet name lookup service. The basic idea is illustrated in Figure 1 DDNS Nodal Indexing.

In DDNS, if a client machine needs information it does not have, it asks a parent server where to find that information. If that server has the information, it answers the requesting client and the interaction stops. If the server does not have the information, it in turn asks its parent server, and so on, up a tree structure of parent-child DDNS machines, until the requested information is found. Once the information is found, it is passed back down to the originating client, which receives forwarding information for a direct site-tosite request, at which point a peer-to-peer connection is made "horizontally" in the tree structure.

It is important to note that, strictly speaking, DDNS is not "Middleware". Although it can appropriately interact with Middleware as necessary.

DDNS provides efficient recovery of records from anywhere on a network, and has no machine-type or operating system restrictions whatsoever. Its architecture provides intrinsic scalability suitable for supporting universal databases that may require diskspace exceeding current technologies for individual sites. Since it resolves namespaces rather than IP addresses, DDNS will seamlessly migrate to new network protocols such as "IP2" whenever traditional IP is replaced. Using namespaces also supports organizational durability, since organizations may change names and have these reticulated through the DDNS structure, or keep the same names and change the undergirding machine hardware supporting those names without impact of data accessibility to the network.

The SDTP/DDNS combination provides an automatic, low-level addressing and

retrieval mechanism on which other functionality can be conveniently built. Such functionality may include automatic invoicing, automatically generated statistical polling of part quality, demographic information for illnesses without access to patient identity, etc. Such functionality supports electronic interaction and electronic commerce.

Used with SDTP and other naming and classification conventions, DDNS can provide global indexing of any kind of image, produced on any kind of image-producing device, making any image retrievable by a click of a barcode reader. Yet images may be produced on different machines in different countries. Implications of such design specifically include SDTP/DDNS/ASIA support for universal image recall through standard medical cards given to patients at local hospitals. This is discussed specifically elsewhere in the document.

Used with other encoding schemes, SDTP/DDNS functionality may conveniently extend into diverse applications. Such applications may include automated part tracking, automated consumer purchase and repurchase, automated manufacturer-retailer profit distribution, and automated assessments of production quality on a plant-by-plant basis.

The major advantages supporting DDNS design include:

1. Machine interactions are name lookups, not actual data transfers, until the very last moment when a site-to-site connection can be made. Thus, interactions are very fast between machines.
2. Information contained on any machine emphasizes minimalist storage. A machine attempts to keep only the most minimal information it needs on its local system, knowing that it can retrieve remote information very quickly whenever needed.
3. Storage of data is genuine distributed. Since DDNS servers only hold index information for where to get information, rather than the information itself,

global databases can be unlimited in size. Even very large global databases that exceed the physical storage possibilities of single sites will have excellent performance.

To illustrate the benefits, consider an example in which local sites cannot usefully store more than 50 terabytes of information. Since a global database supported by SDTP/DDNS only stores addressing information, it can provide information on many such sites, letting those sites resolve the actual data internally.

4. Each machine may cache its previous lookups and thus avoiding vertical lookups for recurrently used data. For data that sister sites will share over and over, the caching mechanism allows site-to-site connections without making parent-node queries. Thus, performance is very fast, even when scaling to very large addressing mechanisms.

5. Local policies determine disk storage and internal data structure for local systems. Yet local information will be available globally.

Flexibility & Ease of Use

Flexibility, generality, and ubiquitous accessibility are core principles of the SDTP/DDNS implementation. With a minimal "backbone" infrastructure of a small collection of machines, DDNS can support numerous concurrent universal databases, conveniently supporting as diverse systems as automated parts tracking in automobile repairs, insurance records, and purchase and repurchase of any scanable item: clothing, home appliances, wood, paint, groceries, etc. Such applications will only require a barcode click on behalf of the user. And then on behalf of that user, a computer queries a DDNS server for data location, and then SDTP retrieves the data from the appropriate site.

Simple Data Transport Protocol (SDTP)

The following terminology and associated definitions are used in this specification:

Database: A collection of records. SDTP supported databases can be local and/or global.

Record: A denotatum stored in a database.

Transaction: An interaction between a client query and server response. Example transactions include modifying a global database and finding a record in a database.

Client Query: A request from a client sent to a server.

Server Response: A response from a server sent to a client.

Message: Generally, a client query or server response. Specifically, a content identifier and data object.

Content Identifier: The first string of a SDTP message that identifies SDTP/0.9 version, command, and arguments to process.

Data Object: A header and body. Data objects may include text, images, video, sound, etc.

Header: Header information in a data object, employing MIME conventions.

Body: Body information in a data object, employing MIME conventions.

The Simple Data Transport Protocol (SDTP) of the present invention is a protocol that applies to dynamically distributed, Internet-wide, database systems.

The SDTP protocol provides universal addressing of database systems, and universal search and retrieval of data stored on such systems. SDTP supports any encoding mechanism, but is optimized for large scale or universal encoding mechanisms for universal image tracking.

SDTP distributed database functionality can seamlessly traverse any network

topology, machine-type, operating system, database system, etc. The protocol supports all forms of data: text, image, video, sound, etc.

SDTP permits intelligent, efficient, fully automated data-sharing on a site-to-site, device-by-device basis, searching and retrieving specific data sets. Data sets can be located anywhere on a network, and have no physical storage-size restrictions. Searching can be local or global. For example, data produced by an ECG machine in Chicago is available to another ECG machine in Bangkok.

In SDTP data are no longer viewed as existing on a single system, or any collection of explicitly linked systems or sub-systems, such as credit card authorization systems. Rather, SDTP views data as query relations, in which a single, very simple query mechanism dynamically organizes and retrieves germane information at a moment of request.

The basic mechanism works such that when a client query is fully satisfied locally, a search can halt. When a client query is not satisfied locally, within a couple of network "hops" a SDTP server response will return a comprehensive list of data locations to the requesting client. A given client needs no initial knowledge that related data even exist, or where or how such data are stored. Yet for any given record, a client query can rapidly find all related records across the Internet-even if related records exist on databases unknown to exist by the requesting client, at the moment of its request.

SDTP can support machine clusters, LANs, WANs, heterogeneous networks, collections of linked networks, or any set of these. This design explicitly includes support for full, Internet-wide search and retrieval of records. Essentially, there are no network restrictions for SDTP; it can transport and retrieve information for local or global systems alike.

SDTP operations rely on client-server transactions. A transaction is characterized by

a client sending a message to a server, and the server sending back a message to the client. SDTP/0.9 supports two basic transactions, Lookup and Modify, each of which has two commands. Table 2 summarizes these relations.

Lookup	index	Retrieve a record's index, but not the record itself
	query	Retrieve a record.
ModifyADD		Add a record to a database.
	DELETE	Remove a record from a database.

Table 2: Transactions

Since SDTP applies to any kind of database, existing anywhere on the Internet, SDTP transactions provide genuinely global searching, retrieving, adding, and removing records from universal databases.

As noted earlier, a message is a client query or a server response. The data structure of messages consists in a content identifier and data object. Table 3 summarizes these relations. A content identifier identifies SDTP version, command, and any arguments. A data object

Content Identifier	
Data Object	Header
	Body

Table 3: Message Data Structure

consists in a header and body, both of which support MIME conventions. A header contains information about the transaction-type and data specifications. A body contains data, which can include MIME multipart documents, among other data.

SDTP relies on uniform interaction between clients and servers, transacted through client query and server response messages. A client query requests actions from a server. A server response answers client queries, and sometimes also performs actions on behalf of the

client called server actions. Both client queries and server responses rely on the data structure of messages.

Table 4 summarizes protocol relations. Since transactions are interactions between client queries and server responses, a 'Lookup index' transaction would involve an exchange between a client query and a server response. In turn, client queries and server responses are subject to content identifiers and data objects.

Transactions	Lookup		index
			query
	Modify	ADD	
			DELETE
Client Query	Content Identifier		
	Data Object		Header
			Body
Server Response	Content Identifier		
	Data Object		Header
			Body

Table 4: Protocol Relations

Message Data Structure

A message is a content identifier and a data object. The SDTP client query content identifier syntax is:

SDTP/version command argument ...

These expansions describe content identifier semantics:

version	SDTP version number.
command	Keyword specifying SDTP activity.
argument	Argument for command.
...	Subsequent arguments.

Example. Consider this legal content identifier:

SDTP/0.9 LOOKUP MedImages 123.abc

Following the content identifier syntax, the command is 'LOOKUP' with two arguments: (1)'MedImages' (the database to search) and (2) '123.abc' (a record or set of

records as might occur in a hospital system).

A data object includes (1) a header and (2) a body. A data object may include text, images, video, sound, any other media or data type, and any combination thereof.

A header consists in one or more lines and is terminated by a blank line. The syntax for such lines is:

fieldname: data

The argument data may have any number of additional arguments separated by semicolons (';'). These expansions describe the header semantics:

fieldname	Label for data field	(e.g., Date, Content-Length,Content-Type, etc.)
data	Data	(e.g., for content-type, cookies etc.)

Client query data object headers additionally can contain preferences for server responses, but SDTP/0.9 does not yet specify these.

For example, consider the following data object header. This example illustrates a Lookup transaction that retrieves a record:

Content-Type: application/sdtp; transaction ="lookup-1"; lookuptype ="query"

A body consists in a MIME body, including multipart bodies [FB96a]. This structure facilitates transmission of all data types such as text, graphics, sound, video, etc.

A body contains content or is null. The exact format of the body depends upon specific databases, and thus is fixed in a separate standardization process not subject to SDTP.

For example, consider the following data object body. This example indicates a successful deletion of record '123.abc':

SUCCEEDED DELETE 123.abc

A client query is a message, and consists in (1) a content identifier and (2) a data

object.

An example of a client query data object is:

Content-Type: application/sdtp; transaction="modification"
From: medical.cenon.com

DELETE 123.abc
ADD DEF0456

A server response is a message, and consists in (1) always a data object, and (2) sometimes an additional server action (e.g., a record deletion). See also Message Data Structure.

Unlike client queries, SDTP server responses have no content identifier. Server responses are data objects.

Server response data object headers are transaction types.

For example, consider the following server response data object header. The Transaction type illustrates address forwarding.

Content-Type: application/sdtp; transaction= "forwarding"

The Server response data object body syntax is determined in the data object header according to the transaction specification. A body contains content or is null. For example, consider the following server response data object body which illustrates successful deletion of record '123. abc', and failed addition of record 'DEF@456'.

SUCCEEDED DELETE 123.abc
FAILED ADD DF.FO456

Example Server Response Data Object

Consider this example of a server response data object, including both header and body:

Content-Type: application/sdtp; transaction="modification"
From: medical.cenon.com

SUCCEEDED DELETE 123.abc
FAILED ADD DEF@456

A server response may invoke a server action, such as adding or deleting a record from a database. SDTP specifies the structure and syntax of data objects. SDTP specifies a semantics associated with the server action, but not structure or detail of implementation. Such considerations axe left to decisions of site-by-site implementation.

Transactions

A transaction consists of (1) a client query (to server), and (2) a server response (to client). The current version, SDTP 0.9, provides two types of transactions, Lookup and Modify. Table 5 illustrates these relations.

	Client Query	Server Response
Lookup	Client queries server for records.	Server returns records, or location instructions for where to find records.
Modify	Client requests server synchronization	Server synchronizes data storage.

Table 5: Transaction Summary

Lookup: A Lookup transaction determines if a node has knowledge of requested record(s).

Client Query: A Lookup client query is a message, and thus contains (1) a content identifier and (2) a data object.

(1) Content Identifier: An sample Lookup content identifieris as follows:

SDTP/0.9 MODIFY MedImages 123.abc

(2) Data Object: A Modify data object will contain (A) a header and (B) a body.

(2A) Header: The Lookup header uses a Content-Type that specifies (1) a Lookup transaction and (2) a lookuptype. A Lookup data object header has syntax:

Content-type: application/sdtp; transaction="lookup"; lookuptype="*type*" '*type* 'in

'lookuptype' has these values and meanings in SDTP/0.9:

Value	Meaning
query	Transfer a record
index	Transfer a record's index, but not the record itself

The following example of a Content-Type data object header retrieves a record's index, but not the record itself:

Content-Type: application/sdtp; transaction="lookup"; lookuptype=-"index"

(2B) Body: A Lookup client query data object body is empty in SDTP/0.9.

Server Response: A Lookup response (1) has no content identifier, and (2) has a data object.

(1) Content Identifier: The Lookup server response has no content identifier.

(2) Data Object: The Lookup server response data object has (A) a header and (B) a body.

(2A) Header: This header specifies the Content-Type of the server response, but may also include other information such as MD5 encrypted signatures, etc.

(2B) Body: The body follows MIME message body conventions [FB96a]. SDTP data object bodies have three forms:

1. One or more records, structured as MIME multipart documents [FB96a].

2. Forwarding instructions, for one or more records, structured as the MIME type application/sdtp with attribute transaction set to forwarding. For example:

Content-Type: application/sdtp; transaction="forwarding"

A following data object body would contain a list of addresses to query for records.

3. Compound responses, structured as MIME multipart documents. Each part of a multipart document will be:

(a) Form 1, One or more records

(b) Form 2, Forwarding instructions

(c) Form 3, Compound responses.

Example Lookup Transaction: This example illustrates a Lookup transaction, in which record '123.abc' is retrieved from universal database 'MedImages'. The transaction consists in a client query and a server response.

Client Query: The following 3 line transcript is a plausible client query Lookup record retrieval request, from medical. cenon.com.

```
SDTP/0.9 LOOKUP MedImages 123.abc
Content-Type: application/sdtp; transaction="lookup"; lookuptype="query"
From: medical.cenon.com
```

This query requests the retrieval of record '123.abc' from universal database 'MedImages'.

Server Response: The following 7 line server response indicates a plausible server reply to the previous client query.

```
SDTP/0.9 LOOKUP MedImages
Content-Type: application/sdtp; transaction="forwarding"
From: medical.cenon.com

ddns-2.uch.net
ddns-2.mag.net
ddns-2.nyc.net
```

The server forwards the client addresses where questions are answered about record '123.abc' in universal database 'MedImages'.

Modify: A Modify transaction synchronizes databases. A client query asks for modification of server-stored data, such as adding or deleting a record.

Client Query: A Modify client query includes (1) a content identifier and (2)a data object.

(1) Content Identifier

See Content Identifier about content identifier syntax and semantics. An example Modify content identifier looks like:

SDTP/0.9 MODIFY MedImages 123.abc

(2) Data Object

See Data Object about data object syntax and semantics. A Modify data object will contain (A) a header and (B) a body.

(2A) Header. A Modify data object header specifies a Content-Type using transaction="modification". An example looks like:

Content-Type: application/sdtp; transaction="modification"

(2B)Body. TheModifydataobjectbodycontainsinstructionsdetailingmodification of the database, such as adding and deleting records. An example data object body request for deleting record '123.abc' and adding record 'DEF@456' could be:

```
DELETE 123.abc
ADD DEF@456
```

Server Response

A Modify server response (1) has no content identifier, and (2) has a data object.

(1) Content Identifier The Modify server response has no content identifier.

(2) Data Object

See Data Object about data object syntax and semantics. The Lookup server response data object has (A) a header and (B) a body.

(2A) Header. This header specifies the Content-Type of the server response, but may also include other information such as MD5 encrypted signatures, etc.

(2B) Body. The body follows MIME message body conventions [FB96a]. The Modify data object body may also contain verification information, such as the success or failure of a request. Verification information often is null.

Example Modify Transaction

The following example illustrates a Modify transaction. This example modifies the universal MedImages database, where the client query requests to delete record 123.abc and to add record DEF@456. The transaction consists in a client query and a server response.

Client Query. The following 6 line transcript requests to delete and add a record from database MedImages.

```
SDTP/0.9 MODIFY MedImages
Content-Type: application/sdtp; transaction="modification"
From: medical.cenon.com

DELETE 123.abc
ADD   DEF@456
```

Line 1. Client query identifies protocol and requests modification of database MedImages.

Line 2. 'Content-Type'identifies a SDTP application; 'transaction' specifies a "modification" transaction type.

Line 3. 'From' identifies client making request.

Line 4. Blank line identifies separation between data object header and data object body.

Line 5. 'DELETE' removes forwarding for Lookup query of record '123.abc'.

Line 6. 'ADD' enables forwarding to 'medical.cenon.com', for Lookup query of record 'DEF@456'.

Server Response. The following 6 line server response indicates a plausible reply to the previous client query.

```
SDTP/0.9 MODIFY MedImages
Content-Type: application/sdtp; transaction="modification"
From: medical.cenon.com

SUCCEEDED DELETE 123.abc
FAILED ADD DEF@456
```

Line 1. Server response identifies protocol and acknowledges request for modification of database MedImages.

Line 2. 'Content-Type' identifies a SDTP application; 'trisection' specifies a "modification" transaction type.

Line 3. 'From' identifies client making request.

Line 4. Blank line identifies separation between data object header and data object body.

Line 5. 'SUCCEEDED' indicates that client query 'DELETE' was completed successfully.

Line 6. 'FAILED' indicates that client query 'ADD' was not completed successfully.

Referring to figure 1 a simplified DDNS Nodal indexing system is illustrated. If the electrocardiogram analyzer **10** has unique identifier which, for purposes of this illustration is noted as the number one. When a user first is established with the system of the present invention the user might be subject to electrocardiogram analyzer testing on, for example, January 11th 1998. This date, in combination with unique electrocardiogram analyzer identifier "one" is then registered was in DDNS server 14 and. In this example the DDNS server is noted as a Level-2 server located at the University of Chicago noted with the abbreviation "UCH."

Other electrocardiogram analyzers **12, 16,** and **18** are also shown as part of the system. Electrocardiogram analyzer **12** is connected to DDNS server **14.** Electrocardiogram analyzer 16 is connected to DDNS server 20 which, in the present example is noted as being associated with Massachusetts general hospital, abbreviated as "MAG.". Electrocardiogram analyzer 18 having the unique identifier "4" is connected to DDNS server 22 in New York City.

DDNS level 2 servers 22, 20, and 14 are connected to a DDNS Level-1 server 24. The purpose of the DDNS Level-1 server 24 is to receive and store a record of the identifiers of of individual date or records created by the individual electrocardiogram analyzers shown in figure 1. It is important to note that the DDNS Level-1 server 24 does not contain the ultimate information, that is, the results of electrocardiograms that have been administered to the particular patient at the various hospitals. (It should be noted that DDNS level 1 server may

actually be serval machines as is later illustrated.) DDNS Level-1 server 24 only contains a record of the indices that show where the information is stored. Thus for example, if a patient receives an electrocardiogram on January 11th 1998 from electrocardiogram analyzer can the information record concerning that analysis is stored and the user is given a medical identification card possessing and ID number associated with at first examination. If that patient is subsequently examined using electrocardiogram analyzer 18 on September 23rd 1998, the practitioner would obtain the medical identification card of the patient, record that information through electrocardiogram analyzer 18 which would then the determine if it had ever seen that particular patient before. If not, a query would proceed from electrocardiogram analyzer 18 to DDNS Level-2 server 22 to inquire if a record of that patient exists. If no such record exists at DDNS Level-2 server 22 that server will send a query to DDNS Level-1 server 24 to determine if it has a record of the particular patient.

DDNS Level-1 server or 24 will have such are record of the existence of the particular patient is existing at electrocardiogram analyzer 10 which can be reached via DDNS server 14. Thereafter DDNS Level-2 22 will make contact with DDNS Level-2 server 14 on behalf of electrocardiogram analyzer 18, with electrocardiogram analyzer 10.

In this example, DDNS servers of two different levels are shown. The level 2 servers store and broker requests for indices relating to medical equipment that is connected to them. The level 1 DDNS servers store and broker requests for indices relating to patients from Level 2 servers connected to them. Thus information is not generally passed when a query is made, only the identification of the location of the data is transferred. It should also be noted that this example of use in the medical arena is not meant to be limiting. As will be explained later, other application areas are equally considered to be within the scope of the present invention.

Referring to figure 2 the network topology of the present invention is illustrated. As

noted earlier, the present invention is device driven rather than driven by a top-down classification schemata. A series of medical devices may be attached to a workstation at a particular hospital. For sample, ECG **4**, CT **6**, and ECG **12** may all be attached to a workstation **2** at a location, for example, the University of Chicago (UCH). ECG **4** will have its own unique identifier generally assigned by the manufacturer. When the ECG 4 is first activated to perform its first examination and creates the appropriate patient record, ECH 4 becomes registered on the system of the present invention. Thus the global identifier for ECG 4 is created the first time the device is activated. In a similar fashion, CT 6 also has a unique identifier as does ECG 12. These devices are also shown as attached to workstation 2.

Alternatively medical devices may be self-contained and amenable to being attached or directly connected to a DDNS server. The situation is also illustrated in figure 2 where CT **8** is shown as directly connected to second level DDNS **14**. Additionally, ECG **10** is also shown as connected to the DDNS level 2 server **14**.

All of the above devices ECG 4, CT 6, ECG 12, CT 8, ECG 10, and workstation 2 are all uniquely identified and registered with the system of the present invention the moment that they are first activated. As will be shown later, a date time stamp is also used in conjunction with the unique identifier to create a unique patient identifier the first time that the patient uses any device that is registered on the system.

In a similar fashion, other medical devices and other geographically disparate locations can also become registered on the system of the present invention. Again referring to Figure 2 ECG devices 13.15, and 16 may all be resident at, for example, Massachusetts General Hospital (in this figure designated as MAG). Additionally, MRI **11** and CT are also shown as located in Massachusetts General hospital. ECG **15** and **16** may be located in emergency room **21** while ECG **13** may be located in and the attached to a workstation and cardiology **19**. MRI **11** and CT

9 may be connected to workstation 17 in radiology. Workstations **21** in the emergency room, **19** in cardiology, and **17** in radiology are all connected to DDNS level 2 server **20**. It is important to note that unique identifiers will only be associated with the devices actually performing the diagnostic task, that is, devices **9,11, 13,15,** and **16**. Workstations **17, 19,** and **21** will not to have unique identifiers since they will not be creating the medical records to be searched. It is of course possible that an individual hospaital may wish to have unique identifiers regarding all devices on a network whether diagnostic or not in order to be able trace all instances of data or information created. The present invention will support this implementation as well.

In Figure 2 yet a third location, hypothetically a hospital in New York City (designated as NYC) is shown as having a series of medical devices as well. In this is an instance ECG **18** is connected to a PC **32**. That PC is in turn connected to a display **30** was capable of displaying the results of the ECG analysis. Similarly, ECG **34** is directly connected to display **30**. Display **30** is connected to a workstation **26** which has an MRI device **28** connected to it. This workstation **26** is in turn attached to DDNS level-2 server **22**.

All of the DDNS level-2 servers **14,20**, and **22** are connected to DDNS level-1 servers **23, 24**, and **25.** These DDNS level-1 servers broker queries for information and client index locations coming from the various geographic locations were a patient may be treated.

It is important to note that once a medical device is activated for the first time, its unique ID is stored at both the DDNS level-2 server and a DDNS level-1 server. This is because the DDNS Level-2 server knows about diagnostic devices connected to it and DDNS Level-1 servers know about DDNS Level-2 connected to them. Thus the DDNS servers learn about the diagnostic devices in different ways. Further, once a patient is treated for the first time using any medical device that is attached to the present system, a permanent designation for that patient is created which comprises the unique identifier of the medical device combined with the date

time stamp of the first treatment of the patient.

In practice, and as will be discussed in detail later, a patient who is treated at ECG **18 in** NYC, and who possesses a medical ID card or barcode label on any card created by the system will cause a query to be created to determine if any other medical records exist for the patient. Initially a query will go as high as DDNS level-2 server **22**. If an index to that client's records exists within the New York City location, that information will be sent to the operator of ECG **18**. If such information does not exist, DDNS level-2 server **22** will add a new record to its database and will send the query to DDNS level-1 servers **23, 24,** and **25** to determine where a patient index for that particular patient does exist. If DDNS Level -1 server knows about the record, it will make a record associating the the new data record with the data record that already exists in its database. If the patient was first treated at University of Chicago, the patient index, derived from the medical ID card, will cause a query to be sent to DDNS level-2 server 14 which will respond with the various indices which indicate that location of records relating to the patient of interest.

Examples

By way of example and to further illustrate a preferred embodiment of the present invention, Figure 3 is presented. Since only data regarding indices to information os being searched, the system of the present invention responds very quickly to queries for the location of patient information. In the examples that follow, only the date@device designation is used. In the full implementation the manufacturers ID would also be present as part of the unique identifier.

1. Jane comes the University of Chicago Hospital on 11 December 1998 for the first time, to receive her first ECG ever, where she receives a University of Chicago Hospital medical card as a normal part of her admission. Upon receiving an ECG exam, Jane's reading is automatically

entered into the University of Chicago Hospital's local database system, and a printer produces a small sticker which a nurse affixed to Jane's medical card.

SDTP/0.9 MODIFY MedImages
Content-Type; application/sdtp; transaction="modification"
From; ddns-2.uch.net

ADD 19981211@1

Since DDDS-2:UCH has never seen record '19981211@1', it attempts to 'ADD' it to the next level "up" (to DDNS-1 Servers). A similar SDTP client query is sent "up" to DDNS-1 Servers.

2. DDNS-1 Servers receive and process the following client query request to ADD record '19981211@1 'to the global 'MedImages' database:

SDTP/0.9 MODIFY MedImages
Content-Type; application/sdtp; transaction='modification"
From: ddns-2.uch.edu

ADD 19981211@1

Since DDNS-1 Servers have not yet seen record '19981211@1' DDNS-1 Servers store it. Using the From: field, DDNS-1 Serviers further associate '19981211@1' with address 'ddns-2.uch.edu.' DDNS-1 Servers will now forward future Lookup requests for record '19981211@1' to DDNS-2:UCH.

DDNS-1 Servers return a SDTP server response to DDNS-2:UCH. The response indicates successful completion of the request ADD for '19981211@1' in database 'MedImages.' The server response is:

SDTP/0.9 MODIFY MedImages
Content-Type: application/sdtp; transaction="modification"
From: ddns-2 uch.edu
SUCCEEDED ADD 19981211@l

The DDNS system has now globally registered record '19981211@1' in the universal database

'MedImages'.

Crucial implications follow from this design

(a) A local system creates a global identifier in a fully automatic manner, without any human intervention whatsoever.

(b) This process requires no form of "root registration" for users of equipment.

(c) A user may operate whatever local system is most desirable, without interference from SDTP/DDNS.

3. Jane returns for a follow-up visit on 22 Dec 1998. A nurse clicks a barcode reader on Jane's medical card, which concurrently prompts DDNS-2:UCH to do an internal 'Lookup' client query for the number encoded onto her card ('19981211@1') which was encoded during her first visit on 11 Dec 1998. Since DDNS-2:UCH has the record '19981211@1' it stops searching, and does not query DDNS-1 Servers. Jane's previous reading of 11 Dec 1998 is automatically recalled onto the screen.

4. The 'ADD' command now saves the 22 Dec 1998 reading, associating it with the 11 Dec 1998 reading through the global index (database "key") '19981211@1'. The SDTP interaction looks like:

```
SDTP/0.9 MODIFY MedImages
Convent-Type:      application/sdtp; transaction="modification"
From: ddns-2.uch.edu

ADD 19981211@1
```

The attending physician refers Jane to a Networked Specialist Physician, who makes an appointment of 5 Jan 1999.

Crucial implications follow from the client-server interactions up to now:

(a) DDNS-1 Servers store a mapping from record '19981211@1' to DDNS-2:UCH. DDNS-2UCH has a mapping to whatever internal mechanism the University of Chicago Hospital uses

to record its data.

(b) DDNS-1 Servers and DDNS-2:UCH only know about one record ('19981211@1'),while the University of Chicago Hospital knows about two records. A "one-to-many" relationship is created.

Because only 1 number is stored at the DDNS-1 Servers level, global system performance is optimized. Only 1 number provides potential access to all of Jane's records at the University of Chicago Hospital.

(c) Routine business at the University of Chicago Hospital remains on site. This reduces system complexity on the local side, and further optimizes Level-1 DDNS performance. DDNS uses global resources only when local resources do not have the needed information.

(d) A user participates in global information sharing without any special interaction besides barcode reading a medical card. Currently, optical readers provide the most robust construction, but any other encoding mechanism could be used. Similarly, rather than affixing a label, the medical card be given at the end of the visit, with the universal identifier indelibly marked on the card.

5. On 5 Jan 1999 Jane arrives for her referral appointment with a Networked Specialist Physician (NSP) made during her last visit to the University of Chicago Hospital on 22 Dec 1998.

A nurse at the NSP barcode-reads Jane's University of Chicago Hospital medical card to begin the process. The NSP local machine does an internal client query 'Lookup' for the number encoded onto Jane's card)'19981211@1'). This record is not found on the local machine, and so the machine sends a client query to DDNS-2:UCH.

SDTP/0.9 LOOKUP MedImages 19981211@1

6. DDNS-2:UCH receives the previous client query and does an internal 'Lookup' for

'19981211@1', which it finds. Since the search for record '19981211@1' is satisfied, DDNS-2:UCH does not query DDNS-1 Servers. DDNS-2:UCH returns records from 11 Dec 1998 and 22 Dec 1998.

Although miles from the University of Chicago Hospital, clicking a barcode reader on Jane's medical card provides the NSP instant retrieval of previous ECG readings at the University of Chicago.

7. Although appearing to the SNP in the same moment, the system now ADDs the reading taken on 5 Jan 1999 to the NSP local syste, associating it with the global index '19981211@1'.

Since record '19981211@1' is stored for the first time on the NSP local machine, the NSP local machine also attempts to ADD "up" record '19981211@1', for global registration in databas 'MedImages'. The NSP local system sends this command to it DDNS server, DDNS-2"UCH:

```
SDTP/0.9 MODIFY MedImages
Convent-Type:        application/sdtp; transaction="modification"
From: specialist.uch.edu

ADD 19981211@1
```

8. DDNS-2:UCH receives the previous client query 'ADD'. Since DDNS-2:UCH has already registered record '19981211@1', it now associates the NSP address with record '19981211@1', as an address answering questions about global record '19981211@1'. DDNS-2:UCH returns a server response indicating the successful status of the client query ADD:

```
SDTP/0.9 MODIFY MedImages
Convent-Type: application/sdtp; transaction="modification"
From: specialist.uch.edu

ADD 19981211@1
```

9. On 6 Jun 1999 Jane visits Massachusetts General Hospital (MAG). A nurse barcode reads Jane's University of Chicago medical card, which posts an internal Lookup client query to

DDNS-2:MAG, for the original ECG taken on 11 Dec 1998 (in Chicago, affixed to Jane's University of Chicago Hospital card).

Not having seen record '19981211@1' before, DDNS-2:MAG asks if DDNS-1 Servers hnow where to find information about this record. DDNS-2:MAG sends this client query Lookup request to DDNS-1 Servers:

SDTP/0.9 LOOKUP MedImages 19981211@1

10. DDNS-1 Servers receive DDNS-2:MaG's previous client query Lookup for record '19981211@1' in global database 'MedImages'. DDNS-1 Servers do know about record '19981211@1': that DDNS-2:UCH answers questions about it.

11. DDNS-1 Servers send a server response indicating that DDNS-2:UCH answers queries about record '19981211@1'. The forwarding message sent is:

SDTP/0.9 LOOKUP MedImages
Content-Type: application/sdtp; transaction="forwarding"

ddns-2.uch.edu

12. DDNS-2:MAG directly connects to DDNS-2:UCH, which queries machine specialist.uch.edu, requesting records related to '19981211@1':

SDTP/0.9 LOOKUP MedImages 19981211@1

DDNS-2:UCH returns records for ECG readings taken on 5 Jan 1999, 22 Dec 1998, and 11 Dec 1998.

Barcode reading Jane's University of Chicago Hospital medical card in Massachusetts General Hospital instantly retrieves Jane's previous records, displaying the images on the screen within a moment of clicking the barcode reader.

13. Although appearing in the same moment from the nurse's point of view, the system now saves the 6 Jun 1999 reading to the local Massachusetts General Hospital machine.

Since DDNS-2:MAG does not have the 'll Dec 1998' reading (globally indexed by '19981211@1'), it adds '19981211@1' to its database, associating it with the new reading taken locally on 6 Jun 1999. Since '19981211@1' is a new record to DDNS-2:MAG, it also attempts to ADD "up" the record just scanned from Jane's University of Chicago Hospital medical card, '19981211@1'. DDNS-2:MAG sends a client query ADD to DDNS-1 Servers.

SDTP/0.9 MODIFY MedImges
Content-Type: application/sdtp; transaction="modification"
From: ddns-2.mag.org

ADD 19981211@1

14. DDNS-1 Servers receive the previous client query request to ADD record '19981211@1' to global database 'MedImages'. Since DDNS-1 Servers already know about record '19981211@1', DDNS-1 Servers store the address in the From: header (ddns-2.mag.org) as a location that will answer queries for global record '19981211@1'.

Future Lookup requests for record '19981211@1' now will receive forwarding instructions for both DDNS-2:MAG and DDNS-2:UCH. DDNS-1 Servers now sends a server response indicating status of the request:

SDTP/0.9 MODIFY MedImages
Content-Type: application/sdtp; transaction="modification"
From: ddns-2.mag.org

SUCCEEDED ADD 19981211@l

15. Jane is in a car accident in New York City, and is rushed to a random hospital, where an attendant discovers a University of Chicago Hospital medical card in her purse.

Clicking a barcode reader on the card, a DDNS-2:NYC internal Lookup learns that record '19981211@1' is unknown. So it sends a client query Lookup request "up", to DDNS-1 Servers.

16. DDNS-L Servers receive a client query Lookup request from DDNS-2:NYC:

SDTP/0.9 LOOKUP MedImages 19981211@1

DDNS-1 Servers know about record '19981211@1', and have two forwarding address associations: DDNS-2:MAG and DDNS-2:UCH.

17. DDNS-1 Servers know that DDNS-2:UCH and DDNS-2:MAG answer queries for record '19981211@1', and return forwarding instructions for these addresses.

SDTP/0.9 LOOKUP MedImages
Content-Type: application/sdtp; transaction="forwarding"

ddns-2.mag.org
ddns-2.uch.edu

18. DDNS-2:NYC directly connects to DDNS-2:MAG and DDNS-2:UCH, querying for record '19981211@1', using the following client query for both addresses:

SDTP/0.9 LOOKUP MedImages 19981211@1

Four records appear on the screen in the emergency room:

6 Jun 1999	DDNS-2:MAG
5 Jan 1999	DDNS-2:UCH
22 Dec 1998	DDNS-2:UCH
11 Dec 1998	DDNS-2:UCH

While the top-level DDNS service (DDNS-1 Servers) only knows about global record '19981211@1', the New York Hospital emergency room now views four records, from three devices, from two different sites, simply by barcode reading a University of Chicago Hospital medical card.

The physicians need not know from which facilities Jane has records, and yet her comprehensive ECG records are available instantaneously.

19. Although appearing to the emergency room in the same moment, the system now ADDs the reading taken on 23 Sep 1999 to the local DDNS-2:NYC system, associating it with the global index of '19981211@1'.

Since record '19981211@1' is stored for the first time on the DDNS-2:NYC, DDNS-

Of course, each address answers queries using its own network architecture, storage

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2:NYC also attempts to ADD "up" record '19981211@1', for global registration in database 'MedImages'.

20. DDNS-1 Servers receives the following client query request to ADD record '19981211@1' to global database 'MedImages', from DDNS-2:NYC.

SDTP/0.9 MODIFY MedImages
Content-Type: application/sdtp; transaction="modification"
From: ddns-2.nyc.com

ADD 19981211@1

Since DDNS-1 Servers already know about record '19981211@1' (from DDNS-2:MAG and DDNS-2:UCH), DDNS-1 Servers add the address in the From: header (ddns-2. nyc.com) to the list of addresses that will answer queries for global record '19981211@1'. DDNS-1 Servers then sends a server response indicating status of DDNS-2:NYC's client query ADD request:

SDTP/0.9 MODIFY MedImages
Content-Type: application/sdtp; transaction="modification"
From: ddns-2.nyc.com

SUCCEEDED ADD 19981211@1

Having made this addition, DDNS-1 Servers will answer future Lookup requests for record '19981211@1' with forwarding instructions to:

DDNS-2:NYC
DDNS-2:MAG
DDNS-2:UCH.

21. While on vacation in the Florida Keys, away from convenient access to a hospital, Jane experiences chest pain. She goes to an Independent Practitioner (IP) on 8 Oct 1999, and presents her University of Chicago Hospital medical card, which the physician barcode reads.

The physician's local machine does an internal client query 'Lookup' for the number

a variety of IBM PC and compatibles are suitable to the task of the workstations attached to the medical diagnostic equipment or as DDNS-Level-2 servers. All that is required is that there be sufficient storage to store the indices noted. The DDNS level-1 servers can also be IBM PC, Sun workstations or indeed any server capable of storing and retrieving information and communicating that information via modems or otherwise to other servers or workstations of the present invention. Thus the software giving rise to the unique identifiers is stored at the lower levels of the system while software for storing, retrieving and associated indices are typically located at the high levels servers of the system.

Further Examples:

- On a home computer, Jane clicks a barcode on the last grocery receipt, which reproduces the same order as the week before. Arriving at the grocery store, the order has been charged to her credit card, and is waiting for pick up.
- On a home computer John clicks a barcode reader on an old pair of athletic shoes. A web page appears on which he is offered a choice to repurchase the same shoes (same brand, size, color, etc.), from the same company. He mouse-clicks on "Accept" and the same credit card is charged that originally purchased the shoes. The shoes are delivered to his house the next day. One barcode click and one mouse click consummate this interaction.
- A student goes to a book store needing several chapters of various books. He selects a book of interest from the shelves, and using the bookstore's PC "kiosk", clicks on Chapter 3. A web-page returns instantly, indicating that he may purchase this chapter for $1.83, for which he may use his credit card or

pay the cashier.

Unknown to the consumer, at the moment of clicking the barcode reader, the publisher has been consulted and the publisher's royalties and bookstore's profit margins have been combined in the $1.83 purchase. Each month the publisher sends automatically generated invoices to bookstores that itemize royalties due. Such a mechanism works just as easily for images in publications, and journal articles, etc., and in libraries and photocopy shops to enhance copyright protection.

- A car owner brings a car to a garage for a muffler repair. Clicking a barcode reader, the mechanic learns that the muffler is in warranty. The mechanic provides better service to the car owner, and receives automatic part restocking from the manufacturer.

The manufacturer not only automatically tracks muffler repairs for a given model, but also the precise plants from which the failed mufflers come. The manufacturer has an automatic way to track part life-cycles, manufacturing defects, repair warranties, replacement policies, etc. Yet such data gathering is accomplished in the process of normal automotive repair.

On site, a furnace repairman clicks a barcode reader at a broken furnace part, a cellular phone calls into a local service provider, which in turn recalls the repair history of the furnace, and the part availability for repair. New parts can be ordered from the portable decoder the repairman brings to on-site jobs.

The repair process is streamlined, permitting the repairman to order parts order directly from the manufacturer, while on-site, through an on-site cellular connection to a local service provider, by passing administrative overhead back at the home office.

Many other such examples apply, such automatic tracing of insurance records by an

insurance company; repurchases of home appliances, wood, paints. The entire process is universally and automatically indexed at production or transaction time, supported by this document's "device-based" approach to universal database construction.

A system and method for establishing and retrieving data based on global indices has been described. As previously noted, although a medical application has been described, it will be appreciated by those skilled in the art from reviewing the specification and the examples given that many other embodiments are possible using the system with departing from the scope of the invention as disclosed.

We claim:

1. A Method for Establishing and Retrieving Data Based on Global Indices comprising:

establishing a unique device ID for each of a plurality of data generating devices on a network;

registering the unique device ID of each of the plurality of data generating devices on the network on at least one server connected to the network when the data generating equipment is first used on the network;

establishing a unique user ID for each user of the data generating devices when the user uses one of the plurality of data generating devices for the first time; and

retrieving data generated by the plurality of data generating devices by searching for instances of the unique user ID.

2. The Method for Establishing and Retrieving Data Based on Global Indices of claim 1 wherein establishing the unique user ID further comprises combining the device ID of the data generating device being used by the user with a date/time stamp of the first use by the user.

3. The Method for Establishing and Retrieving Data Based on Global Indices of claim 2 further comprising storing the unique user ID on a token given to the user.

4. The Method for Establishing and Retrieving Data Based on Global Indices of claim 3 further comprising the user using the token with the unique user ID for all subsequent uses of any of the plurality of data generating devices.

5. The Method for Establishing and Retrieving Data Based on Global Indices of claim 1 wherein the data generated is medical data concerning the user.

6. The Method for Establishing and Retrieving Data Based on Global Indices of claim 1 wherein the data generated is commercial data.

7. A System for Establishing and Retrieving Data Based on Global Indices comprising:

a network;

a plurality of servers connected to the network for storing data and responding to search requests;

a plurality of data generating devices connected to the servers, wherein each data generating device has a unique ID that is registered with at least one server when the data generating device is first used of the network;

unique user ID generator associated with each data generating device whereby a unique user ID is established by combining the unique device ID with a date time stamp of when the user first used any of the plurality of data generating devices on the network; and

search logic for searching for instances of the unique user ID on any of the plurality of servers.

8. The System for Establishing and Retrieving Data Based on Global Indices of claim 7 wherein the data generating devices are medical data generating devices.

9. The System for Establishing and Retrieving Data Based on Global Indices of claim 7 further comprising tokens generated by each of the plurality of data generating devices on which is stored each unique user ID.

10. The System for Establishing and Retrieving Data Based on Global Indices of claim 7 wherein the data generated is commercial data.

11. The System for Establishing and Retrieving Data Based on Global Indices of claim 9 wherein each of the plurality of data generating devices further comprises a token reader for reading the unique user ID stored on the token of a user.

12. The System for Establishing and Retrieving Data Based on Global Indices of claim 7 further comprising data transport logic for transporting data generated from one data

generating device to another once the location of the data has been determined by the search logic identifying instances of the unique user ID on any of the plurality of servers.

13. A Method for Establishing and Retrieving Data Based on Global Indices comprising:

establishing a unique device ID for each of a plurality of data generating devices on a network;

registering the unique device ID of each of the plurality of data generating devices on the network on at least one server connected to the network when the data generating equipment is first used on the network;

establishing a unique record ID for each record of the data generating devices when the record is created using one of the plurality of data generating devices for the first time; and

retrieving data generated by the plurality of data generating devices by searching for instances of the unique record ID.

14. The method for establishing and retrieving data based on global indices of claim 13 wherein the records creating is creating records of parts of an assembly.

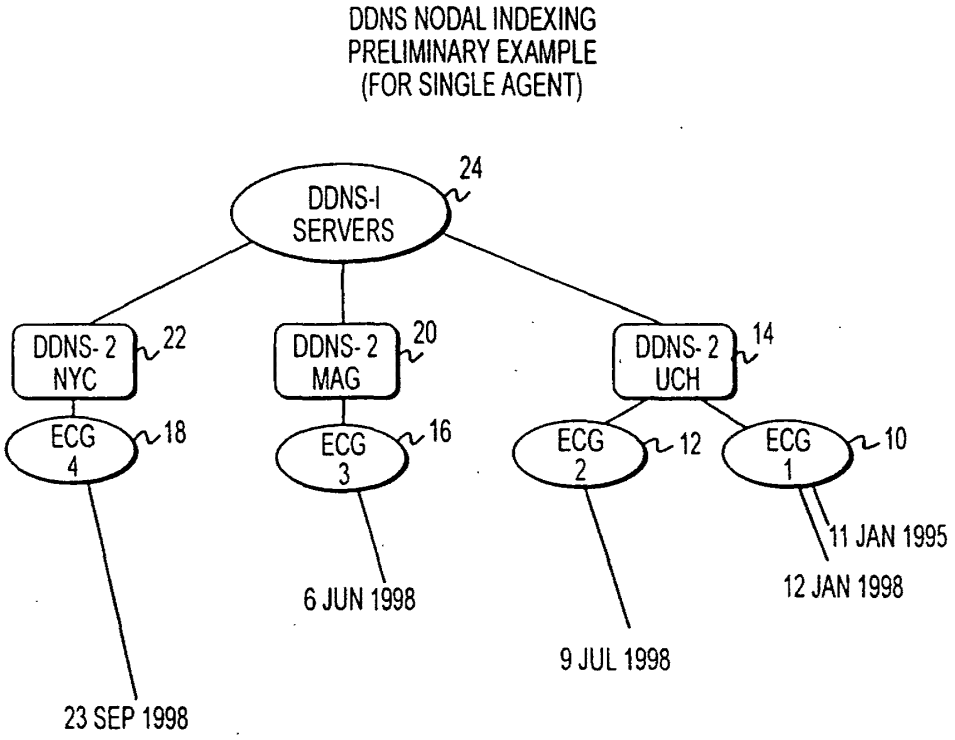

DDNS NODAL INDEXING
PRELIMINARY EXAMPLE
(FOR SINGLE AGENT)
DDNS-I SERVERS
24
DDNS- 2 NYC
22
DDNS- 2 MAG
20
DDNS- 2 UCH
14
ECG 4
18
ECG 3
16
ECG 2
12
ECG 1
10
23 SEP 1998
6 JUN 1998
9 JUL 1998
11 JAN 1995
12 JAN 1998

FIG. 1

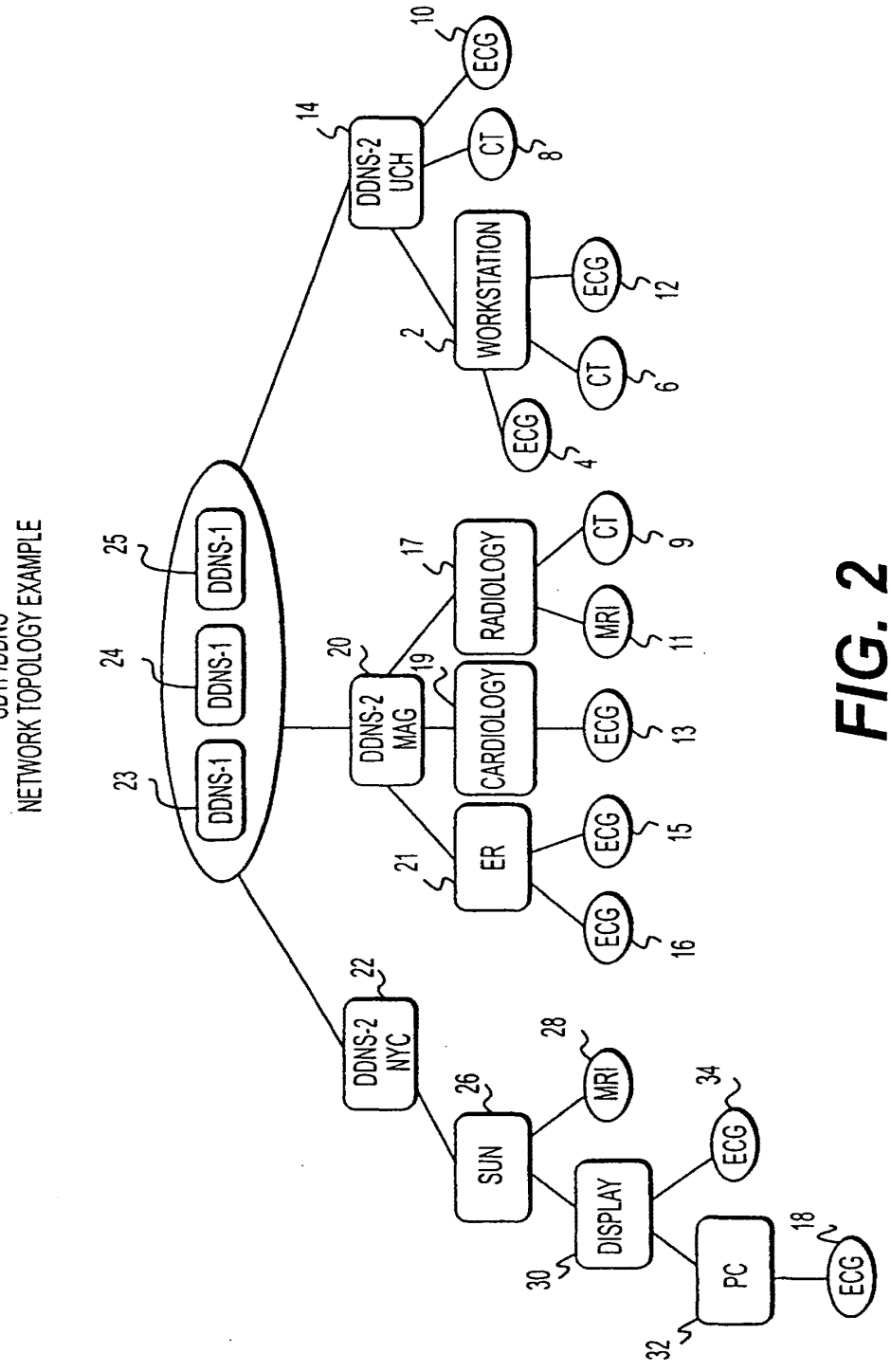

SDTP/DDNS
NETWORK TOPOLOGY EXAMPLE
DDNS-1
DDNS-1
DDNS-1
DDNS-2 NYC
DDNS-2 MAG
DDNS-2 UCH
WORKSTATION
CARDIOLOGY
RADIOLOGY
ER
SUN
DISPLAY
PC
ECG
CT
MRI
23
24
25
22
20
14
2
19
17
21
26
30
32
4
6
8
9
10
11
12
13
15
16
18
28
34

FIG. 2

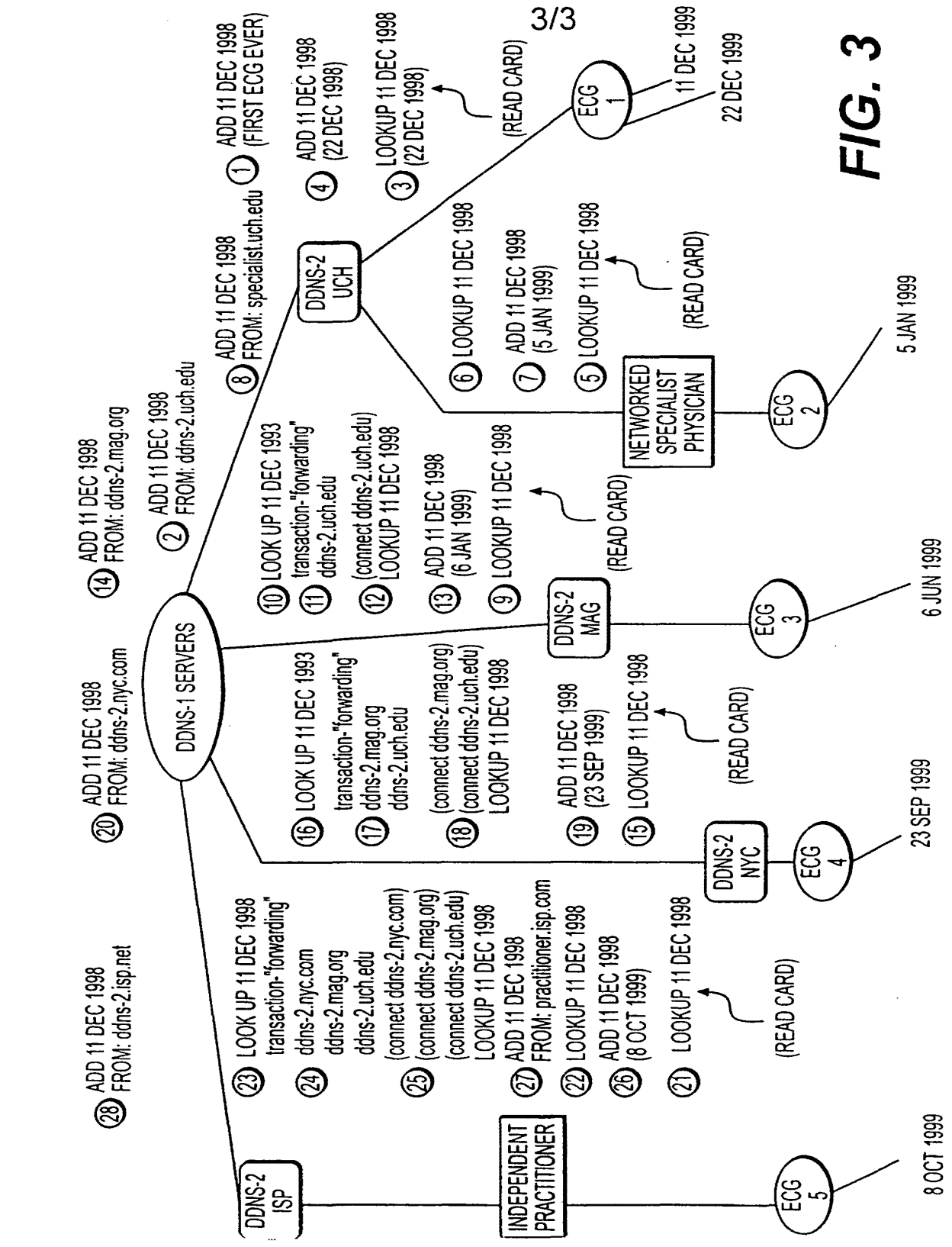

DDNS-1 SERVERS
DDNS-2 ISP
DDNS-2 UCH
DDNS-2 MAG
DDNS-2 NYC
INDEPENDENT PRACTITIONER
NETWORKED SPECIALIST PHYSICIAN
ECG 1
ECG 2
ECG 3
ECG 4
ECG 5
1 ADD 11 DEC 1998 (FIRST ECG EVER)
2 ADD 11 DEC 1998 FROM: ddns-2.uch.edu
3 LOOKUP 11 DEC 1998 (22 DEC 1998)
4 ADD 11 DEC 1998 (22 DEC 1998)
5 LOOKUP 11 DEC 1998
6 LOOKUP 11 DEC 1998
7 ADD 11 DEC 1998 (5 JAN 1999)
8 ADD 11 DEC 1998 FROM: specialist.uch.edu
9 LOOKUP 11 DEC 1998
10 LOOK UP 11 DEC 1993 transaction-"forwarding"
11 ddns-2.uch.edu
12 (connect ddns-2.uch.edu) LOOKUP 11 DEC 1998
13 ADD 11 DEC 1998 (6 JAN 1999)
14 ADD 11 DEC 1998 FROM: ddns-2.mag.org
15 LOOKUP 11 DEC 1998
16 LOOK UP 11 DEC 1993 transaction-"forwarding"
17 ddns-2.mag.org ddns-2.uch.edu
18 (connect ddns-2.mag.org) (connect ddns-2.uch.edu) LOOKUP 11 DEC 1998
19 ADD 11 DEC 1998 (23 SEP 1999)
20 ADD 11 DEC 1998 FROM: ddns-2.nyc.com
21 LOOKUP 11 DEC 1998
22 LOOKUP 11 DEC 1998
23 LOOK UP 11 DEC 1998 transaction-"forwarding"
24 ddns-2.nyc.com ddns-2.mag.org ddns-2.uch.edu
25 (connect ddns-2.nyc.com) (connect ddns-2.mag.org) (connect ddns-2.uch.edu) LOOKUP 11 DEC 1998
26 ADD 11 DEC 1998 (8 OCT 1999)
27 ADD 11 DEC 1998 FROM: practitioner.isp.com
28 ADD 11 DEC 1998 FROM: ddns-2.isp.net
(READ CARD)
(READ CARD)
(READ CARD)
(READ CARD)
(READ CARD)
11 DEC 1999
22 DEC 1999
5 JAN 1999
6 JUN 1999
23 SEP 1999
8 OCT 1999

FIG. 3

INTERNATIONAL SEARCH REPORT

Inte. onal Application No
PCT/US 99/14553

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L29/12 G06F19/00 //G06F159:00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98 15910 A (SCHULTZ JOSEPH PAUL ;SCHULTZ MYRON G (US)) 16 April 1998 (1998-04-16) page 3, line 12 -page 5, line 5 ---	1-5,7-9, 11-13
A	BOURKE D G ET AL: "PROGRAMMABLE MODULE AND CIRCUIT FOR MACHINE-READABLE UNIQUE SERIAL NUMBER" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 27, no. 4A, 1 September 1984 (1984-09-01), pages 1942-1944, XP000715172 ISSN: 0018-8689 the whole document --- -/--	1,7,13

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 October 1999	26/10/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Fournier, C

1

INTERNATIONAL SEARCH REPORT

Inte .onal Application No
PCT/US 99/14553

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	KLEINHOLZ L ET AL: "SUPPORTING COOPERATIVE MEDICINE: THE BERMED PROJECT" IEEE MULTIMEDIA, vol. 1, no. 4, 21 December 1994 (1994-12-21), pages 44-53, XP000484150 ISSN: 1070-986X page 44, left-hand column, line 1 -page 47, left-hand column, line 11 ---	1,5,7,8
A	"METHOD FOR NETWORK NAMING AND ROUTING" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 37, no. 9, 1 September 1994 (1994-09-01), page 255/256 XP000473404 ISSN: 0018-8689 the whole document -----	

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

page 2 of 2

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter onal Application No
PCT/US 99/14553

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9815910 A	16-04-1998	AU 4606597 A	05-05-1998

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(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 568 161 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93202218.9**

(51) Int. Cl.5: **G06F 15/401**, G06F 15/403

(22) Date of filing: **14.01.92**

This application was filed on 27 - 07 - 1993 as a divisional application to the application mentioned under INID code 60.

(30) Priority: **14.01.91 GB 9100733**

(43) Date of publication of application:
03.11.93 Bulletin 93/44

(60) Publication number of the earlier application in accordance with Art.76 EPC: **0 495 622**

(84) Designated Contracting States:
DE FR GB

(71) Applicant: **XEROX CORPORATION**
Xerox Square
Rochester New York 14644(US)

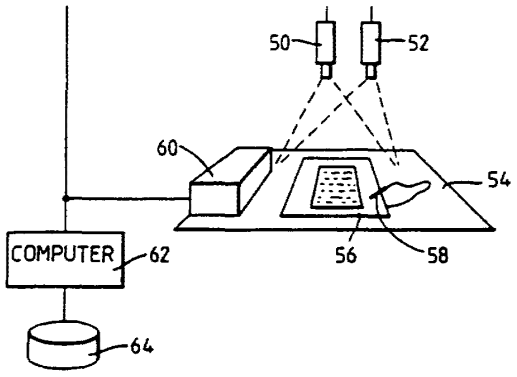
(72) Inventor: **Wellner, Pierre**
57 Carlyle Road
Cambridge CB4 3DH(GB)
Inventor: **Newman, William Maxwell**
Yew Tree Cottage,
Farnham
Blandford Forum, Dorset(GB)
Inventor: **Lamming, Michael G.**
179 Hills Road
Cambridge CB2 2RN(GB)

(74) Representative: **Goode, Ian Roy et al**
Rank Xerox Patent Department,
Albion House,
55-59 New Oxford Street
London WC1A 1BS (GB)

(54) Interctive desktop system.

(57) An interactive desktop system for processing visual information, comprising a work surface (54), a camera (50;60) for sensing visual information located on the work surface (54), and a projector (52) for forming visual images on the work surface (54). Processing means (62, 64), coupled to the camera (50;60) and to the projector (52), encodes and stores data corresponding to the visual information for selective retrieval and decoding; the processing means (62, 64) being further adapted for modifying said visual images in response to one or more functions selected by a user of the system by carrying out various manual operations within the field of view of the camera.

Fig.1.



EP 0 568 161 A1

This invention relates to an interactive desk top system for processing documents and data in visual form.

For desk workers and people attending meetings, access to certain functions (e.g. manipulation of the text of a document) is currently available only *via* display screens: not paper.

There is a need for an interactive system that can deal with any incoming paper document or print-out of an electronic document, and that can provide access to a number of computer-based functions and services. This is particularly so in meeting rooms, where use of paper documents is a firmly-entrenched practice.

The present invention provides an interactive system for processing visual information, comprising: a work surface; means for sensing visual information located on the work surface; means for forming visual images on the work surface; processing means, coupled to the sensing means and to the image forming means, for encoding and storing data corresponding to the visual information for selective retrieval and decoding; wherein the processing means is adapted for modifying said visual images in response to one or more functions selected by a user of the system.

The processing means preferably includes a data store, and the processing means is adapted for operating on the stored data in response to the selected function(s) and for outputting data corresponding to modified visual images to the image forming means.

The system preferably includes means for selecting a function to be performed by the system by selecting a zone of the visual image on the surface. Preferably, the zone comprises a single item from a displayed menu within the visual images, said item corresponding to an operation to be performed on said visual images or stored data.

Alternatively, the selected zone may comprise a portion of text or graphics within a document or said visual images.

The sensing means preferably includes means for recognising graphical or hand printed character information written on the work surface.

The system preferably includes a tablet forming part of the work surface, and a stylus, coupled to the tablet and operable by the user, for entering zone selections or graphical information representing, or the subject of, a selected function.

Preferably, the image forming means comprises a projector supplied with video data by the processing means.

The visual information may comprise the content of a document on said work surface. Preferably, the system includes: means for constructing time-stamped records identifying document pages and indicating operations on the documents; means for encoding and storing the records for later selective retrieval and decoding; and means for enabling identification of the document contents from a record.

Preferably, the sensing means comprises a video camera. Preferably, the processing means includes a frame store.

The sensing means may include a high resolution document scanner, for example located on the desktop. The system may include means for collecting audio signal and other data from the user representing, or the subject of, a selected function.

The present invention further provides a method according to claim 10 of the appended claims.

The present invention further provides a programmable apparatus when suitably programmed for carrying out the method of claim 10.

This invention can be compared either with workstation-based interaction or with traditional paper-based work practice. As an alternative to workstation-based interaction, it has the advantage that it can deal with any paper document, or print-out of an electronic document. Compared with paper-based methods, it has the advantage of providing access to a number of computer-based functions and services. It has particular advantages in meeting rooms, where use of paper documents is a firmly-entrenched practice.

The invention may include activity-based indexing of data sets (and particularly documents or sets of documents), in order to facilitate the fast retrieval at a later date of data (documents) of interest. The system is based on devising pattern-matching techniques for constructing recognisable episodes from raw data. In this way it offers the user the means to arrive quickly at a particular point in one dataset, possibly in order to be able to obtain access more efficiently and quickly into at least one other dataset. This speed of access is one of the essential requirements in making the technique of practical value. Further details of the indexing and retrieval system which may be used in the present invention is disclosed in EP-A-495 622.

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic view of part of a system of the present invention in which the activity being monitored is the presence of various documents on the user's workspace, with at least descriptors of those documents being stored to complement the other data assisting in later retrieval; and

Figures 2(a) to (c) are partial displays of a typical output of the Fig. 1 system.

Fig. 1 shows the system which exploits scanning and image-processing technology to read the

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 20 2218

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 468 694 (EDGAR A.) * the whole document * -----	1-10	G06F15/401 G06F15/403
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			G06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	09 SEPTEMBER 1993	SUENDERMANN R.O.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)

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Fig.1.

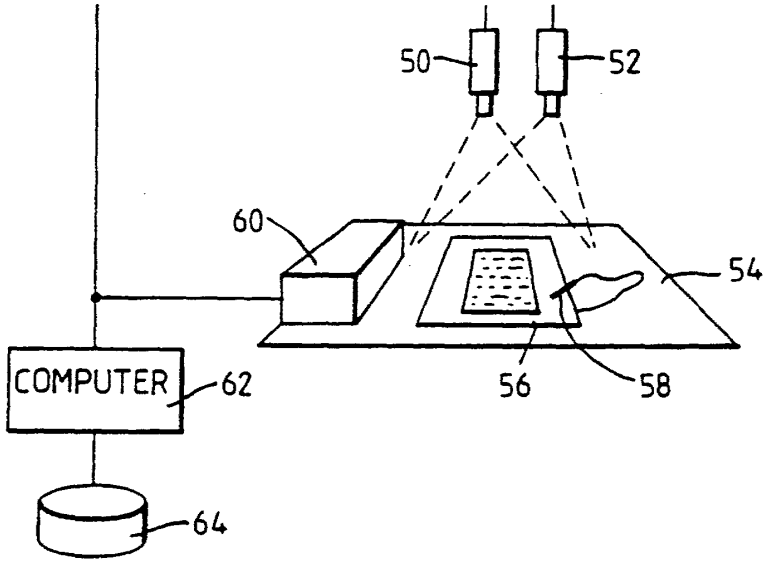


Fig. 2.

(a).

correspondant aux
outils qui se =tools
developpent le plus
souvent autour de la

(b).

217.60
33.58
226.03
315.40
=1092.61

INDEX
CALCULATE
TRANSLATE
DICTIONARY
FILL IN

(c)

(including reading, editing, filing, calculating). The diary composer 14 takes episodes describing individual document pages and builds episodes describing activity on multi-page documents and on folders of documents.

A microphone 68 may be carried by a user, as disclosed with reference to the Fig. 9 system of EP-A-495 622, and the level of the audio signal produced by the microphone is monitored by means of a circuit of the type used in cassette recorders.

Claims

1. An interactive system for processing visual information, comprising:
   a work surface (54);
   means (50;60) for sensing visual information located on the work surface (54);
   means (52) for forming visual images on the work surface (54);
   processing means (62, 64), coupled to the sensing means (50;60) and to the image forming means (52), for encoding and storing data corresponding to the visual information for selective retrieval and decoding;
   wherein the processing means (62, 64) is adapted for modifying said visual images in response to one or more functions selected by a user of the system.

2. A system as claimed in claim 1, in which the processing means (62, 64) includes a data store (64), and the processing means is adapted for operating on the stored data in response to the selected function(s) and for outputting data corresponding to modified visual images to the image forming means (52).

3. A system as claimed in claim 1 or 2, including means for selecting a function to be performed by the system by selecting a zone (Fig.7) of the visual image on the work surface.

4. A system as claimed in claim 3, wherein the zone comprises a single item from a menu (Fig.7(c)) within the visual images, said item corresponding to an operation to be performed on said visual images or stored data.

5. A system as claimed in claim 3, wherein the selected zone comprises a portion of textual or graphical information (Figs 7(a),(b)) within a document, for example a paper document, or said visual images.

6. A system as claimed in any preceding claim, wherein the sensing means (50;60) includes means for recognising graphical or printed character information written on the work surface.

7. A system as claimed in any preceding claim, including a tablet forming part of the work surface, and a stylus, coupled to the tablet and operable by the user, for entering zone selections or graphical information representing, or the subject of, a selected function.

8. A system as claimed in any preceding claim, wherein the image forming means (52) comprises a projector supplied with video data by the processing means.

9. A system as claimed in any preceding claim, wherein the visual information comprises the content of a document on said work surface.

10. A method of operating a system that includes:
    a work surface (54);
    image receiving circuitry (50; 60) for providing input signals indicating images that show the work surface (54);
    image providing circuitry (52) for providing output signals defining images to be presented to a user on the work surface (54); and
    a processor (62; 64) connected to the image receiving circuitry and to the image providing circuitry;
    the method comprising:
    providing first output signals to the image providing circuitry; the first output signals defining a first image;
    receiving first input signals from the image receiving circuitry; the first input signals indicating an image that shows the first image as presented on the work surface;
    using the first input signals to obtain request signals indicating a request by the user; and
    responding to the request signals by using the first input signals to obtain second output signals defining a modified version of the first image and by providing the second output signals to the image providing circuitry.

contents of documents on a deck surface: the user is then able to interact with these contents using a pointer such as a tablet and stylus. A wide range of interaction techniques may be used, including menu selection and dialogue boxes, graphical selection and hand printed character recognition. Moreover, the user is also free simply to write on documents with a pen or with an ink pen in the stylus. Particular tasks for which the system could be effective include: selecting key words for document filing; performing calculations on numeric data; translating foreign words, looking up technical terms in dictionaries, checking and filling in forms, retrieving other documents or information that cannot be printed, e.g. audio or video. The invention could therefore give desk workers and people attending meetings access to functions that are currently available only *via* work stations. The apparatus shown in Fig. 6 includes a video camera 50 and a video projector 52 mounted above a desk 54 at which the user sits, a data tablet 56 with a stylus 58, a high-resolution scanner 60, and a control computer 62 with its data store or memory 64 for images.

The camera 50 is mounted so that it field of view includes the document on the desk 54 in front of the user. The video signal is digitised using a frame store, creating a bit map image of the document. Digital filtering techniques are applied to the image, first to determine size and rotation, and then to classify the document according to properties such as line spacing, line-length distribution, etc. Application of these techniques provides (a) a compact resolution-independent encoding of the images properties for use as a descriptor, and (b) orientation and position information. The data tablet 56 and stylus 58 permit the user to select items such as words or columns of numbers. When the user makes a selection as by pressing down on the tablet surface, the coordinates of the stylus 58 are transformed, using the inverse of the rotation and position information, to determine the selection in the coordinates of the page.

If the image scanned in from the camera 50 is of insufficient resolution to support interaction, the document can be scanned in at high resolution. This operation is done *via* the scanner 60, and it could be performed on the entire contents of the user's in-tray before a work session, or on an entire set of meeting papers before a meeting starts. The same digital filtering techniques as before are applied to the high-resolution page image to construct a descriptor and to correct for rotation. Optical character recognition (OCR) is applied to extract the text of the document. This text is stored for later use, indexed by the document descriptor. The page coordinates of each text item are included with the stored text.

The memory 64 contains layout information for each document page entered into the system, indexed by descriptor. The user need not apply high-resolution scanning or OCR to a document page that is already stored. As soon as the descriptor has been generated from the video scanned data, the existence of a stored version can be determined. Layout information describing computer-generated documents can be written directly to the memory 64, and descriptors generated, without recourse to scanning or OCR.

The descriptor of each page of a multi-page document, or of each single document, is non-unique, but is designed to ensure that descriptors are rarely duplicated. Descriptors for pairs of document images may be compared using a correlator to determine if the two images are of the same document. When the user selects an item with the stylus, the corrected coordinates are used to identify the text item in the stored version. The appropriate function (translation, indexing, etc.) can then be applied to the item. The system can also supply hand-printing recognition to the stylus input, or record changes to the scanned image resulting from conventional handwriting.

Feedback to the user is provided *via* the video projector 52. Examples of such feedback are shown in Fig. 2. Results of translations (Fig. 2a) or calculations (Fig. 2b) would normally be shown alongside the text. If space permits (and the system can determine this) the results could be displayed directly above the selected item. The video projector 52 also displays menus and dialogue boxes (see Fig. 2c) for interactive control.

Each time the user places a new document on the tablet, or turns the pages of a multi-page document, the system can detect the change in the video-scanned image and then recompute the image's descriptor. It searches for a matching descriptor in its file of documents. Thus if it finds a match, it retrieves the document. If, on the other hand, no match is found, it signals to the user to feed the document into the scanner 60.

The "audit trail" left by the system provides a source of data about the user's interaction with paper documents. These data can be used to construct episodes in which paper documents are identified either by selected key words or by optically-read contents. Reference is made to the sub-system shown in Fig. 8 of EP-A-495 622, which uses the data from the computer 62 and memory 64 of the Fig. 6 embodiment. The computer feeds raw document events to a document episode recogniser 66, the events including descriptors, commands and selected data. The recogniser builds episodes from consecutive events applied to the same document; episode descriptions include time-stamp, descriptor and type of episode

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(71) Applicant: ALPHAREL, INC. [US/US]; 765 Flynn Road, Camarillo, CA 93010 (US).

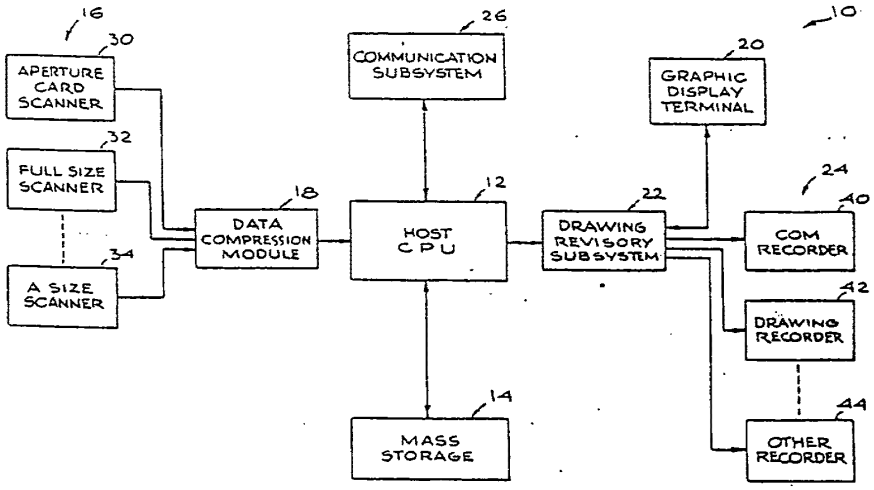
(72) Inventors: McGOVERN, Michael, J. ; 24 West Norman Avenue, Thousand Oaks, CA 91360 (US). ALKER, Bruce, B. ; 860 Crusoe Circle, Thousand Oaks, CA 91362 (US).

(74) Agent: FREILICH, Arthur; 10960 Wilshire Boulevard, #1434, Los Angeles, CA 90024 (US).

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(54) Title: COMPUTER BASED DRAWING MANAGEMENT SYSTEM



(57) Abstract

A system for use with large libraries of existing technical drawings for permitting the drawings to be electronically captured and digitally stored in a central data base. As needed, the documents can be retrieved, displayed, electronically revised, and printed out. The system includes scanners (16) which scan existing drawings to generate a bit stream of pixel data which is then compressed and stored in a mass storage unit (14). A drawing revisory subsystem (22) is provided capable of operating in a DRAWING REVISION MODE and a DRAWING REDISPLAY MODE. When operating in the DRAWING REVISION MODE, as the operator inputs revisory command, the revisory subsystem generates primitives which modify the displayed drawing in real time. When operating in the DRAWING REDISPLAY MODE, the compressed pixel data is expanded and stored in the pixel memory (60) to cause the monitor (52) to display the original drawing.

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COMPUTER BASED DRAWING MANAGEMENT SYSTEM

FIELD OF THE INVENTION

This invention relates generally to computer based systems useful for electronically storing, revising, and displaying technical drawings and other documents. More specifically, this invention relates to improvements in such systems for greatly enhancing their ability to efficiently revise electronically stored drawings.

BACKGROUND OF THE INVENTION

Systems are disclosed in the prior art for electronically storing and retrieving documents. Such prior art systems variously utilize analog and digital storage techniques and are exemplified by U.S. patents 4,205,780 and 4,388,610. Additional patents variously show relevant subsystems for (1) scanning documents; (2) storing electronic document data; (3) modifying stored electronic data; and (4) displaying or producing hard copy output of stored data. For example, see:

IMAGE-DATA HANDLING

4,394,774

4,369,463

4,307,377

4,189,711

3,876,831

STORAGE AND RETRIEVAL

4,271,430
4,152,722
4,141,078
4,020,463
3,868,637
3,854,004
3,757,037
3,751,582
3,697,680

PRINTING, SCANNING, EDITING & STORING

4,333,153
4,270,173
4,270,172
4,231,096
4,196,450
4,038,493
3,828,319
3,653,071
3,601,590

SUMMARY OF THE INVENTION

The present invention is particularly directed to an improved system for digitizing existing technical drawings and for storing the digital data so generated so that the data can later be retrieved for display, electronic revision, and hard copy output of the drawings.

Systems in accordance with the invention are intended primarily for use with large libraries of existing technical drawings to permit the drawings to be electronically captured and digitally stored in a central data base. As needed, the documents can then be retrieved,

displayed, electronically revised, and printed out, if required. Systems in accordance with the invention are intended to accept a wide variety of existing drawing formats, e.g. from aperture cards to full size originals as well as a wide range of drawing sizes, e.g. from A size to K size. Similarly, the systems are intended to drive a variety of hard copy output devices including microfilm recorders and full size plotters.

A system in accordance with the present invention preferably utilizes high resolution scanners capable of scanning existing drawings to generate a bit stream of pixel data at a resolution of at least 200 points per inch. The raw pixel data so generated is then compressed and stored in a mass storage unit associated with a host central processing unit (CPU). The mass storage unit preferably comprises an optical disk unit capable of storing a great many data sets, each set relating to a different drawing. A graphic display terminal is provided having a monitor for displaying drawings and input means enabling an operator to identify stored drawings to be displayed and to describe revisions to be made to such drawings.

In accordance with a significant feature of the invention, a control ("drawing revisory") subsystem provided to interface the graphic display terminal to the host CPU is particularly configured to facilitate the generation, storage, and retrieval of drawing revision data. More particularly, when operating in a DRAWING REVISION MODE, as the operator inputs revisory commands via the graphic display terminal, the subsystem generates primitives (i.e. an elementary display instruction together with parameter data) which modify the displayed drawing in real time by changing the bit map stored in a dedicated pixel memory driving the terminal display monitor. Additionally,

however, the revisory subsystem automatically caches the primitives defining the desired drawing revisions. At the completion of a revisory session, the cached primitives are grouped as a designated Revision Level and transferred via the host CPU to the mass storage unit. Each such stored Revision Level (e.g. Revision A) has information appended to it linking it to a related drawing data set.

In accordance with a significant aspect of the invention, the original drawings are stored in the mass storage unit in the form of highly compressed pixel data. However, the revisory data stored in the mass storage unit is in the form of primitives. When operating in the DRAWING REDISPLAY MODE, the compressed pixel data is accessed from mass storage, expanded, and stored in the pixel memory to cause the terminal monitor to display the original drawing.

In accordance with a significant feature of the invention, the redisplayed drawing is then revised through its successive REVISION LEVELS in an incremental or cinematic manner, level by level. This is accomplished by retrieving the stored primitives for each REVISION LEVEL and successively modifying the pixel memory in accordance therewith.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an overall block diagram of a drawing management system in accordance with the present invention;

Figure 2 is a block diagram primarily depicting the drawing revisory subsystem of Figure 1;

Figure 3 is a block diagram depicting a preferred embodiment of the drawing revisory subsystem of Figure 2;

Figure 4 is a block diagram of the primitive cache and store module depicted in Figure 3;

Figures 5 and 6 comprise flow charts respectively describing system operation during the DRAWING REVISION MODE and the incremental DRAWING REDISPLAY MODE in accordance with the present invention;

Figure 7 depicts exemplary display menus; and

Figure 8 depicts the execution of an exemplary command.

DESCRIPTION OF PREFERRED EMBODIMENT

Attention is now directed to Figure 1 which comprises a block diagram of a drawing management system 10 in accordance with the present invention. The system includes a host central processing unit (CPU) 12 having a large mass storage unit 14 coupled thereto.

The system 10 is intended to operate with large libraries of existing technical drawings to facilitate the electronic storage, revision, display, and hard copy output of the drawings. In order to initially electronically capture the information in an existing physical drawing, an appropriate one of scanning devices 16 scans the drawing to generate a binary data stream representing the pixel information in the drawing. A compression module 18 processes the binary data stream and converts it to a highly compressed form enabling it to be efficiently stored as a unique drawing data set in the mass storage unit 14. It should be understood that each drawing is only scanned when it is initially presented to the system. This initial scanning results in the host CPU 12 storing a digital representation, i.e. a drawing data set of the drawing in mass storage unit 14. In subsequent operations involving each drawing, whether for display, revision, or hard printout, the data set correspondindg to that drawing is accessed from mass storage 14 and operated upon.

System 10 further includes a graphic display terminal 20 which, as will be seen hereinafter, includes an operator input device and a display monitor. By proper utilization of the terminal 20, an operator communicates commands to the host CPU 12 via a control subsystem which, hereinafter, will generally be referred to as the drawing revisory subsystem 22.

In addition to interfacing the graphic display terminal 20 to the host CPU 12, the drawing revisory subsystem 22 interfaces CPU 12 with various output devices including display monitors and hard copy recorders 24. The system preferably also includes a comminication sybsystem 26 which enables system 10 to effectively operate with remote stations.

Prior to describing the preferred embodiment depicted in Figures 2 - 5, the intended application of system 10 will be briefly discussed. The system 10 is primarily intended for applications involving very large libraries of technical drawings (e.g. in excess of 100,000 drawings). Many large industrial companies, as well as government agencies maintain libraries of working and archival drawings of this size. The management of such libraries involves the storage, retrieval, revision, and reproduction of the drawings. This management function is generally cumbersome and expensive. Typically, the drawings vary in size from A size through K size as depicted by the following table:

TABLE 1

DWG	SIZE (in.)
A	8 1/2 X 11
B	11 X 17
C	17 X 22
D	22 X 34
E	34 X 44
F	28 X 40
G	11 X 42-144
H	28 X 48-144
J	34 X 48-144
K	40 X 48-144

Also, the drawings may exist in different formats; i.e. full size on paper (or vellum) or reduced size on microfilm. However, it has become common practice in the industry at this time to capture most drawings on microfilm frames with each frame carried by what is known as an aperture card. Typically, the aperture cards are configured so that they can be readily handled by electromechanical storage and retrieval systems. In order to accommodate a typical existing drawing base containing the aforementioned variety of drawing sizes and formats, the system 10 preferrably includes a variety of scanner devices 16. Thus, Figure 1 depicts an exemplary scanner group including an aperture card scanner 30, a full size drawing scanner 32, and a high speed A size scanner 34.

Various commercially available scanner devices are compatible with the system of Figure 1. Such scanner devices differ from one another in their performance characteristics including, for example, the rate at which they can operate, the variety of drawing formats which can be accommodated, and the resolution at which the drawings can be scanned. The details of such scanner units will not

be discussed herein. For purposes of the present disclosure, it will be assumed that each of the scanners 16 is able to scan a drawing at an effective resolution of 200 lines per inch, both horizontally (X) and vertically (Y), and output a bit stream of raw pixel data representing the content of the drawing.

In accordance with the invention, the raw bit stream output of the scanner 16 is subjected to a compression operation in data compression module 18. Various compression techniques are known in the prior art which could be used to compress the raw scanner output. However, it will be assumed herein that the data is compressed in accordance with what is generally known as the Frank code described in U.S. Patents 3,883,847; 4,103,287; 4,107,648; and 4,189,711.

The compressed digital data associated with a single drawing will herein be referred to as a drawing data set. One of the functions of the host CPU 12 is to store and keep track of the several hundred thousand data sets in a typical system. In accordance with the preferred embodiment, these data sets are stored in a mass storage unit 14, preferably an optical disk system having a storage capacity in the several hundred gigabyte range. An exemplary application of a system in accordance with the invention is depicted by the following Table 2 which demonstrates that a 421.8 gigabyte optical mass storage unit can store approximately four million drawing pages distributed variously amongst A - K size drawings.

TABLE 2

MASS STORAGE REQUIREMENTS

DWG SIZE	NO. DWGS	MEGABYTES PER DWG. UNCOMPRESSED	COMPRESSION RATIO	GIGABYTES COMPRESSED
A	800K	0.4675	8.0	46.75
B	1160K	0.935	15.0	72.30
C	920K	1.87	20.0	86.02
D	840K	3.74	25.0	125.66
E	80K	7.48	30.0	19.95
F-K	200K	6.16	30.0	41.06
Totals				
4000K Pages				391.74
REMAINING STORAGE (Directories, etc.)				30.0
GRAND TOTAL (400 Platters)				421.8

The graphic display terminal 20 is interfaced to the host CPU 12 by control means, designated as a drawing revisory subsystem 22, which is described in detail in the ensuing figures. Subsystem 22 is also used to drive a plurality of output recorders 24 and other output devices such as display terminals. The recorders 24 can include a computer output microfilm recorder 40, a full size drawing recorder or plotter 42, and any of various additional output devices 44 for producing aperture cards, roll film, etc. Suitable output recorders and displays are disclosed in the prior art, differing from one another in their performance characteristics such as output format flexibility, speed of operation, and output resolution. For purposes herein, it will be assumed that the recorder and output devices 24 operate at a resolution of 200 lines per inch.

Attention is now directed to Figure 2 which illustrates the graphic display terminal 20 and drawing revisory subsystem 22 in greater detail. The graphic display terminal is comprised of a keyboard/pointer unit 50 enabling an operator to generate and communicate commands and data to the revisory subsystem 22. The graphic display terminal 20 additionally includes a monitor 52 for displaying drawings output by the revisory subsystem 22. The keyboard/pointer 50 is substantially conventional in nature and includes a keyboard and a pointing device such as a mouse or preferably a graphic tablet. The keyboard/pointer unit 50 is intended for use by an operator to issue commands and to designate points on the monitor display screen 52.

Briefly, in order to operate a system in accordance with the invention, it is initially assumed that the operator has the capability of selectively initiating either a DRAWING REVISION MODE or a DRAWING REDISPLAY MODE. Within each mode of operation, the operator is also able to issue commands identifying the particular drawing data set to be retrieved for display. When operating in the DRAWING REVISION MODE, the operator, via the keyboard/pointer unit 50 is able to revise the displayed drawing by issuing display commands together with related parameter data. As a singular example of such a display command, the operator may issue a DRAW LINE command and then identify the end points of the line to be drawn (i.e. parameter data). In response to operator initiated display commands, subsystem 22 generates elementary display instructions and related parameter data which are sometimes referred to in the art as "primitives". Accordingly, this term will frequently be used hereinafter in discussing the systems revisory capability.

The drawing revisory subsystem 22 as depicted in Figure 2 consists of a pixel memory subsystem 60. The output of the

pixel memory subsystem 60 is connected to the input of the monitor unit 52 of the graphic display terminal 20. As will be discussed hereinafter in greater detail, the subsystem 60 includes a dedicated pixel memory for storing a bit map which is used to control the display monitor 52 on a bit by bit basis. The bit map stored in the pixel memory subsystem 60 is loaded and modified under the control of a graphics function generator 62. The graphics function generator is coupled to the pixel memory subsystem by an address/data/control bus 64. A character/vector generator 66 and a data expansion module 68 are also coupled to the bus 64.

The operator initiated commands provided by the keyboard/pointer unit 50 are supplied to a control microcomputer 70. The microcomputer 70 communicates via the bus 64 and a channel interface module 72 with the host CPU 12. Thus, in response to commands issued by the keyboard/pointer unit 50, the microcomputer 70 can, for example, interrupt the host CPU 12 to access the data set describing the desired drawing from the mass storage unit 14. The data set is communicated by the channel interface module 72 to the bus 64 enabling the data expansion module 68 to expand the highly compressed pixel data set to produce a bit map describing the desired drawing in the pixel memory subsystem 60.

Attention is now directed to Figure 3 which illustrates a preferred embodiment of the drawing revisory subsystem 22. It is initially pointed out that the pixel memory subsystem 60 includes a memory array 100 preferrably containing on the order of eight megabytes (i.e. 67.1 million bits). The memory array 100 will sometimes hereinafter be referred as the "PAN" memory array because it is used to store a bit

map defining the panorama or universe of a selected drawing, only a portion of which is displayed by the monitor 52 at any one time. That is, in the preferred embodiment, the monitor 52 acts as an A size drawing window to an E size drawing panorama. Inasmuch as an E size drawing (34 X 44 inches) having a horizontal and vertical resolution of 200 lines per inch requires 59.8 million pixels, the eight megabyte memory array 100 can accommodate a full E size drawing with capacity remaining for storing additional information; e.g. in performing a zoom function, the extra memory capacity is used to store a bit map of a portion of a drawing depicted on an enlarged scale.

In addition to the memory array 100, the memory subsystem 60 includes a data path module 102 and a graphic display controller 104. the controller 104 functions to access bits from memory array 100 in the appropriate sequence to control the blanking and unblanking of the monitor 52 beam which is deflected by a raster generator (not shown) within controller 104, preferably operating at 158 MHz. Controller 104 preferably refreshes the monitor directly from the memory array 100 at an interlaced frame rate of 30 Hz. A preferred monitor displays 2200 lines vertically (i.e. 200 lines per inch X 11 inches) and 1728 lines horizontally (200 X 8.64 inches).

The graphics function generator 62 comprises a very fast high speed data processor (e.g. bit slice microprocessor) and associated microcode memory 106. The processor 106 is coupled to the aforementioned address/data/control bus 64. Similarly, the aforementioned character/vector generator 66, data expansion module 68, and channel interface module 72, are connected to the bus 64.

The microcomputer 70 is depicted as being comprised of a single board microcomputer including microprocessor 106,

e.g. MOTOROLA 68000. Associated with the microprocessor 106 is a global memory 108 and input/output circuitry 110. The microprocessor 106, memory 108, and I/O circuitry 110 communicate via a standard S-100 bus (IEEE-696) 112. The I/O circuitry 110 is coupled to the PAN memory data path module 102, to be discussed hereinafter. Communication between busses 112 and 64 is effected via I/O circuitry 110 and the data path module 102.

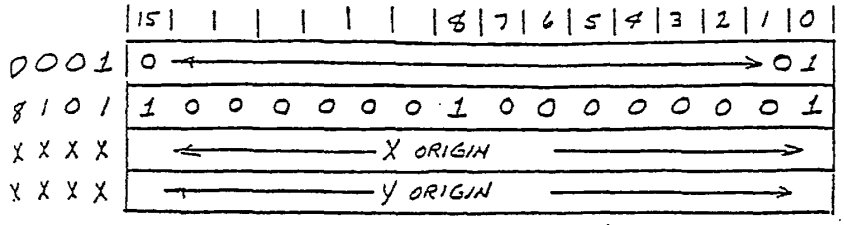
The PAN memory data path module 102 comprises logic circuitry for readily performing simple logical operations (e.g. AND, OR, XOR) with respect to the bit map currently in the PAN memory array 100 and revisory data to produce a modified bit map. It was previously pointed out that the channel interface module is preferably directly coupled to a local host CPU 12. Additionally, the drawing revisory subsystem 22 can be connected to a remote host CPU via a high speed serial channel 120 through I/O circuitry 110 associated with microcomputer 70. The aforementioned keyboard/pointer 50 also communicates through I/O circuitry 110 with microprocessor 106 via bus 112.

In accordance with a very significant feature of the invention, a module 124 is provided for functioning as a cache memory to store primitives generated during operation in the DRAWING REVISION MODE and as a storage device to store primitives accessed from mass storage during operation in the DRAWING REDISPLAY MODE. Briefly, as the operator uses the keyboard/pointer during the DRAWING REVISION MODE, the microprocessor 106 responds to operator commands to appropriately generate the primitives and transfer them to the graphics function generator 62. The graphics function generator 62 responds to the primitives to modify the bit map in the PAN memory array 100 as instructed by the primitives. As the primitives are forwarded along bus 112 to the graphics function generator

62, the cache and store module 124 recognizes the primitives and stores them on a first in/first out basis. That is, the cache and store module 124 recognizes the primitives as they are being transferred to the graphics function generator, and in parallel stores them in the same sequence they are being transferred. Thus, the module 124 can be considered as operating transparently as far as the microprocessor 106 and the graphics function generator 62 are concerned. As previously noted, the term "primitive" refers to an elementary display instruction and related parameter data and consists of a relatively short ordered list of bytes. Table 3 hereto depicts the byte format of the following exemplary display primitives:

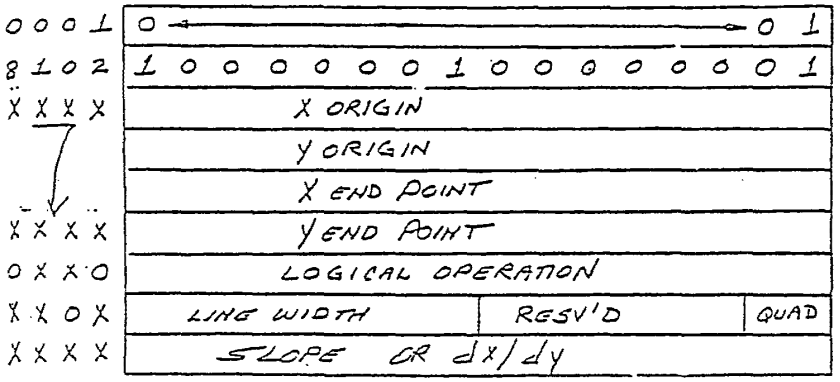
1. DRAW POINT
2. DRAW LINE
3. DRAW ARC
4. COPY BLOCK
5. MOVE BLOCK
6. RECTANGLE FILL

1. DRAW POINT



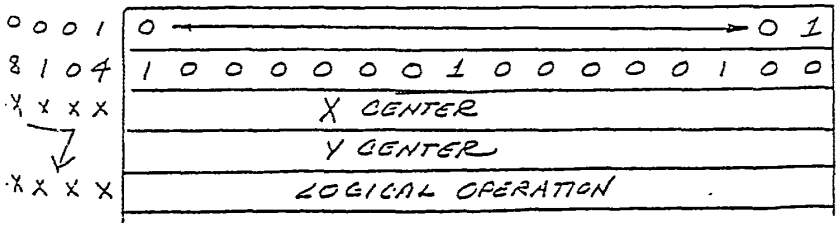
NOTE: REGISTER LG IS USED TO DETERMINE LOGICAL OPERATION (EG. XOR, SET..., CLEAR). REGISTER Wx IS USED TO DETERMINE THE # OF POINTS TO DRAW IN X.

2. DRAW LINE



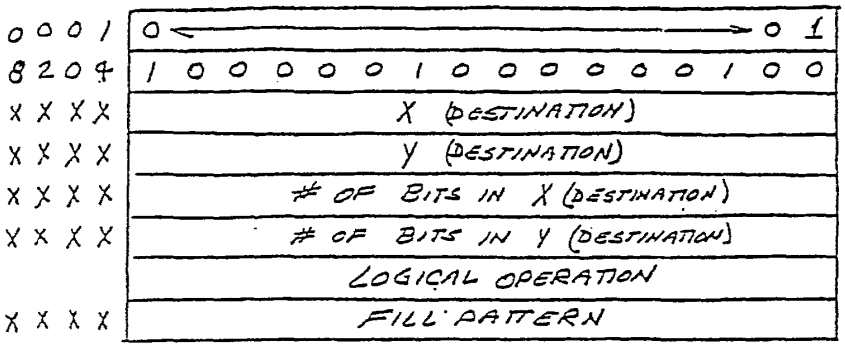


3. DRAW ARC

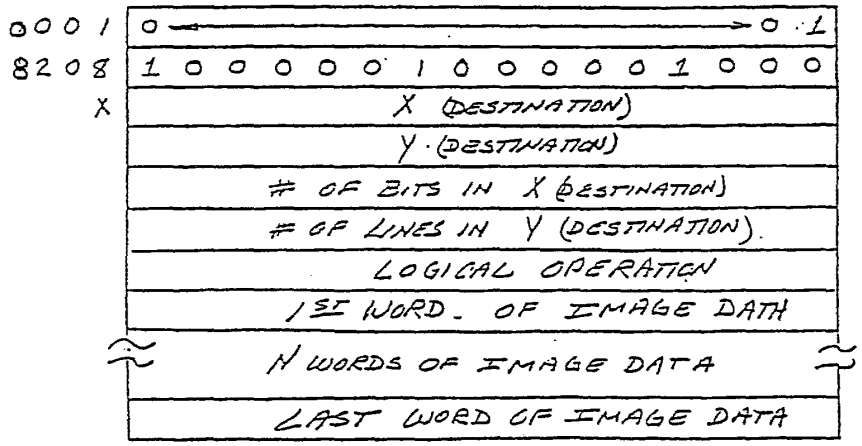


GRAPHIC COMMANDS (RASTER OP)

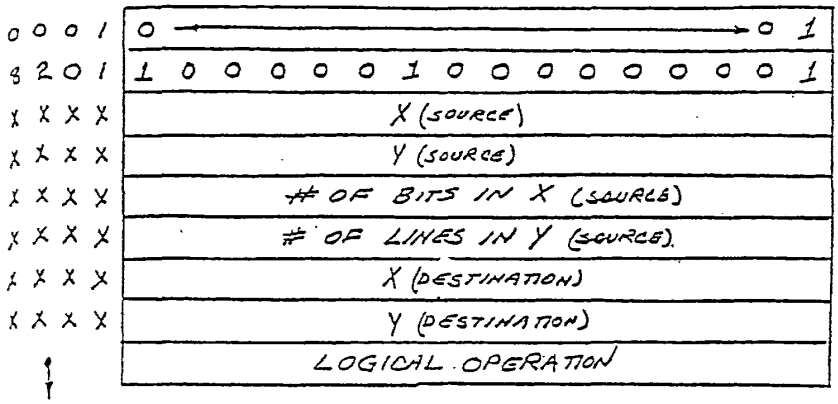
3. RECTANGLE FILL



4. WRITE FROM MPU

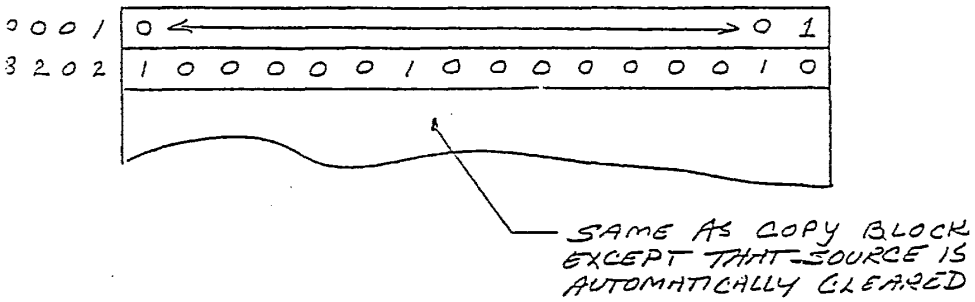


1. COPY BLOCK



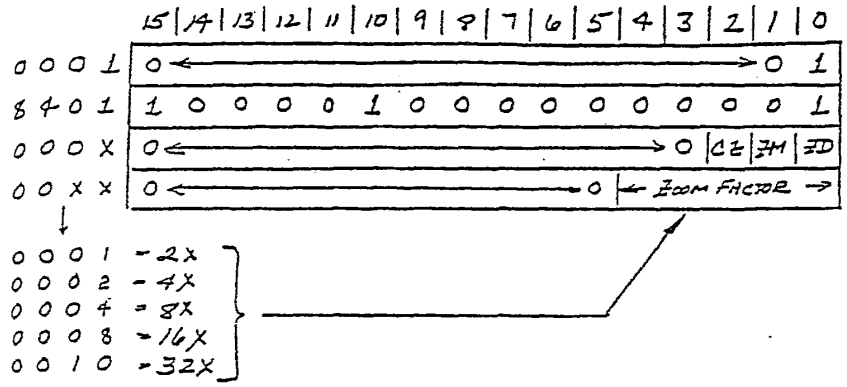
0 1 C 0 = REPLACE (STORE)
0 0 D 0 = OR
0 0 C 0 = XOR
0 0 E 0 = AND

2. MOVE BLOCK

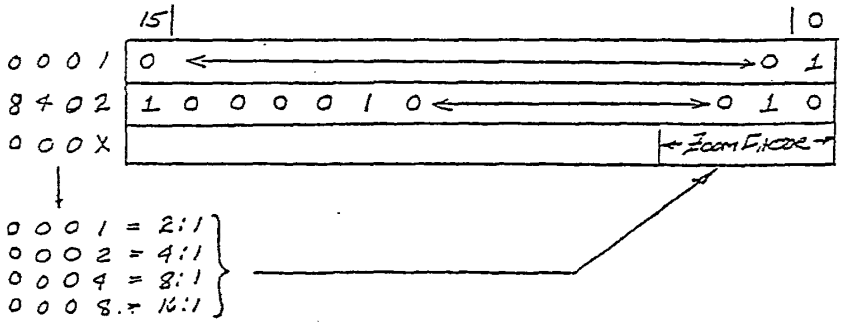


GRAPHICS COMMAND (ZOOM)

1. ZOOM UP



2. ZOOM DOWN



In order to better understand the meaning of "primitive", attention is directed to the exemplary DRAW LINE primitive which is comprised of nine sixteen bit words (words 0-8) with word 1 defining the elementary display instruction, i.e. "DRAW LINE". Word 2 is shown as defining the horizontal value of the starting or origin point and word 3 the vertical value of the same origin point. Word 4 is used to define the horizontal coordinate of the end point and word 5 the vertical coordinate of the end point. Word 6 is used to define a logical operation, e.g. exclusive OR. Additional bits are used to define miscellaneous information including line width, quadrant and slope of the line to be drawn.

The assumed microprocessor 106, i.e. MOTOROLA 68000, has a sixteen bit wide bus. Thus, the nine words associated with the exemplary DRAW LINE primitive are communicated along the bus as nine successive words. In a typical embodiment of the invention, the cache and store module 124 is capable of storing 2000 words, i.e. 4000 bytes, on a first-in/first-out (FIFO) basis.

In order to better understand the functioning of the cache and store module 124, attention is directed to Figure 4 which depicts the module 124 in greater detail. During operation in the DRAWING REVISION MODE, the microprocessor 106 will, in response to operator initiated commands, produce a sequence of primitives addressed to the graphics function generator 62, which are supplied along bus 112. These primitives include a subgroup of display primitives which are specially tagged (i.e. uniquely addressed) for caching by the module 124. Microprocessor 106 may produce other primitives addressed to function generator 62 which are for control purposes and need not be cached. Decoder 132 of module 124 recognizes the specially addressed

primitives and enables, via OR logic 134, the LOAD control terminal 136 of the array 140. When so enabled, the array 140 will accept data from the bus 112 via data input terminal 144. The array 140 operates in a First-in/first-out (FIFO) fashion and has a data output terminal 146 coupled to the bus 112.

Whereas the decoder 132 operates during the DRAWING REVISION MODE to cache primitives produced by microprocessor 106, decoder 150 operates during the DRAWING REDISPLAY MODE to recognize a group of primitives, generally comprising a drawing REVISION LEVEL for storage in array 140. That is, as will be discussed hereinafter, in the course of retrieving previously stored groups of primitives from mass storage unit 14 associated as a drawing REVISION LEVEL, the groups will be accessed from mass storage unit 14 and loaded via bus 112 and input terminal 144 into the array 140.

A further decoder 152 is provided to recognize an instruction from the microprocessor 106 to read out a group of primitives from the array 140 at the end of a revisory session. That is, a group of primitives cached in the array 140, as a consequence of operation in the DRAWING REVISION MODE, are associated together and placed on the bus 112 for storage in the mass storage unit 14. In so doing, each such group of primitives, comprising a REVISION LEVEL, is linked by appropriate header information to a related drawing or more precisely a particular data set associated with the related drawing.

It should also be noted that the First-in/first-out array 140 depicted in Figure 4 is provided with an output control terminal 160 which indicates when the array is full. In this event, interrupt circuit 162 is actuated to supply an

interrupt via bus 112 to microprocessor 106.

Attention is not directed to Figure 5 which comprises a flow chart describing system operation in the DRAWING REVISION MODE. The drawing revisory session is initiated by an operator, represented by block 200, by appropriate keyboard commands. The operator will then identify a drawing stored in mass storage and the digital data set related to that drawing will be retrieved and expanded to produce the appropriate bit map in the "pan" memory array 100. This operation is depicted by block 202 in Figure 5. The data flow required for operation 202 is from the mass storage unit 14 to the host CPU 12 to channel interface module 72 to the data expansion module 68 to the "pan" memory array 100 to the graphic display controller 104 and then to the monitor 52. As previously pointed out, the monitor displays an area of an A size drawing, i.e. 1/16th of the E size drawing which can be fully represented by the bit map stored in the "pan" memory array 100. By using the keyboard/pointer 50, the operator can effectively scroll the full drawing represented by the bit map past the monitor window. Block 204 in Figure 5 represents the operator initiating a pixel edit function, which may for example be selected from a displayed menu. The edit function selected by the operator involves a data transfer from the keyboard/pointer unit 50 to microcomputer 70.

In defining the edit function, the operator may, for example, command the system to draw a rectangle or circle on the displayed drawing at a location identified by the operator by use of the keyboard/pointer 50. The microcomputer 70 then creates a list of primitives as is exemplified by the items in Table 3. This action by microcomputer 70 is represented by block 206.

Microcomputer 70 then generates a command to transfer the

primitive list to the graphic function generator 62, via bus 112, "pan" memory data path 102, and bus 64. This action is represented by block 208 and further calls for the graphics function generator 62 to modify the bit map stored in the memory array 100 to execute the revision commanded by the operator. That is, by appropriately modifying the bit map in the memory array 100, the graphic display controller 104 will correspondingly modify the drawing displayed by the monitor 52.

In accordance with an important aspect of the invention, the cache and store module 124 will respond to the primitive list transfer represented by block 208 to cache those primitives tagged by microprocessor 106. This action, represented by block 210, occurs in parallel with the operations represented by block 208 in a manner which is transparent to the operator.

After the execution of blocks 208 and 210, if the operator has not completed the revisory session, then operation loops back to block 204. However, after decision block 212 detects the end of a revisory session, as indicated by an operator input a command will be sent from the keyboard/pointer 50 to the microprocessor 70 (block 214). Microcomputer 70 will thereafter issue an instruction to cause decoder 152 to read out the contents (i.e. group of primitives) of the first-in/first-out array 140 to the host CPU 12 for storage in the mass storage unit 14. In storing a group of primitives read out of array 140, the host CPU 12 will append a REVISION LEVEL designation and also information linking each such REVISION LEVEL to a particular underlying drawing. This, a header for a data set containing a group of primitives resulting from a single revisory session will include an identification of the underlying drawing, e.g. drawing 000001 and REVISION LEVEL A. This action by the host CPU 12 is represented by

block 218. As is well known in the art, the mass storage unit can also store a directory indicating relationships between stored data sets.

Attention is now directed to Figure 6 which comprises a flow chart depicting operation during the DRAWING REDISPLAY MODE. The DRAWING REDISPLAY MODE is initiated by the operator via a keyboard input represented by block 300. By initiating this operational mode and designating the drawing to be displayed, the data set describing that drawing will be retrieved from mass storage unit 14 to modify the bit map in memory array 100 to thus cause the monitor to display the drawing (block 302). The operation represented by block 302 corresponds to that represented by block 202 in Figure 5.

Thereafter, the operator can request any stored REVISION LEVELS for the drawing displayed by the monitor. This is, in response to an appropriate keyboard input, the microcomputer 70 will command the host CPU 12 to retrieve the desired REVISION LEVEL, i.e. group of primitives, from the mass storage unit 14. This operation is represented by block 304.

In response, the host CPU 12 retrieves the appropriate REVISION LEVEL and transfers the primitives thereof to the First-in/first-out array 140 via decoder 150. This operation is represented by block 306. With the primitives of the desired REVISION LEVEL stored in the array 140, the microcomputer 70 will read the primitives out sequentially and route them via bus 112, and data path module 102 to the graphics function generator 62 (block 308). The graphics function generator 62 will then respond to revise the bit map stored in the memory array 100 (block 310) to modify the displayed drawing.

In order to better understand the use of the system by an operator to revise a displayed drawing, attention is directed to Figures 7 and 8 which depict an exemplary monitor presentation for performing a DRAW LINE revision. Figure 7 depicts three exemplary menus which are successively displayed to the operator. More particularly, a main menu 2 is depicted which gives the operator choices of the following cammands: DRAW, ERASE, MOVE, TRANSFORM, etc. By utilizing the aforementioned pointing device, i.e. mouse or graphic tablet, the user is able to designate the DRAW command, for example. The system will then respond by displaying menu 322 which offers: PEN, LINE, BOX, RECTANGLE, etc. The operator can then select, for example, the LINE entry which produces the next menu 324 which prompts the operator to select a line width.

Attention is now called to Figure 8 which depicts successive monitor screens which would appear to the operator in the course of his performing a DRAW LINE operation. In response to the operator's selection of the DRAW and LINE options in the menus of Figure 7, a cursor will appear on the screen as depicted in Figure 8A. By utilizing the aforementioned pointing device, the operator can move the cursor to an origin or point at which he or she wants the line to start. This is represented in Figure 8B. The operator will then press an action button (e. g. on the mouse) to thereby fix the origin of the line as depicted by Figure 8C. The operator will then move the cursor to the end point of the line. This is depicted by Figure 8D which also shows that the screen displays a rubber band like line trailing the cursor from the origin point. When the operator positions the cursor from the origin point, he or she will again press the action button to cause the system to draw a solid line of specified width between the origin point and the end point, as depicted in Figure 8E.

To enable the system to present the display screens depicted in Figure 8, the microprocessor 106 generates a series of primitives which address the graphics function generator 62 to cause it to modify the bit map within the "pan" memory array 100. Thus, for example, microprocessor 106 generates a COPY BLOCK primitive to move the cursor onto the screen as depicted in Figure 8A.

As the operator moves the cursor into position at the desired origin point, the microprocessor 106 will issue many COPY BLOCK primitives designating exclusive OR logical operations, to remove each previously displayed cursor so that only a single cursor is displayed at a time.

When the operator presses the action button to fix the origin of the line, as depicted by Figure 8C, the microprocessor 106 will generate the DRAW POINT primitive. As the operator then moves the cursor from the origin point to the line end point, as depicted by Figure 8D, many COPY BLOCK primitives will be generated to successively remove or erase each previously displaced cursor. Additionally, many DRAW LINE primitives will be generated to create the aforementioned rubber band effect connecting the fixed origin point with the moving cursor. These DRAW LINE primitives occur in pairs with an exclusive OR operation being used to remove a previous line as each new line is displayed.

When the action button is depressed to draw a solid line between the origin point and line end, as depicted in Figure 8E, a DRAW LINE primitive is generated by the microprocessor 106 which causes the line of specified width to be drawn. It is this last DRAW LINE primitive which is specially addressed by the microprocessor 106 so that in addition to causing the graphic function generator 62 to

modify the bit map in the pan memory array 100, it also caches the DRAW LINE primitive in the cache and store module 124.

From the foregoing, it should now be understood that a system has been disclosed herein for efficiently storing, revising, and redisplaying drawings. By originally storing the raw pixel data in highly compressed binary form, many thousands of drawings can be reasonably stored in available mass storage units (see Table 2). This compressed binary data is expanded when accessed to produce a bit map in the PAN memory for controlling the display monitor. Revisory data is efficiently stored by utilizing a cache memory for automatically storing primitives and associating one or more primitives as a designated REVISION LEVEL linked to an underlying drawing. In the REDISPLAY MODE, these primitives, which represent a highly compressed form of pixel data, are retrieved from mass storage and utilized to modify the bit map currently in PAN memory 100. Accordingly, it should now be understood that in contrast to prior approaches which store data sets representing the latest revision of a drawing, a system in accordance with the present invention retains data sets in compressed binary form representing the pixel data in the original drawing and in addition revisory pixel data in the form of primitives of each REVISION LEVEL. When the latest revision of a drawing is desired, the original drawing is accessed and then each REVISION LEVEL is accessed in sequence to thus successively modify the displayed drawing frame by frame in incremental or cinematic fashion.

CLAIMS

1. A system suitable for electronically storing, revising, and displaying technical drawings comprising:

mass storage means for storing multiple data sets, each data set comprising digital data defining a pixel representation of a different technical drawing;

operator input means for enabling an operator to selectively identify a data set stored in said mass storage means;

monitor means for displaying a drawing; and

control means responsive to said operator input means for controlling said monitor means to display at least a portion of the drawing identified by said input means, said control means including:

pixel memory means for storing a bit map of a drawing;

processor means for retrieving each data set identified by said operator input means and responsive to the digital data therein for loading a bit map into said pixel memory means;

means responsive to said bit map stored in said pixel memory means for causing said monitor to display pixels representing the identified drawing;

said operator input means including means enabling an operator to define a DRAWING REVISION MODE and to initiate the generation of primitives, each primitive defining an elementary display instruction and related parameter data;

said processor means including means responsive to each of said generated primitives for revising said bit map stored in said pixel memory means; and

cache means for temporarily storing each of said generated primitives.

2. The system of claim 1 further including means for grouping primitives stored in said cache means as a designated revision level;

means for storing each revision level primitive group in said mass storage means; and

means for storing linking information associating each revision level primitive group with one of said drawings.

3. The system of claim 2 wherein said operator input means includes means enabling an operator to define a DRAWING REDISPLAY MODE;

means active during said DRAWING REDISPLAY MODE for retrieving from said mass storage means revision level primitive groups associated with the drawing concurrently displayed by said monitor; and wherein

said processor means includes means for revising said bit map stored in said pixel memory means in response to each revision level primitive group retrieved from said mass storage means.

4. The system of claim 3 wherein said means for revising said bit map operates in an incremental manner, whereby said monitor displays in sequence an identified drawing and subsequent revision levels of that drawing

5. The system of claim 2 wherein each of said data sets defining a technical drawing is stored as compressed binary data in said mass storage means; and wherein

said processor means includes means for expanding the compressed binary data for producing said bit map

6. The system of claim 2 wherein said processor means includes:

control means including a microprocessor and a data/control bus coupled thereto;

means coupling said operator input means to said control means microprocessor;

graphic function generator means for producing and revising said bit map;

means for coupling said graphic function generator means to said data/control bus whereby said control means microprocessor generates primitives addressing said function generator means; and wherein

said cache means is coupled to said data/control bus and is responsive to primitives addressed to said function generator means for automatically storing said primitives.

7. The system of claim 1 wherein said mass storage means comprises an optical storage unit

8. The system of claim 1 wherein said cache means comprises a first in/first out read/write memory.

9. A method of storing, displaying and revising existing technical drawings comprising:

scanning said drawings to produce a different set of digital data related to each drawing;

storing each of said digital data sets in a mass storage unit;

accessing a selected one of said data sets to produce a bit map;

responding to said bit map to display the drawing related to said accessed data set;

generating binary coded primitives each defining a display instruction and related parameters;

responding to said generated primitives to revise said bit map;

grouping selected ones of said generated primitives as a revision level;

storing each revision level primitive group together with information linking each group with a stored data set; and

retrieving stored revision level groups associated with the same drawing to sequentially revise the displayed drawing one revision level at a time.

10. The method of claim 9 wherein said scanning step includes producing a stream of bits each representative of a different pixel on a drawing; and including the further step of

compressing said bit stream to produce each data set.

11. The method of claim 10 wherein said accessing step includes expanding the selected data set to produce said bit map

12. The method of claim 10 wherein said step of storing each revision level group comprises storing the primitives thereof in a mass storage unit; and including the further step of;

automatically temporarily storing each of said generated primitives in a cache memory.

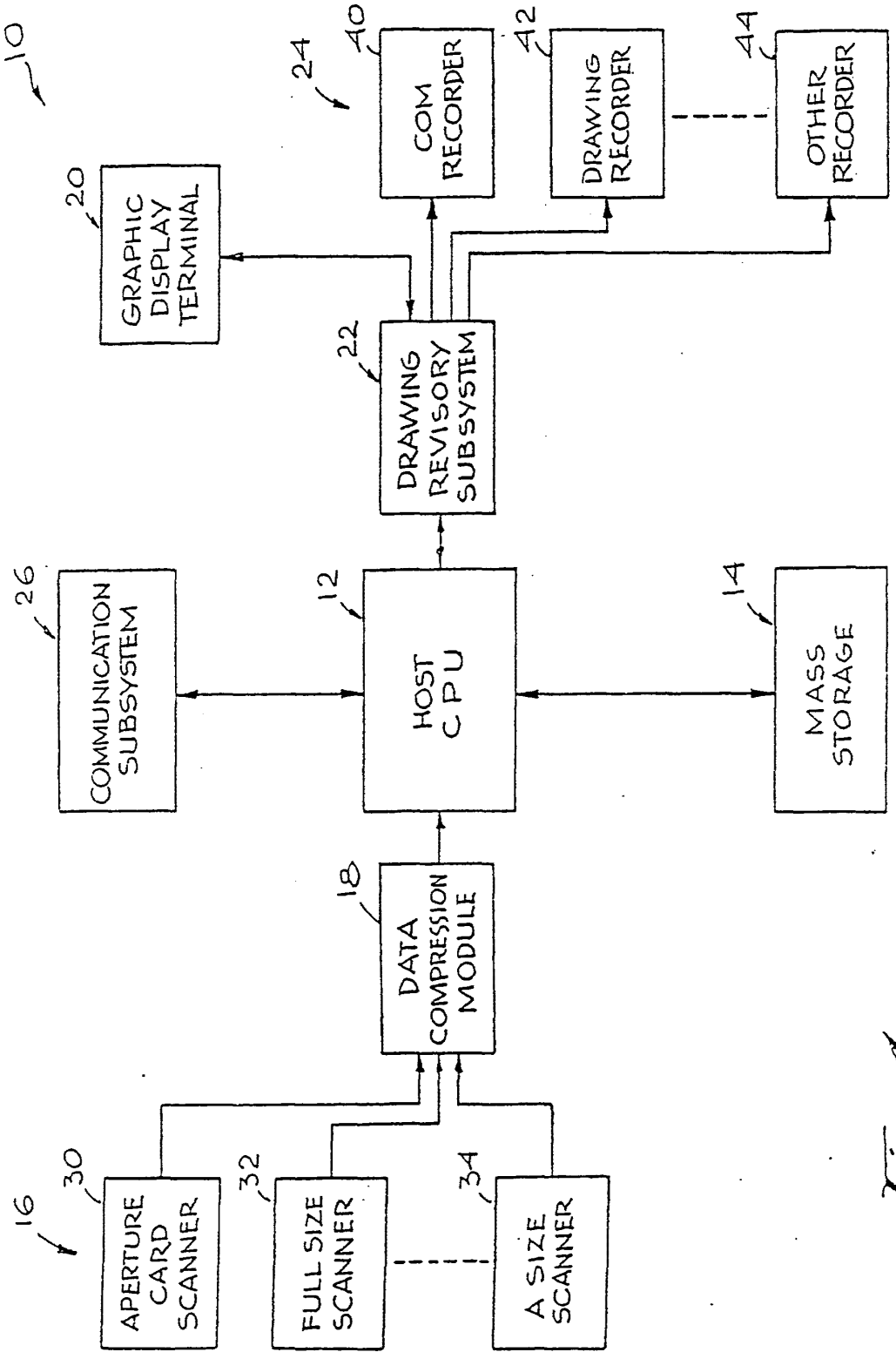

10
24
40
COM RECORDER
42
DRAWING RECORDER
44
OTHER RECORDER
20
GRAPHIC DISPLAY TERMINAL
22
DRAWING REVISORY SUBSYSTEM
26
COMMUNICATION SUBSYSTEM
12
HOST CPU
14
MASS STORAGE
18
DATA COMPRESSION MODULE
16
30
APERTURE CARD SCANNER
32
FULL SIZE SCANNER
34
A SIZE SCANNER

Fig. 1

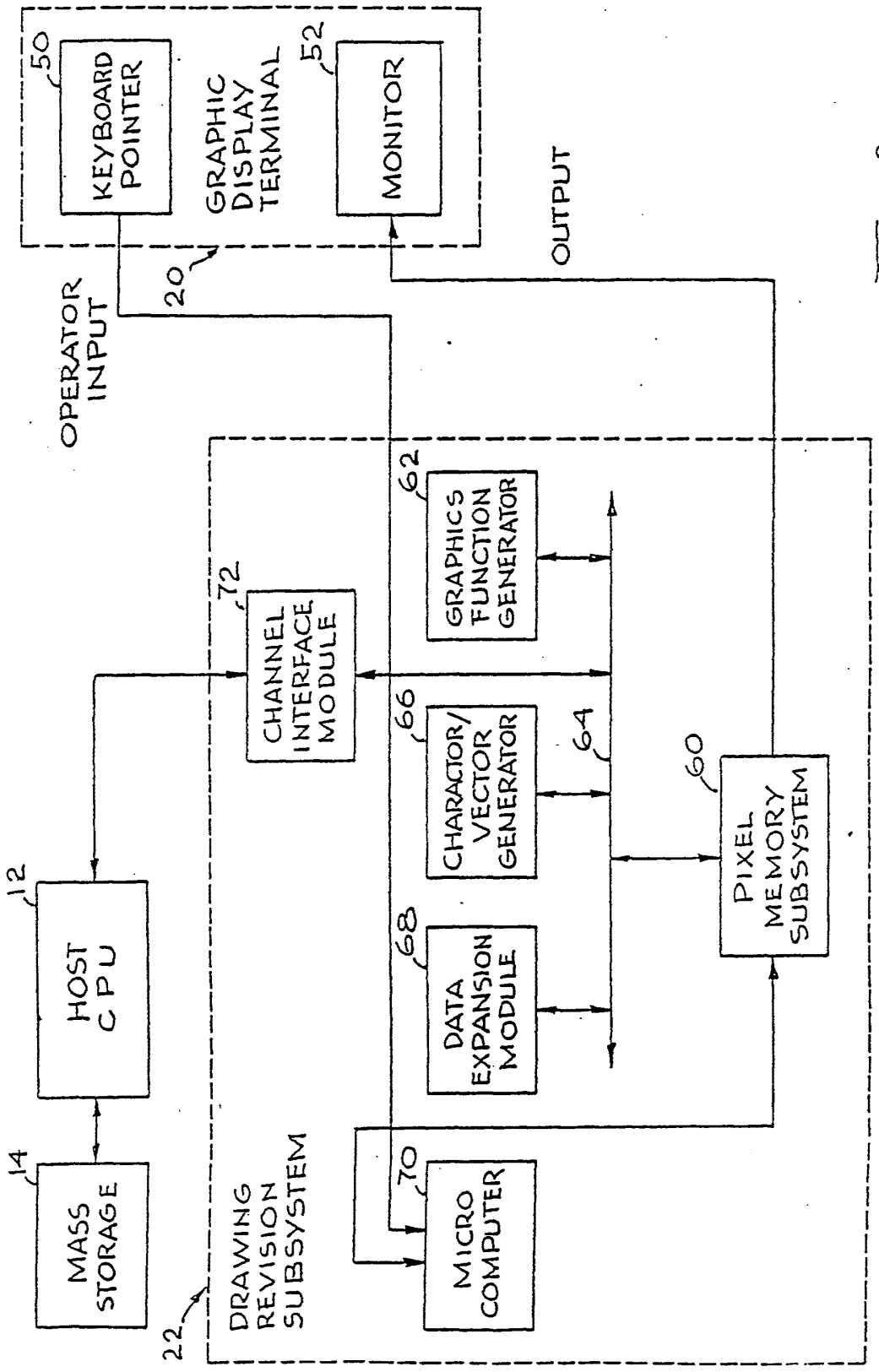

50
KEYBOARD POINTER
GRAPHIC DISPLAY TERMINAL
52
MONITOR
OUTPUT
20
OPERATOR INPUT
62
GRAPHICS FUNCTION GENERATOR
72
CHANNEL INTERFACE MODULE
66
CHARACTOR/ VECTOR GENERATOR
64
60
PIXEL MEMORY SUBSYSTEM
12
HOST CPU
68
DATA EXPANSION MODULE
14
MASS STORAGE
70
MICRO COMPUTER
22
DRAWING REVISION SUBSYSTEM

Fig. 2

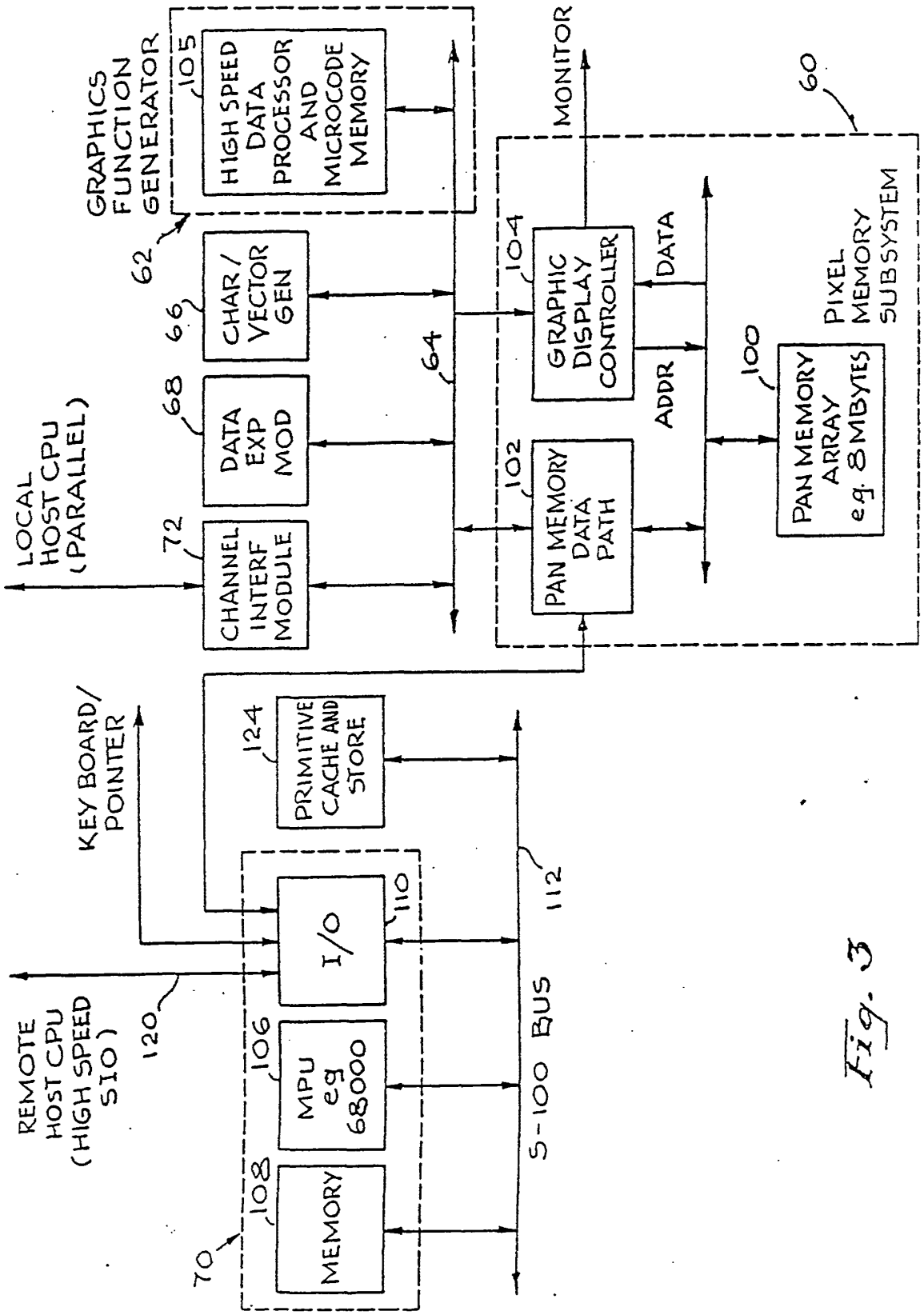

GRAPHICS FUNCTION GENERATOR
62
105
HIGH SPEED DATA PROCESSOR AND MICROCODE MEMORY
66
CHAR/ VECTOR GEN
68
DATA EXP MOD
72
CHANNEL INTERF MODULE
LOCAL HOST CPU (PARALLEL)
64
MONITOR
60
104
GRAPHIC DISPLAY CONTROLLER
DATA
ADDR
100
PAN MEMORY ARRAY eg 8MBYTES
PIXEL MEMORY SUBSYSTEM
102
PAN MEMORY DATA PATH
KEY BOARD/ POINTER
124
PRIMITIVE CACHE AND STORE
I/O
110
112
S-100 BUS
REMOTE HOST CPU (HIGH SPEED SIO)
120
106
MPU eg 68000
108
MEMORY
70

Fig. 3

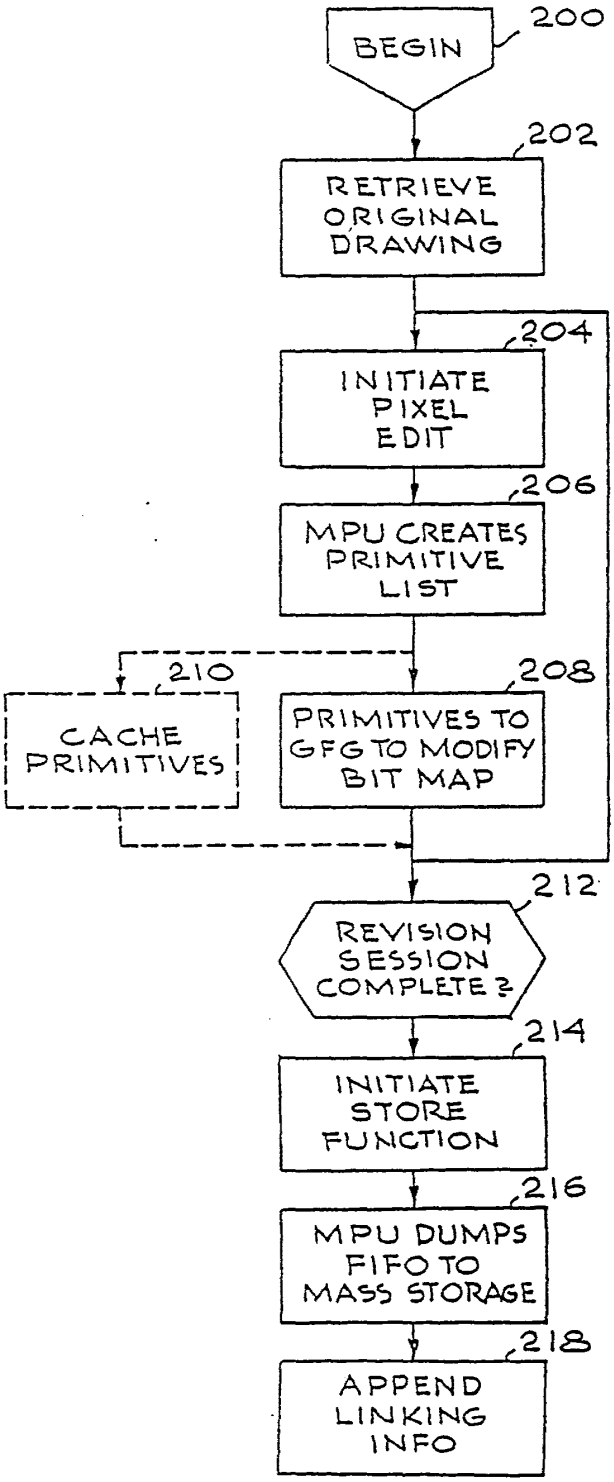

BEGIN
200
RETRIEVE ORIGINAL DRAWING
202
INITIATE PIXEL EDIT
204
MPU CREATES PRIMITIVE LIST
206
CACHE PRIMITIVES
210
PRIMITIVES TO GFG TO MODIFY BIT MAP
208
REVISION SESSION COMPLETE?
212
INITIATE STORE FUNCTION
214
MPU DUMPS FIFO TO MASS STORAGE
216
APPEND LINKING INFO
218

Fig. 5

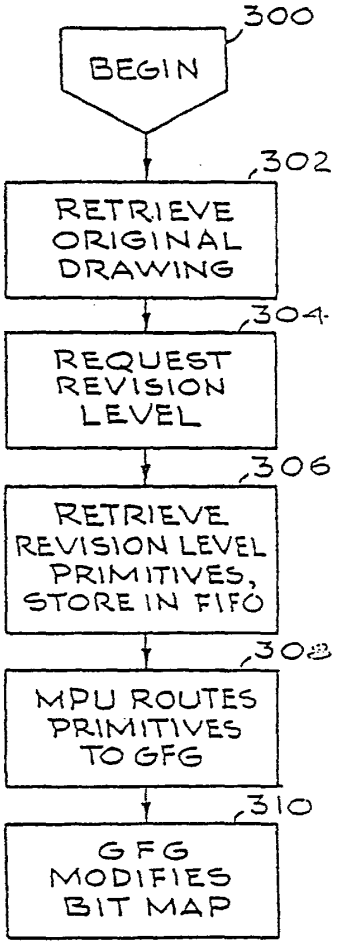

BEGIN
300
RETRIEVE ORIGINAL DRAWING
302
REQUEST REVISION LEVEL
304
RETRIEVE REVISION LEVEL PRIMITIVES, STORE IN FIFO
306
MPU ROUTES PRIMITIVES TO GFG
308
GFG MODIFIES BIT MAP
310

Fig. 6

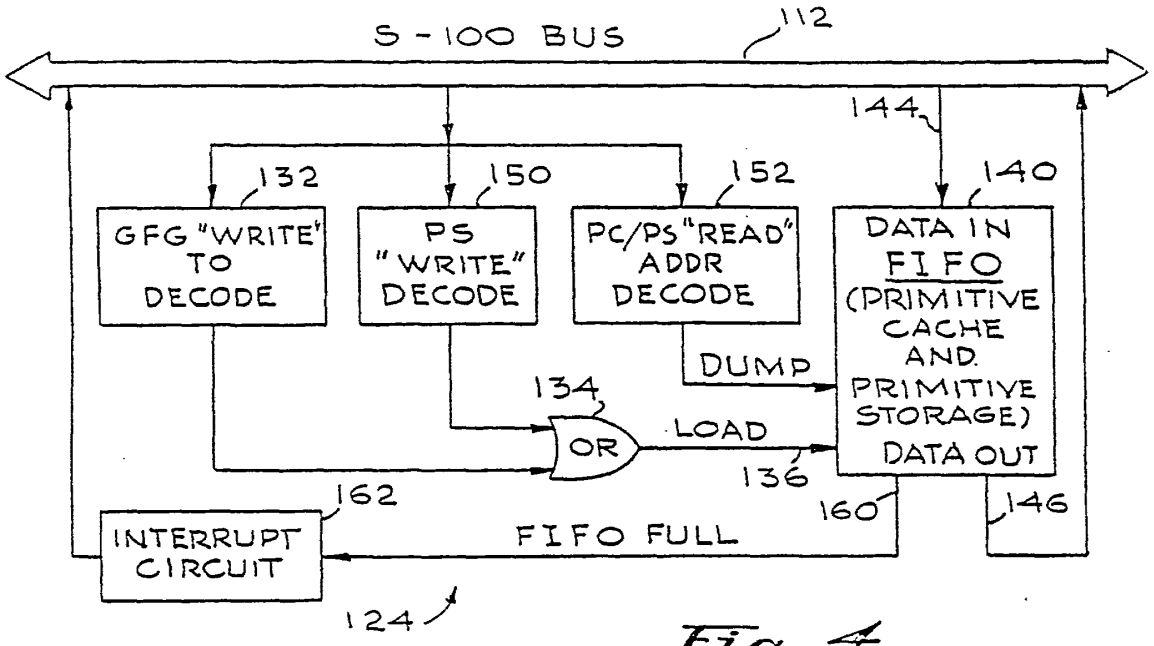


Fig. 4

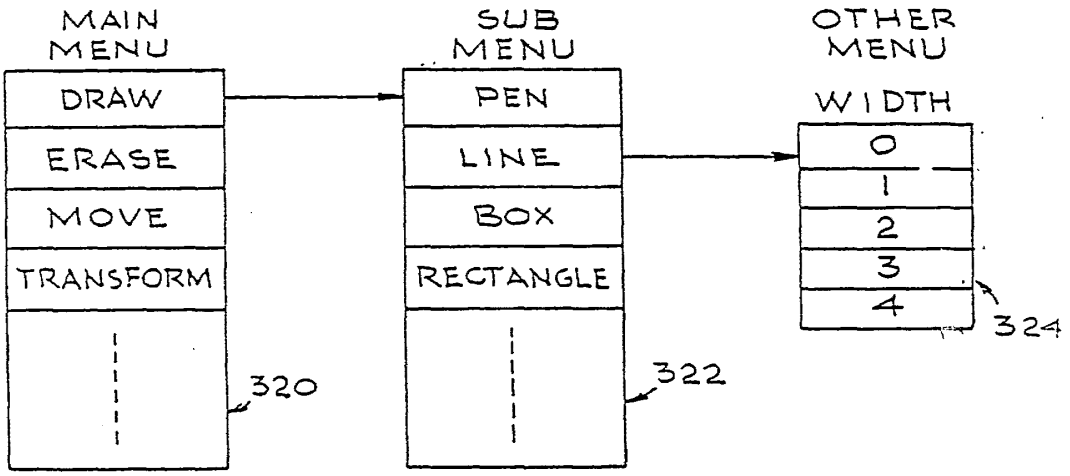


Fig. 7

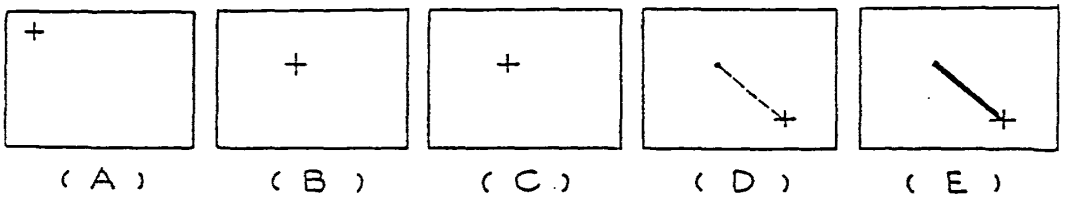


Fig. 8

INTERNATIONAL SEARCH REPORT

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I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

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II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	340/724,731,747; 382/41,44,56,57; 353/25,26R,26A,27R,27A; 364/200,518,521,900

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [6]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
Y	US, A, 4,197,590 (Sukonick et al) 08 April 1980, see column 3, lines 12 to 23, column 4, lines 23 to 49, and column 6, lines 1-19.	1,7-12
A,P	US, A, 4,532,605 (Waller) 30 July 1985, see column 3, line 44 to column 5, line 35.	1-12
A	US, A, 4,388,610 (Tsunekawa) 14 June 1983, see column 3, lines 7-26.	1-12
A	US, A, 4,121,196 (Johnson et al) 17 October 1978, see the entire document.	1-12

* Special categories of cited documents: [15]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
05 MAY 1986	22 MAY 1986
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ISA/US	Leo H. Boudreau

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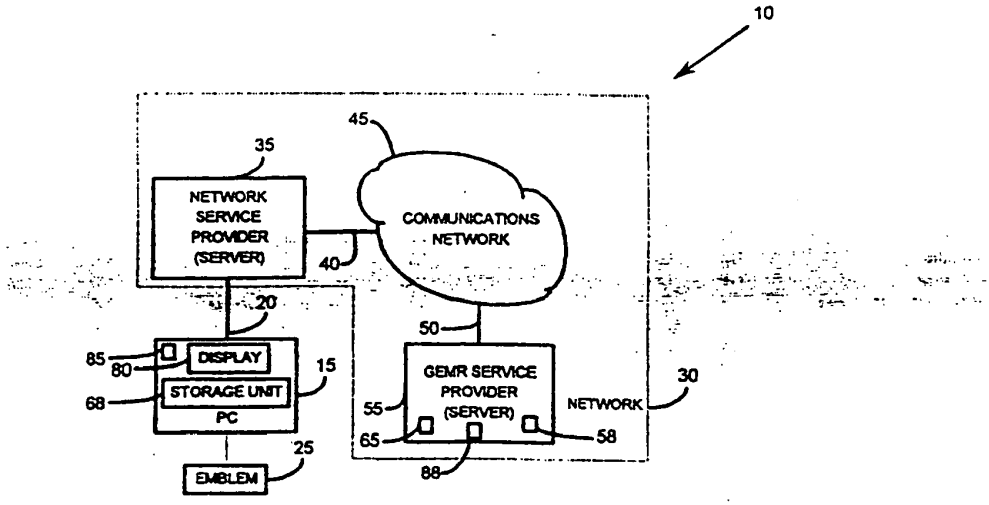
(71)(72) Applicants and Inventors: SCHULTZ, Myron, G. [US/US]; 635 Greystone Park, N.E., Atlanta, GA 30324 (US). SCHULTZ, Joseph, Paul [US/US]; Apartment 4A, 318 East 59th Street, New York, NY 10022 (US).

(74) Agents: HARRIS, John, R. et al.; Jones & Askew, LLP, 37th floor, 191 Peachtree Street, N.E., Atlanta, GA 30303 (US).

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Published
With international search report.

(54) Title: GLOBAL ELECTRONIC MEDICAL RECORD



(57) Abstract

Systems and methods for a secure, confidential, subscriber-driven and updatable Global Electronic Medical Record (GEMR) are provided which is network-based and includes linked subscriber medical information with access limited by network address and password only to the subscriber or an authorized user. The systems and methods are typically used in the medical treatment of subscribers travelling abroad, and the systems include an emblem bearing the network address of the subscriber's GEMR on GEMR servers. The password is provided by the subscriber to the authorized user to access the subscriber's GEMR. In the preferred embodiment, only GEMR server-based subscriber medical information is available to be retrieved, while in the more preferred embodiment, institutional servers or other medical site servers are accessed to obtain additional subscribers medical information to be incorporated in the subscriber's GEMR. In the most preferred embodiment, the GEMR is Web-based with hyperlinks between portions of the subscriber's GEMR.

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DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

GLOBAL ELECTRONIC MEDICAL RECORD

BACKGROUND OF THE INVENTION

The present invention relates generally to the field of medical records, and, more particularly, to the field of electronic medical records, and, even more particularly, to the field of accessible patient-driven electronic medical records for travelers.

An electronic medical record is a computer-stored collection of health information about a single patient. Previous electronic medical record systems have been developed for institutional use. They link clinics and hospitals in order to share their particular portion of information about individual patients with each other. These institutional-oriented electronic medical records, however, have a disadvantage in that they cannot meet the health needs of travelers. Yet, travel is a major feature of our society, and travelers are subject to becoming ill from preexisting conditions, accidents, and diseases in their new environments. The scope of domestic and international travel is shown by the following statistics. In

1995, Americans took 1.17 billion trips at least one hundred miles away from home, a forty five percent increase from 1985. In 1990, there were more than four hundred million international travelers, and the World Travel Organization estimates that the number will double by the year 2010. The rate of illness in travelers is highly variable, depending on the length of the trip, destination purpose, etc., but illness, or the anticipation of illness, is a common characteristic of travel.

When illness strikes someone who is away from home, their medical records are usually not available to an attending physician. Yet, access to the traveler's individual medical history and contact information can play a vital role in the traveler's diagnosis, treatment and survival. In an emergency, there may be no time to gather critical background medical information about the traveler. The traveler may be unconscious or too confused to provide this information. Wallet cards and wrist or neck emblems, by themselves, provide too little information to meet the needs of the examining physician. It is essential that an examining physician have full details about the traveler's complete medical history, including information about the preexisting conditions, medications, allergies, physician contacts, family contacts, past hospital admissions, etc. The electronic medical records that have been developed in the past cannot meet these needs.

There is, therefore, a real human need for a system for addressing these and other related problems.

SUMMARY OF THE INVENTION

For more information related to the present invention, reference is made to the book entitled "*The Internet for Everyone-A Guide for Users and Providers*," by Richard W. Wiggins (McGraw-Hill, Inc., 1995), and, in particular, chapters 1, 2, 3, 4, 12, 13, and 20 thereof, all of which are incorporated herein by reference.

According to the preferred embodiment of the present invention, a method and apparatus is used to enter and store personal health information in a patient-driven electronic medical record system for subsequent rapid access from

anywhere in the world. In its most preferred embodiment, the present invention is a patient-driven Global Electronic Medical Record (GEMR) which is based on the World-Wide Web (www, WWW, W3, or Web) and accessed through Web servers. Home pages on the Web are a new way to organize information on the Internet (the well-known global collection of, or network of, networks spanning international, national, regional, campus, and corporate boundaries), and since many of these Web pages are private and require password access, a similar approach can be used to provide confidential patient information to clinicians through the GEMR. Physicians anywhere in the world who have access to the Internet and valid security codes (passwords) can get this information rapidly by means of the GEMR.

The GEMR, in its most preferred embodiment, is a distinct, singular WWW site (home page), not a disparate collection of electronic objects pulled together by a hospital or clinic dedicated server. The GEMR provides complete and accurate personal health information of individual domestic and international travelers, and those individuals who are unable to provide an accurate medical history or are unable to communicate their current medical needs. This includes persons who are infants, children, mentally impaired, speech impaired, hearing impaired, senile, and foreigners who do not speak the language of their host country.

The GEMR can be accessed by any authorized user, anywhere in the world, with a personal computer (PC), a WWW browser, and access to the Internet, tools that are already globally deployed and rapidly evolving. The GEMR is originated by, and data is entered by, a subscriber (the patient), not by a physician or a healthcare worker. The GEMR is created preferably when the subscriber is well, not when he or she is ill.

The GEMR main directory contains files with the subscriber's vital information including, but not limited to, personal identifiers, emergency contacts, personal physicians, health insurance, advance directives and medical information. Access to each subscriber's GEMR is protected by a combination of a distinctive WWW address and password(s) known only to the subscriber. An audit trail is

created by registration of each user who accesses a subscriber's GEMR. Access is not based on user-authentication that is typically the preferred method for institutional-oriented electronic medical record systems, but, rather, based on providing the subscriber's password and network address.

Once the potential subscriber subscribes to the GEMR, the potential subscriber becomes a subscriber and a wrist emblem, neck emblem, or card (e.g., a plastic card) is sent to them from a company providing the GEMR (referred to hereinafter as the GEMR company). The wrist emblem, neck emblem, or plastic card is inscribed with the subscriber's name and WWW address of their GEMR, and, optionally, has a place thereon for the subscriber to inscribe their subscriber password(s) if he or she so chooses. The WWW address of the subscriber's GEMR and the subscriber's password(s) must be used in combination to link the subscriber, attending physician or healthcare worker, or an authorized GEMR technician to the subscriber's GEMR. The GEMR and subscriber's password are private and the property of the subscriber, and are controlled by the subscriber, not by an institution. The subscriber is, thus, empowered by his or her ownership of his or her own medical record.

Each subscriber's GEMR has additional files, and/or links, to institutional servers and server files, for the subscriber's hospital discharge summaries, clinical notes, laboratory reports, electrocardiograms, radiology reports, scanned documents, clinical photographs, audio files, and other relevant medical data. In addition to the subscriber, with the subscriber's authorization and an enabling password(s), physicians, healthcare workers, and/or technicians will be able to access these additional files in order to enter additional medical information with scanned or embedded data, or to provide services, addresses and pathways (links), e.g., but not limited to, Uniform Resource Locators (URLs) or Uniform Resource Identifiers (URIs) which specify resources on the Internet, to locate these data. Technicians will not have access to the files that contain the subscriber's personal identifiers, emergency contacts, personal physicians, health insurance and medical information unless the technician is authorized by the subscriber and is provided

with an enabling password(s) which is different than the subscriber's password(s) in some alternative embodiments, and is the same as the subscribers password(s) in other alternative embodiments. In addition, each GEMR is equipped with links to servers storing files with standard treatment protocols and medical Internet Web sites, for the benefit of the attending physicians.

The GEMR is also a personal identifier for subscribers who are unable to communicate their identity. This includes persons who are infants, children, mentally impaired, speech impaired, hearing impaired, senile, and foreigners who do not speak the language of their host country. For these subscribers, passwords are nullified.

It is, therefore, an object of the present invention to provide a medical record system which is patient-subscribable.

Another object of the present invention is to provide a secure electronic medical record system.

Another object of the present invention is to provide an Internet-based electronic medical record system.

Another object of the present invention is to provide a confidential Internet-based electronic medical record system.

Another object of the present invention is to provide a World-Wide Web-based electronic medical record system.

Another object of the present invention is to provide a confidential World-Wide Web-based electronic medical record system.

Another object of the present invention is to provide a world-wide personal medical record for travelers.

Another object of the present invention is to provide a world-wide electronic medical record for a traveler which is accessible by an attending healthcare worker for medical treatment of the traveler.

Another object of the present invention is to provide a world-wide electronic medical record for a traveler which is accessible, at any time, at any

place in the world, by an attending healthcare worker for medical treatment of the traveler.

Still another object of the present invention is to provide a world-wide medical record for individuals who are unable to provide an accurate medical history to an attending healthcare worker.

Still another object of the present invention is to provide a world-wide medical record for individuals who are unable to communicate their immediate medical needs.

Still another object of the present invention is to provide an electronic personal identifier for subscribers who are unable to communicate their identity.

Other objects, features and advantages of the present invention will become apparent upon reading and understanding the present specification, when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a block diagram representation of the GEMR in accordance with a preferred embodiment of the present invention.

Fig. 1B is a block diagram representation of the GEMR in accordance with a more preferred embodiment of the present invention.

Fig. 2 is a block diagram representation of the structure of the GEMR in accordance with the preferred embodiment, the more preferred embodiments, and the most preferred embodiment of the present invention.

Figs. 3A and 3B are a flow chart representation for inputting and storing information in accordance with the preferred embodiments and the most preferred embodiment of the present invention.

Fig. 4 is a flow chart representation for accessing information in accordance with the preferred embodiments and the most preferred embodiment of the present invention.

Fig. 5 is a representation of an example home page of the GEMR company.

Fig. 6 is a representation of an example first page of an individual's GEMR.

Fig. 7 is a representation of an example personal identifiers portion of the GEMR.

Fig. 8 is a representation of an example emergency contacts portion of the GEMR.

Fig. 9 is a representation of an example personal physicians & dentist portion of the GEMR.

Fig. 10 is a representation of an example health insurance portion of the GEMR.

Fig. 11 is a representation of an example advance directives portion of the GEMR.

Figs. 12A-12D are representations of an example medical information portion of the GEMR.

Figs. 13A, 13B, and 13C are schematic representations of an example wrist emblem, an example neck emblem, and an example card, respectively, in accordance with preferred embodiments of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference is now made to the drawings wherein like reference numerals designate corresponding parts throughout the several figures. Fig. 1A shows a global electronic medical record (GEMR) system 10 in accordance with the preferred embodiment of the present invention. The GEMR system 10 includes, at least, a network 30, a PC 15, PC-server communication link 20, and an emblem 25. The network 30 includes, at least, a network service provider (server) 35, a GEMR service provider (server) 55, server-communications network links 40 and 50, and a communications network 45. Note that a network service provider (a nonlimiting example of which is an Internet Service Provider or ISP) is actually a private firm, or a local university or community college, through which the network (a nonlimiting example of which is the Internet) is accessed. A network

service provider has a server (nonlimiting examples of which are Web, Archie, Gopher (with or without Veronica), Lynx, FTP, Telnet, or Wide-Area Information (WAIS) servers) which provides access to the network or information on the network. Servers are host computers which could be mainframes, Unix workstations, or some other type of computer that run what is termed server software. Servers form an integral part of a larger concept known as the client/server paradigm in which computing transactions are distributed between the server software residing on the server (host) computer, and client software, residing on a user's workstation or personal computer (a client). The client requests service(s) of another computer, i.e., the server, and the server, which houses this service(s) that you or anyone else connected to it (there may be other intervening servers between the client and the server housing the service(s)) can use, if allowed, fulfills the request, which may include data as well as software. The client also manages most information presentation functionality (user interface), while the server also manages most database functionality and may include network switching functionality. Protocol defines communication between the client and the server.

Note that so far the discussion has involved the network service provider's server. Sometimes a network service provider's server, in performing its service, acts, at times, as either client or server. For this reason, servers are sometimes referred to as client/servers. An explanation of the terminology is afforded if one considers a situation that would occur, for example, if a client made a request to a first server to retrieve information and the first server had to link to a second server in order to retrieve the information. Hence, in this instance, the first server acts as a client to the second server and runs appropriate client-type software, although this software may differ from end user-type client software such as a browser (explained in more detail below). Therefore, it is to be understood that the scope of the present invention includes servers which are also client/servers for the network service providers as well as other servers accessed by the network service providers.

In a more preferred embodiment, a GEMR system 10' is shown in Fig. 1B which is similar to the system 10. The GEMR system 10' includes a network 30', a PC 15', PC-server communication link 20', and an emblem 25' which are similar to the network 30, the PC 15, the PC-server communication link 20, and the emblem 25, receptively. Similar to their corresponding counterparts in the network 30, the network 30' also includes a network service provider (server) 35', a GEMR service provider (server) 55', server-communications network links 40' and 50', and a communications network 45'. However, the network 30' additionally includes, at least, an institutional service provider(s) (server(s)) 75', other medical service provider(s) (server(s)) 95', and associated server-communications network links 60' and 70'.

In both GEMR systems 10 and 10', the personal computers 15, 15' are respectively coupled through the PC-server communication links 20, 20' to the network service providers 35, 35', which are, in turn, respectively coupled through the server-communications network links 40, 40' to the communications networks 45, 45'. Also, in systems 10 and 10', the communications networks 45, 45' are respectively coupled through the server-communications network links 50, 50' to the GEMR servers 55, 55'. In system 10', the institutional server(s) 75' and the other medical server(s) 95' are coupled to the communications network 45' through the server-communications network links 60' and 70', respectively. In particular alternative embodiments of system 10' in accordance with the present invention, the institutional server(s) 75', the other medical server(s) 95', and the server-communications network links 60' and 70' are accessed through private gateways. Note that for both systems 10 and 10', the PCs 15 and 15', the links 20 and 20', the network service provider servers 35 and 35', the links 40 and 40', the communications networks 45 and 45', the links 50 and 50', and the GEMR servers 55 and 55', respectively, provide a path for a user (i.e., the subscriber or an authorized physician, healthcare worker, or technician) to access a subscriber's Global Electronic Medical Record (GEMR) 100 which is described in more detail below.

It should be understood that links such as the PC-server communications links 20, 20', the server-communications network links 40, 40', 50, 50', 60', and 70' as used herein, in accordance with the scope of the present invention, include, but are not limited to: telephone links; PC modems; public switched telephone networks (PSTNs); packet switching networks; high speed data links; T1 lines; T3 lines; integrated services digital network (ISDN) lines; X digital subscriber lines (including asynchronous digital subscriber lines (ADSL); synchronous digital subscriber lines (SDSL); and high-bit-rate digital subscriber lines (HDSL)); cellular telephone-base station links; personal communications services (PCS); satellite links; fiber-optic lines (e.g., employing FDDI); coaxial cable; thinwire cable; twisted pair; cable modems; wireless access; repeaters; bridges; routers; brouters; gateways; and any other appropriate type of communication link, network hardware, or protocol (a language used by computer systems for communication over a network, including compression schemes) as would be understood by those of ordinary skill in the art. It should also be understood that the GEMR servers 55, 55' are not limited to a single server, and the scope of the present invention is meant to include, because of the distributed nature of many services, multiple servers as growth in demand, server load, or the need for new functionality dictates. Examples of systems which are to be included in the scope of the present invention are systems with primary servers, secondary servers, and caching servers, as well as systems with master servers and slave servers. With multiple servers, particular service requests (or portions thereof, as well as procedures necessary for the successful completion thereof) are handled by particular servers of the multiple servers in accordance with the system 10 or 10' design. All the above is also true for the servers 35, 35', 75', and 95'.

In systems 10 and 10', nonlimiting example embodiments of the respective emblems 25, 25' are a wrist emblem 25a, 25a', a neck emblem 25b, 25b', and a card 25c, 25c', which is preferably a plastic card, although it could be constructed of any suitable material, for example, paper, as schematically represented in Figs. 13A, 13B, and 13C, respectively. The emblems 25, 25' have inscribed thereon a

network address for the subscriber's (Global Electronic Medical Record) GEMR 100 in the GEMR servers 55, 55' of the systems 10, 10', respectively, as will be discussed in more detail below. Suffice it to say at this point that the network address for the subscriber's GEMR 100, in addition to the subscriber's security password (or security code), is required to gain access to proprietary portions of the subscriber's GEMR 100. This is because the GEMR 100 is patient-driven (subscriber-driven) and contains very personal medical record information of the subscriber. Hence, security and confidentiality of this information are of paramount importance. Therefore, in accordance with the present invention, both the subscriber's GEMR 100 network address and the subscriber's security password are essential in order to obtain entry to the proprietary portions of the subscriber's GEMR 100. And, referring to Figs. 1A and 1B, the dotted lines between the emblems 25 or 25' and the PCs 15 or 15', respectively, are indicative of the requirement that the network address of the subscriber's GEMR 100, which is inscribed on the emblems 25 or 25', be read by a user (i.e., the subscriber or an authorized physician, healthcare worker, or technician) from the emblems 25 or 25' in order to input the network address to the PCs 15 or 15', respectively (via, for example, input devices associated with the PCs 15 or 15', as described herein). The PCs 15 or 15' receive the subscriber's network address as input information (a query) which is interpreted by the client software and microprocessors 85 and 85' of the PCs 15 or 15', respectively, as a request to gain access to the subscriber's GEMR 100 through the system 10 or 10', respectively, as will described below in further detail. Note that the scope of the present invention includes the user memorizing the subscriber's network address from reading the emblem 25 or 25', or being told the subscriber's network address by the subscriber, a relative or friend of the subscriber, or another individual authorized by the subscriber, before the user inputs that address into the PCs 15 or 15'.

The PCs 15, 15' include, at least, respective displays 80, 80' (e.g., a monitor, a touch screen, or functional equivalents thereof), respective microprocessors 85, 85', respective storage units 68, 68' (i.e., non-volatile and

volatile storage units, examples of which include, but are not limited to, a hard disk drive, a floppy disk drive, a CD-ROM, read-write optical disk, a digital audio tape system, RAM, register memory, or functional equivalents thereof), input devices (e.g., a keyboard, a mouse, a light pen, voice recognition system, or functional equivalents thereof). In alternative embodiments, the PCs 15, 15' are instead so-called "dumb" network terminals of recent notoriety (a stripped down PC with minimal or no applications software stored on-board) which are linked to either a local server (or host), e.g., in an intranet employing Ethernet with TCP/IP (described below) compatibility or a remote (or terminal) server or host, which is, in turn, respectively coupled to the servers 35, 35' for access to respective networks 45, 45'. In some of these alternative embodiments, the PCs 15, 15' do not run client application software and connections are made to a host that runs the client application to communicate with a server. Also, for these alternative embodiments, to maintain drawing simplicity, the local server or the remote server (or the possible client software-running host) are understood, to be included in the communication links 20, 20'. Note that it is to be understood that in the present invention, the term PC, as broadly defined, describes general purpose computers, and includes, but is not limited to, that variety of computer commonly known as a "personal computer."

Note that TCP/IP are protocols, short for Transmission Control Protocol/Internet Protocol, which together let computers on the Internet communicate by providing reliable information (byte) delivery in order through network connections. TCP/IP are addressing and packetizing protocols which let information pass through many networks intact before reaching an ultimate destination. Connections are formed to TCP "ports," allowing a multiplicity of connections per machine. It is to be understood that the scope of the present invention includes, besides TCP/IP, other network protocols, for example, Digital Equipment Corporation's LAT (Local Area Transport) protocol, etc.

Moreover, in the most preferred embodiment, network 45' is the Internet with the GEMR server 55' being a Web server, wherein access from the PC 15' to

the GEMR server 55' is provided by the Web. Also, in the most preferred embodiment, the GEMR server 55' is TCP/IP-based. Note that the Web is a network-based hypertext document delivery system which supports links, an example of which includes, but is not limited to, hot links. Hot links are highlighted or underlined words or phrases which provide jump-off points to other material (files) or sections of the material (file or files) or to other documents (files) within a given document (file). In accordance with the present invention, these other documents (files) either reside on the GEMR server 55' or other servers. The goal of the Web is to work across hardware and operating system platforms and it is up to programmers of client and server software to ensure compatibility with the TCP/IP and HTTP (HyperText Transfer Protocol) protocols. TCP/IP is itself independent of the underlying hardware and the Web and Internet support open systems which are computers or networks that use standards (e.g., TCP/IP) to facilitate communication with computers or networks from different vendors or with different operating platforms. Likewise, the present invention conforms to these standards, but a password(s) (security code(s)) is required to obtain access to certain proprietary portions of a subscriber's GEMR 100 as discussed below in more detail.

Accordingly, in the most preferred embodiment, the PC 15' has a graphical interface and stores and runs a Web browser (nonlimiting examples of which are Netscape Navigator, Microsoft Explorer, Mosaic, Lynx, Cello, and others as would be understood by one of ordinary skill in the art). The browser is a software tool which allows a user to read or scan a file or document on the Web and provides user presentation. The browser employs hypertext mark-up language (HTML) which enables authors to write hypertext (or hypermedia, i.e., combinations of text, still images, video, or sound) links to access the Web. HTML is a set of structures which is compliant with the Standard Generalized Markup Language (SGML) ISO standard for describing structural information embedded within a document. The hypertext or markup documents are interpreted by clients for presentation to users. The browser is compatible with the HTTP

communications protocol which governs the dialog between client (browser) and server and specifies how Web clients fetch documents. In other words, the browser uses HTTP to communicate with servers on the Web. HTTP also provides ways for "meta-information" - information about a document that is not part of the document, such as the date it was last modified - to be exchanged and allows servers to offer different document types.

In addition, secure HTTP is under development which addresses the issue of moving data in a secure fashion across a public environment such as the Internet and which allows business transactions to occur in a secure manner. Thus, secure HTTP offers an environment for features such as authorization and charging. With secure HTTP, consumers are able to browse a service or product offering, such as the GEMR, fill out an application or order form, and subscribe to the service (e.g., to the GEMR) or buy the product, etc. by supplying a credit card number or checking account number for electronic funds transfer, or other payment means. With secure HTTP, or with an equivalent thereof as would be understood by one of ordinary skill in the art, both the GEMR subscriber and the GEMR company are assured (at least to as great an extent as possible) that the transaction is done in a secure manner.

At this point, all of the features of secure HTTP are not yet set. Nevertheless, all of the salient security features of secure HTTP which one of ordinary skill in the art would recognize as being important for the GEMR are included in the scope of the present invention. Note that with secure HTTP no changes to HTML should be required, but if changes in HTML do occur as secure HTTP evolves, such changes are also included in the scope of the present invention. Note that the ability to pay to subscribe to the GEMR off-line, which also further enhances transaction security, is also available to a new subscriber, for example, if the new subscriber pays to subscribe by mailing in a check or a credit card number, or by providing a credit card number via telephone, to the GEMR company.

Note that in certain embodiments in accordance with the present invention, the GEMR 100 (whether like systems 10 or 10') uses data encryption and other protection schemes to add a further level of confidentiality to the subscriber's medical records, especially for the GEMR blocks 112-117 which comprise the proprietary portion of the GEMR 100. Examples of the types of data encryption and other schemes used include, but are not limited to, single key cryptography, public key/private key cryptography, and client authentication, which are understood by one of ordinary skill in the art. In single key cryptography, encryption and decryption software must use the same private key to send and retrieve data, whereas in public key/private key cryptography, encryption software (e.g., PGP in the public domain) uses a public key for encryption of data, but to decrypt the data, a private key must be known and used. In client authentication, which could also be a possible substitute for the subscriber security password, so-called "Personal Certificates" and "Site Certificates" are used. In the most preferred embodiment, Personal certificates verify a person's identity on the Web to the GEMR servers 55 or 55', and will be obtainable from "Certificate Authorities," such as Verisign and GTE, when these become available. Site certificates verify that a person is really connecting to Web sites that he or she thinks they are connecting to. Through these certificates, the identity of a Web merchant or other Web server (e.g., the GEMR servers 55 or 55') can be verified before data transfer or transactions occur. Other embodiments of the present invention use accounting or system auditing utilities to log break-in attempts, and/or to prevent manipulation of confidential data, such as the GEMR blocks 112-117, in each packet of data fields (where packets are used to transfer data), the source address, the destination address, and the port for the particular service provider (e.g., network service providers 35 and 35') whose service is being used are examined to determine which services are allowed through a firewall associated with the GEMR servers 55 and 55' in these embodiments. The firewall examines every packet (e.g., packet filtering by routers) or may involve a gateway or custom software for routing with no default route.

Referring back to Figs. 1A and 1B, the GEMR servers 55 and 55' include, at least, respective storage units 65 and 65' (i.e., volatile and non-volatile memory, e.g., RAM, register memory, a hard disk drive, a floppy disk drive, a CD-ROM, or functional equivalents thereof), respective microprocessors 58 and 58' for controlling the storage units 65 and 65' (note that in both systems 10 and 10', the microprocessors 58 and 58' are coupled to, and control, the storage units 65 and 65', respectively, and the microprocessors 58 and 58' and the storage units 65 and 65' are coupled to respective data buses in the PCs 15 and 15', as would be understood by one of ordinary skill in the art), and are coupled to the respective server-network links 50 and 50', as indicated above. In certain other embodiments, the GEMR servers 55 and 55' also include respective displays 88 and 88' (e.g., a monitor, a touch screen, or functional equivalents thereof), input devices (e.g., a keyboard, a mouse, a light pen, voice recognition system, or functional equivalents thereof). Whether it is the preferred embodiment, the more preferred embodiment, the most preferred embodiment, or these certain other embodiments, the GEMR servers 55 and 55' are accessible for troubleshooting, upgrading, reprogramming, modifying, or altering in any way by a systems administrator or technician as would be understood by those of reasonable skill in the art.

In accordance with the preferred embodiments and the most preferred embodiment of the present invention, subscription to a service such as the systems 10 and 10' provides each subscriber with their personal GEMR 100 stored on either of the GEMR servers 55, 55'. For each subscriber, depending on whether the particular GEMR system being used is the system 10 or 10' (or is available to the subscriber), the GEMR 100 is set up by the individual subscriber and stored in their respective storage units 65, 65' of the GEMR servers 55, 55'. The GEMR 100, whose block diagram structural representation is schematically illustrated in Fig. 2, includes, at least, both personal and medical information blocks. These personal and medical information blocks (software objects in an object-oriented computer environment) encompass a Main Object block 105, additional file/institutional link (object) block 120, and medical link (object) block 130. The

Main Object block 105 includes objects, such as, at least, a Subscriber GEMR Home Page block 111, a Personal Identifiers block 112, an Emergency Contacts block 113, a Personal Physicians block 114, a Health Insurance block 115, an Advance Directives block 116, and a Medical Information block 117. The main object block 105 contains a database (the main files), i.e., the blocks 111-117, of the personal and medical records of a particular subscriber. Each of the constituent GEMR blocks 111-117 of the main object block 105 are linked and embedded in the main object block 105. Note that an object as used herein, in a broad sense, is a self-contained element that contains its own data and methods of processing that data.

Before continuing with a further description of the GEMR blocks 111-117, note that the main object block 105 is linked to a GEMR company Home Page block 110 which has an associated graphical user interface (in this case a network Home Page), an example of which could appear as in Fig. 5. Note that the GEMR company Home Page of the GEMR company Home Page block 110 may be searched and accessed through conventional network search engine queries. In the most preferred embodiment, the GEMR company Home Page is an Internet or Web Home Page which may be searched and accessed through Web search engines, for example, but not limited to, Yahoo!, Lycos, Alta Vista, etc. From an input field of the GEMR company Home Page of the GEMR company Home Page block 110, such as a "Subscribe" button field (Fig. 5), which could also be a text field, a potential subscriber may subscribe to the GEMR 100. Pressing the "subscribe" button will link the potential subscriber to the main object block 105 and a graphical user interface application form similar to Fig. 7 as described below will be displayed on the displays 80 or 80', or on displays 88 or 88' associated with the GEMR servers 55 or 55'. Once this graphical user interface is viewed (or any of the other graphical user interfaces described below are viewed), access may be made back to view the graphical user interface of the GEMR company Home Page block 110 by selecting a "back" screen button or by inputting a network address for the GEMR company Home Page block 110 (i.e., in the most preferred

embodiment, going to a URL of the GEMR company Home Page block 110 by using the browser) as would be understood by one of ordinary skill in the art (note that a "back" button and a "forward" button may be used similarly to freely move amongst graphical user interfaces associated with the proprietary GEMR blocks 112-117 once access has been granted to a user as described herein). Note also that the graphical user interface of the GEMR company Home Page block 110 also presents buttons or text fields which may be selected to access information such as frequently asked questions and to send e-mail (e.g., by using buttons similar to the "Frequently Asked Questions" and "E-Mail" screen buttons of Fig. 5). Moreover, note also that once a subscription is made to the GEMR 100, the subscriber need only go to his or her Subscriber GEMR Home Page block 111 (i.e., to a graphical user interface thereof, as discussed below), and not through the GEMR company Home Page block 110, to access their GEMR 100 information.

Reference is now made to Fig. 2 and the GEMR blocks 111, 112, 113, 114, 115, 116, and 117 (collectively referred to herein as GEMR blocks 111-117) which form the personal and medical records database. Some details about these blocks, and how these blocks are linked, are now provided. The Subscriber GEMR Home Page block 111 includes a file/database of information which presents a graphical interface to a user (i.e., the subscriber or an authorized physician or healthcare worker attending to the subscriber's medical needs, or an authorized technician) for gaining access to view the file/database contents of the other GEMR blocks 112-117 which comprise the proprietary portion of the GEMR 100. An example of the graphical user interface of the Subscriber GEMR Home Page block 111 which is presented to the user after the user has gained access to the graphical user interface is a screen or page such as is shown in Fig. 6 in the preferred (system 10) and more preferred (system 10') embodiments . The user gains access to the graphical user interface by connecting (i.e., by entering the network address for the subscriber's GEMR 100 either through the PCs 15 or 15') to the subscriber's GEMR 100 on the GEMR servers 55 or 55', or by directly connecting to the subscriber's GEMR 100 through the GEMR servers 55 or 55'

themselves. In the most preferred embodiment, the network address is an Internet Web address and the graphical user interface of the Subscriber Home Page block 111 is a Web home page. Upon viewing the graphical user interface of the Subscriber GEMR Home Page block 111, the user is prompted to register in appropriate text boxes as indicated in Fig. 6. These text boxes are so-called "form" (described below) text boxes in the most preferred embodiment.

Upon entering appropriate information to register as a user desiring to gain access to the subscriber's GEMR 100 via the Subscriber GEMR Home Page block 111, in order for the user to gain access to the other proprietary GEMR blocks 112-117 of the subscriber's GEMR 100, the user must enter the subscriber's password (security code) as prompted in Fig. 6 (note that in certain embodiment, personal certificates are used in lieu of the password as described above). The subscriber's password is a sequence or string of alphanumeric symbols which are entered as input to the graphical user interface in any suitable manner, for example, by entering the password in a text box as indicated in Fig. 6. The scope of the present invention includes entering the password via keyboard, light pen, mouse, etc., or audibly through a voice recognition system forming part of the systems 10 or 10'. The subscriber's password is preferably a 10 symbol sequence or string, but may be longer or shorter for security reasons as long as its length is sufficient enough to make the possibility of an unauthorized user discovering the subscriber's password extremely remote. Recall that the GEMR 100 is patient-driven (subscriber-driven), and to provide for the confidentiality of the subscriber's personal medical records, the combination of both the subscriber's unique GEMR 100 (Subscriber GEMR Home Page block 111) network address and the subscriber's unique security password is required to enter the proprietary GEMR blocks 112-117. Note that the scope of the present invention includes using a one or more additional password, in addition to the password discussed so far, for controlling access to certain portions or all of the proprietary GEMR blocks 112-117.

However, once a user has entered the proper address and security password information, the user enters the proprietary portion of the GEMR 100 as a link is formed to the Personal Identifier block 112 of the GEMR 100. At this point, a graphical user interface of the Personal Identifiers block 112, an example of which is depicted in Fig. 7, is presented to the user on the displays 80 or 80' or on the displays 88 or 88' of the GEMR servers 55 or 55', depending on which of the systems 10 or 10' is being employed. Once access is made to the proprietary GEMR blocks 112-117, it is possible to jump or switch (for example, but not limited to, by using hypertext links) to any one of the other blocks and back. This is generally indicated at the bottom of each of Figs. 7-12D where a user-selectible field (selectible via keyboard, mouse, voice recognition, light pen, touchscreen, etc., for example, as a so-called virtual selection, as would be understood by one of ordinary skill in the art), for example, a text field, is provided, although any other appropriate field, such as a user-selectible screen button field, would work equally well. The user-selectible field includes entries which each correspond to one of the proprietary GEMR blocks 112-117 as well as to other GEMR 100 tools. For example, as indicated in Figs. 7-12D, if the user-selectible field is a user-selectible text field, entries for such a field could include "Personal Identifiers," "Emergency Contacts," "Personal Physicians," "Health Insurance," "Medical Information," "Text Editor," "Search," "Exit," "and "Find Out More About **Global Electronic Medical Records**" (note that the scope of the present invention encompasses other appropriate fields as would occur to one of reasonable skill in the art). Selection of any one of the first five of these entries provides a link to, and jump or switch to, the corresponding one of the proprietary GEMR blocks 112-117 (see Figs. 8-12D) having the same name. Note that Figs. 12A-12D are screen examples of the information accessed through the Medical Information block 117. Selection of "Text Editor" provides on-screen access on the displays 80 or 80', or on the displays 88 or 88' of the GEMR servers 55 or 55' to a computer text editor tool which can be used to input or edit any text field of data (on page or screen; see, for example, Figs. 6-12D) that is user-selectible and

accepts user input or is user selectible and updatable, whereas selection of "Search" provides a tool to search objects or text within any one of the proprietary GEMR blocks 112-117 or within the files/databases of the additional file/institutional link block 120 (file/institutional link blocks 121-128) which are described below. Finally, selection of "Exit" provides, in certain embodiments, a means for exiting from the proprietary GEMR blocks 112-117 back to the Subscriber GEMR Home Page block 111 graphical user interface screen (for example, see Fig. 6) of the GEMR 100, while in other embodiments, it provides a means for exiting from the proprietary GEMR blocks 112-117 back to a browser home page on the PCs 15 or 15' (or on the GEMR servers 55 or 55'), or back to a browser provided by the network service providers (servers) 35 or 35' to the PCs 15 or 15', respectively. No matter what the embodiment, for security reasons, once exit is made from any of the proprietary GEMR blocks 112-117, the user must again enter the security password to re-enter any of proprietary GEMR blocks 112-117, for example, by going back to the graphical user interface presented to the user upon linking again to the Subscriber GEMR Home Page block 111.

Note that in the most preferred embodiment, the main object block 105 is an HTML object with the user-selectible field entries corresponding to the each of the proprietary GEMR blocks 112-117 being hypertext links between each and every one of the proprietary GEMR blocks 112-117. Note also that each of the example screens of Figs. 5-12D are nonlimiting representative examples of graphical user interfaces which are presented to the user. Other examples of these types of screens would occur to ones of ordinary skill in the art and such other examples are included within the scope of the present invention. Each of these screen or page example figures will be addressed as apparatus and methods of the present invention are discussed in detail below.

Returning to Fig. 2, the additional file/institutional link block 120 includes links to personal medical information (other files or databases) accessible from institutional network sites and/or from within the GEMR servers 55 and 55'. Link block 120 includes links (link objects), such as, at least, hospital discharge

summary link block 121, clinical notes link block 122, laboratory reports link block 123, electrocardiograms link block 124, radiology reports link block 125, scanned documents link block 126, clinical photographs link block 127, and other files link block 128, collectively referred to herein as file/institutional link blocks 121-128. In the preferred embodiment of system 10, the file/institutional link blocks 121-128 of the link block 120 are software links to storage locations (addresses) of files/databases stored in the storage unit 65 (e.g., but not limited to, storage in volatile memory or random access memory (RAM), register memory, hard disk memory, CD-ROM, digital audio tape systems, or equivalents thereof) which contain personal and medical information corresponding to the names of the individual file/institutional link blocks 121-128. When a user (the subscriber, an authorized attending physician or healthcare worker, or an authorized technician) of the system 10 wishes to retrieve the information corresponding to the link blocks 121-128 from the storage unit 65, a request (a query) is made from the PC 15 or the GEMR server 55 by the user selecting from a user-selectible input field presented to the user on the display 80 of the PC 15 or the display 88 on the GEMR server 55. Fig. 12D generally depicts an example representation of such an input field corresponding to the link blocks 121-128 in the form of user-selectible regions defined on the display 80 (or defined on the display 88 of the GEMR server 55) which are responsive to selection by an input device. These input devices include, but are not limited to, a mouse, a light pen, a keypad or keyboard, a finger (if the display 80 or the display 88 of the GEMR server 55 is a touchscreen), a voice recognition system, or functional equivalents thereof as would be understood by one of ordinary skill in the art. Moreover, a nonlimiting example of user-selectible regions defined on the display 80 of the PC 15 or the display 88 of the GEMR server 55 as generally depicted in Fig. 12D are software screen display buttons as would be understood by one of ordinary skill in the art. Once selection is made from amongst the choices in the user-selectible field, the microprocessor 85 of the PC 15 (or the microprocessor 58 of the GEMR server 55) interprets the selection as a query to retrieve the personal and medical

information corresponding to the particular one of the link blocks 121-128 related to the selection. The queried information is then provided from files/databases stored in the storage unit 65 of the GEMR server 55 to be displayed on the display 80 of the PC 15 (or the display 88 of the GEMR server 55 itself), or it is available for hard copy output to the user via peripheral (e.g., printer) connection to the PC 15 (or the GEMR server 55). Note that the information corresponding to link block 128 includes, in the preferred, the more preferred, and the most preferred, embodiments, audio information, for example, sound bites of heart sounds.

In certain alternative more preferred embodiments similar to the system 10', and in complete analogy to the preferred embodiment of the system 10, the link block 120 (i.e., the link blocks 121-128) includes links to corresponding file/database storage or memory locations (addresses) within the storage unit 65' for retrieval of their contents. In these alternative more preferred embodiments, the input capability to retrieve the personal and medical information such as depicted and described above in relation to Fig. 12D is also available. Moreover, in certain other alternative more preferred embodiments similar to the system 10', the link block 120 (i.e., the individual file/institutional link blocks 121-128) includes links to personal and medical information file/database storage or memory locations (addresses) in the institutional server(s) 75' for retrieval of their contents as well. The contents of these files/databases are retrievable for viewing by the user (or in hard copy) in much the same way as described above, except that the information is retrieved by a query from the PC 15' to the GEMR server 55' (or totally within the GEMR server 55' if display is to occur on a display of the GEMR server 55) which then links to, and retrieves, the files/database information from the institutional server(s) 75' to be displayed on the display 80' of the PC 15'. Therefore, in these other alternative more preferred embodiments, communications links external to the GEMR server 55' are required to link to the institutional server(s) 75' as described in more detail below. A technician may access the same information from the GEMR server 55' or from a computer (e.g., a PC), even from the PC 15', for viewing the same personal and medical

information corresponding to the names of the individual file/institutional link blocks 121-128 (Fig. 12D type capability also available) if the technician is authorized by the subscriber.

In addition to these alternative embodiments of the system 10', note that there are certain additional alternative more preferred embodiments of the system 10' in which the personal and medical information corresponding to the titles of the individual file/institutional link blocks 121-128 is, instead, retrieved (Fig. 12D type capability also available) as a combination of both file/database information stored in the storage unit 65' and files/databases from (or through) the institutional server(s) 75'. Here, the latter files/databases may be stored in the institutional server(s) 75' or linked through the institutional server(s) 75' to their storage location on another remote server(s). In other words, in these certain additional more preferred embodiments, the link blocks 121-128 contain hardware and/or software links to both the storage or memory locations (addresses) of files/databases within the storage unit 65' in the GEMR server 55' and to the storage or memory locations of files/databases within the institutional server(s) 75', depending on the design of these systems and the location of patient information. Note that access to these files/databases within (or through) the institutional server(s) 75', because of security reasons associated with the institutional server(s) 75', may require that the subscriber obtain permission, for example, by application to authorities in control of the institutional server(s) 75' at the time of subscribing to the GEMR. With such permission, or if no permission is required, a subscriber may be able to access (or make additional linkage to) the institutional server(s) 75' as described above and copy information stored in (or gain access to such information through) the institutional server(s) 75' which is associated with the GEMR 100 and the link blocks 121-128. The scope of the present invention encompasses the ability for the subscriber to obtain permission, if required, from the authorities in control of the information stored in (or obtained through) the institutional server(s) 75' in order to obtain that information associated with the link blocks 121-128. Moreover, the scope of the present

invention also encompasses the ability to obtain such information when no prior permission need be obtained.

The link blocks 121-128 are already provided for, or, at least, the capability to create them is already provided for, in the GEMR 100 (software), whether or not actual patient information is available to retrieve or store. Storage space is available in the storage unit 65' to store the links/addresses for the link blocks 121-128 once these addresses/links, and the information to which they pertain, become available for retrieval, whereupon a user may supply these links/addresses to the GEMR 100 and the GEMR server 55'. Note that in these certain additional alternative more preferred embodiments, communications links external to the GEMR server 55' are required to link to the institutional server(s) 75' as will be described below. Note also that in addition to the above certain additional more preferred embodiments, there are yet further more preferred embodiments in which all of the link blocks 121-128 only link to (or through) the institutional server(s) 75' to retrieve the personal and medical information corresponding to the names of the link blocks 121-128 from their storage or memory locations. For all embodiments which require access to the institutional server(s) 75' to obtain information associated with the link blocks 121-128, it is assumed that the subscriber either has obtained or can obtain any necessary permission from the institutional server(s) 75' authorities, as above, in order to make the information available to the subscriber or an authorized user of the GEMR 100, or no permission is required.

In the most preferred embodiment, the user-selectible inputs (selectible by a user input device, as described above), for example, the on-screen "buttons" (such on-screen buttons are understood by those of reasonable skill in the art) designated "Hospital Discharge Summary," "Clinical Notes," "Laboratory Reports," "Electrocardiogram," "Radiology Reports," "Scanned Documents," "Clinical Photographs," "Other files," "Treatment Protocols," and "Medical Internet Links" of the example page or screen of Fig. 12D are defined by what are termed "forms" by those of ordinary skill in the art. A form is a designated area of an HTML page

made available for user input. The form is defined by starting and ending "tags" with attributes for specifying how the form's input should be processed. The basic idea of a form is to define and present input fields to the user for typing in text information, and radio buttons, check boxes and pop-up menus for selecting items from option lists as would be understood by one of ordinary skill in the art. The form typically defines a set of action buttons, such as the user-selectible inputs of Fig. 12D, as just discussed, and may include a "Reset" button and a "Submit" button (discussed further below in reference to Figs. 5-12D) as well. The action buttons instruct the browser of the PC 15' (or the GEMR server 55') to take an action specified in an ACTION attribute of the form. The action is taken according to a method specified in a METHOD attribute of the form. The ACTION attribute uses a URL value and the action is taken with either a METHOD=GET or a METHOD=POST method, which determine the processing of information in the form.

When the GET method is employed, the browser forms a query URL which includes a current page URL (e.g., a URL of the Fig. 12D-type page) containing the form. In the query URL, the current page URL is followed by an ensuing question mark, which is followed by the values of the form's input fields and objects. The browser sends the query URL from the PC 15' to an executable script or program on the GEMR server 55' identified by the URL in the Action attribute. The script or program can, amongst other things, use this information to search and update databases (even search and update databases associated with the GEMR 100, for example, databases associated with, and linked to through, the link blocks 121-128, assuming prior permission is obtained by the subscriber, or no permission is required, to do so). For a particular screen or page like Fig. 12D, once an action button is selected, the corresponding link of link blocks 121-128 forms part of the query URL to start a search which is performed by the script or program in the GEMR server 55' to retrieve the personal or medical information sought. The process ends with the GEMR server 55' returning a new screen or page to the user on the display 80' of the PC 15', possibly one dynamically created

by the GEMR server 55' script. Alternatively, with the POST method, the contents of the form are sent to the script of the GEMR server 55' as a block of data to standard input. However, with either the GET or POST methods, a new HTML page (e.g., the contents of the personal or medical files/databases sought by the user in the GEMR 100) is sent back to the user for viewing on the display 80' or for hard copy output in response to what is written to standard output by the script.

The collection of interactions, as discussed above, between the browser of the PC 15' and the GEMR server 55' (or a browser within the GEMR server 55' and executable scripts or programs also located therein) is known as the Common Gateway Interface (CGI). Servers such as the GEMR servers 55 and 55' each have their own set of scripts and programs needed to process information from Web pages on that server. For servers running on Unix machines, some of which may be the GEMR servers 55 and 55' (in some embodiments), these scripts are usually written in the PERL or TCL languages and are stored in a directory with the name "cgi.bin," as would be understood by one of ordinary skill in the art. The scope of the present invention is inclusive of all of the above information on forms, attributes, scripts, etc. and certain other aspects thereof will be discussed as necessary in relation to Figs. 5-12D below.

Returning again to Fig. 2, it is observed that the file/institutional link blocks 121-128 of the additional file/institutional link block 120 are individually linked to the main object block 105 through a link 118 and respective links 118a-118f as indicated in Fig. 2. Depending on whether the GEMR system is the system 10 or 10', and depending on the design of the GEMR 100 as well as the physical location of the information to be retrieved through links of the file/institutional link blocks 121-128, the communications links 118a-118f of the additional file/institutional link block 120 (i.e., of the file/institutional link blocks 121-128) and the communications link 118 of the main object block 105 include respective hardware and/or software link portions of the server-network links 50, 50', the communications networks 45, 45', the server-communications network link 60'

(system 10' only), and the storage units 65, 65' (or, alternatively, internal data buses or other hardware links and software links, respectively, within the PCs 15, 15'), the GEMR servers 55, 55', or the GEMR 100 itself between the storage units 65, 65' and the link block 120 (i.e., the link blocks 121-128). In the system 10', personal and medical file information located in (or through) the institutional server(s) 75' and linked to by the file/institutional link blocks 121-128 is accessed and retrieved either through the link 60', the communications network 45', and the link 60' from the institutional server(s) 75' and sent to the PC 15' from the GEMR server 55' through the link 50', the communications network 45', the link 40', the server 35', and the link 20' (i.e., if not already stored in the GEMR server 55'), or the information is accessed through the internal data buses or other hardware links and software links (i.e., if already stored in the GEMR server 55'), for viewing by the subscriber or the authorized attending physician, authorized healthcare worker, or authorized technician after a query is made for this information from the PC 15'.

Like the linking between each of the constituent GEMR blocks 112-117 of the main file object 105 amongst themselves, each of the file/institutional link blocks 121-128 of the additional file/institutional link block 120 amongst themselves, as well as between each of the GEMR blocks 112-117 and each of the link blocks 121-128 are similarly linked as manifested in a user-selectible manner, the latter linkage occurring through the links 118 and 118a-118f. In the most preferred embodiment, links 118 and 118a-118f include software links, for example hypertext links such as were described above in reference to Figs. 7-12D for the proprietary GEMR blocks 112-117. As an example of such software links for links 118 and 118a-118f, in linking from the proprietary GEMR blocks 112-117 to the file/institutional link blocks 121-128, the user would select (queries) the "Medical Information" text entry in the user-selectible block appearing on the displays 80, 80' or the displays 88, 88' of the GEMR servers 55, 55' as indicated at the bottom of Figs. 7-12D. The microprocessors 85, 85' of the PCs 15, 15' (if using displays 80 or 80', respectively) or microprocessors 58, 58' of the GEMR servers 55, 55' (if using the GEMR server 55, 55' displays 88, 88', respectively)

interprets the selection (query) as a request to select information associated with the proprietary Medical Information block 117 and recover this information (and links) from appropriate memory addresses, directories, files, or databases in the storage 65, 65', respectively. The user would then be presented with the information associated with the Medical Information block 117 as generally indicated in Figs. 12A-12D. The user would then scroll down to, or hot link (from within the proprietary Medical Information block 117) to, the user-selectible input block of Medical Information block 117 as in Fig. 12D, and select an input entry with an appropriate input device (described above) to retrieve (from either a file/database on the GEMR servers 55, 55' or by linking to the institutional server(s) 75' for the desired information as discussed above.

Moreover, software linking via links 118 and 118a-118f from the link block 120 (i.e., from link blocks 121-128) back to the main object block 105 (i.e., back to any of the proprietary blocks 112-117) is accomplished by selection of a corresponding entry from a user-selectible block (not shown), for example, similar to the user-selectible text blocks at the bottom of Figs. 7-12D, which appear at the bottom of every screen of information associated with any of the link blocks 121-128 presented to the user once access has been made to that information (access to this information has been described above). Thus, links 118 and 118a-118f include all the software links necessary to implement the above linking scheme between main object block 105 and block 120 (i.e., the link blocks 121-128) in order for the user to obtained his or her desired information on the subscriber as would be understood by one of ordinary skill in the art.

In the systems 10 and 10', in addition to the block 120, as indicated in Fig. 2, the GEMR 100 also includes the medical link block 130. The medical link block 130 includes links to other medical files (addresses) within the GEMR servers 55, 55' (systems 10 and 10', respectively), and/or links to other medical network server(s) or sites 95' which are external to the GEMR server 55' (system 10' only). More specifically, the link block 130 includes objects, such as, at least, treatment protocol block 131 and a medical file and network site(s) block 132. The

block 131 has links to medical treatment protocols which may be retrieved from these other medical network sites (system 10' only) or from files within the GEMR servers 55, 55' (i.e., in storage units 65 and 65' of systems 10 and 10', respectively), whereas the block 132 has links to medical files from within the GEMR servers 55,55' (i.e., in storage units 65 and 65' of systems 10 and 10', respectively) and network sites (system 10' only) for other medical information, all of which may contain useful information to an authorized attending physician or healthcare worker in treating the subscriber. The blocks 131 and 132 are similar to the blocks 121-128 in the above alternative embodiments in which database information is retrieved from the GEMR servers 55, 55' (systems 10 or 10') or from an external server(s) like the server(s) 75' (system 10' only), except in this latter case the information is retrieved from the server(s) 95', although some of the information may come from particular institutional server(s) 75'.

The information associated with the link blocks 131 and 132 is not specific to the subscriber. In other words, the link blocks 131 and 132 neither contain links to files/databases (addresses) in the GEMR servers 55, 55' in systems 10 or 10, nor to network addresses (or URLs in certain embodiments) in system 10' which are particular to the subscriber and form part of the medical record of the subscriber. Instead, the link blocks 131 and 132 establish links to auxiliary medical information for the benefit and edification of the user (the subscriber or an authorized physician, authorized healthcare worker, or authorized technician). For particular embodiments of system 10' where access is made to other medical network server(s) or sites 95', it is to be understood that, in similarity to obtaining information through link blocks 121-128 for systems having access to institutional server(s) 75', the subscriber will obtain any necessary prior permission required by authorities in control of the medical network server(s) or sites 95' in order to obtain such information. Note that system 10, which has no links to institutional server(s) 75', also has no links to other medical server(s) or sites 95', yet system 10 uses the GEMR 100 which means that the link block 130 (i.e., link blocks 131 and 132) are links to files/databases or directories solely within the GEMR server

55. However, the GEMR 100 supports the establishment of links system 10 and institutional server(s) 75' or medical network server(s) or sites 95', thereby converting system 10 into an example of system 10' with all the features described above in relation to system 10'.

Like the link blocks 121-128 of the link block 120, the link blocks 131 and 132 of the link block 130 can be selected from a user-selectible block by an appropriate input device for accessing treatment protocols, medical files and network sites in similarity to what is described above in relation to the link blocks 121-128. An example of the user-selectible block includes user-selectible screen button blocks corresponding to the treatment protocols, medical files and network sites. Such a screen button block is illustrated in Fig. 12D, where it can been observed that a screen button labeled "Treatment Protocols" corresponds to the link block 131 and a screen button labeled "Medical Internet Links corresponds to the link block 132. The scope of the present invention includes alternative types of user-selectible blocks for the treatment protocols, medical files and network sites corresponding to the link blocks 131 and 132, including user-selectible text blocks and hypertext link blocks as would be understood by one of ordinary skill in the art.

The constituent blocks 131 and 132 of the medical link block 130 are coupled by communications links 119a and 119b, respectively to the communications link 118 of the main object block 105. Again, as for communications links 118 and 118a-118f, depending on whether the GEMR system is the system 10 or 10' and depending on the design of the GEMR 100 and the physical location of the information to be retrieved by linking with the link blocks 131 and 132, the communications links 119a and 119b include software links and hardware link portions of the server-network links 50', the network 45', the server-communications network link 70', and the storage units 65' (system 10' only), or, alternatively, internal data buses or links within the GEMR 100 itself between the storage units 65, 65' (systems 10 or 10') and the block 130 (the blocks 131 and 132). Also, like the linking between each of the constituent GEMR

blocks 112-117 of the main file object 105 amongst themselves, the link blocks 131 and 132 are linked to each other in similarity to the linking amongst each of the file/institutional link blocks 121-128, as well as in similarity to each of the GEMR blocks 112-117. Further, like both the proprietary GEMR blocks 112-117 and the link blocks 121-128, the link blocks 131 and 132 are linked as manifested in a user-selectible manner, the latter linkage occurring through the links 118 and 119a-119b. In the most preferred embodiment, links 118 and 119a-119b include software links, for example hypertext links such as were described above in reference to Figs. 7-12D for the proprietary GEMR blocks 112-117. As an example of such software links for links 118 and 119a-119b, in linking from the proprietary GEMR blocks 112-117 to the link blocks 131 and 132, the user also would select (queries) the "Medical Information" text entry in the user-selectible block appearing on the displays 80, 80' or the displays 88, 88' of the GEMR servers 55, 55' as indicated at the bottom of Figs. 7-12D. The microprocessors 85, 85' of the PCs 15, 15' (if using displays 80 or 80', respectively) or the microprocessor 58, 58' of the GEMR servers 55, 55' (if using the GEMR server 55, 55' displays 88, 88', respectively) interprets the selection (query) as a request to select information associated with the proprietary Medical Information block 117 and recovers this information (and links) from appropriate memory addresses, directories, files, or databases in the storage 65, 65', respectively. The user would then be presented with the information associated with the Medical Information block 117 as generally indicated in Figs. 12A-12D. The user would then scroll down to, or hot link (from within the proprietary Medical Information block 117) to, the user-selectible input block of Medical Information block 117 as in Fig. 12D, and select an input entry with an appropriate input device (described above) to retrieve (from either a file/database on the GEMR servers 55, 55' or by linking to the other medical server(s) or site(s) 95' (includes institutional server(s) 75' in some embodiments) for the desired treatment protocol, or medical files and network sites information in similarity to what was discussed above in relation to obtaining information corresponding to link blocks 121-128.

Moreover, software linking via links 118 and 119a-119b from the link block 130 (i.e., from link blocks 131 and 132) back to the main object block 105 (i.e., back to any of the proprietary blocks 112-117) is accomplished by selection of a corresponding entry from a user-selectible block (not shown), for example, similar to the user-selectible text blocks at the bottom of Figs. 7-12D, which appear at the bottom of every screen of information associated with any of the link blocks 131 or 132 presented to the user once access has been made to that information just like for link blocks 121-128 (described above). Thus, links 118 and 119a-119b include all the software links necessary to implement the above linking scheme between main object block 105 and block 130 (i.e., the link blocks 131 and 132) in order for the user to obtained his or her desired treatment protocol or medical file and network site information as would be understood by one of ordinary skill in the art.

At this point, attention is focused on the inventive methods of the preferred embodiment, more preferred embodiment, and the most preferred embodiment in accordance with the present invention. Reference is now made to Figs. 3A and 3B which together form a flow chart representation of a method 200 for inputting and storing information in the GEMR 100. Steps shown in Figs. 3A and 3B will be described in combination with Figs. 5-18 as appropriate to describe the GEMR 100. In step 202 of Fig. 3A, a potential subscriber accesses the GEMR 100 main network server (site) which presents information on the GEMR to the potential subscriber on a display of a PC (which may be on the display 80 of the PC 15 in certain embodiments). Fig. 5 shows an example way of presenting GEMR information to the potential subscriber in the form of a Web Home Page for a GEMR company providing the GEMR 100 in accordance with the most preferred embodiment of the present invention. For the preferred embodiments, other types of presentation information screens are possible depending on the particular network and client/server software applications being run on the PC and the GEMR 100 as would be understood by those of average skill in the art. In step 204, the potential subscriber is prompted to subscribe by selecting a user-selectible

field, a nonlimiting example of which is selecting (i.e., by using a mouse, trackball, light pen, touch screen, etc.) a subscribe screen button object on the home page as indicated in Fig. 5 in which case a new graphical user interface, for example a screen or display application form appears which is similar to Fig. 7, except that there is no text field block, like the hot link block at the bottom, but rather a field in which the subscriber creates his or her new security password for his or her subscription. If the potential subscriber chooses not to subscribe in step 204, then flow proceeds back to step 202 with the information on the GEMR again presented to the potential subscriber, or the potential subscriber can exit from the GEMR company's Home Page.

If, however, the potential subscriber decides to subscribe in step 204, then flow proceeds to step 206, where the potential subscriber is prompted to choose between receiving a hard copy subscription form (e.g., by mail or other delivery) or continuing with on-line subscription. Choosing to subscribe on-line, the potential subscriber fills in (first pass through) an on-line application form in step 208 and makes a payment to the company providing the GEMR 100 (e.g., by entering credit card information on-line which is sent to the company through the GEMR server 55 in certain embodiments or by telephoning in credit card information to a telephone number provided by the company, etc.) and the form is then reviewed for accuracy on-line in step 210. If the form is correct in step 210, flow proceeds as generally indicated in Figs. 3A and 3B through connectors "A" to step 212. However, if the form is not correct in step 210, flow proceeds back to step 208 for correction (second or subsequent pass through).

Alternatively, back in step 206, if the potential subscriber chooses to receive and fill out the hard copy subscription form, then the potential subscriber supplies his or her address in step 218, for example, on-line, by telephone, or by delivery to the company, all of which are nonlimiting embodiments. Proceeding on, once the potential subscriber receives the hard copy subscription form, he or she fills it in (first pass through) and sends the completed form to the GEMR company in step 220. The potential subscriber also sends a payment or provides credit card

information to the GEMR company along with the completed hard copy subscription form in similarity to what was discussed above with respect to subscribing on-line. Note that whether subscription is made on-line or by hard copy, once payment is made, the potential subscriber becomes a subscriber. A GEMR company technician then transcribes the hard copy information from the completed form into the on-line application form in step 222. Whether the new subscriber subscribes on-line or uses a technician to enter application form information on-line to subscribe to the GEMR, the information is entered in text fields, examples of which are similar to the screens illustrated in Figs. 7-12C, except that there are no hot link text fields at the bottom of each screen. These hot link text fields are created after the new subscriber subscribes to the GEMR. Text entered on-line via keyboard, mouse, etc. (i.e., by the input devices described above) during subscription or correction of existing information are correctable in that characters or groups of words are individually or block selectible for deletion, backspacing, overwriting, etc. as would be understood by one of ordinary skill in the art.

Subsequent to step 222, the on-line information entered by the technician is reviewed for accuracy in step 213. An inaccurate form in step 213 leads back to step 220 for an opportunity for the subscriber to correct (second or later passes through) entries or inaccuracies to the hard copy application form and sending (as described above or my any means) the corrected, or a new, hard copy application form back to the GEMR company from the subscriber. Note, however, that the scope of the present invention includes correcting the on-line form information originally entered by the technician by telephone call or other communications between a representative of the GEMR company and the subscriber, independent of whether the information was originally provided on-line or by hard copy.

However, if the form information is, instead, accurate in step 213, then flow proceeds through the connectors "A" as above to step 212 (Fig. 3B) where a record (i.e., the GEMR 100) is created for the subscriber and the subscriber information is stored in the storage unit 65 of the GEMR server 55. Note that

connectors A only connect Figs 3A and 3B for drawing space and size convenience and do not represent any type of step in method 200. In step 214, an enrollment notice is sent to the subscriber with a network address for the individual subscriber's GEMR 100. In the most preferred embodiment, the network address is a Web address for the subscriber's GEMR 100. Finally, in step 216, an emblem 25 (for example, see Figs. 13A, 13B, and 13C) , such as a wrist emblems 25a or 25a', neck emblems 25b or 25b', or cards (e.g., plastic cards) 25c or 25c' are created by the GEMR company and sent to the subscriber. The emblem has inscribed on it the network address for the subscriber's GEMR 100. Note that both the subscriber's network address and security password are required to access the subscriber's GEMR 100 as also was discussed above.

During subscription, in the preferred embodiments, the subscriber has the option of choosing the security password on-line with an appropriate input device, for example, with a keyboard attached to the PCs 15 or 15', or a keyboard attached directly to the GEMR servers 55 or 55' or the user may choose a password at a later time, including by mail or other delivery to the GEMR company, or by telephone call to the GEMR company. Note that if the subscriber uses the telephone for choosing a password, it is to be understood that the identification and authenticity of the subscriber must first be verified by other methods before a new or updated password is set up for the subscriber. On-line password selection is implemented with a graphical user interface, for example, a screen similar to Fig. 6, which is presented to the subscriber on the displays 80 or 80' or on the displays 88 or 88' of the GEMR servers 55 or 55' (depending on whether system 10 or 10' is being used), when the subscriber is first entering Personal Identifier information. In other embodiments, the subscriber has the option of allowing a security password to be chosen for them by the GEMR company which subsequently informs the subscriber of their security password. The security password may be changed at any time after subscription by the subscriber or an authorized technician using an update procedure described below in relation to Fig. 4. The security password may also be changed after subscription

by mail or other delivery, or by telephone call (assuming appropriate identification procedures are followed by the GEMR company) from the subscriber to the GEMR company.

More detail is now provided on entering information in, and the information content of, the GEMR 100 with further reference to Figs. 6-12D. Note that Figs. 6-12D are just one set of examples of possible screens associated with the subscriber's GEMR 100 and it is to be understood that the present invention includes other similar screens which would occur to one of ordinary skill in the art. In the preferred embodiments, the Subscriber GEMR Home Page block 111 has its graphical user interface screen which is presented to the user on the displays 80 or 80', or on the displays 88 or 88' attached to the GEMR servers 55 or 55'. An example graphical user interface of the Subscriber GEMR Home Page block 111 is a screen with, at least, a text field identifying the network address of the Subscriber GEMR Home Page block 111 of the subscriber's GEMR 100, a text field identifying the screen as a the GEMR 100 for the subscriber and identifying the subscriber by name, a text field for registering the user by input, a text field for entering the subscriber password, a "Reset" text field or screen button for the user to reset or make corrections to their entered user registration information and for the user to reset or make corrections to the entered subscriber password in the subscriber password text field, and a "Submit" text field or screen button for the user to submit the entered subscriber password in the subscriber password text field for verification and validation before permitting the user to access the proprietary GEMR blocks 112-117, the links blocks 121-128, and the link blocks 131 and 132. All the above entries (inputs) for the graphical user interface of the Subscriber GEMR Home Page block 111, as well as for all entries (inputs) for graphical user interfaces described herein for any of the other proprietary GEMR blocks 112-117, whether by text entry (input) or by button selection, are made with an appropriate input device, for example, a keyboard, mouse, etc. as described above.

A example graphical user interface of the Subscriber GEMR Home Page block 111 having characteristics similar to what is described above is shown in Fig. 6. In the most preferred embodiment, the graphical user interface of the Subscriber GEMR Home Page block 111 is a Web home page for the Subscriber GEMR Home Page block 111 and the subscriber's GEMR 100 and the network address in the network address text field of the Subscriber GEMR Home Page block 111 is an Internet URL.

A screen similar to Fig. 7 is one possible example of the graphical user interface of the Personal Identifiers block 112 which could be first presented to the user after submitting the correct subscriber security password as a starting point in the subscriber's GEMR 100 from which access is provided to all of the proprietary GEMR blocks 112-117 and files/databases therein. Fig. 7 includes, at least, a text field identifying the network address of the Personal Identifiers block 112, at least one image field for a scanned and/or digitized photograph of the subscriber, a text field identifying the name, address, date of birth, telephone number(s), Social Security number, occupation, sex, height, weight, race, eye color, hair color, religion, scars or marks, and primary language (if not English) of the subscriber. In addition, a hot link text field as described above is included near the bottom of Fig 7. In the most preferred embodiment, the graphical user interface of the Personal Identifiers block 112 is a Web page and the network address in the network address text field of the Personal Identifiers block 112 within the GEMR 100 is a URL. Note that, upon subscription, the subscriber is requested to optionally submit his or her ID or passport-type photograph(s) to the GEMR company for scanning and/or digitizing and insertion into a portion (the image field) of the screen of the Personal Identifiers block 112 of the subscriber's GEMR 100 for viewing upon access to the GEMR 100 as generally indicated in Fig. 7.

Reference is now made to Fig. 8 which is a representation of a possible example screen for a graphical user interface of the Emergency Contacts block 113. Like blocks 111 and 112, the graphical user interface of the Emergency Contacts block 113 includes a text field identifying the network address of the

Emergency Contacts block 113 and a hot link text field as described above. Like Fig. 7, in Fig. 8, the hot link text block described above is also included near the bottom. The graphical user interface of the Emergency Contacts block 113 also includes a text field for identifying the names, addresses, relationships, and telephone number(s) of a person(s) to contact in case of emergency which is (are) entered (input) by the subscriber or an authorized technician. In the most preferred embodiment, the graphical user interface of the Emergency Contacts block 113 is a Web page and the network address in the network address text field of the Emergency Contacts block 113 within the GEMR 100 is a URL.

Fig. 9 is a representation of a possible example screen for a graphical user interface of the Personal Physicians & Dentist block 114. Like blocks 111-113, the graphical user interface of the Personal Physicians block 114 includes a text field identifying the network address of the Personal Physicians & Dentist block 114 and a hot link text field as described above. The graphical user interface of the Personal Physicians & Dentist block 114 also includes a text field for identifying the names, specialties, and telephone number(s) of the subscriber's personal physicians and dentist(s) which are entered (input) by the subscriber or an authorized technician. In the most preferred embodiment, the graphical user interface of the Personal Physicians & Dentist block 114 is a Web page and the network address in the network address text field of the Personal Physicians & Dentist block 114 within the GEMR 100 is a URL.

Fig. 10 represents a possible example screen for a graphical user interface of the Health Insurance block 115. Like blocks 111-114, the graphical user interface of the Health Insurance block 115 includes a text field identifying the network address of the Health Insurance block 115 and a hot link text field as described above. The graphical user interface of the Health Insurance block 115 also includes a text field for identifying the names, and telephone number(s) of the subscriber's health insurance company(ies), as well as the subscriber's health insurance policy or group numbers, which are entered (input) by the subscriber or an authorized technician. In the most preferred embodiment, the graphical user

interface of the Health Insurance block 115 is a Web page and the network address in the network address text field of the Health Insurance block 115 within the GEMR 100 is a URL.

A possible example screen for a graphical user interface of the Advance directives block 116 is represented in Fig. 11. Like blocks 111-115, the graphical user interface of the Advance directives block 116 includes a text field identifying the network address of the Advance Directives block 115 and a hot link text field as described above. The graphical user interface of the Advance Directives block 116 also includes a text field for identifying the names, relationships, and telephone number(s) of a person(s) to contact for information on the subscriber's Living Will, for information about the subscriber's Durable Power of Attorney for Health Care, for information about the subscriber's Organ Donation Directives, and for any medical information that the subscriber does not wish to disclose in the Medical Information block 117 of his or her GEMR 110. All of the information content in the graphical user interface's text fields of the Advance Directives block 116 is entered (input) by the subscriber or an authorized technician. In the most preferred embodiment, the graphical user interface of the Advance Directives block 116 is a Web page and the network address in the network address text field of the Advance Directives block 116 within the GEMR 100 is a URL.

Figs. 12A-12D represent possible example screens for a graphical user interface of the Medical Information block 117. Note that in certain embodiments in accordance with the present invention, the screens shown in Figs. 12A-12D comprise one page of information retrieved by a query to the GEMR 100 which, because of the size of the page, require the user to scroll down or up between the screen to view all of the information contained in the screens as would be understood by one of ordinary skill in the art. In other embodiments, hot links are provided to jump between portions of these screens, while in still other embodiments, a combination of scrolling and hot links are provided for (as in, for example, the most preferred embodiment). In yet other embodiments, each of the

medical information screens comprise multiple pages of information rather than one page with scrolling capability and/or hot links therebetween, as above.

Like blocks 111-116, the graphical user interface of the Medical Information block 117 includes a text field identifying the network address of the Medical Information block 117 and a hot link text field as described above is present at the bottom of each screen. The graphical user interface of the Medical Information block 117 also includes text fields for identifying the health status, blood type and current medical conditions (like Fig. 12A);current medications, allergies and immunizations record (like Fig. 12B); and hospitalizations, pregnancies and special needs (like Fig. 12C) of the subscriber within the GEMR 100, all of which are entered (input) by the subscriber or an authorized technician. An example text field for health status, as indicated in Fig. 12A, includes, at least, text subfields for user-selectible for "Excellent," "Good," "Fair," "and "Poor." The text field for blood type includes, at least, text subfields user selectible for A+, A-, B+, B-, AB+, AB-, O+, O-, and Don't Know. The text field for Current Medical Conditions includes, at least, text subfields for Heart & Circulation, Metabolic, Blood, Eyes & Ears, Intestine, Liver & Spleen, Respiratory, Kidney, Neuromuscular conditions, and Other Conditions of the subscriber. As an example, the text subfield for Heart & Circulation includes user-selectible text subfields for Abnormal EKG, Angina, Cardia Dysrhythmia, Collagen-Vascular Disease, Congenital Heart Disease, Congestive Heart Failure, Coronary Bypass Graft, Heart Valve Prosthesis, Heart Transplant, Hypertension, Hypertrophic Cardiomyopathy, Mitral Valve Prolapse, Pacemaker, and Situs Inversus. Similarly, the text subfields for Metabolic through Neuromuscular contain further subfields to indicate the Current Medical Condition of the subscriber.

An example text field for Current Medications, as indicated in Fig. 12B includes, at least, text subfields for None, and Trade or Generic Name, Dose, and How Often taken. Likewise, the text field for Allergies includes, at least, text subfields for None, Drug, Food, Insect, Vaccine, and Usual Reactions. Moreover,

the text field for Immunizations includes, at least, text subfields for various diseases and dates of immunizations as represented in Fig. 12B.

In addition, an example text field for Hospitalizations, as indicated in Fig. 12C, includes, at least, text subfields for Condition, Date, Hospital, Hospital Telephone Number, Doctor, Doctor telephone Number. Similarly, text subfields are included for the Pregnancies text field and the Special Needs text fields, as represented in Fig. 12C. Note that the screens shown in Figs. 12A-12C are merely examples and variations of the medical and contact information text fields provided in the GEMR 100, and the arrangement, updating, inclusion, or lack of inclusion, of certain similar text fields as would occur to one of ordinary skill in the art are included within the scope of the present invention.

Finally, as discussed above, for the retrieval of subscriber additional medical information, when a user of the system 10 or 10' wishes to retrieve the information corresponding to the link blocks 121-128, a request (a query) is made by the user selecting from a user-selectible input field presented to the user. Fig. 12D generally depicts the example representation of such an input field in the form of user-selectible screen regions (on displays 80 or 80', or the displays 88 or 88' associated with the GEMR servers 55 or 55') which are responsive to selection by an input device. The example screen of Fig. 12D includes, at least, a text field for Additional Medical Information and user-selectible text fields or screen buttons to select and retrieve Hospital Discharge Summaries through Medical Internet Links, as described above. Once selection is made from amongst the choices in the user-selectible field, the queried information is provided from files/databases stored in the GEMR servers 55 or 55', or it is available for hard copy output to the user via a peripheral (e.g., printer) device. In the most preferred embodiment, the graphical user interface of the Medical Information block 117 is a Web page or pages with possible screens like Figs 12A-12D, and the network address in the network address text field of the Medical Information block 117 within the GEMR 100 is a URL.

Consideration is now given to methods for accessing a subscriber's GEMR 100 of the present invention. Reference is now made to Fig. 4 which is a flow chart representation of steps of a method 300 of reviewing and updating the GEMR 100 in accordance with the preferred, more preferred, and most preferred embodiments of the present invention. Reviewing and updating the GEMR 100 for a particular subscriber can occur for any of various reasons, including, but not limited to, emergency situations in which an authorized physician or healthcare worker is treating an injured or sick subscriber and may need vital medical information that may help with the treatment of the subscriber. This could occur, for example, while the subscriber is away from home traveling. Also, review and update could occur if the subscriber wanted to replace old information in his or her GEMR 100 with new information, for example, new medical test results or address changes, and the like, or if the system 10 was converted to system 10' with the addition of newly linked institutional server(s) 75' or other medical server(s) or network sites 95'. In this case, the subscriber may want to add a link corresponding to one of the link blocks 121-128, for example, by specifying a network address to one of the institutional server(s) 75' for additional personal medical records. The new link (address) would be stored in the storage unit 65' of the GEMR server 55', respectively. Recall that the link blocks 121-128 are already provided for, or, at least, the capability to create them is already provided for, in the GEMR 100 (software), whether or not actual patient information is available to retrieve or store. Storage space is available in the storage units 65' to store the links/addresses for the link blocks 121-128 once these addresses/links, and the information to which they pertain, become available for retrieval, whereupon a user may supply these links/addresses to the GEMR 100 and the GEMR server 55'. Note that for both system 10 (GEMR server 55) and system 10' (GEMR server 55') these links/addresses may be for personal medical data/information to be stored in, and accessed from, the respective storage units 65 and 65' in some embodiments (described above) rather than from the institutional server(s) 75'.

Returning again to Fig. 4, in step 302, the user (the subscriber, or an authorized physician, healthcare worker, or technician) begins to access the subscriber's GEMR 100 at either the PC 15 (system 10) or the PC 15' (system 10') to connect to the GEMR server 55 (system 10) or the GEMR server 55', respectively. Alternatively, the user begins to access the subscriber's GEMR 100 at the GEMR servers 55 or 55' directly. In step 304 the user enters the subscriber's network address on the PCs 15 or 15' (or on the GEMR servers 55 or 55') in order to access the subscriber's GEMR 100 by first accessing the Subscriber GEMR Home Page block 111. Recall that in order to access the GEMR 100 via the Subscriber GEMR Home Page block 111, the subscriber must be a valid subscriber, his or her GEMR 100 must already exist, and the user must have the subscriber's valid security password. Also, recall that in the most preferred embodiment, the GEMR servers 55, 55' are Web servers and each subscriber's GEMR 100 has a URL address on the Internet.

Once the Subscriber GEMR Home Page block 111 belonging to the subscriber is accessed, the user is prompted in step 306 to register his or her information, including the user's name and address (see Fig. 6) on-line on the graphical user interface of the Subscriber GEMR Home Page block 111 belonging to the subscriber. Once the user completely registers by supplying all the information requested (i.e., inputs all the information in the initially blank text field block under "Please register" in the center region of a screen corresponding to Fig. 6) via, for example, a keyboard or another appropriate input device (described above) attached to the PC 15, then in step 308, the user enters the subscriber's security password in the password field of the graphical user interface of the Subscriber GEMR Home Page block 111 belonging to the subscriber. From the graphical user interface of the Subscriber GEMR Home Page block 111 belonging to the subscriber, the only way to gain access to the proprietary portions of the subscriber's GEMR 100 (i.e., proprietary GEMR blocks 112-117 and link blocks 121-128) is by supplying all registration information and entering a valid subscriber security password associated with the Subscriber GEMR Home Page block 111

belonging to the subscriber. If the password is invalid as determined in step 310, then flow proceeds back to step 308 to allow the user to re-enter the valid password. If in step 310, it has been determined that the valid password has been entered, then flow continues to step 312 in which the subscriber's medical information may be reviewed and/or updated, or new subscriber medical information, or links (to files/databases or network addresses) thereto, may be entered and stored in the subscriber's GEMR 100 as previously described.

Note that the GEMR 100 provides complete and accurate personal health information of individual domestic and international travelers, and, as briefly discussed above, of those individuals who are unable to provide an accurate medical history or are unable to communicate their current medical needs. This includes, but is not limited to, persons who are infants, children, mentally impaired, speech impaired, hearing impaired, senile, and foreigners who do not speak the language of their host country. For these people, who may be unable to communicate their identity, the GEMR 100 is also a personal identifier and emergency contact identifier. Therefore, there are particular embodiments of the GEMR 100 in accordance with the present invention in which the password requirement to access the proprietary portions and other portions of the GEMR 100 (i.e., the blocks 112-117, blocks 121-128, and blocks 131 and 132) are nullified. An example of such an embodiment is one for which the network address is a particular type of network address which is recognized as identifying a GEMR 100 for these people. In other embodiments, only access to the Personal Identifiers block 112 and the Emergency Contacts block 113 of the GEMR 100 is provided with the password requirement being nullified. Alternatively, in some embodiments, only personal identification and emergency contacts information are entered in the GEMR 100 (i.e., associated with Personal Identifiers block 112 and the Emergency Contacts block 113) and the password requirement is nullified, and as such, these embodiments would render the GEMR 100 (i.e., like the systems 10 and 10') as a global electronic identification system. Note that for these

subscribers, an adult or guardian would enter a subscription to the GEMR to create a GEMR 100 on their behalf.

It is intended that the scope of the present invention also include various other embodiments. Accordingly, it should be understood that the each of the embodiments disclosed herein, including the preferred, more preferred, and most preferred embodiments, includes features and characteristics which are considered independently inventive. Thus, the disclosure of variations and alterations of these preferred embodiments are intended only to reflect on the breadth of the scope of the present invention without suggesting that any of the specific features and characteristics of these preferred embodiments are more obvious or less important.

Regarding specific application of the many inventive aspects of the present invention, a variety of environmental and economic considerations are understood to contribute to the alteration or omission of selected inventive aspects. For example, in certain applications of the present invention, it may be more desirable or cost effective to use the system 10 of the preferred embodiment to cover the subscriber's most basic medical needs for an authorized attending physician or healthcare worker rather than the system 10' of the more preferred or most preferred embodiments.

While the embodiments of the present invention which have been disclosed herein are the preferred forms, other embodiments of the present invention will suggest themselves to persons skilled in the art in view of this disclosure. Therefore, it will be understood that variations and modifications can be effected within the spirit and scope of the present invention and that the scope of the present invention should only be limited by the claims below. Furthermore, the corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims below are intended to include any structure, material, or acts for performing the functions in combination with other claimed elements as specifically claimed.

What is claimed is:

1. A global electronic medical record system, comprising:

a network, including

a network service provider server,

a global electronic medical record server having a storage unit and a secure global electronic medical record stored in the storage unit, the secure global electronic medical record identifiable by a network address and having an associated security code, and

a communications network coupled to the network service provider server and the global electronic medical record server;

an emblem having the network address for the secure global electronic medical record inscribed thereon; and

a computer coupled to the network,

wherein said computer, the network service provider server, the communications network, and the global electronic medical record server provide a path to access the secure global electronic medical record in the global electronic medical record server upon input of the network address from said emblem and the security code to said computer.

2. The system of claim 1, wherein said network further includes institutional servers and other medical servers coupled to the communications network.

3. The system of claim 1, wherein said emblem is one of a wrist emblem, a neck emblem, and a card.

4. The system of claim 1, wherein said network is the World-Wide Web.

5. The system of claim 1, wherein said network is the Internet.

6. The system of claim 1, wherein the network address is a Uniform Resource Locator.

7. The system of claim 1, wherein said network service provider is an Internet service provider.

8. The system as claimed in claim 1, wherein the secure global electronic medical record includes text and image information.

9. The system as claimed in claim 1, wherein the secure global electronic medical record includes audio information.

10. The system of claim 1, wherein the secure global electronic medical record is created by, and updatable by, a subscriber.

11. A global electronic medical record stored in a server for implementation on a network, comprising:

a main files object including

a home page block, and

a first plurality of proprietary personal and medical information blocks, wherein the home page block is linked to the first plurality of proprietary personal and medical information blocks and each block of the first plurality of

personal and medical information blocks are linked to other blocks of the first plurality of personal and medical information blocks; and

an additional files/links institutional object including a second plurality of personal and medical information blocks, wherein each of the second plurality of personal and medical information blocks of the additional files/links institutional object are linked to said main files object.

12. The record of claim 11, further comprising a medical file/network site object including a plurality of medical information blocks linked to said main files object.

13. A method of creating a global electronic medical record for a subscriber in a global electronic medical record system, said method comprising steps of:

viewing information on the global electronic medical system while connected on-line to the system;

filling out and submitting an application form to subscribe to the global electronic medical record system;

creating the global electronic medical record from the application form;

storing the global electronic medical record in the global electronic medical record system; and

sending an emblem to the subscriber with a network address inscribed thereon for identifying a location for the global electronic medical record.

14. The method as claimed in claim 13, wherein said creating step includes entering subscriber medical information into the global electronic medical record.

15. The method as claimed in claim 13, further comprising a step of electronically paying for subscription to the global electronic medical record.

16. The method as claimed in claim 13, wherein said creating step includes a step of entering personal medical information into the global electronic medical record necessary useful for medical treatment of the subscriber.

17. The method as claimed in claim 13, wherein said creating step includes a step of creating the global electronic medical record through a plurality of linked blocks.

18. The method as claimed in claim 13, wherein said creating step includes a step of creating the global electronic medical record in a plurality of graphical user interfaces linked through hypertext links.

19. A method of accessing a subscriber's global electronic medical record in a global electronic medical record system by a user, the method comprising steps of:

begin accessing the subscriber's global electronic medical record on a computer;

entering a network address for the subscriber's global electronic medical record on the computer;

registering the user in the subscriber's global electronic medical record; and

entering a security password, which only in combination with the network address entered in said entering a network address step, will allow access to proprietary portions of the global electronic medical record.

20. The method of claim 19, further comprising a step of reviewing medical information in the subscriber's global electronic medical record.

21. The method of claim 19, further comprising a step of entering new medical information in the subscriber's global electronic medical record.

22. The method of claim 19, further comprising a step of updating medical information in the subscriber's global electronic medical record.

23. The method of claim 19, further comprising a step of viewing a network home page for the subscriber's global electronic medical record upon entering the network address.

24. The method as claimed in claim 19, further comprising a step of accessing proprietary portions of the subscriber's global electronic medical record through hyperlinks amongst the proprietary portions.

25. The method as claimed in claim 19, wherein said entering a network address step includes a step of entering a World-Wide Web address for the subscriber's global electronic medical record.

26. A method of accessing a global electronic medical record of a subscriber in a global electronic medical record system on the Internet, said method comprising steps of:

accessing a home page of the global electronic medical record through an Internet service provider by entering an Internet address for the global electronic medical record on a computer coupled to the Internet service provider; and

providing to the global electronic medical record system, through an input field on the home page, a security code recognizable to the global electronic medical record system and associated with the global electronic medical record, which, only in conjunction with the Internet address of the global electronic medical record, allows access to the proprietary portions of the global electronic medical record.

27. The method as claimed in claim 26, further comprising a step of retrieving information from the global electronic medical record at the computer.

28. The method as claimed in claim 26, further comprising a step of retrieving information from the global electronic medical record at the computer using hypertext links in the proprietary portions.

29. A global electronic medical record system used for identification of a subscriber, comprising:

a network, including

a network service provider server,

a global electronic medical record server having a storage unit and an identification portion of a global electronic medical record identifying the subscriber stored in the storage unit, the global electronic medical record identifiable by a network address, and

a communications network coupled to the network service provider server and the global electronic medical record server;

an emblem having the network address for the global electronic medical record inscribed thereon; and

a computer coupled to the network,

wherein said computer, the network service provider server, the communications network, and the global electronic medical record server provide a path to access the identification portion of the global electronic medical record identifying the subscriber in the global electronic medical record server upon input of the network address from said emblem to said computer.

30. The system of claim 29, wherein the global electronic medical record server has an emergency contacts portion identifying emergency contacts for the subscriber stored in the storage unit.

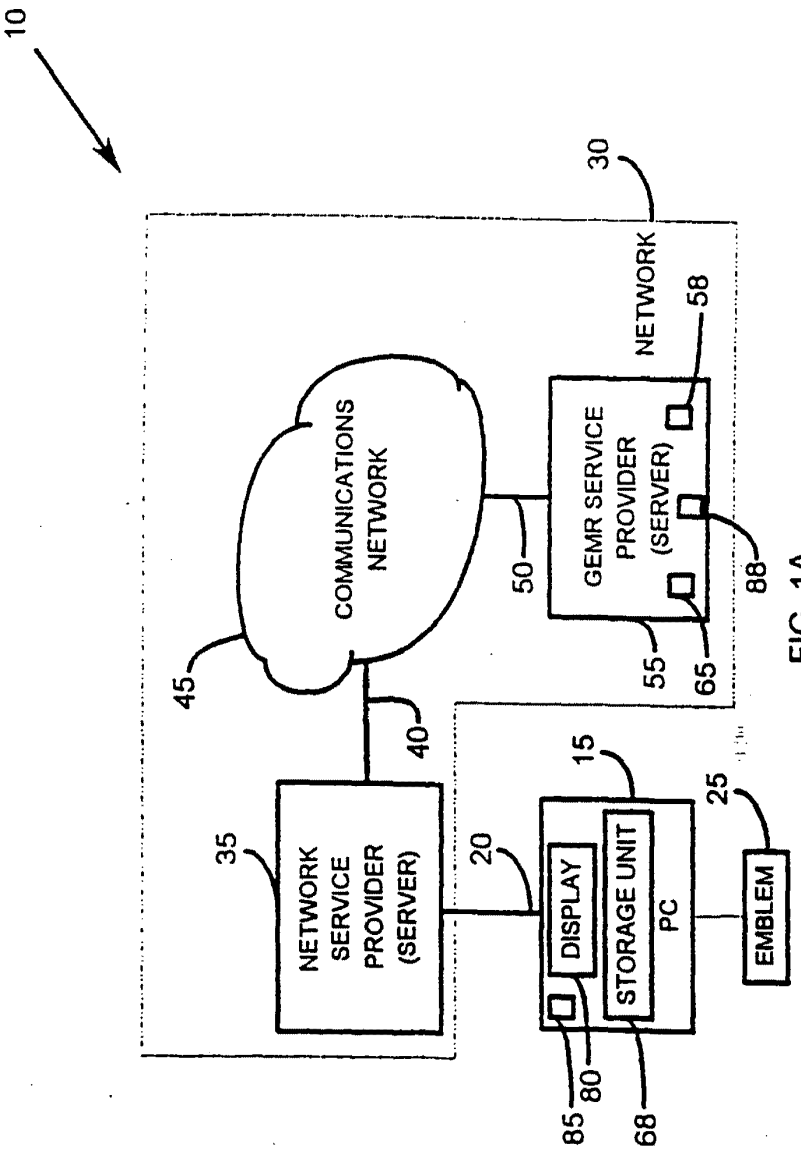

10
30
NETWORK
58
COMMUNICATIONS NETWORK
GEMR SERVICE PROVIDER (SERVER)
50
88
55
65
45
40
15
25
35
NETWORK SERVICE PROVIDER (SERVER)
20
DISPLAY
STORAGE UNIT
PC
EMBLEM
85
80
68

FIG. 1A

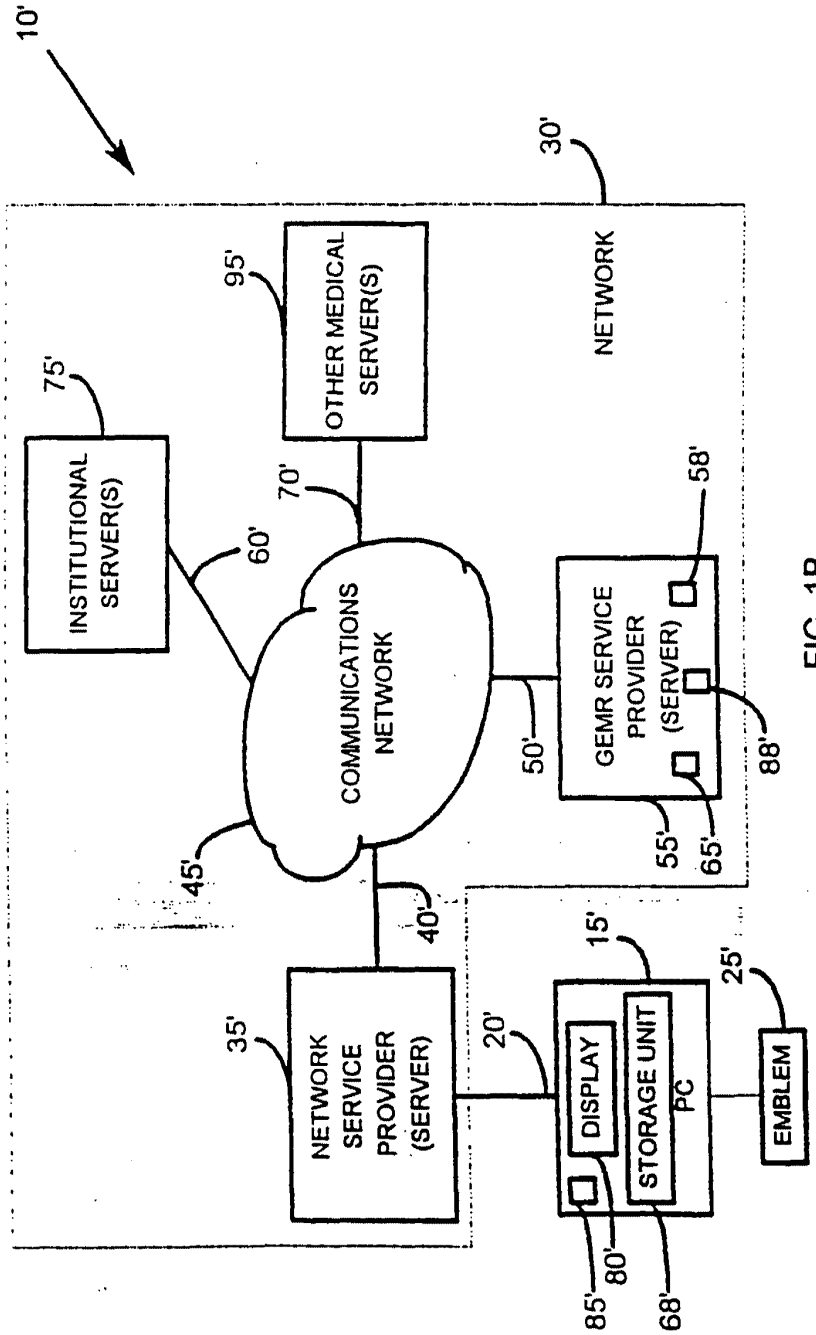

10'
30'
NETWORK
95'
OTHER MEDICAL SERVER(S)
75'
INSTITUTIONAL SERVER(S)
70'
60'
COMMUNICATIONS NETWORK
58'
GEMR SERVICE PROVIDER (SERVER)
50'
88'
55'
65'
45'
40'
35'
NETWORK SERVICE PROVIDER (SERVER)
20'
15'
DISPLAY
STORAGE UNIT
PC
25'
EMBLEM
85'
80'
68'

FIG. 1B

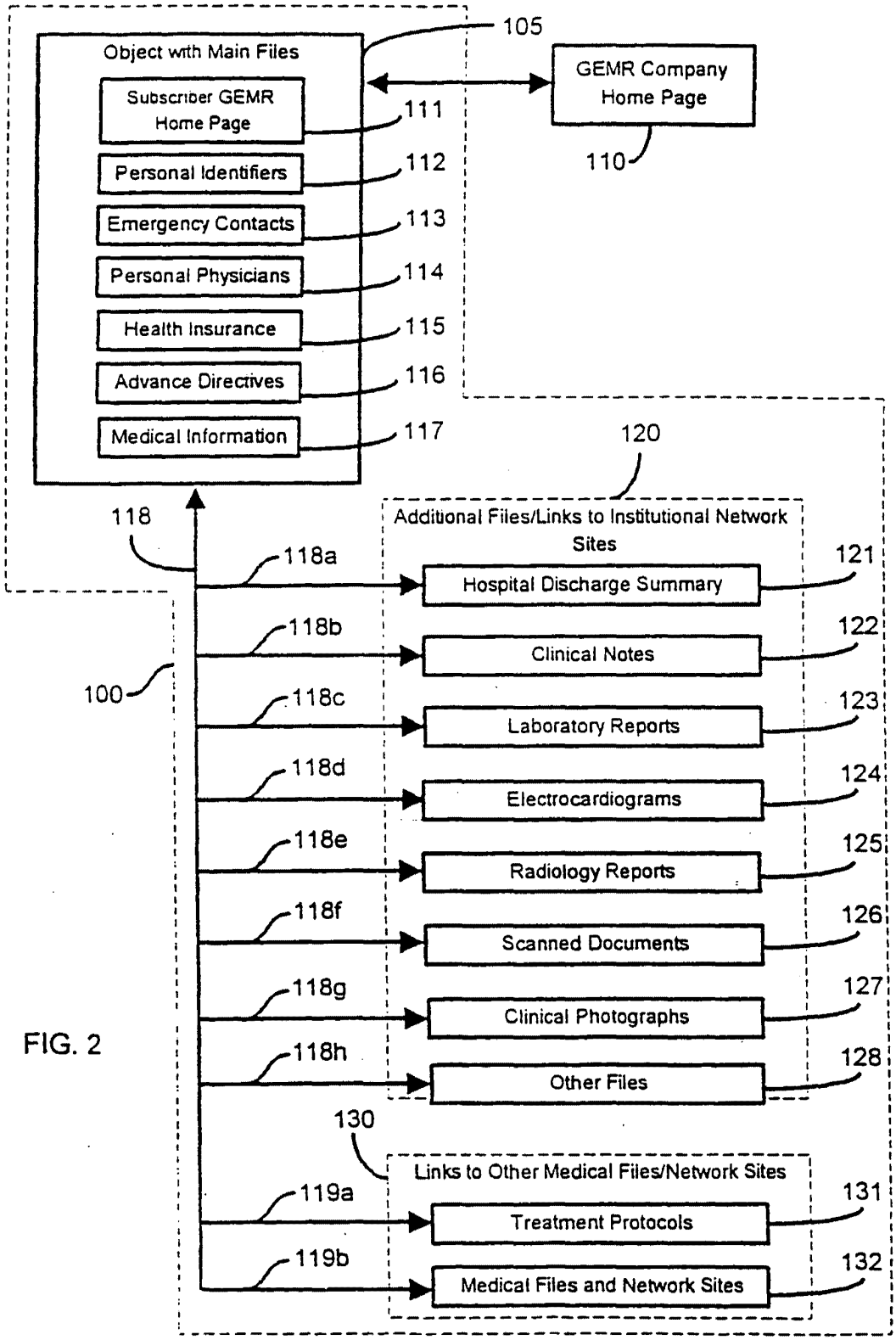

105
Object with Main Files
Subscriber GEMR Home Page
111
Personal Identifiers
112
Emergency Contacts
113
Personal Physicians
114
Health Insurance
115
Advance Directives
116
Medical Information
117
GEMR Company Home Page
110
120
Additional Files/Links to Institutional Network Sites
118
118a
Hospital Discharge Summary
121
118b
Clinical Notes
122
100
118c
Laboratory Reports
123
118d
Electrocardiograms
124
118e
Radiology Reports
125
118f
Scanned Documents
126
118g
Clinical Photographs
127
118h
Other Files
128
130
Links to Other Medical Files/Network Sites
119a
Treatment Protocols
131
119b
Medical Files and Network Sites
132

FIG. 2

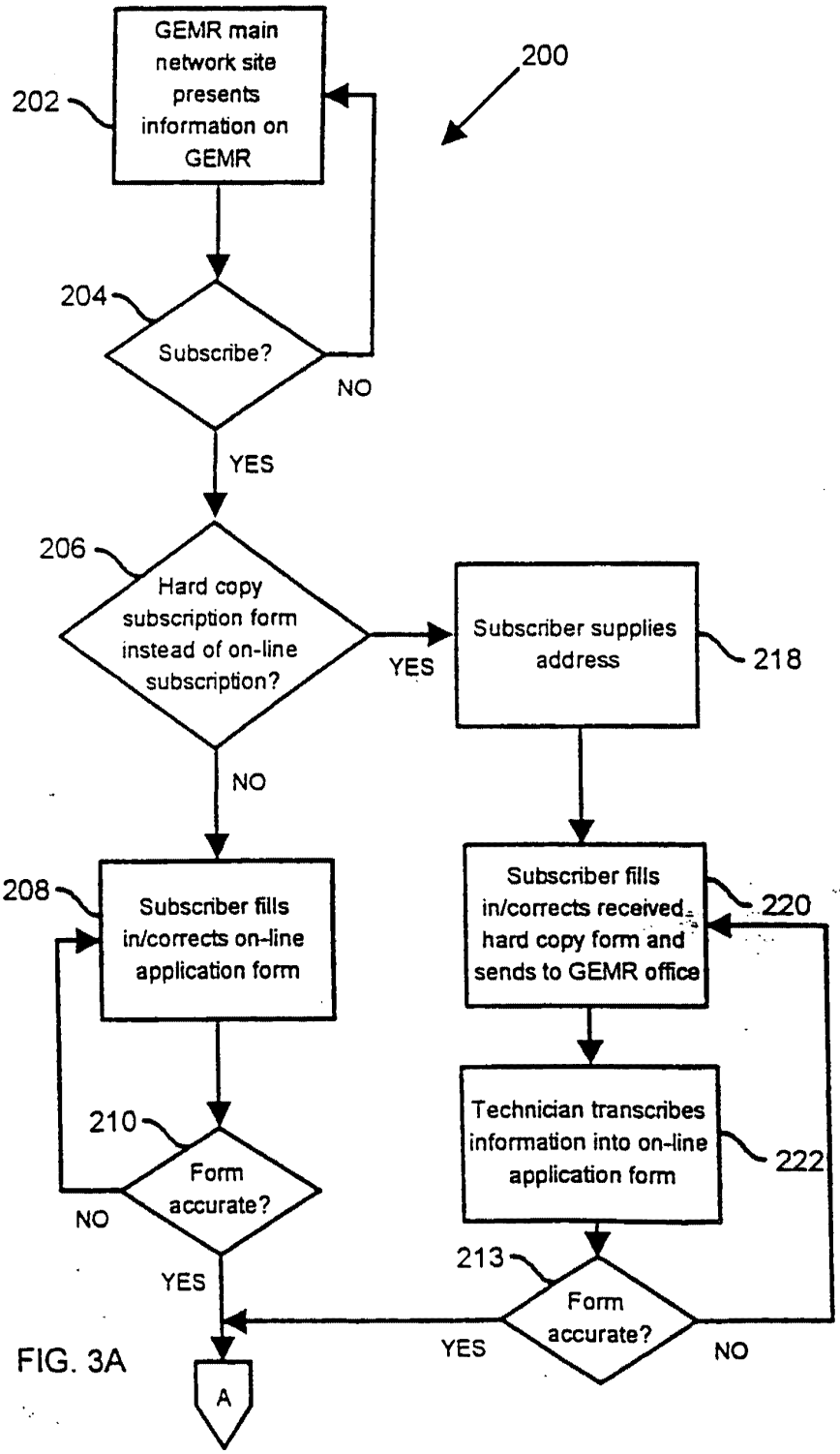

GEMR main network site presents information on GEMR
202
200
204
Subscribe?
NO
YES
206
Hard copy subscription form instead of on-line subscription?
YES
Subscriber supplies address
218
NO
208
Subscriber fills in/corrects on-line application form
Subscriber fills in/corrects received hard copy form and sends to GEMR office
220
210
Form accurate?
NO
YES
Technician transcribes information into on-line application form
222
213
Form accurate?
YES
NO
A

FIG. 3A

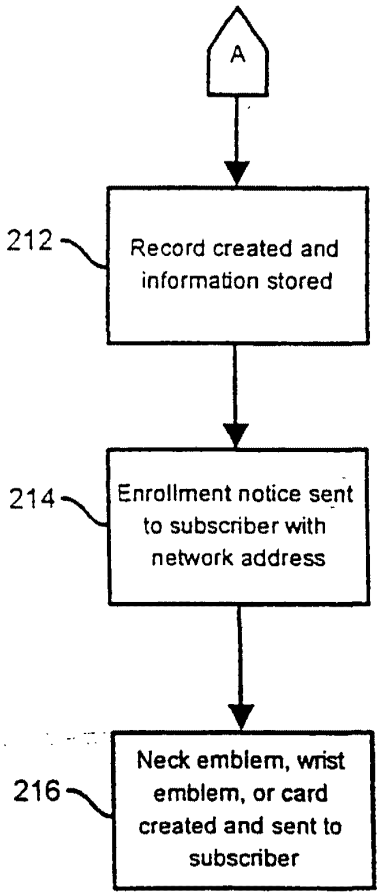

A
212
Record created and information stored
214
Enrollment notice sent to subscriber with network address
216
Neck emblem, wrist emblem, or card created and sent to subscriber

FIG. 3B

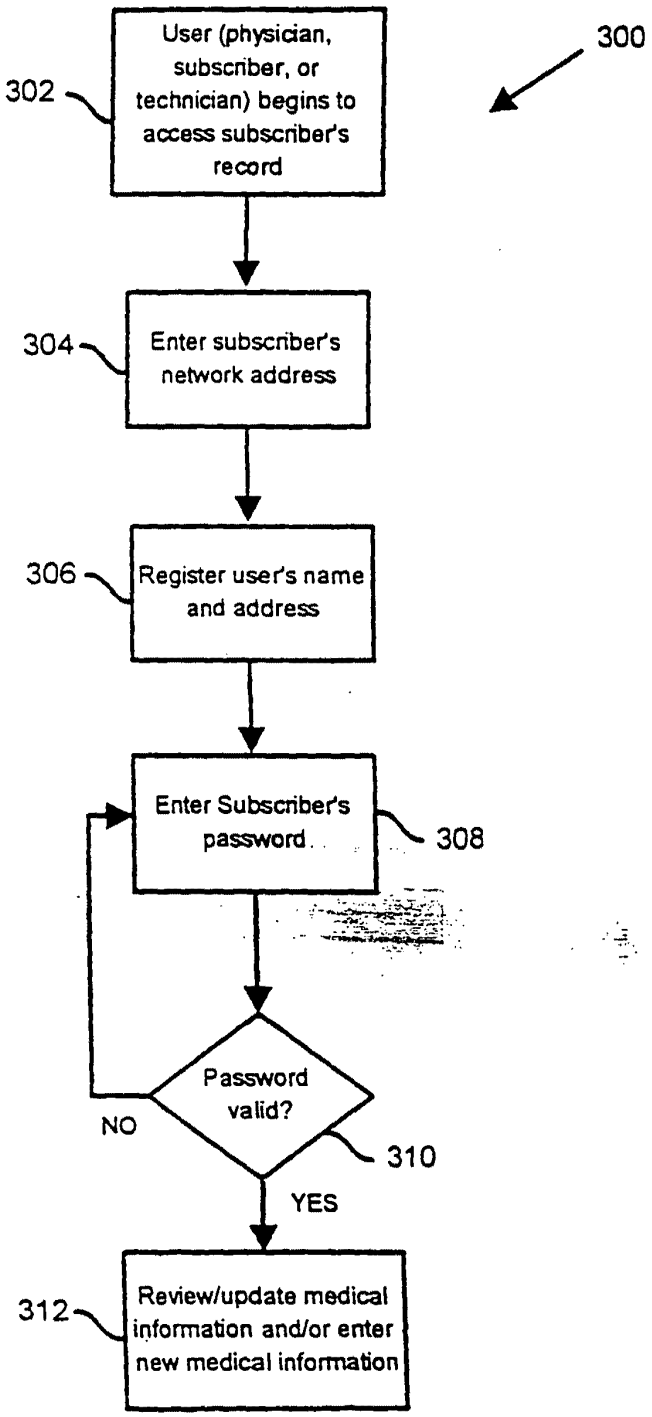

300
User (physician, subscriber, or technician) begins to access subscriber's record
302
Enter subscriber's network address
304
Register user's name and address
306
Enter Subscriber's password
308
Password valid?
NO
310
YES
Review/update medical information and/or enter new medical information
312

FIG. 4

This is the

HOME PAGE

of the

GLOBAL ELECTRONIC MEDICAL RECORD COMPANY

This section will present:

What You Need to Know About GEMR

Contact Information

Testimonials

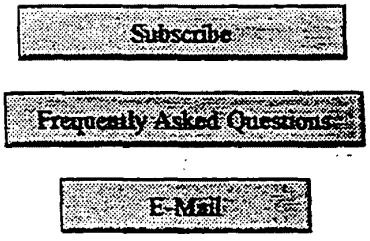


Figure 5

GEMR Home Page http://www.gemr.com/johndoesalias/homepage.html

This is

John Doe's

GLOBAL ELECTRONIC MEDICAL RECORD

Please register

Last Name

First Name

Address

City

State/Province

Country

Please enter password

Attention Attending Physician: In case the Subscriber is too ill to provide the password, it should have been written on the Subscriber's Membership Card.
Attention Subscriber: Keep your Membership Card with you at all times.

Submit

Reset

Record Last Updated - Date

Figure 6

PERSONAL IDENTIFIERS

Last Name_____

First Name_____

Middle Name_____

Date of Birth_____

Street Address_____

City_____

State_____

Zip_____

Home Tel. No._____

Social Security No._____

Work Tel. No._____

Occupation_____

Front-view photograph

Side-view photograph

Sex ☐M ☐F **Height**____ft.____in. **Weight**_____**lbs.**

Race_____ **Eye Color**_____ **Hair Color**_____

Religion_____

Identifying Scars or Marks_____

_____

Primary Language_____

Personal Identifiers Emergency Contacts Personal Physicians
Health Insurance Advance Directives Medical Information Text Editor Search Exit
Find Out More About Global Electronic Medical Records

Figure 7

EMERGENCY CONTACTS

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Personal Identifiers Emergency Contacts Personal Physicians
Health Insurance Advance Directives Medical Information Text Editor Search Exit
Find Out More About Global Electronic Medical Records

Figure 8

PERSONAL PHYSICIANS & DENTIST

Physician's Name_____

Specialty_____ **Tel No.**_____

Physician's Name_____

Specialty_____ **Tel No.**_____

Physician's Name_____

Specialty_____ **Tel No.**_____

Dentist's Name_____

Specialty_____ **Tel No.**_____

Personal Identifiers Emergency Contacts Personal Physicians
Health Insurance Advance Directives Medical Information Text Editor Search Exit
Find Out More About Global Electronic Medical Records

Figure 9

HEALTH INSURANCE

Primary Insurance Company_____

Policy or Group No. _____

I.D. No._____ **Insurance Company Tel No.**_____

Secondary Insurance Company_____

Policy or Group No. _____

I.D. No._____ **Insurance Company Tel No.**_____

Personal Identifiers Emergency Contacts Personal Physicians
Health Insurance Advance Directives Medical Information Text Editor Search Exit
Find Out More About Global Electronic Medical Records

Figure 10

ADVANCE DIRECTIVES

Person(s) to contact for information about your Living Will:

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Person(s) to contact for information about your Durable Power of Attorney for Health Care:

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Person(s) to contact for information about your Organ Donation Directives:

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Person(s) to contact for any medical information that you do not wish to disclose in the following section:

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Name_____ **Relationship**_____

Home Tel No._____ **Work Tel No.**_____

Personal Identifiers Emergency Contacts Personal Physicians
Health Insurance Advance Directives Medical Information Text Editor Search Exit
Find Out More About Global Electronic Medical Records

Figure 11

GEMR Medical Information http://www.gemr.com/johndoesalias/medinfo.html

MEDICAL INFORMATION

GENERAL HEALTH STATUS

☐ Excellent ☐ Good ☐ Fair ☐ Poor

BLOOD TYPE

☐ A+ ☐ A- ☐ B+ ☐ B- ☐ AB+ ☐ AB- ☐ O+ ☐ O- ☐ Don't Know

CURRENT MEDICAL CONDITIONS **None ☐**

Heart & Circulation
- ☐ Abnormal EKG
- ☐ Angina
- ☐ Cardia Dysrhythmia
- ☐ Collagen-Vascular Disease
- ☐ Congenital Heart Disease
- ☐ Congestive Heart Failure
- ☐ Coronary Bypass Graft
- ☐ Heart Valve Prosthesis
- ☐ Heart Transplant
- ☐ Hypertension
- ☐ Hypertrophic Cardiomyopathy
- ☐ Mitral Valve Prolapse
- ☐ Pacemaker
- ☐ Situs Inversus

Metabolic
- ☐ Adrenal Insufficiency
- ☐ Diabetes/Insulin Dependent
- ☐ Diabetes/Non-Insulin Dependent
- ☐ Hyperthyroidism
- ☐ Hypoglycemia
- ☐ Hypothyroidism
- ☐ Malignant Hyperthermia

Blood
- ☐ Bleeding Disorder
- ☐ Clotting Disorder
- ☐ Hemolytic Anemia
- ☐ HIV Positive
- ☐ Leukemia
- ☐ Lymphomas
- ☐ Sickle Cell Anemia

Eyes & Ears
- ☐ Cataracts
- ☐ Eye Surgery
- ☐ Glaucoma
- ☐ Hearing Impaired
- ☐ Vision Impaired

Intestine, Liver & Spleen
- ☐ Cirrhosis
- ☐ Inflammatory Bowel Disease
- ☐ Liver Transplant
- ☐ Splenectomy

Respiratory
- ☐ Asthma
- ☐ Laryngectomy

Kidney
- ☐ Hemodialysis
- ☐ Kidney Transplant

Neuromuscular
- ☐ Alzheimer's
- ☐ Memory Impaired
- ☐ Myasthenia Gravia
- ☐ Neurosis
- ☐ Psychosis
- ☐ Seizure Disorder
- ☐ Speech Impaired
- ☐ Stroke

Other Conditions: _____

_____

_____

Personal Identifiers Emergency Contacts Personal Physicians
Health Insurance Advance Directives Medical Information Text Editor Search Exit
Find Out More About Global Electronic Medical Records

Figure 12A

GEMR Medical Information http://www.gemr.com/johndoesalias/medinfo.html

CURRENT MEDICATIONS None ☐

Trade name_____ Generic name_____

Dose_____ How Often_____

Trade name_____ Generic name_____

Dose_____ How Often_____

Trade name_____ Generic name_____

Dose_____ How Often_____

Trade name_____ Generic name_____

Dose_____ How Often_____

ALLERGIES None ☐

Drug_____ Usual Reaction_____

Food_____ Usual Reaction_____

Insect_____ Usual Reaction_____

Vaccine_____ Usual Reaction_____

IMMUNIZATIONS:

☐ Cholera Date_____
☐ Hepatitis A Date_____
☐ Hepatitis B Date_____
☐ Influenza Date_____
☐ Japanese Encephalitis Date_____
☐ Measles, Mumps, Rubella Date_____
☐ Meningococcal Meningitis Date_____
☐ Plague Date_____
☐ Pneumococcal Pneumonia Date_____
☐ Poliomyelitis Date_____
☐ Rabies Date_____
☐ Tetanus/Diptheria Date_____
☐ Typhoid Date_____
☐ Yellow Fever Date_____

Other (specify) _____

Personal Identifiers Emergency Contacts Personal Physicians
Health Insurance Advance Directives Medical Information Text Editor Search Exit
Find Out More About Global Electronic Medical Records

Figure 12B

GEMR Medical Information http://www.gemr.com/jonndoesalias/medinfo.html

HOSPITALIZATIONS None ☐

Condition_____ Date_____

Hospital_____ Tel No._____

Doctor_____ Tel No._____

Condition_____ Date_____

Hospital_____ Tel No._____

Doctor_____ Tel No._____

PREGNANCIES None ☐

Expected Delivery Date_____ No. of Prior Pregnancies___ No. of Prior Deliveries____

Prior Complications (if any)_____

Obstetrician's Name_____ Tel No._____

SPECIAL NEEDS None ☐

☐ Christian Scientist
☐ Contact Lens Prescription (enter below)
☐ Drug or Alcohol Dependency
☐ Eye Glasses Prescription (enter below)
☐ Jehovah's Witness
☐ Language Problem
☐ Prostheses (specify below)

☐ Special Diet
☐ Lactase Deficient
☐ Low Salt
☐ Low Sugar
☐ Kosher
☐ Vegetarian

Details:_____

_____

_____

Personal Identifiers Emergency Contacts Personal Physicians
Health Insurance Advance Directives Medical Information Text Editor Search Exit
Find Out More About Global Electronic Medical Records

Figure 12C

ADDITIONAL MEDICAL INFORMATION

Hospital Discharge Summary

Clinical Notes

Laboratory Reports

Electrocardiogram

Radiology Reports

Scanned Documents

Clinical Photographs

Other Files

Treatment Protocols

Medical Internet Links

Figure 12D

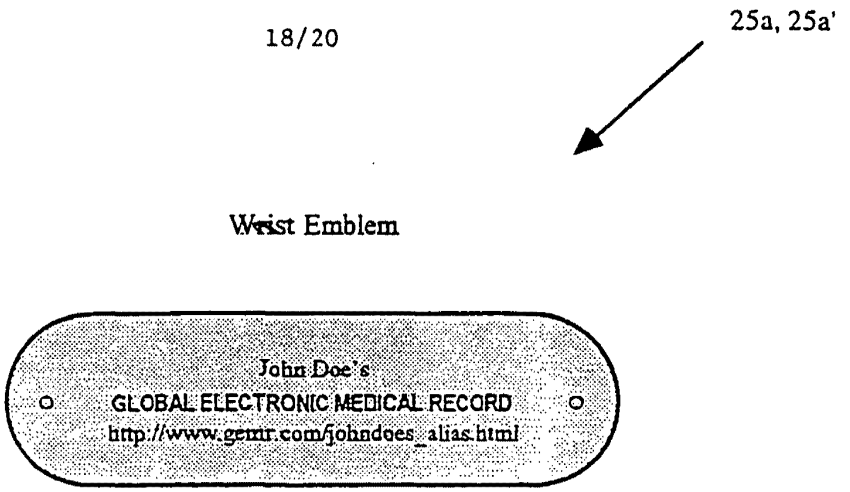

25a, 25a'
Wrist Emblem
John Doe's
GLOBAL ELECTRONIC MEDICAL RECORD
http://www.gemr.com/johndoes_alias.html

Figure 13A

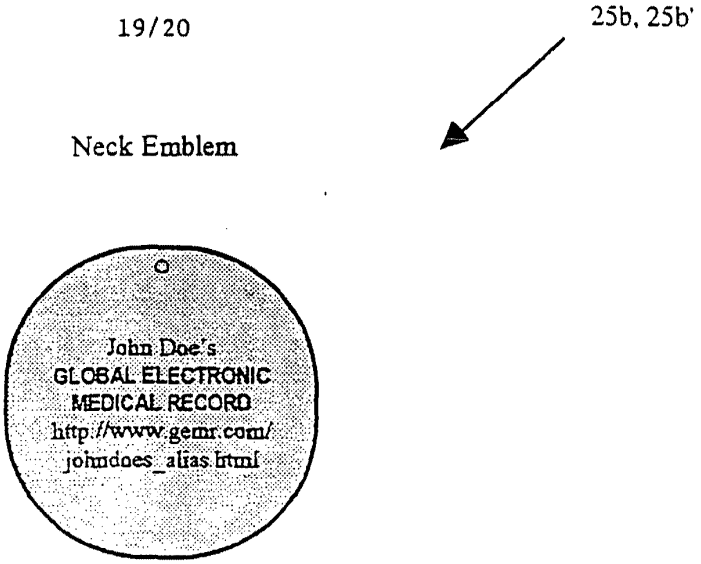

25b, 25b'
Neck Emblem
John Doe's
GLOBAL ELECTRONIC
MEDICAL RECORD
http://www.gemr.com/
johndoes_alias.html

Figure 13B

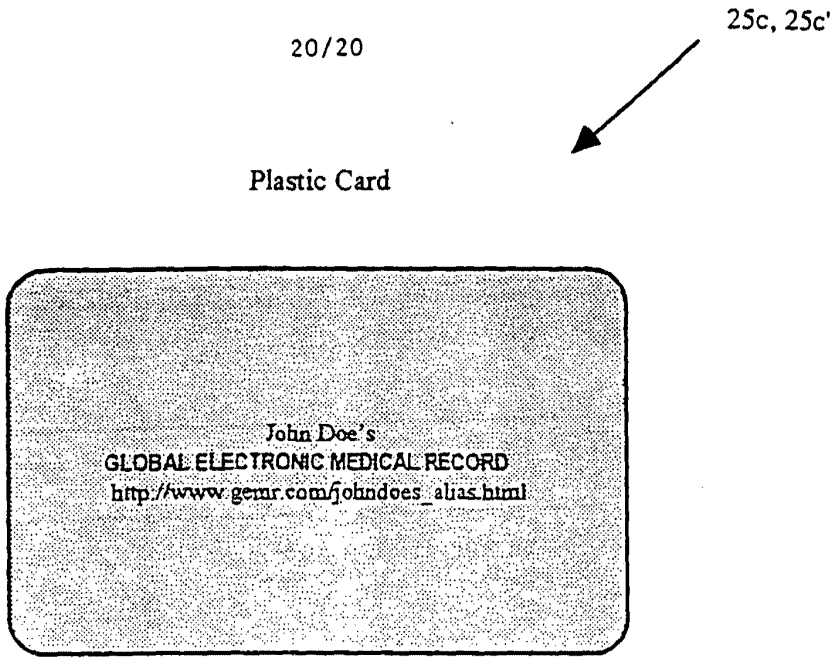

25c, 25c'
Plastic Card
John Doe's
GLOBAL ELECTRONIC MEDICAL RECORD
http://www.gemr.com/johndoes_alias.html

Figure 13C

Patent document cited in search repor	Publication date	Patent family mem' :)	Publication date
WO 9608755 A	21-03-96	AU 3606795 A	29-03-96
		CA 2199934 A	21-03-96
		DE 19580995 D	04-12-97
		EP 0781428 A	02-07-97

Form PCT/ISA/210 (patent family annex) (July 1992)

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WASHINGTON, D.C. 20231
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
09/661,222	09/13/2000	John K. Overton	10406/43

FORMALITIES LETTER

OC000000005546610

Jonathan E Retsky
Brinks Hofer Gilson & Lione
P O Box 10395
Chicago, IL 60610

Date Mailed: 11/13/2000

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given TWO MONTHS from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

- **The balance due by applicant is $ 475.**

A copy of this notice MUST be returned with the reply.

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Initial Patent Examination Division (703) 308-1202
PART 3 - OFFICE COPY

#5 N.N

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Date of Deposit



Joseph F. Hetz - Reg. No. 41,070
Name of Applicant, Assignee or
Registered Representative

Signature

Patent
Our Case No. 10406-43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		)
	Overton et al.	)
		)
Serial No.:	09/661,222	)
		)
Filed:	September 13, 2000	)
		)
For:	Network Distributed Tracking Wire Transfer Protocol	)

FIRST SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Pursuant to the obligation under 37 C.F.R. § 1.56 and in conformance with 37 C.F.R. §§ 1.97-1.99, Applicants hereby submit documents A1-A11 listed on the attached form PTO-1449 for consideration by the Examiner. Copies of the documents are enclosed herewith. Applicants respectfully request that the Examiner review the entire disclosure of these documents and make them of record.

The filing of this Information Disclosure Statement does not constitute an admission that the information cited herein is, or is considered to be, material to patentability as defined in 37 C.F.R. § 1.56(b). Further, Applicants reserve the right to contest that these documents are prior art against the present application.

Dated: December 4, 2000

Respectfully submitted,



Joseph F. Hetz
Reg. No. 41,070
Attorney for Applicants

BRINKS HOFER
GILSON & LIONE
P.O. Box 10395
Chicago, Illinois 60610
(312) 321-4719

DEC 0 8 2000
PATENT & TRADEMARK OFFICE

FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 10406/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT
(use several sheets if necessary)	APPLICANT(S): OVERTON ET AL.	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
	A1	5,347,600	09/13/94	BARNSLEY ET AL.		
	A2	4,636,858	01/13/87	HAGUE ET AL.		
	A3	5,809,161	09/15/98	AUTY ET AL.		
	A4	5,864,482	01/26/99	HAZAMA ET AL.		
	A5	5,610,653	03/11/97	ABECASSIS		
	A6	5,579,067	11/26/96	WAKABAYASHI		
	A7	5,649,247	07/15/97	ITOH ET AL.		
	A8	5,193,185	03/09/93	LANTER		
	A9	5,008,700	04/16/91	OKAMOTO		
	A10	4,728,978	03/01/88	INOUE ET AL.		
	A11	5,499,113	03/12/96	TSUBOI ET AL.		

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS/ SUBCLASS	TRANSLATION YES	NO

EXAMINER INITIAL	OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)	

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Dec.-99
PTO Misc\10406-43 Form PTO-1449 2.doc

0300

TRANSMITTAL LETTER			Case No. 10406/43
Serial No. 09/661,222	Filing Date September 13, 2000	Examiner	Group Art Unit
Inventor(s) OVERTON ET AL.			
Title of Invention NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL			

OIPE JC134 DEC 0 8 2000 PATENT & TRADEMARK OFFICE

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is a First Supplemental Information Disclosure Statement (2 pages); Form PTO-1449 (1 page); 11 U.S. References; Postcard Receipt.

☐ Small entity status of this application under 37 CFR § 1.27 has been established by verified statement previously submitted.

☐ A verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27 is enclosed.

☐ Petition for a _____month extension of time.

☐ No additional fee is required.

☐ The fee has been calculated as shown below:

	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Small Entity Rate	Small Entity Add'l Fee	or	Other Than Small Entity Rate	Other Than Small Entity Add'l Fee
Total		Minus			x $9 =			x $18 =	
Indep.		Minus			x 40 =			x $80 =	
First Presentation of Multiple Dep. Claim					+ $135 =			+ $270 =	
					Total add'l fee	$		Total add'l fee	$

☐ Please charge Deposit Account No. 23-1925 (BRINKS HOFER GILSON & LIONE) in the amount of $_____. A duplicate copy of this sheet is enclosed.

☐ A check in the amount of $_____ to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this communication or credit any overpayment to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

☒ I hereby petition under 37 CFR § 1.136(a) for any extension of time required to ensure that this paper is timely filed. Please charge any associated fees which have not otherwise been paid to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Joseph F. Hetz
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on December 4, 2000.

Date: December 4, 2000 Signature: _____

rev. Oct.-00
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#3

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WASHINGTON, D.C. 20231
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
09/661,222	09/13/2000	John K. Overton	10406/43

Jonathan E Retsky
Brinks Hofer Gilson & Lione
P O Box 10395
Chicago, IL 60610

TPE JC131 FEB 01 2001 PATENT & TRADEMARK OFFICE

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NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given TWO MONTHS from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

- **The balance due by applicant is $ 475.**

A copy of this notice MUST be returned with the reply.

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 2 - COPY TO BE RETURNED WITH RESPONSE

02/05/2001 ETULU1 00000011 09661222

01 FC:205 65.00 OP
~~02 FC:215 55.00 OP~~



#3

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on January 30, 2001
Date of Deposit
Joseph F. Hetz, Esq. – Reg. No. 41,070
Name of applicant, assignee or Registered Representative

Signature

Case No. 10406/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

JOHN K. OVERTON ET AL.

Serial No.: 09/661,222 Examiner:
Group Art Unit: 2171

Filed: September 13, 2000

For: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

RESPONSE TO NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION FILING DATE GRANTED

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

In accordance with the Notice to File Missing Parts of Nonprovisional Application Filing Date Granted dated November 13, 2000, a copy of which is attached, enclosed herewith for filing are the following documents:

☒ Fully executed Declaration for Patent Application (2 pages), Power of Attorney (1 page) and Assignment (3 pages) for the above-referenced patent application.

☒ Applicant is:

☒ a small entity

☐ other than small entity

☒ 1 Check totaling $65.00 for:

☐ Filing Fee of $_____.

☒ Surcharge of $65.00.

☐ Additional Claim Fees of $_____.

☒ 1 Check totaling $40.00 for:

☒ Assignment Recordation Fee of $40.00.

☒ Petition for Extension of Time (37 C.F.R. § 1.136(a)) to file missing parts (in duplicate).

☒ Other: **Check - $55.00** for One-Month Extension of Time; Postcard Receipt.

☒ The Commissioner is hereby authorized to charge any deficiencies in fees or credit overpayment to Deposit Account No. 23-1925. A duplicate copy of this paper is enclosed.

Respectfully submitted,

Dated: January 30, 2001

Joseph F. Hetz
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610
(312)321-4200

rev. Jan-97
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SECTORA

#3

TRANSMITTAL LETTER			Case No. 10406/43
Serial No. 09/661,222	Filing Date September 13, 2000	Examiner	Group Art Unit 2171
Inventor(s) JOHN K. OVERTON ET AL.			
Title of Invention NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL			

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JAN. 31 2001
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FEB 01 2001
PATENT & TRADEMARK OFFICE

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is Notice to File Missing Parts of Nonprovisional Application (1 page); Response to Notice to File Missing Parts of Nonprovisional Application (2 pages in duplicate); Fully executed Declaration for Patent Application (2 pages); Power of Attorney (1 page); Assignment (3 pages); Assignment Recordation Cover Sheet (1 page); **Check-$40.00** for Assignment Recordation Fee; Postcard Receipt.

☒ Small entity status of this application under 37 CFR § 1.27 has been established.

☐ A verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27 is enclosed.

☒ Petition for a one month extension of time.

☒ A check in the amount of $55.00 to cover the one month extension fee.

☐ The fee has been calculated as shown below:

	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Small Entity Rate	Small Entity Add'l Fee	or	Other Than Small Entity Rate	Other Than Small Entity Add'l Fee
Total		Minus			x $9 =			x $18 =	
Indep.		Minus			x 40 =			x $80 =	
First Presentation of Multiple Dep. Claim					+ $135 =			+ $270 =	
					Total add'l fee	$		Total add'l fee	$

☐ Please charge Deposit Account No. 23-1925 (BRINKS HOFER GILSON & LIONE) in the amount of $_____. A duplicate copy of this sheet is enclosed.

☒ A check in the amount of $65.00 to cover the surcharge is enclosed.

☒ The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this communication or credit any overpayment to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

☒ I hereby petition under 37 CFR § 1.136(a) for any extension of time required to ensure that this paper is timely filed. Please charge any associated fees which have not otherwise been paid to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Joseph F. Hetz
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on January 30, 2001.

Date: January 30, 2001 Signature: _____

rev. Dec.-00
C:\Joe\OverX, Inc\10406-43 Resp Miss Parts, F. Papers One-Mo. Ext. Trans.doc

OIPE JC#91
FEB 0 1 2001
PATENT & TRADEMARK OFFICE

#3

Case No. 10406/43

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL, the specification of which:

- ☐ is attached hereto.
- ☒ was filed on September 13, 2000 as Application Serial No. 09/661,222.
- ☐ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability as defined in Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
			☐ Yes	☐ No
(Number)	(Country)	(Day/Month/Year Filed)		

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

60/153,709	September 13, 1999
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

09/111,896	July 8, 1998	Pending
(Application Serial No.)	(Filing Date)	(Status-patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Inventor's Signature	_____ Date: 22 Jan 2001
Full name of sole or first inventor	JOHN K. OVERTON
Residence	CHICAGO, ILLINOIS
Citizenship	UNITED STATES OF AMERICA
Post Office Address	5825 South Blackstone, Chicago, Illinois 60637

Case No. 10406/43

Inventor's Signature	Date: 25-JAN-2001
Full name of second joint inventor, if any	STEPHEN W. BAILEY
Residence	CHICAGO, ILLINOIS
Citizenship	UNITED STATES OF AMEICA
Post Office Address	5617 South Dorchester Avenue, 2N, Chicago, Illinois 60637

BRINKS HOFER GILSON & LIONE
P.O. Box 10395
Chicago, IL 60610
(312) 321-4200

rev. Dec.-99
C:\Joe\OverX, Inc\10406-43 Declaration(2).doc

Case No. 10406/43

Inventor(s): JOHN K. OVERTON, STEPHEN W. BAILEY

Title: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

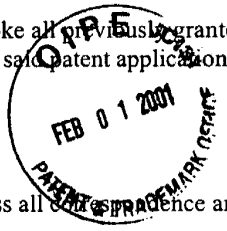
#3

POWER OF ATTORNEY

The specification of the above-identified patent application:

☐ is attached hereto
☒ was filed on September 13, 2000 as application Serial No. 09/661,222

I hereby revoke all previously granted powers of attorney in the above-identified patent application and appoint the following attorneys to prosecute said patent application and to transact all business in the Patent and Trademark Office connected therewith:



William A. Webb - 28,277
Joseph F. Hetz - 41,070

Please address all correspondence and telephone calls to JOSEPH F. HETZ in care of:

Brinks Hofer Gilson & Lione
P.O. Box 10395
Chicago, IL 60610
(312)321-4200

The undersigned hereby authorizes the U.S. attorneys named herein to accept and follow instructions from JOSEPH F. HETZ as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorneys named herein will be so notified by the undersigned.

OVERX, INC., a corporation, certifies that it is the assignee of the entire right, title and interest in the patent application identified above by virtue of either:

☒ An assignment from the inventor(s) of the patent application identified above, a copy of which is attached hereto.
OR

☐ An assignment from the inventor(s) of the patent application identified above. The assignment was recorded in the Patent and Trademark Office at Reel _____, frame _____.
OR

☐ A chain of title from the inventor(s), of the patent application identified above, to the current assignee as shown below:

1. From _____ To: _____
The document was recorded in the Patent and Trademark Office at
Reel _____, frame _____, or a copy thereof is attached.

2. From _____ To: _____
The document was recorded in the Patent and Trademark Office at
Reel _____, frame _____, or a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

The undersigned has reviewed the assignment or all the documents in the chain of title of the patent application identified above and, to the best of undersigned's knowledge and belief, title is in the assignee identified above.

The undersigned (whose title is supplied below) is empowered to act on behalf of the assignee.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signature _____ Date: 1.12.1
Name: JOHN K. OVERTON
Title: CHIEF TECHNOLOGY OFFICER

Rev. Dec.-99
C:\Joe\OverX, Inc\10406-43 POA(2).doc

OIPE JC131 FEB 0 1 2001 PATENT & TRADEMARK OFFICE

#4

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage, as first class mail in an envelope addressed to:

Commissioner for Patents
Washington, D.C. 20231
on January 30, 2001

Date of Deposit

OIPE JC131 JAN 30 2001 PATENT & TRADEMARK OFFICE MAIL DATE CANCELLED

Joseph F. Hetz – Reg. No. 41,070
Name of applicant, assignee or Registered Representative

Signature

1/30/01
Date of Signature

Case No. 10406/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

JOHN K. OVERTON ET AL.

Serial No: 09/661,222

Examiner:

Filed: September 13, 2000

Group Art Unit: 2171

For: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

PETITION AND FEE FOR EXTENSION OF TIME (37 CFR § 1.136(a))

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

This is a petition for an extension of the time to respond to the Notice to File Missing Parts of Nonprovisional Application Filing Date Granted dated November 13, 2000 for a period of one month(s).

☒ Applicant is:
- ☒ a small entity
- ☐ other than small entity

02/05/2001 ETULU1 00000011 09661222

~~01 FC:205 65.00 OP~~
02 FC:215 55.00 OP

	Extension Months	Other Than Small Entity	Small Entity
☒	One Month	$110	$55
☐	Two Months	$390	$195
☐	Three Months	$890	$445
☐	Four Months	$1,390	$695
☐	Five Months	$1,890	$945

Fee Payment

☒ Attached is a check for $55.00 for the Petition fee.

☐ Charge Petition fee to Deposit Account No. 23-1925. A duplicate copy of this Petition is attached.

☒ Charge any additional fee required or credit for any excess fee paid to Deposit Account No. 23-1925. A duplicate copy of this Petition is attached.

Respectfully submitted,

Dated: January 30, 2001

Joseph F. Hetz
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610
(312)321-4200

Rev. Oct.-00
C:\Joe\OverX, Inc\10406-43 Petit One-Mo. Ext.doc

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

ASSISTANT SECRETARY AND COMMISSIONER
OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

RECEIVED
JUN 20 2001
Technology Center 2100

#4

CHANGE OF ADDRESS/POWER OF ATTORNEY

FILE LOCATION 21G3 SERIAL NUMBER 09661222 PATENT NUMBER

THE CORRESPONDENCE ADDRESS HAS BEEN CHANGED TO CUSTOMER # 757

THE PRACTITIONERS OF RECORD HAVE BEEN CHANGED TO CUSTOMER # 757

ON 05/31/01 THE ADDRESS OF RECORD FOR CUSTOMER NUMBER 757 IS:

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO IL 60610

AND THE PRACTITIONERS OF RECORD FOR CUSTOMER NUMBER 757 ARE:

17013	19391	19795	20493	22131	24569	24587	24825	26284	26805
26983	27024	27396	28257	28277	28647	29002	30337	30563	30665
30670	30805	31424	31605	31609	31612	31735	31972	32305	32309
32806	33411	33551	33597	33674	33868	34167	34401	34440	34483
34699	34880	35323	35596	36026	36068	36444	36675	37112	37218
37680	37834	37883	37921	37947	38591	38629	39212	40141	40409
40437	40560	41070	42223	42445	42711	42716	42959	43557	44183
44410	44529	44542	44701	44714	44882	44916	44926	45369	45662
45712	46162	46193	46268	46958	48059				

PTO INSTRUCTIONS: PLEASE TAKE THE FOLLOWING ACTION WHEN THE CORRESPONDENCE ADDRESS HAS BEEN CHANGED TO CUSTOMER NUMBER: RECORD, ON THE NEXT AVAILABLE CONTENTS LINE OF THE FILE JACKET, 'ADDRESS CHANGE TO CUSTOMER NUMBER'. LINE THROUGH THE OLD ADDRESS ON THE FILE JACKET LABEL AND ENTER ONLY THE 'CUSTOMER NUMBER' AS THE NEW ADDRESS. FILE THIS LETTER IN THE FILE JACKET. WHEN ABOVE CHANGES ARE ONLY TO FEE ADDRESS AND/OR PRACTITIONERS OF RECORD, FILE LETTER IN THE FILE JACKET.
THIS FILE IS ASSIGNED TO GAU 2171.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail with sufficient postage in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231 on April 24, 2003
Date of Deposit

Joseph F. Hetz - Reg. No. 41,070
Name of Applicant, Assignee or Registered Representative

Signature

OIPE
APR 28 2003
PATENT & TRADEMARK OFFICE

Patent
Our Case No. 11958-43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Overton et al.	Group Art Unit:	2171
Serial No.:	09/661,222		
Filed:	September 13, 2000		
For:	Network Distributed Tracking Wire Transfer Protocol		

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APR 2 9 2003
Technology Center 2100

SECOND SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
Washington, D.C. 20231

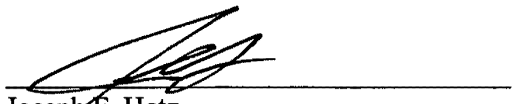
Dear Sir:

Pursuant to the obligation under 37 C.F.R. § 1.56 and in conformance with 37 C.F.R. §§ 1.97-1.99, Applicants hereby submit documents A1-A4 listed on the attached form PTO-1449 for consideration by the Examiner. Copies of the documents are enclosed herewith. Also enclosed is a copy of an International Search Report, which cited these four documents in a corresponding PCT application. Applicants respectfully request that the Examiner review the entire disclosure of these documents and make them of record.

The filing of this Information Disclosure Statement does not constitute an admission that the information cited herein is, or is considered to be, material to patentability as defined in 37 C.F.R. § 1.56(b). Further, Applicants reserve the right to contest that these documents are prior art against the present application.

Dated: April 24, 2003

Respectfully submitted,



Joseph F. Hetz
Reg. No. 41,070
Attorney for Applicants

BRINKS HOFER
GILSON & LIONE
P.O. Box 10395
Chicago, Illinois 60610
(312) 321-4719

GAU 2171

TRANSMITTAL LETTER			Case No. 11958-43
Serial No. 09/661,222	Filing Date September 13, 2000	Examiner	Group Art Unit 2171
Inventor(s) OVERTON ET AL.			
Title of Invention NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL			

APR 2 8 2003 JC37 PATENT & TRADEMARK OFFICE

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is Transmittal Letter (in duplicate); Second Supplemental Information Disclosure Statement; Form PTO-1449; 4 Cited References; Copy of International Search Report; and Postcard Receipt.

☐ Small entity status of this application under 37 CFR § 1.27 has been established by verified statement previously submitted.

☐ A verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27 is enclosed.

☐ Petition for a _month extension of time.

☒ No additional fee is required.

☐ The fee has been calculated as shown below:

	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Small Entity Rate	Small Entity Add'l Fee	or	Other Than Small Entity Rate	Other Than Small Entity Add'l Fee
Total		Minus			x $9=			x $18=	
Indep.		Minus			x 42=			x $84=	
First Presentation of Multiple Dep. Claim					+$140=			+ $280=	
					Total add'l fee	$		Total add'l fee	$

☐ Please charge Deposit Account No. 23-1925 (BRINKS HOFER GILSON & LIONE) in the amount of $_____. A duplicate copy of this sheet is enclosed.

☐ A check in the amount of $ to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this communication or credit any overpayment to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

☒ I hereby petition under 37 CFR § 1.136(a) for any extension of time required to ensure that this paper is timely filed. Please charge any associated fees which have not otherwise been paid to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

JOSEPH F. HETZ
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

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APR 2 9 2003
Technology Center 2100

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on April 24, 2003.

Date: April 24, 2003 Signature: _____

rev. Dec.-00
Y:\jfh\11958-43 tl re 2nd supp ids.doc

L Number	Hits	Search Text	DB	Time stamp
-	3	(("5913210") or ("5950173") or ("5978773")).PN.	USPAT	2004/02/19 10:15
-	48	("6338082" "6470332" "6131095" "6418448" "6173279" "6009478" "6199111" "5491800" "5499343" "5515508" "5548723" "5832219" "6223217" "6223217" "5920863" "5938733" "6014134" "6061708" "6061708" "6282281" "6289012" "6304576" "6411966" "6463418" "6466570" "6477434" "6542515" "6044468" "5974447" "5632031" "5659727" "5664181" "5687365" "5721895" "5778223" "5970494" "5764906" "6101537" "6052782" "6016500" "6243716" "6131067" "6330594" "6009266" "5475817" "5907675" "5894585" "6173287" "6243708" "5260942").pn.	USPAT	2004/02/19 10:16
-	89	5764906.URPN.	USPAT	2004/02/19 10:20
-	14	("4659877" | "5351276" | "5423003" | "5438568" | "5452350" | "5546452" | "5703940" | "5708780" | "5799317" | "5873077" | "6021126" | "6023724" | "6026441" | "6029203").PN.	USPAT	2004/02/19 10:35
-	30	6131095.URPN.	USPAT	2004/02/19 10:36
-	87	5950173.URPN.	USPAT	2004/02/19 10:42
-	8	("5918214" | "5950173" | "6064979" | "6068188" | "6092069" | "6119944" | "6151624" | "6199048").PN.	USPAT	2004/02/19 10:50

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/661,222	09/13/2000	John K. Overton	10406/43	7777

757 7590 02/25/2004

GENERAL NUMBER 00757
BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60611

EXAMINER	
KAPADIA, MILAN S	

ART UNIT	PAPER NUMBER
2144	

DATE MAILED: 02/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 09/661,222	Applicant(s) OVERTON ET AL.	
	Examiner Milan S Kapadia	Art Unit 2144	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 September 2000*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 7.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Notice to Applicant

1. This communication is in response to the application filed 18 October 2000. Claims 1-26 are pending.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 14 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

(A) Claim 14 recites the limitation "the second client entity " in lines 4-5. There is insufficient antecedent basis for this limitation in the claim. For the purpose of prior art rejection, the examiner assumes "the second client entity" to be "the client entity."

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 5-7, and 9-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Edelstein et al. (5,764,906).

(A) As per claim 1, Edelstein teaches a network distributed tracking wire transfer protocol comprising:

a variable length identification string, the identification string for specifying the identity of an entity in a distributed data collection (Edelstein; abstract and col. 11, line 66-cpl. 12, line 1); and

a variable length location string, the location string for specifying the network location of data associated with an entity in a distributed data collection (Edelstein; col.4, lines 8-11 and col.12, lines 22-45);

wherein a relationship between the identification string and the location string can be spontaneously and dynamically created and modified (Edelstein; col. 8, lines 46-54 and col. 10, line 64-col. 11, line 9).

(B) As per claim 5, Edelstein teaches a system having a network distributed tracking wire transfer protocol for storing and identifying data with a distributed data collection, comprising:

a data repository, the data repository for storing data in a distributed data collection (Edelstein; col. 7, lines 30-37);

a client entity, the client entity for manipulating data in the distributed data collection (Edelstein; col. 6, lines 32-45); and

a first server entity, the first server entity operative to locate data in the distributed data collection (Edelstein; col. 12, lines 10-19; the Examiner interprets the "local server" as the "first server entity");

wherein the client entity transmits an identifier string to the first server entity along with a client request and the first server entity provides at least one location string to the client entity in response thereto)Edelstein; col. 11, line 66-12, line 1 and col. 12, lines 10-45).

(C) As per claim 6, Edelstein teaches a second server entity coupled to the first server entity (Edelstein; col. 12, lines 22-45; the Examiner interprets the "root server" as the "second server entity").

(D) As per claim 7, Edelstein teaches wherein the first server entity maps the identifier string received from the client entity to the at least one location string (Edelstein; col.4, lines 8-11 and col.12, lines 10-19).

(E) As per claim 9, Edelstein teaches wherein the first server entity transmits the client request to the second server entity if the first server entity cannot provide the at least one location string to the client entity (Edelstein; col. 12, lines 19-22).

(F) As per claim 10, Edelstein teaches wherein the second server entity maps the identifier string received from the first server entity to at least one location string (Edelstein; col. 12, lines 22-45).

(G) As per claim 11, Edelstein teaches wherein the second server entity transmits the at least one location string to the first server entity for transmission to the client entity (Edelstein; col. 12, lines 22-45).

(H) As per claim 12, Edelstein teaches a method for storing and retrieving tracking information over a network (Edelstein; col. 3, lines 40-43) using a wire transfer protocol, comprising the steps of:

providing a location string and an identification string, the location string for specifying the location of data associated with an entity in a distributed data collection and the identification string for specifying the identification of an entity in the distributed data collection (Edelstein; col. 4, lines 8-11, col. 4, lines 46-52, and col. 7, lines 31-55);

storing information at a data repository entity by associating an identification string with each particular stored unit of information and by mapping the identification string to at least one location string associated with the data repository entity, the identification string and the at least one location string for a particular unit of information being stored at a first server entity coupled to the data repository entity (Edelstein; col. 7, lines 31-55; the Examiner interprets the "local server" as the "first server entity");

transmitting a request from a client entity to the first server entity to retrieve at least one location string associated with a particular stored unit of information, the request including the identification string associated with the particular stored unit of information; and receiving the request at the first server entity and responding to the client entity by providing at least one

location string associated with the particular stored unit of in1brmation to the client entity (Edelstein; col. 12, lines 12-19).

(I) As per claim 13, Edelstein teaches the step of transmitting the request to a second server entity prior to responding to the client entity, the second server entity coupled to the first server entity and having stored therewith the mapping of the identification string and the at least one location string for the particular unit of information (Edelstein; col. 12, lines 21-45; the Examiner interprets the "root server" as the "second server entity").

(J) As per claim 14, Edelstein teaches wherein the second server entity responds to the client entity by providing the location string associated with the particular stored unit of information to the client entity (Edelstein; col. 12, lines 22-45).

(K) As per claim 15, Edelstein teaches wherein the lengths of the identification string and the at least one location string are variable (Edelstein; col. 4, lines 7-11 and col. 4, line 64-col. 5, line 10).

(L) As per claim 16, Edelstein teaches the step of spontaneously and dynamically manipulating the mapping of identification string to a location string (Edelstein; col. 8, lines 46-54 and col. 10, line 64-col. 11, line 9).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Edelstein et al. (5,764,906) as applied to claims 1 and 6 above and further in view of Call (6,418,441).

(A) As per claims 2-4, Edelstein fails to expressly teach wherein the protocol is application independent, organizationally independent, and geographically independent. However, this feature is old and well known in the art, as evidenced by Call's teachings with regards to wherein the protocol is application independent, organizationally independent, and geographically independent (Call; abstract and col. 4, lines 1-19). It is respectfully submitted, that it would have been obvious, to one having ordinary skill in the art at the time the invention was made, to expand the system taught by Edelstein with Call's teaching with regards to this limitation, with the motivation of providing a low-cost and worldwide information retrieval system (Hunt; col. 4, lines 3-18).

8. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Edelstein et al. (5,764,906) as applied to claim 7 above and further in view of official notice.

(A) As per claim 8, Edelstein fails to expressly teach wherein the mapping is performed using a hash operation. However, the Examiner takes Official Notice (see MPEP § 2144.03) that the use of a s hashing operation in a computer networking environment was well known in the art at the time the invention was made. The Applicant is entitled to traverse any/all official notice taken in this action according to MPEP § 2144.03. However, MPEP § 2144.03 further states "See also In re Boon, 439 F.2d 724, 169 USPQ 231 (CCPA 1971) (a challenge to the taking of judicial notice must contain adequate information or argument to create on its face a reasonable doubt regarding the circumstances justifying the judicial notice)." Specifically, In re Boon, 169 USPQ 231, 234 states "as we held in Ahlert, an applicant must be given the opportunity to challenge either the correctness of the fact asserted or the notoriety or repute of the reference cited in support of the assertion. We did not mean to imply by this statement that a bald challenge, with nothing more, would be all that was needed". Further note that 37 CFR § 1.671(c)(3) states "Judicial notice means official notice". Thus, a traversal by the Applicant that is merely "a bald challenge, with nothing more" will be given very little weight.

Thus, it is respectfully submitted, that it would have been obvious, to one having ordinary skill in the art at the time the invention was made, to provide the mapping as taught by Edelstein by using well-established hashing operation, with the motivation of providing a highly efficient searching algorithm that enables direct or almost direct access to the target element.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The cited but not applied art teaches a routing string indicative of a location of a

database on a web associated with a product in commerce (6,377,986); an object oriented distributed computing system processing request to other object model with code mapping by object managers located by manager of object managers (5,475,817); and a method of accessing a target entity over a communications network (6,131,095).

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Milan S Kapadia whose telephone number is 703-305-3887. The examiner can normally be reached on Monday through Friday, 8:30 A.M. to 5:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wiley can be reached on 703-308-5221. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular communications and 703-872-9327 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1113.

mk

February 19, 2004

DAVID WILEY
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100

Notice of References Cited	Application/Control No. 09/661,222	Applicant(s)/Patent Under Reexamination OVERTON ET AL.	
	Examiner Milan S Kapadia	Art Unit 2144	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,764,906	06-1998	Edelstein et al.	709/219
	B	US-6,418,441	07-2002	Call, Charles G.	707/10
	C	US-6,377,986	04-2002	Philyaw et al.	709/219
	D	US-5,475,817	12-1995	Waldo et al.	719/316
	E	US-6,131,095	10-2000	Low et al.	707/10
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

OIPE JC37
APR 28 2003
PATENT & TRADEMARK OFFICE

FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 11958-43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT 2171
(use several sheets if necessary)	APPLICANT(S): Overton et al.	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER Number-Kind Code (if known)	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
mf	A1	5,913,210	06/15/1999	Call		
mf	A2	5,950,173	09/07/1999	Perkowski		
mf	A3	5,978,773	11/2/1999	Hudetz et al.		

EXAMINER INITIAL		OTHER ART – NON PATENT LITERATURE DOCUMENTS (Include name of author, title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date page(s), volume-issue number(s), publisher, city and/or country where published.
mf	A4	"Service Location in an Open Distributed Environment," Beitz et al, Second International Workshop on Services in Distributed and Networked Environments, IEEE Comput. Soc., pp. 28-34 (June 1995).

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Technology Center 2100

EXAMINER mf	DATE CONSIDERED 2/18/04

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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"Express Mail" mailing label number EV 325 994 062 US

Date of Deposit: August 25, 2004

OIPE JC61 AUG 25 2004 PATENT & TRADEMARK OFFICE

Our Case No. 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

JOHN OVERTON

Serial No. 09/661,222

Filing Date: September 13, 2000

For NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

Examiner: Kapadia, M.

Group Art Unit: 2144

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SEP 0 1 2004
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AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action dated February 25, 2004, please enter the following amendments and consider the remarks provided below.

08/31/2004 MBERHE 00000005 231925 09661222
01 FC:2202 9.00 DA

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A network distributed tracking wire transfer protocol comprising:

a request message formatted to transport a variable length identification string, the identification string for specifying the identity of an entity in a distributed data collection; and

a response message formatted to transport a variable length location string, the location string for specifying the ~~network~~ location of data associated with an entity in a distributed data collection; and

a redirect message formatted to transport redirection information, the redirection information comprising information for determining a location of location information associated with the entity specified in the identification string;

wherein the protocol supports a machine-independent relationship between the identification string and the location string ~~can be spontaneously and dynamically created and modified~~.

2. (Original) The network distributed tracking wire transfer protocol defined in claim 1, wherein the protocol is application independent.

3. (Original) The network distributed tracking wire transfer protocol defined in claim 1, wherein the protocol is organizationally independent.

4. (Original) The network distributed tracking wire transfer protocol defined in claim 1, wherein the protocol is geographically independent.

5. (Currently Amended) A system having a network distributed tracking wire transfer protocol for storing and identifying data with a distributed data collection, comprising:

a data repository, the data repository for storing data in a distributed data collection;

a client entity, the client entity for manipulating data in the distributed data collection; and

a first server entity, the first server entity operative to locate data in the distributed data collection;

wherein the first server entity is responsive to a client request from the first client entity to provide a redirection message to the first client entity if the first server entity cannot provide at least one location string to the client entity corresponding to an identifier string in the client request ~~the client entity transmits an identifier string to the first server entity along with a client request and the first server entity provides at least one location string to the client entity in response thereto~~.

6. (Currently Amended) The system defined in claim 5, wherein the client entity comprises a first data server of a plurality of data servers and the ~~further comprising a second server entity coupled to the~~ first server entity comprises a second data server of the plurality of data servers in communication with the first data server.

7. (Currently Amended) The system defined in claim 5, wherein each of the client entity and the first server entity comprises a shared function and wherein the client entity is configured to apply the shared function to the redirect message to determine a location of a location string corresponding to the identifier string ~~maps the identifier string received from the client entity to the at least one location string~~.

8. (Currently Amended) The system defined in claim 7, wherein the shared function comprises a hash function and the redirect message comprises a data table configured for operation with the hash function ~~mapping is performed using a hash operation~~.

9. (Currently Amended) The system defined in claim 6, wherein the first data server is configured to transmit the client request to another data server, the another data server determined from the redirection message upon receipt of the redirection

message. ~~entity transmits the client request to the second server entity if the first server entity cannot provide the at least one location string to the client entity.~~

10. -11. (Canceled)

12. (Currently Amended) A method for storing and retrieving tracking information over a network using a wire transfer protocol, comprising the steps of:

providing a location string and an identification string, the location string for specifying the location of data associated with an entity in a distributed data collection and the identification string for specifying the identification of an entity in the distributed data collection;

storing information at a data repository entity by associating an identification string associated with an entity with each particular stored unit of information associated with the entity and by mapping the identification string to at least one location string associated with the data repository entity, the identification string and the at least one location string ~~for a particular unit of information~~ being stored at a first server entity coupled to the data repository entity;

transmitting a request from a client entity to the first server entity to retrieve at least one location string associated with the entity ~~a particular stored unit of information~~, the request including the identification string associated with the entity ~~stored unit of information~~; and

receiving the request at the first server entity; and

~~responding to the client entity by providing at least one location string associated with the particular stored unit of information to the client entity~~ responding to the client entity with a redirect message containing information for determining the location of at least one location string if the at least one location string is not at the first server entity.

13. (Currently Amended) The method for storing and retrieving tracking information defined in claim 12, further comprising the step of transmitting the request to a second server entity ~~prior to responding to the client entity~~, the second server entity coupled to the first server entity and having stored therewith a [[the]] mapping of the

identification string and the at least one location string for the entity ~~particular unit of information~~.

14. (Currently Amended) The method for storing and retrieving tracking information defined in claim 13, wherein the second server entity responds to the client entity by providing the location string associated with the entity ~~particular stored unit of information~~ to the ~~second~~ client entity.

15. (Original) The method for storing and retrieving tracking information defined in claim 12, wherein the lengths of the identification string and the at least one location string are variable.

16. (Original) The method for storing and retrieving tracking information defined in claim 12, further comprising the step of spontaneously and dynamically manipulating the mapping of an identification string to a location string.

17. (New) The protocol of claim 1, wherein the information relating to the location of location information comprises data configured in a table for use in calculating the location of location information with a shared function, whereby a client entity configured with the protocol and receiving the table, and a server entity configured with the protocol and sending the table to the client entity, each comprise the shared function.

18. (New) The protocol of claim 1, wherein the information relating to the location of location information comprises a function.

19. (New) The system of claim 5, wherein the redirection message comprises information on a location of location data pertaining to data associated with the identifier string in the client request.

20. (New) The system of claim 19, wherein the redirection message comprises a function description adapted for use by the client entity to obtain the location of location information by applying the function description to the identifier string in the client request.

21. (New) The method of claim 12, wherein responding to the client entity with a redirect message comprises sending the client entity data configured in a table and the client entity determining the location of at least one location string by applying a shared function to the table.

22. (New) The method of claim 12, wherein responding to the client entity with a redirect message comprises the first server entity sending a function description to the client entity adapted for use by the client entity to obtain the location of the at least one location string.

23. (New) The method of claim 22, wherein the client entity applies the function from the redirect message to the identification string to obtain the location of the at least one location string.

REMARKS

I. Office Action Summary

Claims 1-16 are currently pending. Claims 1, 5 and 12 are the independent claims. In the Office Action dated February 25, 2004, the Examiner rejected all of the claims. Claim 14 was rejected as indefinite under 35 U.S.C. § 112, second paragraph. Claims 1, 5-7 and 9-16 were rejected as anticipated by Edelstein et al. (U.S. 5,764,906) under 35 U.S.C. § 102(b). Claims 2-4 were rejected as obvious over Edelstein in combination with Call (U.S. 6,418,441) and claim 8 was rejected as obvious over the combination of Edelstein and "official notice".

II. Rejections Under 35 U.S.C. § 112, Second Paragraph

Applicant agrees with the Examiner that the phrase "the second client entity" in claim 14 should instead read "the client entity". Applicant has amended claim 14 to reflect this correction.

III. Rejections Under 35 U.S.C. § 102(b)

Claims 1, 5-7 and 9-16 were rejected as anticipated by Edelstein. Applicant has amended claim 1, 5 and 12 and respectfully traverses the rejection.

CLAIM 1

Claim 1 recites a transfer protocol. Specifically, claim 1 recites a network distributed tracking wire transfer protocol that defines certain message formats that permit extremely efficient management of data through the management of the location information regarding that data. As amended, the transfer protocol of claim 1 includes, *inter alia*,

> a redirect message formatted to transport redirection information, the redirection information comprising information for determining a location of location information associated with the entity specified in the identification string;
>
> wherein the protocol supports a machine-independent relationship between the identification string and the location string.

Amended claim 1 recites a redirect message format that transports redirection information. The redirect message provides information for determining a location of location of information relating to an entity specified in the identification string. Support for this feature may be found throughout the specification, as for example at pages 23-27 and FIGS. 9(a) and 9(b).

One example of the redirect function supported by the transfer protocol of claim 1 is seen in FIGS. 11-12 and described in the specification at page 28, line 21 to page 30, line 18. Using messages formatted according to the claimed transfer protocol, a client sends a request to a server for the location of information relating to a particular entity. If the server does not have the location of information relating to the entity identified in the identifier string, it returns a redirect message to the client. The redirect message contains information for determining location of the location information. The client can then query the location determined from the redirect message (in the example of FIG. 12, NDTP Server1), and retrieve the location data associated with the entity of interest. Using this retrieved location information, the client can then access data relating to the entity by communicating with the location(s) identified in NDTP Server1 as containing data relating to the entity of interest. This is one of many permutations of data management schemes supported by the transfer protocol recited in claim 1.

The Edelstein reference, unlike claim 1, does not describe a transfer protocol. Instead, Edelstein recites an application for managing aliases and nicknames for a specific address. Rather than describing a transfer protocol that might be able to efficiently accomplish the tasks recited in Edelstein, Edelstein appears to assume that the application can be carried out somehow using whatever existing protocol is available. The portions of Edelstein's disclosure cited by the Examiner relate to a specific, fixed, device-dependent hierarchy where nicknames and aliases for a particular address are searched up the predetermined device hierarchy. The address information, once the relationship between alias/nickname and the desired address has been discovered, is then replicated at the local server level to reduce future search time, thus slowing down processing performance in proportion to the number of devices and system complexity of the system using the Edelstein approach. The transfer protocol of

claim 1 addresses such limitations and provides predictable performance regardless of system complexity.

For example, Edelstein fails to teach or suggest a redirect message format as recited in claim 1. Edelstein mechanically checks each and every server in the predetermined hierarchy rather than providing a current location of the sought after location information to the inquiring client. As recited in claim 1, the redirect message provides "information for determining a location of location information . . ." so that a client may bypass any machine-dependent hierarchy to more directly access the desired location information. Accordingly, for at least these reasons, Applicant submits that claim 1 is allowable over the cited art. Claims 2-4 and 17-18 are dependent claims, therefore their allowability directly follows from the allowability of independent claim 1.

Although Applicant notes that the dependent claims to claim 1 are allowable for at least the same reasons as provided for claim 1, Applicant has added claims 17 and 18 to further clarify aspects of the redirect mechanism. New claim 17 relates to one embodiment of the redirect mechanism where information carried in the redirect message is a table of information for the recipient of that table to process using a predetermined function in order to determine where next to look for location of location data. New claim 18 recites another version of the information carried by the redirect message where a function is passed as part of the message. Support for these claims may be found, for example, at page 24, line 13 – page 26, line 9 in the specification.

CLAIM 5

Amended claim 5 relates to a system having a network distributed tracking wire transfer protocol for storing and identifying data with a distributed data collection. The system includes, *inter alia,* a first server entity responsive to a client request to provide a redirection message to the first client entity if the first server entity cannot provide at least one location string to the client entity. As discussed above with respect to claim 1, Edelstein defines a device hierarchy dependent application that fails to teach or suggest any redirection mechanism that is communicated to the client or other servers. Accordingly, for at least these reasons, Applicant respectfully submits that claim 5 is

allowable over the cited art. Claims 6-9 and 19-20 are dependent claims, therefore their allowability directly follows from the allowability of independent claim 5.

Although Applicant notes that the dependent claims to claim 5 are allowable for at least the same reasons as provided for claim 5, Applicant has amended (or added) these claims to further clarify aspects of the claimed system. Support for the amendments to claims 6-9 and added claims 19 and 20 may be found throughout the specification as at, for example, page 24, line 13 – page 25, line 9; page 29, lines 20-31 and FIGS. 11-13.

CLAIM 12

Amended claim 12 relates to a method for storing and retrieving tracking information over a network using a wire transfer protocol. The method includes the step of a server entity responding to the client entity with a redirect message if an appropriate location string is not found at the first server entity. For at least the same reasons as discussed above with claims 1 and 5, Applicant submits that Edelstein lacks any teaching or suggestion of the features of claim 12. Claims 13-16 and 21-23 are dependent claims, therefore their allowability directly follows from the allowability of independent claim 12.

Although Applicant notes that the dependent claims to claim 12 are allowable for at least the same reasons as provided for claim 12, Applicant has amended (or added) these claims to further clarify aspects of the claimed method. Support for the amendments to claims 13-16 and added claims 21-23 may be found throughout the specification as at, for example, page 24, line 13 – page 25, line 9; page 29, lines 20-31 and FIGS. 11-13.

III. Rejections Under 35 U.S.C. § 103(a)

Applicant respectfully disagrees with the Examiner's rejections of dependent claims 2-4 and 8. Applicant notes that claims 2-4 and 8, in addition to each reciting features that distinguish over the cited references, depend from amended independent claims 1 and 5, respectively. Accordingly, claims 2-4 and 8 are allowable for at least the same reasons as their respective independent claims.

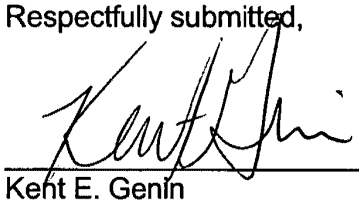
IV. Previously Submitted Information Disclosure Statements

Applicant notes that the PTO-1449 forms for two timely submitted information disclosure statements were not attached to the February 25, 2004, Office Action. Applicant has attached copies of the information disclosure statements (one mailed Oct. 26, 2000 and stamped received on Oct. 30, 2000; the other mailed Dec. 4, 2000 and stamped received Dec. 8, 2000) , including the associated PTO-1449's, along with their respective transmittal letters and return postcards (stamped received). Applicant requests that the Examiner review the previously provided references and sign and return the attached PTO-1449's.

V. Conclusion

Applicant has amended claims 1, 5-9, 12-14, canceled dependent claims 10-11, and added dependent claims 17-23. In light of the above remarks and amendments, Applicant submits that claims 1-9 and 12-23 are now in condition for allowance. If any issues arise or questions remain, the Examiner is invited to contact the undersigned at the number listed below in order to expedite disposition of this case.

Respectfully submitted,



Kent E. Genin
Registration No. 37,834
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail with sufficient postage in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231 on October 26, 2000
Date of Deposit

Joseph F. Hetz - Reg. No. 41,070
Name of Applicant, Assignee or Registered Representative

Signature

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Patent
Our Case No. 10406-43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		)
	Overton et al.	)
		)
Serial No.:	09/661,222	)
		)
Filed:	September 13, 2000	)
		)
For:	Network Distributed Tracking Wire Transfer Protocol	)

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Pursuant to the obligation under 37 C.F.R. § 1.56 and in conformance with 37 C.F.R. §§ 1.97-1.99, Applicants hereby submit documents A1-A62 listed on the attached form PTO-1449 for consideration by the Examiner. Copies of the documents are enclosed herewith. Applicants respectfully request that the Examiner review the entire disclosure of these documents and make them of record.

Applicants also would like to bring the Examiner's attention to the following three pending U.S. patent applications:

U.S. patent application serial number 09/503,441; filed February 14, 2000; titled "Automated System for Image Archiving"

U.S. patent application serial number 09/111,896; filed July 8, 1998; titled "System and Method for Establishing and Retrieving Data Based on Global Indices"

U.S. patent application serial number 09/367,461; filed August 13, 1999; titled "Automated Image Archiving System"

Also, Applicants note that document A52 is a published PCT application corresponding to the '461 patent application and that document A53 is a published PCT application corresponding to the '896 patent application.

The filing of this Information Disclosure Statement does not constitute an admission that the information cited herein is, or is considered to be, material to patentability as defined in 37 C.F.R. § 1.56(b). Further, Applicants reserve the right to contest that these documents are prior art against the present application.

Dated: October 26, 2000

Respectfully submitted,

Joseph F. Hetz
Reg. No. 41,070
Attorney for Applicants

BRINKS HOFER
GILSON & LIONE
P.O. Box 10395
Chicago, Illinois 60610
(312) 321-4719

OIPE JC61 AUG 25 2004 PATENT & TRADEMARK OFFICE

FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 10406/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT
(use several sheets if necessary)	APPLICANT(S): OVERTON ET AL.	

REFERENCE DESIGNATION **U.S. PATENT DOCUMENTS**

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
	A1	5,384,643	01/24/95	INGA ET AL.		
	A2	5,208,623	05/04/93	TAKAHASHI		
	A3	5,124,814	06/23/92	TAKAHASHI ET AL.		
	A4	4,553,261	11/12/85	FROESSL		
	A5	5,008,700	04/16/91	OKAMOTO		
	A6	5,193,185	03/09/93	LANTER		
	A7	5,579,067	11/26/96	WAKABAYASHI		
	A8	5,455,648	10/03/95	KAZAMI		
	A9	5,649,247	07/15/97	ITOH ET AL.		
	A10	5,319,401	06/07/94	HICKS		
	A11	4,728,978	03/01/88	INOUE ET AL.		
	A12	5,669,029	09/16/97	FYSON ET AL.		
	A13	5,875,302	02/23/99	OBHAN		
	A14	5,872,973	02/16/99	MITCHELL ET AL.		
	A15	5,848,246	12/08/98	GISH		
	A16	5,813,006	09/22/98	POLNEROW ET AL.		
	A17	5,809,495	09/15/98	LOAIZA		
	A18	5,802,518	09/01/98	KARAEV ET AL.		
	A19	5,784,565	07/21/98	LEWINE		
	A20	5,781,725	07/14/98	SAITO		
	A21	5,774,670	06/30/98	MONTULLI		
	A22	5,764,906	06/09/98	EDELSTEIN ET AL.		
	A23	5,764,889	06/09/98	AULT ET AL.		
	A24	5,664,170	09/02/97	TAYLOR		
	A25	5,617,570	04/01/97	RUSSELL ET AL.		
	A26	5,551,027	08/27/96	CHOY ET AL.		
	A27	5,550,981	08/27/96	BAUER ET AL.		
	A28	5,974,124	10/26/99	SCHLUETER, JR. ET AL.		
	A29	5,915,240	06/22/99	KARPF		
	A30	5,987,519	11/16/99	PEIFER ET AL.		
	A31	5,920,702	07/06/99	BLEIDT ET AL.		
	A32	5,576,952	11/19/96	STUTMAN ET AL.		
	A33	5,961,610	10/05/99	KELLY ET AL.		
	A34	5,995,965	11/30/99	EXPERTON		
	A35	5,940,844	08/17/99	CAHILL ET AL.		
	A36	4,800,488	01/24/89	AGRAWAL ET AL.		
	A37	4,825,406	04/25/89	BEAN ET AL.		

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EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Rev. Dec.-99
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FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 10406/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT
(use several sheets if necessary)	APPLICANT(S): Overton ET AL.	

REFERENCE DESIGNATION **U.S. PATENT DOCUMENTS**

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
	A38	4,914,571	04/03/90	BARATZ ET AL.		
	A39	5,414,841	05/09/95	BINGHAM ET AL.		
	A40	5,522,077	05/28/96	CUTHBERT ET AL.		
	A41	5,537,547	07/16/96	CHAN ET AL.		
	A42	5,557,790	09/17/96	BINGHAM ET AL.		
	A43	5,560,005	09/24/96	HOOVER ET AL.		
	A44	5,625,841	04/29/97	DAWKINS ET AL.		
	A45	5,809,331	09/15/98	STAATS ET AL.		
	A46	5,907,837	05/25/99	FERREL ET AL.		
	A47	5,966,705	10/12/99	KONERU ET AL.		
	A48	5,978,773	11/02/99	HUDETZ ET AL.		
	A49	6,032,175	02/29/00	FLETCHER ET AL.		
	A50	6,047,332	04/04/00	VISWANATHAN ET AL.		
	A51	6,055,544	04/25/00	DEROSE ET AL.		

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS/ SUBCLASS	TRANSLATION YES	NO
	A52	WO 98/31138	07/16/98	PCT			
	A53	WO 00/03526	01/20/00	PCT			
	A54	EPO 568 161 A1	03/11/93	EPO			
	A55	WO 86/05610	09/25/86	PCT			
	A56	0 889 422 A2	01/07/99	EPO			
	A57	WO 98/15910	04/16/98	PCT			

EXAMINER INITIAL		OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)
	A58	Callaghan V L et al: "Structures and Metrics for Image Storage and Interchange" Journal of Electronic Imaging, vol. 2, no. 2, 1 april 1993, pages 126-137.
	A59	Bourke D G et al: "Programmable Module and Circuit for Machine-Readable Unique Serial Number" IBM Technical Disclosure Bulletin, vol. 27, no. 4A, 1 September 1984 pages 1942-1944.
	A60	Kleinholz L et al: "Supporting Cooperative Medicine: The Bermed Project" IEEE Multimedia, vol. 1, no. 4, 21 December 1994 pages 44-53.
	A61	"Method for Network Naming and Routing" IBM Technical Disclosure Bulletin, vol. 37, no. 9, 1 September 1994 page 255.
	A62	"Minimizing Locking To Access Global Shared Data", IBM Technical Disclosure Bulletin, pp 619-622, February 1995.

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail with sufficient postage in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231 on December 4, 2000
Date of Deposit

Joseph F. Hetz - Reg. No. 41,070
Name of Applicant, Assignee or Registered Representative

Signature

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Patent
Our Case No. 10406-43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Overton et al.	)
Serial No.:	09/661,222	)
Filed:	September 13, 2000	)
For:	Network Distributed Tracking Wire Transfer Protocol	)

FIRST SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Pursuant to the obligation under 37 C.F.R. § 1.56 and in conformance with 37 C.F.R. §§ 1.97-1.99, Applicants hereby submit documents A1-A11 listed on the attached form PTO-1449 for consideration by the Examiner. Copies of the documents are enclosed herewith. Applicants respectfully request that the Examiner review the entire disclosure of these documents and make them of record.

The filing of this Information Disclosure Statement does not constitute an admission that the information cited herein is, or is considered to be, material to patentability as defined in 37 C.F.R. § 1.56(b). Further, Applicants reserve the right to contest that these documents are prior art against the present application.

Dated: December 4, 2000

Respectfully submitted,



Joseph F. Hetz
Reg. No. 41,070
Attorney for Applicants

BRINKS HOFER
GILSON & LIONE
P.O. Box 10395
Chicago, Illinois 60610
(312) 321-4719

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FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 10406/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT
(use several sheets if necessary)	APPLICANT(S): OVERTON ET AL.	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
	A1	5,347,600	09/13/94	BARNSLEY ET AL.		
	A2	4,636,858	01/13/87	HAGUE ET AL.		
	A3	5,809,161	09/15/98	AUTY ET AL.		
	A4	5,864,482	01/26/99	HAZAMA ET AL.		
	A5	5,610,653	03/11/97	ABECASSIS		
	A6	5,579,067	11/26/96	WAKABAYASHI		
	A7	5,649,247	07/15/97	ITOH ET AL.		
	A8	5,193,185	03/09/93	LANTER		
	A9	5,008,700	04/16/91	OKAMOTO		
	A10	4,728,978	03/01/88	INOUE ET AL.		
	A11	5,499,113	03/12/96	TSUBOI ET AL.		

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FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS/ SUBCLASS	TRANSLATION YES	NO

EXAMINER INITIAL	OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)	

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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"Express Mail" mailing label number EV 325 994 062 US
Date of Deposit: August 25, 2004

Our Case No.: 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

J. Overton

Serial No.: 09/661,222

Filing Date: September 13, 2000

For: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

Examiner: Kapadia, M.

Group Art Unit No.: 2144

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THIRD SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
Alexandria, VA 22313-1450

Dear Sir:

In compliance with the duty of disclosure under 37 C.F.R. § 1.56, it is respectfully requested that this Third Supplemental Information Disclosure Statement be entered and the documents listed below and on the attached Form PTO-1449 be considered by the Examiner and made of record. Copies of the listed documents required by 37 C.F.R. § 1.98(a)(2) are enclosed for the convenience of the Examiner.

The references now cited are the following:

U.S. PATENTS

Patent No.	Date	Inventor
4,835,372	05/1989	Gombrich et al.
5,291,399	03/1994	Chaco
5,479,654	12/1995	Squibb
5,740,428	04/1998	Mortimore et al.
5,903,889	05/1999	de la Huerga et al.

08/30/2004 MBERHE 00000166 231925 09661222
01 FC:1806 180.00 DA

Patent No.	Date	Inventor
5,918,241	06/1999	Perkowski
6,058,193	05/02/00	Cordery et al.
6,092,189	07/18/00	Fisher et al.
6,108,787	08/2000	Anderson et al.
6,154,873	11/2000	Call
6,188,766 B1	02/13/01	Kocher
6,201,931 B1	03/13/01	Cipolla et al.
6,202,070 B1	03/13/01	Nguyen et al.
6,209,095 B1	03/27/01	Anderson et al.
6,212,280 B1	04/03/01	Howard, Jr. et al.
2002/0112048	08/2002	Gruyer et al.

OTHER ART

Muniz, R., et al., "A robust software barcode reader using the Hough transform", Abstract from IEEE/IEE Electronic Library online, printed 4/30/01, 2 pages

Fresonke, D., "In-fab identification of silicon wafers with clean, laser marked barcodes", Abstract from IEEE/IEE Electronic Library online, printed 4/30/01, 2 pages

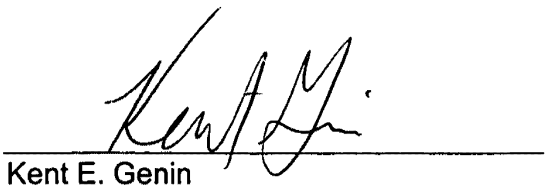
Sriram, T., et al., "Applications of barcode technology in automated storage and retrieval systems", Abstract from IEEE/IEE Electronic Library online, printed 4/30/01, 2 pages

In accordance with 37 C.F.R. § 1.97(g),(h), this Third Supplemental Information Disclosure Statement is not to be construed as a representation that a search has been made and is not to be construed to be an admission that the information cited is, or is considered to be, material to patentability as defined in 37 C.F.R. § 1.56(b).

This Third Supplemental Information Disclosure Statement is being filed pursuant to 37 C.F.R. §1.97(c). The Commissioner is hereby authorized to deduct the fee as set forth in 37 C.F.R. § 1.17(p) in the amount of $180.00 from Brinks Hofer Gilson & Lione Deposit Account No. 23-1925. A duplicate copy of this document is enclosed.

Applicant(s) respectfully request that the listed documents be made of record in the present case.

Respectfully submitted,



Kent E. Genin
Registration No. 37,834
Attorney for Applicant(s)

BRINKS HOFER GILSON & LIONE
P.O. Box 10395
Chicago, IL 60610
(312) 321-4200

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FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 11958/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE 09/13/2000	GROUP ART UNIT 2144
(use several sheets if necessary)	APPLICANT(S): J. Overton	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER Number-Kind Code (if known)	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
	D1	4,835,372	05/1989	Gombrich et al.		
	D2	5,291,399	03/1994	Chaco		
	D3	5,479,654	12/1995	Squibb		
	D4	5,740,428	04/1998	Mortimore et al.		
	D5	5,903,889	05/1999	de la Huerga et al.		
	D6	5,918,241	06/1999	Perkowski		
	D7	6,058,193	05/02/00	Cordery et al.		
	D8	6,092,189	07/18/00	Fisher et al.		
	D9	6,108,787	08/2000	Anderson et al.		
	D10	6,154,873	11/2000	Call		
	D11	6,188,766 B1	02/13/01	Kocher		
	D12	6,201,931 B1	03/13/01	Cipolla et al.		
	D13	6,202,070 B1	03/13/01	Nguyen et al.		
	D14	6,209,095 B1	03/27/01	Anderson et al.		
	D15	6,212,280 B1	04/03/01	Howard, Jr. et al.		
	D16	2002/0112048	08/2002	Gruyer et al.		

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EXAMINER INITIAL		OTHER ART – NON PATENT LITERATURE DOCUMENTS (Include name of author, title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date page(s), volume-issue number(s), publisher, city and/or country where published.
	D17	Muniz, R., et al., "A robust software barcode reader using the Hough transform", Abstract from IEEE/IEE Electronic Library online, printed 4/30/01, 2 pages
	D18	Fresonke, D., "In-fab identification of silicon wafers with clean, laser marked barcodes", Abstract from IEEE/IEE Electronic Library online, printed 4/30/01, 2 pages
	D19	Sriram, T., et al., "Applications of barcode technology in automated storage and retrieval systems", Abstract from IEEE/IEE Electronic Library online, printed 4/30/01, 2 pages

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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AUG 25 2004
PATENT & TRADEMARK OFFICE

TRANSMITTAL LETTER			Case No. 10406/43
Serial No. 09/661,222	Filing Date September 13, 2000	Examiner	Group Art Unit
Inventor(s) OVERTON ET AL.			
Title of Invention NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL			

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is a First Supplemental Information Disclosure Statement (2 pages); Form PTO-1449 (1 page); 11 U.S. References; Postcard Receipt.

☐ Small entity status of this application under 37 CFR § 1.27 has been established by verified statement previously submitted.

☐ A verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27 is enclosed.

☐ Petition for a _____month extension of time.

☐ No additional fee is required.

☐ The fee has been calculated as shown below:

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	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Small Entity Rate	Small Entity Add'l Fee	or	Other Than Small Entity Rate	Other Than Small Entity Add'l Fee
Total		Minus			x $9 =			x $18 =	
Indep.		Minus			x 40 =			x $80 =	
First Presentation of Multiple Dep. Claim					+ $135 =			+ $270 =	
					Total add'l fee	$		Total add'l fee	$

☐ Please charge Deposit Account No. 23-1925 (BRINKS HOFER GILSON & LIONE) in the amount of $_____. A duplicate copy of this sheet is enclosed.

☐ A check in the amount of $_____ to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this communication or credit any overpayment to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

☒ I hereby petition under 37 CFR § 1.136(a) for any extension of time required to ensure that this paper is timely filed. Please charge any associated fees which have not otherwise been paid to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Joseph F. Hetz
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on December 4, 2000.

Date: December 4, 2000 Signature: _____

rev. Oct.-00
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TRANSMITTAL LETTER			Case No. 10406/43
Serial No. 09/661,222	Filing Date September 13, 2000	Examiner	Group Art Unit
Inventor(s) OVERTON ET AL.			
Title of Invention NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL			

OIPE JC91
AUG 25 2004
PATENT & TRADEMARK OFFICE

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is a Information Disclosure Statement (2 pages); Form PTO-1449 (2 pages); 51 U.S. References; 6 Foreign References; 5 Other Art References; Postcard Receipt.

☐ Small entity status of this application under 37 CFR § 1.27 has been established by verified statement previously submitted.

☐ A verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27 is enclosed.

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☐ Petition for a _____month extension of time.

☐ No additional fee is required.

☐ The fee has been calculated as shown below:

	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Small Entity Rate	Small Entity Add'l Fee	or	Other Than Small Entity Rate	Other Than Small Entity Add'l Fee
Total		Minus			x $9 =			x $18 =	
Indep.		Minus			x 40 =			x $80 =	
First Presentation of Multiple Dep. Claim					+ $135 =			+ $270 =	
					Total add'l fee	$		Total add'l fee	$

☐ Please charge Deposit Account No. 23-1925 (BRINKS HOFER GILSON & LIONE) in the amount of $_____. A duplicate copy of this sheet is enclosed.

☐ A check in the amount of $_____ to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this communication or credit any overpayment to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

☒ I hereby petition under 37 CFR § 1.136(a) for any extension of time required to ensure that this paper is timely filed. Please charge any associated fees which have not otherwise been paid to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Joseph F. Hetz
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on October 26, 2000.

Date: October 26, 2000 Signature: _____

rev. Oct.-00
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AUG 25 2004
PATENT & TRADEMARK OFFICE

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Express Mail Label No.: EV 325 994 062 US

Date of Deposit: August 25, 2004

BRINKS
HOFER
GILSON
&LIONE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: J. Overton

Appln. No.: 09/661,222

Filed: September 13, 2000

For: Network Distributed Tracking Wire Transfer Protocol

Attorney Docket No: 11958/43

Examiner: Kapadia, M.

Art Unit: 2144

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Technology Center 2100

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL

Sir:

Attached is/are:

☒ Check for $475.00 (three month extension); Transmittal Letter (in duplicate); Petition and Fee for Extension of Time (in duplicate); Amendment; Copy of Previously Submitted Information Disclosure Statements; Third Supplemental Information Disclosure Statement (in duplicate); PTO Form 1449; One Copy of References D1-D19

☒ Return Receipt Postcard

Fee calculation:

☐ No additional fee is required.

☐ Small Entity.

☒ An extension fee in an amount of $475 for a three-month extension of time under 37 C.F.R. § 1.136(a).

☐ A petition or processing fee in an amount of $_____ under 37 C.F.R. § 1.17(_____).

☒ An additional filing fee has been calculated as shown below:

					Small Entity			Not a Small Entity	
	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Rate	Add'l Fee	or	Rate	Add'l Fee
Total	21	Minus	20	1	x $9=	9		x $18=	
Indep.	3	Minus	3	0	x 43=			x $86=	
First Presentation of Multiple Dep. Claim					+$145=			+ $290=	
					Total	$9		Total	$

Fee payment:

☐ A check in the amount of $_____ is enclosed.

☒ Please charge Deposit Account No. 23-1925 in the amount of $9.00. A copy of this Transmittal is enclosed for this purpose.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

Respectfully submitted,

August 25, 2004
Date

Kent E. Genin (Reg. No. 37,834)

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AUG 2 5 2004
PATENT & TRADEMARK OFFICE

Case No. 10406/43
Applicant OVERTON ET AL.
MAILED: OCTOBER 26, 2000

Director of The United States Patent & Trademark Office
Washington, D.C. 20231

O I P E JC8
OCT 30 2000
PATENT & TRADEMARK OFFICE

Please acknowledge receipt of the below-identified:

SERIAL NO: 09/661,222
Transmittal Letter (1 page in duplicate) with 10/26/00 Certificate of Mailing; Information Disclosure Statement (2 pages) with 10/26/00 Certificate of Mailing; Form PTO-1449 (2 pages); 51 U.S. References; 6 Foreign References; 5 Other Art References; Postcard Receipt.

BRINKS HOFER GILSON & LIONE
Joseph F. Hetz, Esq. – Reg. No. 41,070

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Case No. 10406/43
Applicant OVERTON ET AL.
MAILED: DECEMBER 4, 2000

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Please acknowledge receipt of the below-identified:

SERIAL NO: 09/661,222
Transmittal Letter (1 page in duplicate) with 12/4/00 Certificate of Mailing; First Supplemental Information Disclosure Statement (2 pages) with 12/4/00 Certificate of Mailing; Form PTO-1449 (1 page); 11 U.S. References; Postcard Receipt.

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Joseph F. Hetz, Esq. – Reg. No. 41,070

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AUG 25 2004
PATENT & TRADEMARK OFFICE

TRANSMITTAL LETTER			Case No. 10406/43
Serial No. 09/661,222	Filing Date September 13, 2000	Examiner	Group Art Unit
Inventor(s) OVERTON ET AL.			
Title of Invention NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL			

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is a First Supplemental Information Disclosure Statement (2 pages); Form PTO-1449 (1 page); 11 U.S. References; Postcard Receipt.

☐ Small entity status of this application under 37 CFR § 1.27 has been established by verified statement previously submitted.

☐ A verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27 is enclosed.

☐ Petition for a _____month extension of time.

☐ No additional fee is required.

☐ The fee has been calculated as shown below:

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	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Small Entity Rate	Small Entity Add'l Fee	or	Other Than Small Entity Rate	Other Than Small Entity Add'l Fee
Total		Minus			x $9 =			x $18 =	
Indep.		Minus			x 40 =			x $80 =	
First Presentation of Multiple Dep. Claim					+ $135 =			+ $270 =	
					Total add'l fee	$		Total add'l fee	$

☐ Please charge Deposit Account No. 23-1925 (BRINKS HOFER GILSON & LIONE) in the amount of $_____. A duplicate copy of this sheet is enclosed.

☐ A check in the amount of $_____ to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this communication or credit any overpayment to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

☒ I hereby petition under 37 CFR § 1.136(a) for any extension of time required to ensure that this paper is timely filed. Please charge any associated fees which have not otherwise been paid to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Joseph F. Hetz
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on December 4, 2000.

Date: December 4, 2000 Signature: _____

rev. Oct.-00
C:\Joe\PTO Miscel\10406-43 1st Suppl IDS, 1449 Trans 2.doc

TRANSMITTAL LETTER			Case No. 10406/43
Serial No. 09/661,222	Filing Date September 13, 2000	Examiner	Group Art Unit
Inventor(s) OVERTON ET AL.			
Title of Invention NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL			

OIPE JC91
AUG 25 2004
PATENT & TRADEMARK OFFICE

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is a Information Disclosure Statement (2 pages); Form PTO-1449 (2 pages); 51 U.S. References; 6 Foreign References; 5 Other Art References; Postcard Receipt.

☐ Small entity status of this application under 37 CFR § 1.27 has been established by verified statement previously submitted.

☐ A verified statement to establish small entity status under 37 CFR §§ 1.9 and 1.27 is enclosed.

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☐ Petition for a _____month extension of time.

☐ No additional fee is required.

☐ The fee has been calculated as shown below:

	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Small Entity Rate	Small Entity Add'l Fee	or	Other Than Small Entity Rate	Other Than Small Entity Add'l Fee
Total		Minus			x $9 =			x $18 =	
Indep.		Minus			x 40 =			x $80 =	
First Presentation of Multiple Dep. Claim					+ $135 =			+ $270 =	
					Total add'l fee	$		Total add'l fee	$

☐ Please charge Deposit Account No. 23-1925 (BRINKS HOFER GILSON & LIONE) in the amount of $_____. A duplicate copy of this sheet is enclosed.

☐ A check in the amount of $_____ to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this communication or credit any overpayment to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

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Respectfully submitted,

Joseph F. Hetz
Registration No. 41,070
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on October 26, 2000.

Date: October 26, 2000 Signature: _____

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OIPE JC61
AUG 25 2004
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DEPOSIT INFORMATION

Express Mail Label No.: EV 325 994 062 US

Date of Deposit: August 25, 2004

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: J. Overton

Appln. No.: 09/661,222

Filed: September 13, 2000

For: Network Distributed Tracking Wire Transfer Protocol

Attorney Docket No: 11958/43

Examiner: Kapadia, M.

Art Unit: 2144

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Technology Center 2100

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL

Sir:

Attached is/are:

☒ Check for $475.00 (three month extension); Transmittal Letter (in duplicate); Petition and Fee for Extension of Time (in duplicate); Amendment; Copy of Previously Submitted Information Disclosure Statements; Third Supplemental Information Disclosure Statement (in duplicate); PTO Form 1449; One Copy of References D1-D19

☒ Return Receipt Postcard

Fee calculation:

☐ No additional fee is required.

☐ Small Entity.

☒ An extension fee in an amount of $475 for a three-month extension of time under 37 C.F.R. § 1.136(a).

☐ A petition or processing fee in an amount of $_____ under 37 C.F.R. § 1.17(_____).

☒ An additional filing fee has been calculated as shown below:

					Small Entity			Not a Small Entity	
	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Rate	Add'l Fee	or	Rate	Add'l Fee
Total	21	Minus	20	1	x $9=	9		x $18=	
Indep.	3	Minus	3	0	x 43=			x $86=	
First Presentation of Multiple Dep. Claim					+$145=			+ $290=	
					Total	$9		Total	$

Fee payment:

☐ A check in the amount of $_____ is enclosed.

☒ Please charge Deposit Account No. 23-1925 in the amount of $9.00. A copy of this Transmittal is enclosed for this purpose.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

August 25, 2004
Date

Respectfully submitted,

Kent E. Genin (Reg. No. 37,834)

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AUG 2 5 2004
PATENT & TRADEMARK OFFICE

Case No. 10406/43
Applicant OVERTON ET AL.
MAILED: OCTOBER 26, 2000

Director of The United States Patent & Trademark Office
Washington, D.C. 20231

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OCT 30 2000
PATENT & TRADEMARK OFFICE

Please acknowledge receipt of the below-identified:

SERIAL NO: 09/661,222
Transmittal Letter (1 page in duplicate) with 10/26/00 Certificate of Mailing; Information Disclosure Statement (2 pages) with 10/26/00 Certificate of Mailing; Form PTO-1449 (2 pages); 51 U.S. References; 6 Foreign References; 5 Other Art References; Postcard Receipt.

BRINKS HOFER GILSON & LIONE
Joseph F. Hetz, Esq. – Reg. No. 41,070

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Case No. 10406/43
Applicant OVERTON ET AL.
MAILED: DECEMBER 4, 2000

Director of The United States Patent & Trademark Office
Washington, D.C. 20231

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PATENT & TRADEMARK OFFICE

Please acknowledge receipt of the below-identified:

SERIAL NO: 09/661,222
Transmittal Letter (1 page in duplicate) with 12/4/00 Certificate of Mailing; First Supplemental Information Disclosure Statement (2 pages) with 12/4/00 Certificate of Mailing; Form PTO-1449 (1 page); 11 U.S. References; Postcard Receipt.

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Date of Deposit: August 25, 2004

Case No. 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Technology Center 2100

In re Application of:

J. Overton

Serial No: 09/661,222

Filed: September 13, 2000

For: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

Examiner: Kapadia, M.

Group Art Unit: 2144

PETITION AND FEE FOR EXTENSION OF TIME (37 CFR § 1.136(a))

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is a petition for an extension of the time to respond to the Office Action dated February 25, 2004 for a period of three month(s).

☒ Applicant:

☒ claims small entity status. See 37 C.F.R. §1.27.

☐ is other than small entity

	Extension Months	Other Than Small Entity	Small Entity
☐	One Month	$110.00	$55.00
☐	Two Months	$420.00	$210.00
☒	Three Months	$950.00	$475.00
☐	Four Months	$1,480.00	$740.00
☐	Five Months	$2,010.00	$1,005.00

08/30/2004 MBERHE 00000165 09661222
01 FC:2253 475.00 OP

Fee Payment

☒ Attached is a check for $475 for the Petition fee.

☐ Attached is a credit card authorization form for $_____ for the Petition fee.

☐ Charge Petition fee to Deposit Account No. 23-1925. A duplicate copy of this Petition is attached.

☒ Charge any additional fee required or credit for any excess fee paid to Deposit Account No. 23-1925. A duplicate copy of this Petition is attached.

Respectfully submitted,

Dated: August 25, 2004

Kent E. Genin
Registration No. 37,834
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610
(312)321-4200

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/661,222	09/13/2000	John K. Overton	10406/43	7777

757 7590 02/09/2005

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610

EXAMINER	
THOMPSON, MARC D	

ART UNIT	PAPER NUMBER
2144	

DATE MAILED: 02/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/661,222	OVERTON ET AL.	
	Examiner	Art Unit	
	Marc D. Thompson	2144	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 August 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9 and 12-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9 and 12-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 September 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 20001030, 20001208, 20030428, 20040825, 20040825, 20040825
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This application has been reassigned to a new Examiner. See Conclusion section below, for new Examiner contact information.

2. The latest claim amendment, received 8/25/2004, has been entered into record.

3. Claims 1-9 and 12-23 are now pending.

Priority

4. This application claims priority to provisional application 60/153,709, filed 9/14/1999.

5. The effective filing date for the subject matter defined in the pending claims in this application which has support in the parent provisional application is 9/14/1999.

Drawings

6. The Examiner contends that the drawings submitted on 9/13/2000 are acceptable for examination proceedings.

Information Disclosure Statements

7. It should be noted that the applicant has submitted an exorbitant amount of prior art on numerous PTO-1449's which on initial consideration appears to not all have relevancy or pertinence to the instant invention as claimed. The applicant is requested in response to this office action to point out which of these numerous prior art are pertinent or relevant to the patentability of the invention as claimed in this instant application. It should be noted that it would be advantageous to the Applicant to provide a concise explanation of why each of the prior art is being submitted and how it is understood to be relevant. "Concise explanations are helpful to the Office, particularly where documents are lengthy and complex and applicant is aware of a section that is highly relevant to patentability or where a large number of documents

are submitted and applicant is aware that one or more are highly relevant to patentability." (See MPEP 609 under subheading "A. CONTENT").

Claim Rejections - 35 USC § 101

8. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

9. Claims 1-4 and 17-18 are rejected under 35 U.S.C. 101 because the claimed invention the claimed invention is directed to non-statutory subject matter, being inoperative, therefore lacking patentable utility.

10. The claims recite a "wire transfer protocol" comprising a number of "message[s] formatted to transport" information on a network. The messages do not actually effect transfer of anything as currently recited in the claimed invention. A protocol being defined in this art as "rules determining the format and transmission of data" does not explicitly or inherently require the mandate for transmission of such data. The joining of the physical machinery and any/all associated state changes of this machinery with the methodology actually performed, which optionally uses this protocol format(s) to effect physical changes and events in the system as a whole is required for proper recitation of statutory subject matter in this art. See, MPEP § 2106. "Protocols", per se, are accepted, predetermined, commonly understood and interpreted data structures dictating communication formats, and constitute non-statutory subject matter since no functionality is inherently associated with the protocol definition(s).

Claim Rejections - 35 USC § 112

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

12. Claims 1-23 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

13. Claim 1 recites the limitation "...the identity of an entity..." in Line 4 of the claim, and recites "...location of data associated with an entity..." in Lines 7-8 of the claim. Minimally, it is unclear whether these two entities are distinct or not. That is, it is unclear whether there are two entities recited in the claim which have corresponding information associated therewith, or whether the two recited entities are one and the same. Further, "the entity" is recited in Line 11 of the claim, lacking sufficient antecedent basis for this limitation in the claim.

14. Claim 1 recites "wherein the protocol supports a machine-independent relationship between the identification string and the location string" in the last Lines of the claim. There are no ascertainable metes and bounds to this limitation. The Examiner is at a total loss to discern what this limitation is attempting to describe, and further, the limitations set forth in dependent claims 2-4 also provide for "application", "organizationally" and "geographically" "independent" protocol definition, also fail to describe any definition of actual "independence". The bounds of what is attempting to be described by these limitations is vague and indefinite.

15. Claim 5 dictates a "redirection message" but fails to expressly recite what this message is, what function it has, how it operates, or the end result of its use. Minimally, while a client and a first server entity are recites, no second entity is recited to justify the use of the term "redirection". It is unclear, partially due to the breadth ("skeletal nature") of the claims, what is being described. Significant clarification and elaboration is required.

16. Claim 12 also recites "an entity" multiple times (Line 4, Line 5, Line 8), in combination with the use of "the entity" (Line 9, Line 14, Line 15) in a similar fashion to the deficiencies noted with claim 1. Further, other "entities" are recited in the claim. Clarification of the claimed invention using specific terms with clear and unambiguous language is required according to 35 U.S.C. §112.

17. Claim 12 also exhibits limitations in such breadth that functionality appears to occur in a vacuum, without any associated machinery. For example, the first limitation recites "providing a location string and an identification string..." It is unclear what "provides" this, where it is "provided" to, and other general details to clearly and concisely describe the system. Again, there is a failure to particularly point out and distinctly claim the inventive concept in accordance with the statutes.

18. Various claims recites the use of "hashing" function(s) and tables which do not properly specify what values are present in the table(s), what function the hashing function(s) perform, any specific functionality of the function(s) or use of the table(s), or an end result of actually implementing the functions and tables. If a functional element is recited in the claims, it is prudent to state its function as well as any details required to understand the process executed to effect the function in order to comply with 35 U.S.C. §112.

19. Lastly, the claims allegedly recite a "wire line transfer protocol" as argued by Applicant. However, none of the claims provide the transfer of information beyond location and identification data. It is presumed this information actually recited effects setup of a session/connection with remote networking equipment, which results in information transfer between two (or more) terminals. It is unclear from the claims the bounds of what constitutes

this "wire line transfer protocol" due to the failure of the claimed invention to recite sufficient details to discern the methodology attempting to be defined, and how any intended use set forth in the preamble(s) are actually performed/achieved. Significant clarification and narrowing of the claims is suggested to advance prosecution of this application. Presently, Examiner notes a basic framework of limitations in the claims without enough details to properly analyze the claims properly in scope with the specification.

20. All dependent claims inherit these deficiencies present in their respective parent claims.

Claim Rejections - 35 USC § 102

21. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

22. Claims 1-9 and 12-23 are rejected under 35 U.S.C. §102(b) as being anticipated by Beitz et al. ("Service location in an open distributed environment", Second International Workshop on Services in Distributed and Networked Environments, ISBN 0818670924, June 1995), hereinafter referred to as Beitz.

23. The claims describe a client generated message which effects a redirection message which is sent to another server process when the initial server process cannot provide a "location

string" in response to the client request. Simply, the invention resolves "identification string(s)" into "location string(s)" using a second server process in response to a "redirection" of an initial client request. Further details include hashing and the use of tables to correlate location information and identification information.

24. Beitz disclosed a request message for requesting "locators" to resolve names into access data for particular name server(s), which in turn resolve the request into returned access list(s) (See, inter alia, Section 2.3). This section also expressly provided multiple naming servers, and service locators providing "dynamic extensibility" using "interworking" of multiple naming servers. See, inter alia, Figure 3. These naming servers inherently implemented tables, with mapping hashing functions to lookup location/address/etc. information, as well as to effect direction of naming requests to other naming servers. See, inter alia, Section 2.3 and 3.2. The storage, retrieval, functional lookup, database maintaining, client/server interoperation of request/response, and current network addressing and naming conventions were all explicitly disclosed by Beitz. See, above cited sections, and Section 4.

25. Claims 1-9 and 12-23 are rejected.

26. Claims 1-9 and 12-23 are rejected under 35 U.S.C. §102(e) as being clearly anticipated by Perkowski (U.S. Patent Number 5,950,173), hereinafter referred to as Perkowski.

27. The claims describe a client generated message which effects a redirection message which is sent to another server process when the initial server process cannot provide a "location string" in response to the client request. Simply, the invention resolves "identification string(s)" into "location string(s)" using a second server process in response to a "redirection" of an initial

client request. Further details include hashing and the use of tables to correlate location information and identification information.

28. Perkowski disclosed an information collection, transmission, and delivery system effecting universal product code (UPC) to universal resource locators (URL) correlation, translation, resolving, and data correlation effecting information storage, lookup and transfer. See, inter alia, Column 11, Line 34 through Column 12, Line 35. In this section, the provision for multiple servers acting to translate/resolve identification information into location information was also provided with the express provision for the use of mapping tables and inherent hashing algorithms for information access and retrieval from remote database(s). See, inter alia, Figures 2A1, 2A2, 4A1, 4A2, and 4B. Also, Figures 5A and 5B expressly provide a protocol providing redirection of information mapping request(s) to multiple servers implementing functionality as claimed identically. See, inter alia, Column 22, Line 24 through Column 23, Line 5. All remaining limitations are either expressly provided by Perkowski or inherent in the Perkowski system.

29. Claims 1-9 and 12-23 are rejected.

30. Claims 1-9 and 12-23 are rejected under 35 U.S.C. §102(e) as being anticipated by Hudetz et al. (U.S. Patent Number 5,978,773), hereinafter referred to as Hudetz.

31. The claims describe a client generated message which effects a redirection message which is sent to another server process when the initial server process cannot provide a "location string" in response to the client request. Simply, the invention resolves "identification string(s)" into "location string(s)" using a second server process in response to a "redirection" of an initial

client request. Further details include hashing and the use of tables to correlate location information and identification information.

32. Hudetz disclosed an information collection, transmission, and delivery system effecting universal product code (UPC) to universal resource locators (URL) correlation, translation, resolving, and data correlation effecting information storage, lookup and transfer, including network locational information using multiple resolving servers. See, inter alia, Abstract, Column 7, Lines 1-16, and Column 9, Lines 22-42. The redirection of requests and the transmission of redirection messages/responses was fully provided, inter alia, in Column 9, Lines 54-64. Lastly, the express use of tables, hashing algorithms, and mapping functions in a distributed environment was expressly provided in, inter alia, Column 7, Lines 64-65, and Figure 4. All remaining limitations were either expressly provided by Hudetz, or inherent in the Hudetz system.

33. Claims 1-9 and 12-23 are rejected.

34. Claims 1-9 and 12-23 are rejected under 35 U.S.C. §102(e) as being anticipated by Call (U.S. Patent Number 5,913,210), hereinafter referred to as Call.

35. The claims describe a client generated message which effects a redirection message which is sent to another server process when the initial server process cannot provide a "location string" in response to the client request. Simply, the invention resolves "identification string(s)" into "location string(s)" using a second server process in response to a "redirection" of an initial client request. Further details include hashing and the use of tables to correlate location information and identification information.

36. Call disclosed a product code translator acting to store, access, lookup, and deliver cross-referenced product code(s) with associated network location information. See, inter alia, Abstract, Column 6, Line 66 through Column 7, Line 6. The implementation of tables holding database records, intrinsically involving hashing/mapping function(s), implemented in a distributed environment was disclosed, inter alia, in Column 5, Line 5 through Column 6, Line 31, Column 7, Lines 7-48, etc., and Figure 2. Redirection of information access/lookup request(s) was expressly envisioned, inter alia, Column 8, Lines 33-65. Additonally, see Column 7, Lines 7-30, where this overly broad characterized functional behavior was also described in yet another type of embodiment, i.e., email. All remaining limitations were either expressly provided by Call, or inherent in the Call disclosure.

37. Claims 1-9 and 12-23 are rejected.

Response to Arguments

38. The arguments presented by Applicant in the response, received on 8/25/2004, are not considered persuasive.

39. Applicant argues differing reasons of distinguishing subject matter for each of claims 1, 5 and 12. It is respectfully submitted that each and every one of these independent claims relate to an identical inventive concept, and so, arguments set forth for one should be relevant to each. That is, all the independent claims relate to the same general invention, and so a common thread of distinguishing over the prior art of record must be ascertainable but is not adopted by Applicant in the response received 8/25/2004. In order to properly define the claimed invention over the prior art of record, a common theme of functional limitations found in each of the base

claims must be identified and discussed. No one set of claims is considered to teach anything above and beyond the other sets of claims.

40. Applicant has failed to modify the claim language to distinguish over the prior art of record by clarifying or substantially narrowing the claim language. Thus, Applicant apparently intends that a broad interpretation be given to the claims and the Examiner has adopted such in the present and previous Office action rejections. See *In re Prater and Wei*, 162 USPQ 541 (CCPA 1969), and MPEP § 2111. Additionally, Applicant employs broad language which includes the use of words and phrases which have broad meanings in the art. In addition, Applicant has not argued any narrower interpretation of the claim language, nor amended the claims significantly enough to construe a narrower meaning to the limitations. As the claims breadth allows multiple interpretations and meanings which are broader than Applicant's disclosure, the Examiner is forced to interpret the claim limitations as broadly as reasonably possible, in determining patentability of the disclosed invention. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). The current claims infer coverage breadth which is inconsistent with breadth of the disclosure and are not found distinguishable above the prior art of record.

41. In regard to Applicant's arguments addressed to claims 2-4 and 8, these fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

42. Lastly, Applicant's arguments with respect to the pending claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

43. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Marc D. Thompson whose telephone number is 571-272-3932. The Examiner can normally be reached on Monday-Friday, 9am-4pm. If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, William Cuchlinski, Jr. can be reached at 571-272-3925. The fax phone number for the organization where this application or proceeding is assigned remains 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MARC D. THOMPSON
MARC THOMPSON
PRIMARY EXAMINER

Marc D. Thompson
Primary Examiner
Art Unit 2144

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OCT 30 2000
PATENT & TRADEMARK OFFICE
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FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 10406/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT
(use several sheets if necessary)	APPLICANT(S): OVERTON ET AL.	

REFERENCE DESIGNATION **U.S. PATENT DOCUMENTS**

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MDT	A50	6,047,332	04/04/00	VISWANATHAN ET AL.		
MDT	A51	6,055,544	04/25/00	DEROSE ET AL.		

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MDT	A52	WO 98/31138	07/16/98	PCT			
MDT	A53	WO 00/03526	01/20/00	PCT			
MDT	A54	EPO 568 161 A1	03/11/93	EPO			
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MDT	A61	"Method for Network Naming and Routing" IBM Technical Disclosure Bulletin, vol. 37, no. 9, 1 September 1994 page 255.
MDT	A62	"Minimizing Locking To Access Global Shared Data", IBM Technical Disclosure Bulletin, pp 619-622, February 1995.

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MDT	A6	5,579,067	11/26/96	WAKABAYASHI		
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MDT	A8	5,193,185	03/09/93	LANTER		
MDT	A9	5,008,700	04/16/91	OKAMOTO		
MDT	A10	4,728,978	03/01/88	INOUE ET AL.		
MDT	A11	5,499,113	03/12/96	TSUBOI ET AL.		

FOREIGN PATENT DOCUMENTS

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LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT 2171
(use several sheets if necessary)	APPLICANT(S): Overton et al.	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER Number-Kind Code (If known)	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
MF	A1	5,913,210	06/15/1999	Call		
MF	A2	5,950,173	09/07/1999	Perkowski		
MF	A3	5,978,773	11/2/1999	Hudetz et al.		

EXAMINER INITIAL	OTHER ART – NON PATENT LITERATURE DOCUMENTS (Include name of author, title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date page(s), volume-issue number(s), publisher, city and/or country where published.	
MF	A4	"Service Location in an Open Distributed Environment," Beitz et al, Second International Workshop on Services in Distributed and Networked Environments, IEEE Comput. Soc., pp. 28-34 (June 1995).

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LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE 09/13/2000	GROUP ART UNIT 2144
(use several sheets if necessary)	APPLICANT(S): J. Overton	

REFERENCE DESIGNATION **U.S. PATENT DOCUMENTS**

EXAMINER INITIAL		DOCUMENT NUMBER Number-Kind Code (if known)	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
MDT	D1	4,835,372	05/1989	Gombrich et al.		
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	A53	WO 00/03526	01/20/00	PCT			
	A54	EPO 568 161 A1	03/11/93	EPO			
	A55	WO 86/05610	09/25/86	PCT			
	A56	0 889 422 A2	01/07/99	EPO			
	A57	WO 98/15910	04/16/98	PCT			

EXAMINER INITIAL		OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)
	A58	Callaghan V L et al. "Structures and Metrics for Image Storage and Interchange" Journal of Electronic Imaging, vol. 2, no. 2, 1 april 1993, pages 126-137.
	A59	Bourke D G et al. "Programmable Module and Circuit for Machine-Readable Unique Serial Number" IBM Technical Disclosure Bulletin, vol. 27, no. 4A, 1 September 1984 pages 1942-1944.
	A60	Kleinholz L et al. "Supporting Cooperative Medicine: The Bermed Project" IEEE Multimedia, vol. 1, no. 4, 21 December 1994 pages 44-53.
	A61	"Method for Network Naming and Routing" IBM Technical Disclosure Bulletin, vol. 37, no. 9, 1 September 1994 page 255.
	A62	"Minimizing Locking To Access Global Shared Data", IBM Technical Disclosure Bulletin, pp 619-622, February 1995.

EXAMINER M THOMPSON	DATE CONSIDERED 04FEB 2005

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Rev. Feb.-97
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Index of Claims



Application/Control No.	Applicant(s)/Patent under Reexamination
09/661,222	OVERTON ET AL.
Examiner	**Art Unit**
Marc D. Thompson	2144

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	+	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	2/4/05
	1	√
	2	√
	3	√
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Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination
	09/661,222	OVERTON ET AL.
	Examiner	Art Unit
	Marc D. Thompson	2144

SEARCHED			
Class	Subclass	Date	Examiner
709	227	2/3/2005	MDT
709	228	2/3/2005	MDT

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
consulted 101 Panel concerning claims 1-4+: appropriate rejection under 35 USC 101	2/3/2005	MDT
updated EAST text search: USPAT, EPO, DERWENT	2/3/2005	MDT
updated class/subclass search	2/3/2005	MDT
extensive IDS review	2/4/2005	MDT

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FACSIMILE COVER SHEET

Date: June 16, 2005

To: Examiner Marc Thompson
Group Art Unit: 2144
Fax No: 703-872-9306

From: Kent E. Genin
Tel. No: 312-321-7732

Serial No.: 09/661,222
Client No: 11958/43

No. of Pages
(inc. this page): 4

Confirmation Copy To Follow: Yes ___ No ✓

A Professional Corporation
Intellectual Property Attorneys

NBC Tower - Suite 3600
455 N. Cityfront Plaza Drive
Chicago, Illinois 60611-5599
Facsimile 312-321-4299
Telephone 312-321-4200

Indianapolis, IN
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COVER MESSAGE:

Dear Examiner Thompson:

Attached please find a proposed Agenda and proposed amendment to independent claim 12 (and associated dependent claims) for discussion at tomorrow's Interview. We look forward to meeting you tomorrow.

Very truly yours,

Kent E. Genin
Reg. No. 37,834

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FOR DISCUSSION PURPOSES ONLY

Our Case No. 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
JOHN OVERTON	
Serial No. 09/661,222	Examiner: Thompson. M.
Filing Date: September 13, 2000	Group Art Unit: 2144
For NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL	

INTERVIEW AGENDA

Dear Sir:

Applicant proposes to discuss the following items with the Examiner at the in-person interview scheduled for 3 p.m. on Friday, June 17, 2005:

I. Invention Overview

II. Review of Embodiment Relating to Claimed Redirection Feature

III. Review of Independent Claim 12 and Proposed Amendment

IV. Discussion of the Four Cited References Used in Current §102 Rejections

PAGE 2/4 * RCVD AT 6/16/2005 1:09:50 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:312 321 4299 * DURATION (mm-ss):01-32

PROPOSED AMENDMENT – FOR DISCUSSION PURPOSES ONLY

12. (Currently Amended) A method for storing and retrieving tracking information over a network using a wire transfer protocol, comprising the steps of:

providing a location string and an identification string, the location string for specifying the location of data ~~associated with an entity~~ in a distributed data collection and the identification string for specifying the identification of the data ~~an entity~~ in the distributed data collection;

storing information at a data repository ~~entity~~ by associating an identification string associated with the data ~~an entity with each particular stored unit of information associated with the entity and~~ by mapping the identification string to at least one location string associated with the data repository ~~entity~~, the identification string and the at least one location string ~~for a particular unit of information~~ being stored at a first server in communication with ~~entity coupled~~ to the data repository ~~entity~~;

transmitting a request from a client ~~entity~~ to a second ~~the first~~ server ~~entity~~ to retrieve at least one location string associated with the data ~~the entity~~, the request including the identification string associated with the data~~entity~~; and

receiving the request at the second ~~first~~ server ~~entity~~; [[and]]

responding to the client ~~entity~~ with a redirect message containing information for determining a [[the]] location of at least one location string if the at least one location string is not at the second server ~~first server entity~~, wherein the client calculates the location of the at least one location string based on the redirect message.

13. – 14. (Cancelled)

15. (Original) The method for storing and retrieving tracking information defined in claim 12, wherein the lengths of the identification string and the at least one location string are variable.

16. (Original) The method for storing and retrieving tracking information defined in claim 12, further comprising the step of spontaneously and dynamically manipulating the mapping of an identification string to a location string.

---

21. (Currently Amended) The method of claim 12, wherein responding to the client ~~entity~~ with a redirect message comprises sending the client ~~entity data configured in~~ a server table and the client calculates ~~entity determining~~ the location of at least one location string by applying a shared function to the server table.

22. (Currently Amended) The method of claim 12, wherein responding to the client ~~entity~~ with a redirect message comprises the second server ~~first server entity~~ sending a function ~~description~~ to the client ~~entity~~, the function adapted for use by the client ~~entity~~ to obtain the location of the at least one location string.

23. (Previously Presented) The method of claim 22, wherein the client entity applies the function from the redirect message to the identification string to obtain the location of the at least one location string.

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARK
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
09/661,222	9/13/2000	OVERTON	11958/43

EXAMINER	
THOMPSON, M	
ART UNIT	PAPER NUMBER
2144	20050617

DATE MAILED:

INTERVIEW SUMMARY

All participants (applicant, applicant's representative, PTO personnel):

(1) MARC THOMPSON (USPTO) (3) JOHN OVERTON (INVENTOR)

(2) KENT GENIN (# 37,834) (4) _____

Date of Interview 17 JUNE 2005

Type: ☐ Telephonic ☐ Televideo Conference ☒ Personal (copy is given to ☐ applicant ☒ applicant's representative).

Exhibit shown or demonstration conducted: ☐ Yes ☒ No If yes, brief description: _____

Agreement ☐ was reached. ☒ was not reached.

Claim(s) discussed: PROPOSED CLAIM 12

Identification of prior art discussed: _____

Description of the general nature of what was agreed to if an agreement was reached, or any other comments:

RESTRUCTURING OF THE CLAIMED INVENTION WAS DISCUSSED TO INCLUDE FUNCTIONALITY CRITICAL TO THE INVENTION. APPLICANT ADVISED TO RESUBMIT CLAIMS + HOLD FURTHER DISCUSSIONS IN LINE WITH INTERVIEW DISCUSSION.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

☐ It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary. A FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has are ready been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

Examiner Note: You must sign this form unless it is an attachment to another form.

MARC D. THOMPSON
MARC THOMPSON
PRIMARY EXAMINER

FORM PTOL-413 (REV. 2-98)

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PATENT & TRADEMARK OFFICE

"Express Mail" mailing label number EV 655 031 406 US
Date of Deposit: August 9, 2005

Our Case No. 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
JOHN OVERTON	
Serial No. 09/661,222	Examiner: Thompson, M.
Filing Date: September 13, 2000	Group Art Unit: 2144
For NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL	

AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the non-final Office Action dated February 9, 2005, please enter the following amendments and consider the remarks provided below.

08/11/2005 JBALINAN 00000053 09661222

02 FC:2201 100.00 OP
03 FC:2202 100.00 OP

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. - 23. (Cancelled)

24. (New) A method for retrieving data location information for data stored in a distributed network, comprising the steps of:

a) receiving at a first client a data query for retrieving data associated with an identification string, wherein the data is stored at a data repository and wherein a location string associated with the identification string of the data is stored in at least one of a plurality of data location servers;

b) transmitting a data location request from the first client to a server to retrieve the location string associated with the identification string in the data query, the data location request including the identification string;

c) if the server is not a data location server, then operating the server as a next client and transmitting the data location request from the next client to a server logically associated with the next client;

d) repeating c) until the data location request is transmitted to a data location server, wherein a communication path is defined between the first client and the data location server; and

e) if the data location server does not possess the location string, transmitting a redirect message to the first client over the communication path, the redirect message containing information with which the first client is configured to determine a location of a second data location server, wherein the second data location server contains the location string.

25. (New) The method of claim 24, wherein transmitting the redirect message comprises transmitting a data location server table to the first client.

26. (New) The method of claim 25, further comprising:

f) calculating at the first client the location of the second data location server with a function commonly known to the data location server and the first client and based on the identification string and the data location server table.

27. (New) The method of claim 26, wherein the function comprises a hash function and wherein the first client applies the hash function to the identification string and the data location server table to obtain the location of the second data location server.

28. (New) The method of claim 24, wherein transmitting the redirect message comprises transmitting a function to the first client.

29. (New) The method of claim 28, further comprising:

f) calculating at the first client the location of the second data location server with the transmitted function.

30. (New) The method of claim 29, wherein calculating at the first client the location of the second data location server comprises applying the transmitted function to the identifier string.

31. (New) The method of claim 30, wherein applying the transmitted function generates a URL of the second data location server.

32. (New) The method of claim 24, wherein a length of the identification string and the location string each is variable.

33. (New) A method for retrieving data location information for data stored in a distributed network, comprising the steps of:

a) receiving at a first client a data query for retrieving data associated with an identification string, wherein the data is stored at a data repository in the distributed network and wherein a location string associated with the identification string of the data is stored in at least one of a plurality of data location servers;

b) transmitting a data location request from the first client to a first data location server to retrieve the location string associated with the identification string in the data query, the data location request including the identification string;

c) if the first data location server does not possess the location string, transmitting a redirect message to the first client, the redirect message containing information for use by the first client to calculate a location of a second data location server, wherein the second data location server contains the location string;

d) calculating the location of the second data location server at the first client; and

e) transmitting the data query from the first client to the second data location server.

34. (New) The method of claim 33, wherein transmitting the redirect message comprises transmitting a data location server table to the first client.

35. (New) The method of claim 34, wherein calculating the location of the second data location server comprises calculating the location of the second data location server with a function commonly known to the first data location server and the first client and based on the data location server table and the identification string.

36. (New) The method of claim 35, wherein the function comprises a hash function and wherein the first client applies the hash function to the identification string and the data location server table to obtain the location of the second data location server.

37. (New) The method of claim 33, wherein transmitting the redirect message comprises transmitting a function to the first client.

39. (New) The method of claim 37, wherein calculating at the first client the location of the second data location server comprises applying the transmitted function to the identifier string.

40. (New) The method of claim 38, wherein applying the transmitted function generates a URL of the second data location server.

41. (New) A system for retrieving data location information for data stored in a distributed network, the system comprising:

a plurality of data repositories configured to store data, wherein the data is associated with a respective identifier string in each data repository;

a data location server network having a plurality of data location servers, each of the plurality of data location servers containing location strings associated with respective identifier strings and each of the plurality of data location servers having computer executable code configured to execute the following steps:

in response to receiving a data location request from a client to retrieve a location string associated with an identification string provided in the data location request, transmitting a redirect message to the client if the identification string is not associated with a location string at the data location server, wherein the redirect message contains information for use by the client to calculate a location of a different data location server in the plurality of data location servers, wherein the different data location server contains the location string.

42. (New) A system for retrieving data location information for data stored in a distributed network, the system comprising:

a data repository configured to store data, wherein the data is associated with an identifier string;

a client responsive to a data query to query a data location server for location information associated with the identifier string;

a data location server network comprising a plurality of data location servers, at least one of the plurality of data location servers containing location information associated with the identifier string, wherein each of the plurality of data location servers comprises computer executable code configured to execute the following steps in response to receiving a data location request from the client:

if the data location server contains the location string associated with the identification string provided in the data location request, the data location server transmits location information for use by the client to calculate a location of the data associated with the identification string;

if the data location server does not contain the location string associated with the identification string, the location server transmits a redirect message to the client, wherein the redirect message contains redirect information for use by the client to

calculate a location of a different data location server in the plurality of data location servers, wherein the different data location server contains the location string.

43. (New) The system of claim 42, wherein the client and the plurality of data location servers each comprise a function commonly known to the client and the plurality of data location servers and wherein the client is configured to apply the commonly known function to the location information or redirect information.

44. (New) The system of claim 43, wherein the redirect message comprises a data location server table.

45. (New) The system of claim 44, wherein the commonly known function comprises a hash function and wherein the client is configured to apply the hash function to the identification string and the data location server table to obtain the location of the different data location server.

46. (New) The system of claim 42, wherein the redirect message comprises a transmitted function for use by the client.

47. (New) The system of claim 46, wherein the client is configured to calculate the location of the different data location server by applying the transmitted function to the identifier string.

48. (New) The system of claim 42, wherein the location information comprises a portion of a hash table distributed over the plurality of data location servers.

49. (New) The system of claim 42, further comprising a plurality of servers related in a logical hierarchy between the client and the data location servers, wherein each of the plurality of servers is configured to function as a next client and retransmit the data location request to a next logically associated server until a data location server receives the data location request.

REMARKS

I. Office Action Summary

In the Office Action dated February 9, 2005, the Examiner rejected claims 1-9 and 12-23. The Examiner requested Applicant's assistance in understanding the reason behind the citation of prior art references. Claims 1-4 and 17-18 were rejected under 35 USC §101 as directed to non-statutory subject matter. Claims 1-9 and 12-23 were rejected as indefinite under 35 U.S.C. §112, second paragraph. Finally, all of the pending claims were rejected as anticipated by each of the following:

Reference	Statutory Basis
Beitz et al. ("Service Location In An Open Distributed Environment" Second International Workshop on Services in Distributed and Networked Environments, June 1995)	§102(b)
Perkowski (U.S. 5,950,173)	§102(e)
Hudetz et al. (U.S. 5,978,773)	§102(e)
Call (U.S. 5,913,210)	§102(e)

II. Request For Information Regarding the IDS

Applicant has cited the references currently of record in response to the duty of disclosure under 37 CFR § 1.56 and in the format required by MPEP § 609. The cited references include relevant references cited in corresponding foreign applications and references in the possession of Applicant. Applicant is reluctant to go beyond the duty of disclosure mandated by the rules and describe the teachings of each reference out of concern that any such characterization would be misconstrued as erroneous or misleading. The undersigned has discussed the pertinence of the cited art with the Examiner and believes that the Examiner's questions have now been addressed.

III. Rejections Under 35 U.S.C. § 101

Applicant respectfully disagrees that claims 1-4 and 17-18 were directed to non-statutory subject matter. Applicant has cancelled these claims to focus more directly on aspects of the invention recited in new claims 24-49. Accordingly, Applicant submits that this rejection is now moot. Furthermore, none of new claims 24-49 utilize the term "protocol" identified as objectionable by the Examiner.

IV. Rejections Under 35 U.S.C. § 112, Second Paragraph

Applicant respectfully disagrees that claims 1-9 and 12-23 were indefinite. Applicant has cancelled these claims to focus more directly on aspects of the invention recited in new claims 24-49. Accordingly, Applicant submits that this rejection is now moot. New claims 24-49 do utilize the terms "redirect message" and "hash function" in several instances; however, Applicant submits that these terms are properly understandable in the context of the new claims in which they are now being used.

V. Rejections Under 35 U.S.C. § 102

Applicant respectfully disagrees with the Examiner's rejections of claims 1-9 and 12-23 as anticipated by the 4 cited references. However, in order to expedite allowance of claims 24-49 directed to certain aspects of the invention, claims 1-9 and 12-23 have been cancelled.

VI. New Claims 24-29

New claims 24-49 relate to systems and methods that decentralize the processing requirements that can burden traditional databases, such as relational databases. The claimed method and system generally relates to a highly scalable and dynamic way of handling extremely large amounts of data by distributing the way data location information is handled (i.e. the information on where a piece of data is stored in a network), distributing it across a logical pool of participating machines, and distributing data location computation across participating machines, for example by allowing the clients that request the location of data to participate in the computation.

One aspect of a system configured with a communication protocol to implement this data handling strategy is the redirect message supported by the communication protocol. Examples of one type of redirection include the "well-known" and "passed function" redirection described in the specification, for example at pages 24-26.

In 'well-known function' redirection both servers and clients compute the same function on the same data to generate the same location results. This guarantees that a system configured with the protocol described (NDTP) distributes computation across clients and servers. The disclosure illustrates this using the standard hashpjw function from a reference computer science text book.

> The first appropriate NDTP server is selected from the table in the NDTP_RDR_RSP message by applying a well-known function to the identifier string and using the function result as an index into the NDTP server table. The well-known function preferably applied is the *hashpjw* function presented by Aho, Sethi and Ullman in their text Compilers, Principles, Techniques and Tools (Specification at p. 24, ll. 26–31).

That is, the system distributes hash-function computation, or creates a "distributed hash table". This is fundamentally different than relational database management systems, which are not hash tables. This well-known function can be applied to both clients and servers in their original programming.

> The first variant of the NDTP_RDR_RSP function mechanism specifies a well-known function that all NDTP server and client implementations know when they are programmed, and the NDTP_RDR_RSP message carries a table of NDTP server URLs. (Specification at p.24, ll.20).

As discussed in the specification in one embodiment, when a client requests data from a server for which the server is not responsible, the server returns a NDTP_RDR_RSP message containing a table listing the currently deployed server configuration. This does not indicate where the data is, only which servers currently are operating in a server pool. NDTP_RDR_RSP returns the very same information that the servers use to compute where to put the data in the first place, so the client will compute the location just like the servers originally knew how to store it. Both servers and clients hash the location, using the same information. Receiving NDTP_RDR_RSP, a client runs the same computation, on the same data and therefore computes the same result.

> The appropriate NDTP server is selected from the table in the NDTP_RDR_RSP message by applying a well-known function to the identifier string and using the function result as an index into the NDTP server table (Specification at p. 24, ll. 26–28).

In another disclosed redirection approach, the 'communicated function' redirection, servers use NDTP_RDR_RSP message to pass new function definitions to clients, rather than requiring clients and servers to share the same "well-known" function.

> The second variant of the NDTP_RDR_RSP function mechanism specifies that a general function description will be sent to the NDTP client in the NDTP_RDR_RSP message. The client will apply this function to the identifier string and the output of the function will be the NDTP server URL to which to send NDTP requests for the particular identifier string. (Specification at p. 25, ll. 32–p. 26, ll. 2).

Communicated function allows passing entirely new functions to clients, and therefore allows modifying system behavior at the moment of interaction with the NDTP distributed system. Rather than recalling millions of clients to replace the well-known function in both clients and servers, this allows dynamically remapping the identifier string space to the deployed system in the field. An example of this might be if a company installs one or more NDTP (data location) servers and then learns that it would benefit by portioning certain "General Electric" identifier location strings to a new location. Using communicated function redirection via NDTP_RDR_RSP would allow this.

> The advantage of this technique over the well-known function approach is that it allows application-specific partitions of the identifier string space. This can permit useful administrative control. For example, if General Electric manages all identifies beginning with the prefix "GE", a general function can be used to make this selection appropriately. The disadvantage of using a general function is it may be less efficient to compute than a well-known function, (Specification at p. 25, ll. 32–p. 26, ll. 2).

Finally, communicated function redirection may allow changing the processing behavior of clients and servers dynamically that are already deployed in the field.

Each of new claims relates to aspects of the redirection process and system configuration. Claim 24, for example, relates to the process supported by redirection

(including both the well-known function and the communicated function versions as recited in claims 26 and 28). Support for claim 24 may be found throughout the specification as discussed above and in FIGS. 10-12.

Referring to claim 24, when a user enters a request at a client for data at a first client, the data query includes an identifier string (e.g. a file name or URI) and expects to receive information (a location string) on where the data corresponding to that filename resides. The location strings are stored in one or more data location servers in the network. The first client then transmits a data location request to a server to retrieve the location string associated with the identification string in the data query. If the server is not a data location server, then that server can turn around and operate as a "next client" transmitting the data location request to a server logically associated with it. This process of the queried server then functioning as a client to ask another server in the logical chain repeats until the data location request is transmitted to a data location server. During this navigation process, if a data location server does not possess the sought after location string, it transmits a redirect message back along the communication path the data location request traveled to the first client. The redirect message that is sent back to the first server contains information with which the first client is configured to determine a location of a second data location server that does contain the sought after location string. In other words, the redirect message allows the first server to calculate a new data location server address so that the first server "redirects" its query to the right data location server. An example of a network topology that the method of claim 24 may work with is shown in FIG. 10. However, the method of claim 24 is not limited to any particular physical hierarchy, simply a logical hierarchy.

Similarly, the method of claim 33 also includes includes the feature of redirection, however claim 33 addresses a more simplified scenario such as shown in FIG. 12, where there are not necessarily any intervening devices between the client and the data location servers.

New independent claims 41 and 42 relate to system configurations adapted to incorporating software instructions implementing the redirection process.

The specific network deployments of FIGS. 10-13 are merely illustrative examples to aid discussion because diagramming the combinatorial relationships can reach into factorial complexity. Discussion relating to this is found in the specification:

> In FIG. 10, the client 112 and data repository 114 of FIG. 11 were merged into the single client entity 106 for ease of discussion. Their distinction can now be separated and identified in order to illustrate the storage and retrieval of data in a distributed data collection" (Specification at p. 27, ll. 30—p. 28, ll. 2).

FIG 11. illustrates a client (112) that queries the server pool (110) for location information. Receiving the location information, the client queries a "data repository" (114) in the distributed data collection. As an example of the dynamism of the system, FIG. 10 labels:

(a) 108 to represent a collection of a highest logical level of servers ("Level 1" servers)
(b) 104 to represent next logical level of servers ("Level "2" servers)
(c) 106 to represent a collections of clients and repositories, in which ANY client can connect to ANY other client acting like a repository, and *visa versa*.

This can become exponentially complex, theoretically, using the claimed redirection mechanisms:

> "NDTP supports two specific redirection mechanisms, which are not mutually exclusive and may be combined in any way within a single NDTP server constellation" (Specification at p. 29, ll. 5–7).

In a hypothetical system that needs to track 100s of billions of objects across 100s of millions of clients and repositories in which any object can "spontaneously and dynamically" change location from any client to any other client in real-time, there are significant challenges. The claimed redirection feature is intended to help address and solve problems like these, using a theoretically one-point-failure-retry redirection method that configurably distributes computation among clients and servers.

None of the previously cited references teach or suggest the features of claims 24-49.

Beitz et al. discloses a system that needs some type of improved data management system, for example see p. 32 of Beitz, but fails to address how that data management system would be implemented. Accordingly, Beitz does not teach or suggest a redirection mechanism as recited in the pending claims.

Call discloses mapping UPC codes to IP addresses in a standard relational database using mirrored servers each having a complete copy of a look-up table. (See Col. 3, line 61 – Col. 4, line 9). Call does not disclose or suggest the claimed redirection mechanism.

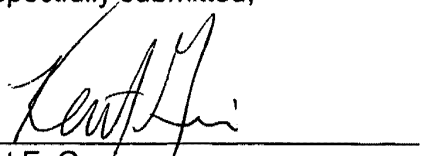
Perkowski discloses linking consumers to product information using a relational database. Perkowski teaches the use of traditional relational databases using centralized or mirrored deployment. (See Col. 7, lines 38-42; Col. 11, lines 34-61; Col. 12, lines 30-35; and Col. 18, lines 13-35). Perkowski fails to teach or suggest a redirect message containing information for a client or server to determine the location of another data location server, a client or server computing redirection information or of the location of servers changing dynamically.

Similarly, Hudetz et al. discloses mapping UPC numbers to IP addresses that can provide the consumer more information on the product. The disclosure mentions in passing a database that stores the UPC-to-IP data table and does not disclose or suggest a dynamic data management system with a redirection function. (See FIG. 4; Col. 7, lines 1-9).

VII. Conclusion

Applicant wishes to thank Examiner Thompson for the courtesy extended in the in-person interview with Applicant and the undersigned on June 17, 2005. Applicant has cancelled claims 1-9 and 12-23, and added claims 24-49. Applicant submits that no new matter has been added. In light of the above remarks and amendments, Applicant submits that claims 24-49 are in condition for allowance. If any issues arise or questions remain, the Examiner is invited to contact the undersigned at the number listed below in order to expedite disposition of this case.

Respectfully submitted,



BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

Kent E. Genin
Registration No. 37,834
Attorney for Applicant

OIPE JC172
AUG 0 9 2005
PATENT & TRADEMARK OFFICE

"Express Mail" mailing label number EV 655 031 406 US

Date of Deposit: August 9, 2005

Case No. 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

J. Overton

Serial No: 09/661,222

Examiner: M. Thompson

Filed: September 13, 2000

Group Art Unit: 2144

For: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

PETITION AND FEE FOR EXTENSION OF TIME (37 CFR § 1.136(a))

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is a petition for an extension of the time to respond to the Office Action dated February 9, 2005 for a period of three month(s).

☒ Applicant:

☒ claims small entity status. See 37 C.F.R. §1.27.

☐ is other than small entity

	Extension Months	Other Than Small Entity	Small Entity
☐	One Month	$120.00	$60.00
☐	Two Months	$450.00	$225.00
☒	Three Months	$1,020.00	$510.00
☐	Four Months	$1,590.00	$795.00
☐	Five Months	$2,160.00	$1,080.00

08/11/2005 JBALINAN 00000053 09661222
01 FC:2253 510.00 OP

Fee Payment

☒ Attached is a check for $510 for the Petition fee.

☐ Attached is a credit card authorization form for $_____ for the Petition fee.

☐ Charge Petition fee to Deposit Account No. 23-1925. A duplicate copy of this Petition is attached.

☒ Charge any additional fee required or credit for any excess fee paid to Deposit Account No. 23-1925. A duplicate copy of this Petition is attached.

Respectfully submitted,

Dated: August 9, 2005

Kent E. Genin
Registration No. 37,834
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610
(312)321-4200

OIPE JC172
AUG 09 2005
PATENT & TRADEMARK OFFICE

8-10-05

TRN 2144/5

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Date of Deposit: August 9, 2005

BRINKS HOFER GILSON &LIONE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of:	J. Overton	
Appln. No.:	09/661,222	Examiner: M. Thompson
Filed:	September 13, 2000	Art Unit: 2144
For:	Network Distributed Tracking Wire Transfer Protocol	

Attorney Docket No: 11958/43

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL

Sir:

Attached is/are:

☒ Two Checks for $510.00 (three month extension) and $200.00 (additional claims); Transmittal (in duplicate); Petition and Fee for Extension of Time (in duplicate); Amendment; Interview Summary

☒ Return Receipt Postcard

Fee calculation:

☐ No additional fee is required.

☒ Small Entity.

☒ An extension fee in an amount of $510.00 for a three-month extension of time under 37 C.F.R. § 1.136(a).

☐ A petition or processing fee in an amount of $_____ under 37 C.F.R. § 1.17(_____).

☒ An additional filing fee has been calculated as shown below:

					Small Entity			Not a Small Entity	
	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Rate	Add'l Fee	or	Rate	Add'l Fee
Total	25	Minus	21	4	x $25=	100		x $50=	
Indep.	4	Minus	3	1	X100=	100		x $200=	
First Presentation of Multiple Dep. Claim					+$180=			+ $360=	
					Total	$200		Total	$

Fee payment:

☐ A check in the amount of $_____ is enclosed.

☐ Please charge Deposit Account No. 23-1925 in the amount of $. A copy of this Transmittal is enclosed for this purpose.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

Respectfully submitted,

August 9, 2005
Date

Kent E. Genin (Reg. No. 37,834)

OIPE JC172 AUG 0 9 2005 PATENT & TRADEMARK OFFICE

"Express Mail" mailing label number EV 655 031 406 US
Date of Deposit: August 9, 2005

Our Case No. 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
JOHN OVERTON	
Serial No. 09/661,222	Examiner: Thompson, M.
Filing Date: September 13, 2000	Group Art Unit: 2144
For NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL	

INTERVIEW SUMMARY

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicant and the undersigned discussed the above-identified application in an in-person interview conducted on June 17, 2005. During the interview, the invention was discussed, including claim 12. Applicant described several features and attributes of his invention, for example the redirection mechanism. The Examiner agreed to consider a new set of claims more clearly directed to specific aspects of the invention. The undersigned wishes to thank the Examiner for the courtesy extended during the interview.

Respectfully submitted,

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

Kent E. Genin
Registration No. 37,834
Attorney for Applicant

PATENT APPLICATION FEE DETERMINATION RECORD
Effective December 29, 1999

Application or Docket Number: 09/660222

CLAIMS AS FILED - PART I

	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA
FOR		
BASIC FEE	Provisional	
TOTAL CLAIMS	16 minus 20=	*
INDEPENDENT CLAIMS	3 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		

SMALL ENTITY TYPE ☑ RATE	FEE	OR	OTHER THAN SMALL ENTITY RATE	FEE
	345.00	OR		690.00
X$ 9=		OR	X$18=	
X39=		OR	X78=	
+130=		OR	+260=	
TOTAL	345	OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

8/25/04

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 21	Minus	** 20	= 1
Independent	* 3	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
X$ 9=	9	OR	X$18=	
X39=		OR	X78=	
+130=		OR	+260=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 25	Minus	** 21	= 4
Independent	* 4	Minus	*** 3	= 1
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
~~X$ 25=~~	100	OR	X$18=	
~~X39 50=~~	100	OR	X78=	
+130=		OR	+260=	
TOTAL ADDIT. FEE	200	OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				

SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X39=		OR	X78=	
+130=		OR	+260=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875
(Rev. 12/99)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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=== COVER PAGE ===

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FROM: BRINKS FAX

FAX: 13123214299

TEL: 13123214200

COMMENT:

PAGE 1/6 * RCVD AT 10/3/2005 2:57:00 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/32 * DNIS:2738300 * CSID:13123214299 * DURATION (mm-ss):01-30

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BRINKS HOFER GILSON & LIONE
A Professional Corporation
Intellectual Property Law Worldwide

FACSIMILE COVER SHEET

Date: October 3, 2005

To: United States Patent and Trademark Office
Fax No: (571) 273-8300

From: Kent Genin
Tel. No: (312) 321-7732

Client No: 11958/43

No. of Pages
(inc. this page): 5

Confirmation Copy To Follow: Yes ☐ No ☒

IF YOU HAVE ANY PROBLEMS RECEIVING THIS MESSAGE,
PLEASE CALL 312-321-4200 AND ASK FOR: Pam x 4431

THIS MESSAGE IS INTENDED ONLY FOR THE INDIVIDUAL OR ENTITY TO WHICH IT IS ADDRESSED. IT MAY CONTAIN PRIVILEGED, CONFIDENTIAL, ATTORNEY WORK PRODUCT, OR TRADE SECRET INFORMATION WHICH IS EXEMPT FROM DISCLOSURE UNDER APPLICABLE LAWS. IF YOU ARE NOT THE INTENDED RECIPIENT, OR AN EMPLOYEE OR AGENT RESPONSIBLE FOR DELIVERING THE MESSAGE TO THE INTENDED RECIPIENT, YOU ARE HEREBY NOTIFIED THAT ANY DISSEMINATION, DISTRIBUTION, OR COPYING OF THIS MESSAGE IS STRICTLY PROHIBITED. IF YOU HAVE RECEIVED THIS MESSAGE IN ERROR, PLEASE NOTIFY US IMMEDIATELY BY TELEPHONE AND RETURN THE ORIGINAL MESSAGE (AND ALL COPIES) TO US BY MAIL AT THE ABOVE ADDRESS. WE WILL REIMBURSE YOU FOR POSTAGE.

COVER MESSAGE:

Attached Are:

- Transmittal
- Fifth Supplemental Information Disclosure Statement
- PTO-1449 (One Sheet - 5 US references listed)

PAGE 2/6 * RCVD AT 10/3/2005 2:57:00 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/32 * DNIS:2738300 * CSID:13123214299 * DURATION (mm-ss):01-30

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CERTIFICATE OF FACSIMILE TRANSMISSION UNDER 37 C.F.R. §1.8

I hereby certify that this correspondence, totaling 4 pages including recited attachments, is being facsimile transmitted to the United States Patent and Trademark Office at facsimile no.: 571-273-8300 (Central number) on the below date:

Date: October 3, 2005 Name: Kent E. Genin Signature:

BRINKS HOFER GILSON &LIONE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: J. Overton

Appln. No.: 09/661,222 Examiner: M. Thompson

Filed: September 13, 2000 Art Unit: 2144

For: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

Attorney Docket No: 11958/43

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL

Sir:

Attached is/are:

☒ A Transmittal Letter (in duplicate); Fifth Supplemental Information Disclosure Statement; Form PTO-1449; and

☐ Return Receipt Postcard

Fee calculation:

☐ No additional fee is required.

☐ Small Entity.

☐ An extension fee in an amount of $_____ for a _____-month extension of time under 37 C.F.R. § 1.136(a).

☐ A petition or processing fee in an amount of $_____ under 37 C.F.R. § 1.17(_____).

☐ An additional filing fee has been calculated as shown below:

	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra		Small Entity Rate	Add'l Fee	or	Not a Small Entity Rate	Add'l Fee
Total		Minus				x $25=			x $50=	
Indep.		Minus				x 100=			x $200=	
First Presentation of Multiple Dep. Claim						+$180=			+ $360=	
						Total	$		Total	$

Fee payment:

☐ A check in the amount of $_____ is enclosed.

☐ Please charge Deposit Account No. 23-1925 in the amount of $. A copy of this Transmittal is enclosed for this purpose.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

October 3, 2005
Date

Respectfully submitted,

Kent E. Genin (Reg. No. 37,834)

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CERTIFICATE OF FACSIMILE TRANSMISSION UNDER 37 C.F.R. §1.8
I hereby certify that this correspondence, totaling 4 pages including recited attachments, is being facsimile transmitted to the United States Patent and Trademark Office at facsimile no.: 571-273-8300 (Central number) on the below date:
Date: October 3, 2005 Name: Kent E. Genin Signature:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of:	J. Overton		
Appln. No.:	09/661,222	Examiner:	M. Thompson
Filed:	September 13, 2000	Art Unit:	2144
For:	NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL		
Attorney Docket No:	11958/43		

FIFTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

In accordance with the duty of disclosure under 37 C.F.R. §1.56 and §§1.97-1.98, and more particularly in accordance with 37 C.F.R. §1.97(c), Applicant hereby cites the following reference(s):

U.S. Patent No.	Date of Publication	Patentee/Applicant/Assignee
6,438,652	08-2002	Jordan et al.
6,463,454	10-2002	Lumelsky et al.
6,466,980	10-2002	Lumelsky et al.
6,578,068	06-2003	Bowman-Amuah, Michel K.
6,711,408	03-2004	Raith, Alex Krister

Applicant is enclosing Form PTO-1449 (one sheet), along with a copy of each listed reference for which a copy is required under 37 C.F.R. §1.98(a)(2). As each of the listed references is in English, no further commentary is believed to be necessary, 37 C.F.R §1.98(a)(3). Applicant respectfully requests the Examiner's consideration of the above reference(s) and entry thereof into the record of this application.

By submitting this Statement, Applicant is attempting to fully comply with the duty of candor and good faith mandated by 37 C.F.R. §1.56. As such, this Statement is not

intended to constitute an admission that any of the enclosed references, or other information referred to therein, constitutes "prior art" or is otherwise "material to patentability," as that phrase is defined in 37 C.F.R. §1.56(a).

Applicant hereby certifies pursuant to 37 C.F.R. §1.97(e)(2) that no item of information contained in this Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Statement was known to any individual designated in 37 C.F.R. §1.56(c), more than three months prior to the filing of this Statement. Accordingly, Applicant has calculated no fee to be due in connection with the filing of this Statement. However, the Director is authorized to charge any fee deficiency associated with the filing of this Statement to a deposit account, as authorized in the Transmittal accompanying this Statement.

Respectfully submitted,

October 3, 2005
Date

Kent E. Genin (Reg. No.37,834)

PAGE 5/6 * RCVD AT 10/3/2005 2:57:00 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/32 * DNIS:2738300 * CSID:13123214299 * DURATION (mm-ss):01-30

FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 11958/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE 09/13/2000	GROUP ART UNIT 2144
(use several sheets if necessary)	APPLICANT(S): J. Overton	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER Number-Kind Code (If known)	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
	F1	6,438,652	08-2002	Jordan et al.		
	F2	6,463,454	10-2002	Lumelsky et al.		
	F3	6,466,980	10-2002	Lumelsky et al.		
	F4	6,578,068	06-2003	Bowman-Amuah, Michel K.		
	F5	6,711,408	03-2004	Raith, Alex Krister		

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Rev. Dec.-99
Y:\kgenin\Econnectix 11958\11958-43\11958-43 PTO 1449.6.doc

PAGE 6/6 * RCVD AT 10/3/2005 2:57:00 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/32 * DNIS:2738300 * CSID:13123214299 * DURATION (mm-ss):01-30

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UNITED STATES DEPARTMENT OF COMMERCE
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NOTICE OF ALLOWANCE AND FEE(S) DUE

757 7590 11/14/2005

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610

EXAMINER
THOMPSON, MARC D

ART UNIT	PAPER NUMBER
2144	

DATE MAILED: 11/14/2005

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/661,222	09/13/2000	John K. Overton	10406/43	7777

TITLE OF INVENTION: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$700	$0	$700	02/14/2006

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 07/05) Approved for use through 04/30/2007.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571) 273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

757 7590 11/14/2005

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/661,222	09/13/2000	John K. Overton	10406/43	7777

TITLE OF INVENTION: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$700	$0	$700	02/14/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
THOMPSON, MARC D	2144	709-217000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:

☐ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):

☐ A check in the amount of the fee(s) is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/661,222	09/13/2000	John K. Overton	10406/43	7777

757 7590 11/14/2005

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610

EXAMINER	
THOMPSON, MARC D	

ART UNIT	PAPER NUMBER
2144	

DATE MAILED: 11/14/2005

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 734 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 734 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571) 272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

PTOL-85 (Rev. 07/05) Approved for use through 04/30/2007.

Notice of Allowability	Application No. 09/661,222	Applicant(s) OVERTON ET AL.	
	Examiner Marc D. Thompson	Art Unit 2144	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the amendment received 8/9/2005*.

2. ☒ The allowed claim(s) is/are *24-48*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 20051003, 20040825 x3, 20001208 (5) TOTAL
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

MARC D. THOMPSON
MARC THOMPSON
PRIMARY EXAMINER

EXAMINER AMENDMENT

1. An Examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to Applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this Examiner's amendment was given in a telephone interview with Kent Genin (Reg. #37,834), on 10/28/2005. This amendment is purely meant to address an inadvertent misnumbering of the claims.

2. The application has been amended as follows:

This listing of claims will replace all prior versions and listings of claims in the application.

Claims 1- 23. (Cancelled)

24. (New) A method for retrieving data location information for data stored in a distributed network, comprising the steps of:

a) receiving at a first client a data query for retrieving data associated with an identification string, wherein the data is stored at a data repository and wherein a location string associated with the identification string of the data is stored in at least one of a plurality of data location servers;

b) transmitting a data location request from the first client to a server to retrieve the

location string associated with the identification string in the data query, the data location request including the identification string;

c) if the server is not a data location server, then operating the server as a next client and transmitting the data location request from the next client to a server logically associated with the next client;

d) repeating c) until the data location request is transmitted to a data location server, wherein a communication path is defined between the first client and the data location server; and

e) if the data location server does not possess the location string, transmitting a redirect message to the first client over the communication path, the redirect message containing information with which the first client is configured to determine a location of a second data location server, wherein the second data location server contains the location string.

25. (New) The method of claim 24, wherein transmitting the redirect message comprises transmitting a data location server table to the first client.

26. (New) The method of claim 25, further comprising:

f) calculating at the first client the location of the second data location server with a function commonly known to the data location server and the first client and based on the identification string and the data location server table.

27. (New) The method of claim 26, wherein the function comprises a hash function and

wherein the first client applies the hash function to the identification string and the data location server table to obtain the location of the second data location server.

28. (New) The method of claim 24, wherein transmitting the redirect message comprises transmitting a function to the first client.

29. (New) The method of claim 28, further comprising:

f) calculating at the first client the location of the second data location server with the transmitted function.

30. (New) The method of claim 29, wherein calculating at the first client the location of the second data location server comprises applying the transmitted function to the identifier string.

31. (New) The method of claim 30, wherein applying the transmitted function generates a URL of the second data location server.

32. (New) The method of claim 24, wherein a length of the identification string and the location string each is variable.

33. (New) A method for retrieving data location information for data stored in a distributed network, comprising the steps of:

a) receiving at a first client a data query for retrieving data associated with an identification string, wherein the data is stored at a data repository in the distributed network and wherein a location string associated with the identification string of the data is stored in at least one of a plurality of data location servers;

b) transmitting a data location request from the first client to a first data location server to retrieve the location string associated with the identification string in the data query, the data location request including the identification string;

c) if the first data location server does not possess the location string, transmitting a redirect message to the first client, the redirect message containing information for use by the first client to calculate a location of a second data location server, wherein the second data location server contains the location string;

d) calculating the location of the second data location server at the first client; and

e) transmitting the data query from the first client to the second data location server.

34. (New) The method of claim 33, wherein transmitting the redirect message comprises transmitting a data location server table to the first client.

35. (New) The method of claim 34, wherein calculating the location of the second data location server comprises calculating the location of the second data location server with a function commonly known to the first data location server and the first client and based on the data location server table and the identification string.

36. (New) The method of claim 35, wherein the function comprises a hash function and wherein the first client applies the hash function to the identification string and the data location server table to obtain the location of the second data location server.

37. (New) The method of claim 33, wherein transmitting the redirect message comprises transmitting a function to the first client.

38. (New) The method of claim 37, wherein calculating at the first client the location of the second data location server comprises applying the transmitted function to the identifier string.

39. (New) The method of claim 38, wherein applying the transmitted function generates a URL of the second data location server.

40. (New) A system for retrieving data location information for data stored in a distributed network, the system comprising:

a plurality of data repositories configured to store data, wherein the data is associated with a respective identifier string in each data repository;

a data location sewer network having a plurality of data location servers, each of the plurality of data location servers containing location strings associated with respective identifier strings and each of the plurality of data location servers having computer executable code configured to execute the following steps:

in response to receiving a data location request from a client to retrieve a location string associated with an identification string provided in the data location request, transmitting a redirect message to the client if the identification string is not associated with a location string at the data location server, wherein the redirect message contains information for use by the client to calculate a location of a different data location server in the plurality of data location servers, wherein the different data location server contains the location string.

41. (New) A system for retrieving data location information for data stored in a distributed network, the system comprising:

a data repository configured to store data, wherein the data is associated with an identifier string;

a client responsive to a data query to query a data location server for location information associated with the identifier string;

a data location server network comprising a plurality of data location servers, at least one of the plurality of data location servers containing location information associated with the identifier string, wherein each of the plurality of data location servers comprises computer executable code configured to execute the following steps in response to receiving a data location request from the client:

if the data location server contains the location string associated with the identification string provided in the data location request, the data location server transmits location information for use by the client to calculate a location of the data associated with the identification string;

if the data location server does not contain the location string associated with the identification string, the location server transmits a redirect message to the client, wherein the redirect message contains redirect information for use by the client to calculate a location of a different data location server in the plurality of data location servers, wherein the different data location server contains the location string.

42. (New) The system of claim 41, wherein the client and the plurality of data location servers each comprise a function commonly known to the client and the plurality of data location servers and wherein the client is configured to apply the commonly known function to the location information or redirect information.

43. (New) The system of claim 42, wherein the redirect message comprises a data location server table.

44. (New) The system of claim 43, wherein the commonly known function comprises a hash function and wherein the client is configured to apply the hash function to the identification string and the data location server table to obtain the location of the different data location server.

45. (New) The system of claim 42, wherein the redirect message comprises a transmitted function for use by the client.

46. (New) The system of claim 45, wherein the client is configured to calculate the location of the different data location server by applying the transmitted function to the identifier string.

47. (New) The system of claim 41, wherein the location information comprises a portion of a hash table distributed over the plurality of data location servers.

48. (New) The system of claim 41, further comprising a plurality of servers related in a logical hierarchy between the client and the data location servers, wherein each of the plurality of servers is configured to function as a next client and retransmit the data location request to a next logically associated server until a data location server receives the data location request.

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marc D. Thompson whose telephone number is 571-272-3932. The examiner can normally be reached on Monday-Friday, 9am-4pm. If attempts to reach the examiner by telephone are unsuccessful, the Examiner's supervisor, David Wiley can be reached at 571-272-3923. The fax phone number for the organization where this application or proceeding is assigned has recently changed, and is now 571-273-8300.

4. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MARC D. THOMPSON
MARC THOMPSON
PRIMARY EXAMINER

Marc D. Thompson
Primary Examiner
Art Unit 2144

FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 11958/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE 09/13/2000	GROUP ART UNIT 2144
(use several sheets if necessary)	APPLICANT(S): J. Overton	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER Number-Kind Code (if known)	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
MDT	F1	6,438,652	08-2002	Jordan et al.		
MDT	F2	6,463,454	10-2002	Lumelsky et al.		
MDT	F3	6,466,980	10-2002	Lumelsky et al.		
MDT	F4	6,578,068	06-2003	Bowman-Amuah, Michel K.		
MDT	F5	6,711,408	03-2004	Raith, Alex Krister		

EXAMINER M THOMPSON	DATE CONSIDERED 28OCT2005

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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AUG 25 2004
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FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 10406/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT
(use several sheets if necessary)	APPLICANT(S): OVERTON ET AL.	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
	A1	5,347,600	09/13/94	BARNSLEY ET AL.		
	A2	4,636,858	01/13/87	HAGUE ET AL.		
	A3	5,809,161	09/15/98	AUTY ET AL.		
	A4	6,864,482	01/26/00	HAZAMA ET AL.		
	A5	5,610,653	03/11/97	ABECASSIS		
	A6	5,579,067	11/26/06	WAKABAYASHI		
	A7	6,649,247	07/16/07	ITOH ET AL.		
	A8	5,193,185	03/09/93	LANTER		
	A9	5,008,700	04/16/91	OKAMOTO		
	A10	4,728,978	03/01/88	INOUE ET AL.		
	A11	5,499,113	03/12/96	TSUBOI ET AL.		

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FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS/ SUBCLASS	TRANSLATION YES	TRANSLATION NO

EXAMINER INITIAL	OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)	

EXAMINER M THOMPSON	DATE CONSIDERED 28 OCT 2005

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(use several sheets if necessary)	APPLICANT(S): J. Overton	

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EXAMINER INITIAL		DOCUMENT NUMBER Number-Kind Code (if known)	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
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MDT	D3	5,479,654	12/1995	Squibb		
MDT	D4	5,740,428	04/1998	Mortimore et al.		
MDT	D5	5,903,889	05/1999	de la Huerga et al.		
MDT	D6	5,918,241	06/1999	Perkowski		
MDT	D7	6,058,193	05/02/00	Cordery et al.		
MDT	D8	6,092,189	07/18/00	Fisher et al.		
MDT	D9	6,108,787	08/2000	Anderson et al.		
MDT	D10	6,154,873	11/2000	Call		
MDT	D11	6,188,766 B1	02/13/01	Kocher		
MDT	D12	6,201,931 B1	03/13/01	Cipolla et al.		
MDT	D13	6,202,070 B1	03/13/01	Nguyen et al.		
MDT	D14	6,209,095 B1	03/27/01	Anderson et al.		
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MDT	D16	2002/0112048	08/2002	Gruyer et al.		

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EXAMINER INITIAL		OTHER ART – NON PATENT LITERATURE DOCUMENTS (Include name of author, title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date page(s), volume-issue number(s), publisher, city and/or country where published.)
MDT	D17	Muniz, R., et al., "A robust software barcode reader using the Hough transform", Abstract from IEEE/IEE Electronic Library online, printed 4/30/01, 2 pages
MDT	D18	Fresonke, D., "In-fab identification of silicon wafers with clean, laser marked barcodes", Abstract from IEEE/IEE Electronic Library online, printed 4/30/01, 2 pages
MDT	D19	Sriram, T., et al., "Applications of barcode technology in automated storage and retrieval systems", Abstract from IEEE/IEE Electronic Library online, printed 4/30/01, 2 pages

EXAMINER M THOMPSON	DATE CONSIDERED 28 OCT 2005

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(use several sheets if necessary)	APPLICANT(S): OVERTON ET AL.	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
MDT	A1	5,384,643	01/24/95	INGA ET AL.		
MDT	A2	5,208,623	05/04/93	TAKAHASHI		
MDT	A3	5,124,814	06/23/92	TAKAHASHI ET AL.		
MDT	A4	4,553,261	11/12/85	FROESSL		
MDT	A5	5,008,700	04/16/91	OKAMOTO		
MDT	A6	5,193,185	03/09/93	LANTER		
MDT	A7	5,579,067	11/26/96	WAKABAYASHI		
MDT	A8	5,455,648	10/03/95	KAZAMI		
MDT	A9	5,649,247	07/15/97	ITOH ET AL.		
MDT	A10	5,319,401	06/07/94	HICKS		
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MDT	A12	5,669,029	09/16/97	FYSON ET AL.		
MDT	A13	5,875,302	02/23/99	OBHAN		
MDT	A14	5,872,973	02/16/99	MITCHELL ET AL.		
MDT	A15	5,848,246	12/08/98	GISH		
MDT	A16	5,813,006	09/22/98	POLNEROW ET AL.		
MDT	A17	5,809,495	09/15/98	LOAIZA		
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MDT	A19	5,784,565	07/21/98	LEWINE		
MDT	A20	5,781,725	07/14/98	SAITO		
MDT	A21	5,774,670	06/30/98	MONTULLI		
MDT	A22	5,764,906	06/09/98	EDELSTEIN ET AL.		
MDT	A23	5,764,889	06/09/98	AULT ET AL.		
MDT	A24	5,664,170	09/02/97	TAYLOR		
MDT	A25	5,617,570	04/01/97	RUSSELL ET AL.		
MDT	A26	5,551,027	08/27/96	CHOY ET AL.		
MDT	A27	5,550,981	08/27/96	BAUER ET AL.		
MDT	A28	5,974,124	10/26/99	SCHLUETER, JR. ET AL.		
MDT	A29	5,915,240	06/22/99	KARPF		
MDT	A30	5,987,519	11/16/99	PEIFER ET AL.		
MDT	A31	5,920,702	07/06/99	BLEIDT ET AL.		
MDT	A32	5,576,952	11/19/96	STUTMAN ET AL.		
MDT	A33	5,961,610	10/05/99	KELLY ET AL.		
MDT	A34	5,995,965	11/30/99	EXPERTON		
MDT	A35	5,940,844	08/17/99	CAHILL ET AL.		
MDT	A36	4,800,488	01/24/89	AGRAWAL ET AL.		
MDT	A37	4,825,406	04/25/89	BEAN ET AL.		

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EXAMINER M THOMPSON	DATE CONSIDERED 28 OCT 2005

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(use several sheets if necessary)	APPLICANT(S): Overton ET AL.	

REFERENCE DESIGNATION **U.S. PATENT DOCUMENTS**

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
MDT	A38	4,914,571	04/03/90	BARATZ ET AL.		
MDT	A39	5,414,841	05/09/95	BINGHAM ET AL.		
MDT	A40	5,522,077	05/28/96	CUTHBERT ET AL.		
MDT	A41	5,537,547	07/16/96	CHAN ET AL.		
MDT	A42	5,557,790	09/17/96	BINGHAM ET AL.		
MDT	A43	5,560,005	09/24/96	HOOVER ET AL.		
MDT	A44	5,625,841	04/29/97	DAWKINS ET AL.		
MDT	A45	5,809,331	09/15/98	STAATS ET AL.		
MDT	A46	5,907,837	05/25/99	FERREL ET AL.		
MDT	A47	5,966,705	10/12/99	KONERU ET AL.		
MDT	A48	5,978,773	11/02/99	HUDETZ ET AL.		
MDT	A49	6,032,175	02/29/00	FLETCHER ET AL.		
MDT	A50	6,047,332	04/04/00	VISWANATHAN ET AL.		
MDT	A51	6,055,544	04/25/00	DEROSE ET AL.		

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS/ SUBCLASS	TRANSLATION YES	NO
MDT	A52	WO 98/31138	07/16/98	PCT			
MDT	A53	WO 00/03526	01/20/00	PCT			
MDT	A54	EPO 568 161 A1	03/11/93	EPO			
MDT	A55	WO 86/05610	09/25/86	PCT			
MDT	A56	0 889 422 A2	01/07/99	EPO			
MDT	A57	WO 98/15910	04/16/98	PCT			

EXAMINER INITIAL	OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)	
MDT	A58	Callaghan V L et al: "Structures and Metrics for Image Storage and Interchange" Journal of Electronic Imaging, vol. 2, no. 2, 1 april 1993, pages 126-137.
MDT	A59	Bourke D G et al: "Programmable Module and Circuit for Machine-Readable Unique Serial Number" IBM Technical Disclosure Bulletin, vol. 27, no. 4A, 1 September 1984 pages 1942-1944.
MDT	A60	Kleinholz L et al: "Supporting Cooperative Medicine: The Bermed Project" IEEE Multimedia, vol. 1, no. 4, 21 December 1994 pages 44-53.
MDT	A61	"Method for Network Naming and Routing" IBM Technical Disclosure Bulletin, vol. 37, no. 9, 1 September 1994 page 255.
MDT	A62	"Minimizing Locking To Access Global Shared Data", IBM Technical Disclosure Bulletin, pp 619-622, February 1995.

EXAMINER M THOMPSON	DATE CONSIDERED 28 OCT 2005

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Rev. Feb.-97
C:\Doc\PTO Miscel\10406-43 Form PTO-1449.doc

DEC 0 8 2000
PATENT & TRADEMARK OFFICE

FORM PTO-1449	SERIAL NO. 09/661,222	CASE NO. 10406/43
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	FILING DATE September 13, 2000	GROUP ART UNIT
(use several sheets if necessary)	APPLICANT(S): OVERTON ET AL.	

REFERENCE DESIGNATION U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS/ SUBCLASS	FILING DATE
MDT	A1	5,347,600	09/13/94	BARNSLEY ET AL.		
MDT	A2	4,636,858	01/13/87	HAGUE ET AL.		
MDT	A3	5,809,161	09/15/98	AUTY ET AL.		
MDT	A4	5,864,482	01/26/99	HAZAMA ET AL.		
MDT	A5	5,610,653	03/11/97	ABECASSIS		
MDT	A6	5,579,067	11/26/96	WAKABAYASHI		
MDT	A7	5,649,247	07/15/97	ITOH ET AL.		
MDT	A8	5,193,185	03/09/93	LANTER		
MDT	A9	5,008,700	04/16/91	OKAMOTO		
MDT	A10	4,728,978	03/01/88	INOUE ET AL.		
MDT	A11	5,499,113	03/12/96	TSUBOI ET AL.		

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS/ SUBCLASS	TRANSLATION YES	NO

EXAMINER INITIAL	OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)	

EXAMINER M THOMPSON	DATE CONSIDERED 28 OCT 2005

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	09/661,222	OVERTON ET AL.	
	Examiner	Art Unit	
	Marc D. Thompson	2144	

ISSUE CLASSIFICATION

ORIGINAL CLASS	ORIGINAL SUBCLASS	CROSS REFERENCE(S) CLASS	CROSS REFERENCE(S) SUBCLASS (ONE SUBCLASS PER BLOCK)
709	217	709	219
INTERNATIONAL CLASSIFICATION		707	10
G 0 6 F	15/16		
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	/		
	/		
	/		

(Assistant Examiner) (Date)

(Legal Instruments Examiner) 11/10/05 (Date)

MARC D. THOMPSON
MARC THOMPSON
PRIMARY EXAMINER
(Primary Examiner) (Date) 10/05

Total Claims Allowed: 25

O.G. Print Claim(s)	O.G. Print Fig.
1	10

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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6	29		59		89		119		149		179		209
7	30		60		90		120		150		180		210

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
09/661,222	OVERTON ET AL.
Examiner	**Art Unit**
Marc D. Thompson	2144

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
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Claim		Date
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Claim		Date
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Claim		Date
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Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination
	09/661,222	OVERTON ET AL.
	Examiner	Art Unit
	Marc D. Thompson	2144

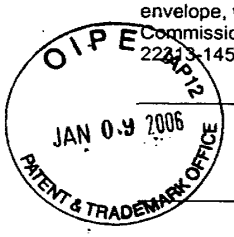
SEARCHED			
Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
709	**217**	**10/28/2005**	**MDT**
709	219	10/28/2005	MDT
707	10	10/28/2005	MDT

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
updated full text EAST search: USPAT, USPGPUB, EPO, DERWENT	10/28/2005	MDT
updated NPL text search: IEEE, ACM, Google (internet)	10/28/2005	MDT
updated class/subclass search	10/28/2005	MDT

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Kent E. Genin
Name of Applicant, Assignee or Registered Representative

Signature

1/6/2006
Date of Signature

Our Case No. 11958/45

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
J. Overton	
Serial No. 09/661,222	Examiner: M. Thompson
Filing Date: September 13, 2000	Group Art Unit No. 2144
Title: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL	Confirmation No. 7777

REQUEST FOR REVIEW OF PATENT TERM ADJUSTMENT

MAIL STOP ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

It has recently come to our attention that there may be an error in the patent term adjustment calculated by the U.S. Patent and Trademark Office for the above-referenced patent application. Specifically, the patent term adjustment pursuant to 35 U.S.C. 154(b) of 734 days indicated on the Determination of Patent Term Adjustment, PTOL-85, may extend the term of this patent by too many days. Please review the calculation of the patent term adjustment and make corrections, if necessary.

Respectfully submitted,

Kent E. Genin, Reg. No. 37,834
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

PART B - FEE(S) TRANSMITTAL

OIPE JAN 09 2006 PATENT & TRADEMARK OFFICE

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571) 273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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757 7590 11/14/2005

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01/10/2006 CNGUYEN1 00000036 09661222

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Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Kent E. Genin	(Depositor's name)
	(Signature)
January 6, 2006	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/661,222	09/13/2000	John K. Overton	10406/43	7777

TITLE OF INVENTION: NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$700	$0	$700	02/14/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
THOMPSON, MARC D	2144	709-217000

B

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Brinks Hofer Gilson & Lione
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Econnectix, LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Chicago, Illinois

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):
- ☒ A check in the amount of the fee(s) is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized to charge the required fee(s), or credit any overpayment, to Deposit Account Number 23-1925 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature Kent E. Genin Date Jan. 6, 2006

Typed or printed name Kent E. Genin Registration No. 37,834

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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Date: January 6, 2006 Name: Kent E. Genin Signature: [signature]

BRINKS HOFER GILSON & LIONE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: J. Overton

Appln. No.: 09/661,222 Examiner: M. Thompson

Filed: September 13, 2000 Art Unit: 2144

For: Network Distributed Tracking Wire Transfer Protocol

Attorney Docket No: 11958/43

Mail Stop Issue Fee
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL

Sir:

Attached is/are:

☒ Check for $700 (issue fee); Transmittal (in duplicate); Issue Fee Transmittal (in duplicate); Submission of Formal Drawings; 12 Sheets of Formal Drawings; Request for Review of Patent Term Adjustment

☒ Return Receipt Postcard

Fee calculation:

☐ No additional fee is required.

☐ Small Entity.

☐ An extension fee in an amount of $_____ for a _____-month extension of time under 37 C.F.R. § 1.136(a).

☐ A petition or processing fee in an amount of $_____ under 37 C.F.R. § 1.17(_____).

☐ An additional filing fee has been calculated as shown below:

						Small Entity			Not a Small Entity	
	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra		Rate	Add'l Fee	or	Rate	Add'l Fee
Total		Minus				x $25=			x $50=	
Indep.		Minus				x 100=			x $200=	
First Presentation of Multiple Dep. Claim						+$180=			+ $360=	
						Total	$		Total	$

Fee payment:

☒ A check in the amount of $700 is enclosed.

☐ Please charge Deposit Account No. 23-1925 in the amount of $. A copy of this Transmittal is enclosed for this purpose.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

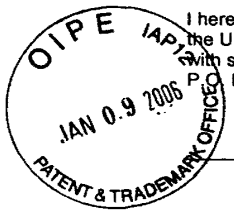
☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

1/6/2006
Date

Respectfully submitted,

[signature]
Kent E. Genin (Reg. No. 37,834)

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January 6, 2006
Date of Deposit

Kent E. Genin
Name of Applicant, Assignee or Registered Representative

Signature

1/6/2006
Date of Signature

Our Case No. 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

J. Overton

Serial No. 09/661,222

Filing Date: September 13, 2000

For NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

Examiner: M. Thompson

Group Art Unit No. 2144

LETTER TO OFFICIAL DRAFTSMAN

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attn: Official Draftsman

Dear Sir:

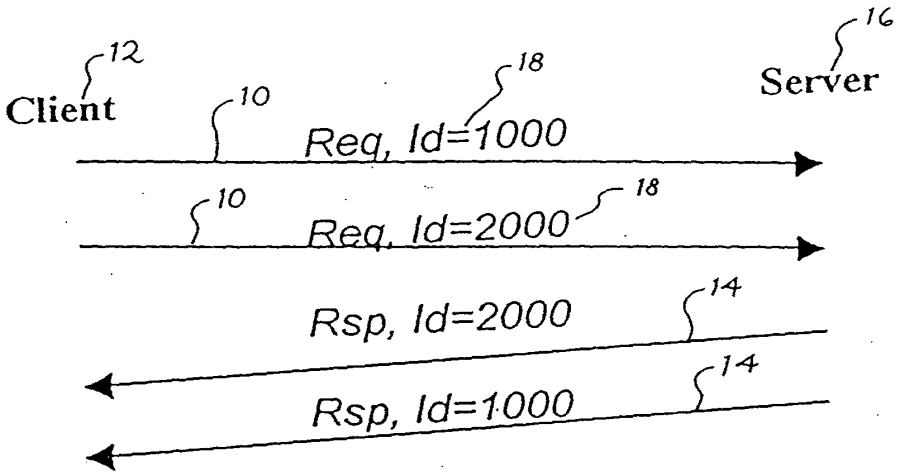
Please substitute the enclosed 12 sheets of formal drawings (FIGS. 1-13) for the previously submitted drawings.

Respectfully submitted,

Kent E. Genin, Reg. No. 37,834
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

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JAN 09 2006
PATENT & TRADEMARK OFFICE



Use Of Request Identifiers

Fig. 1

OIPE IAP12 JAN 09 2006 PATENT & TRADEMARK OFFICE

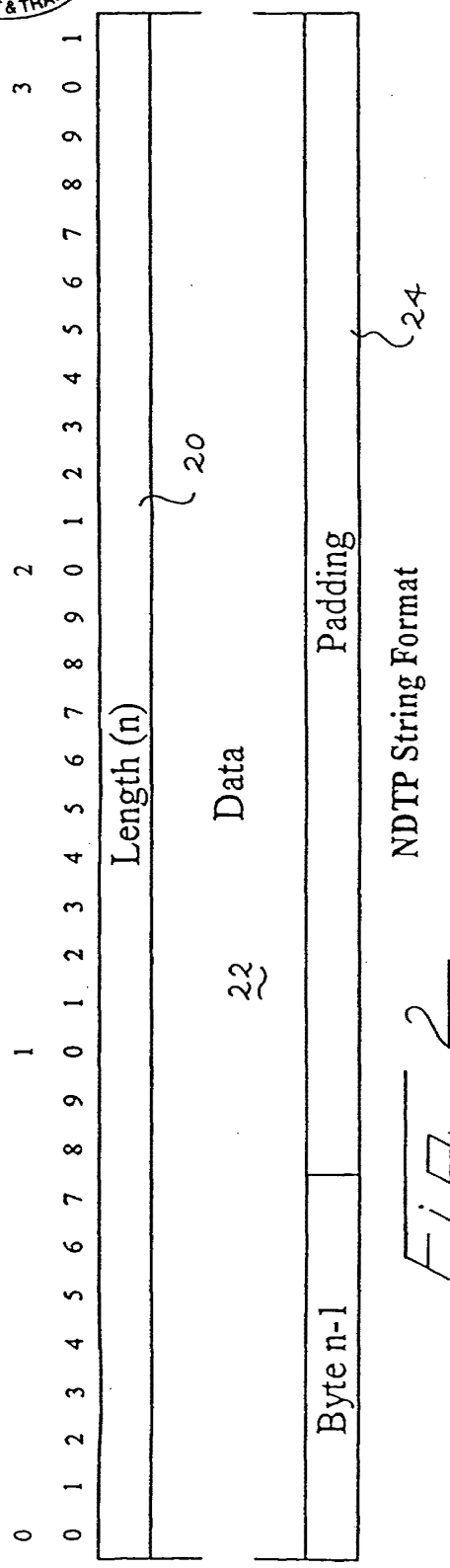


Fig. 2

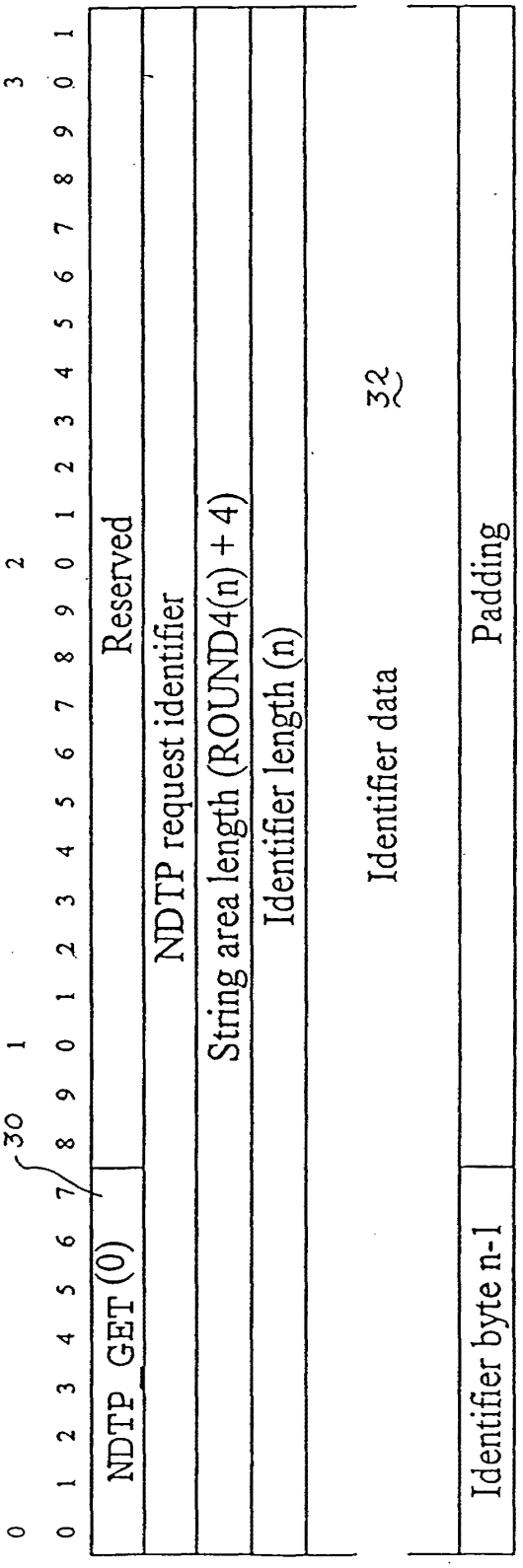


Fig. 3

OIPE IAP12 JAN 0,9 2006 PATENT & TRADEMARK OFFICE

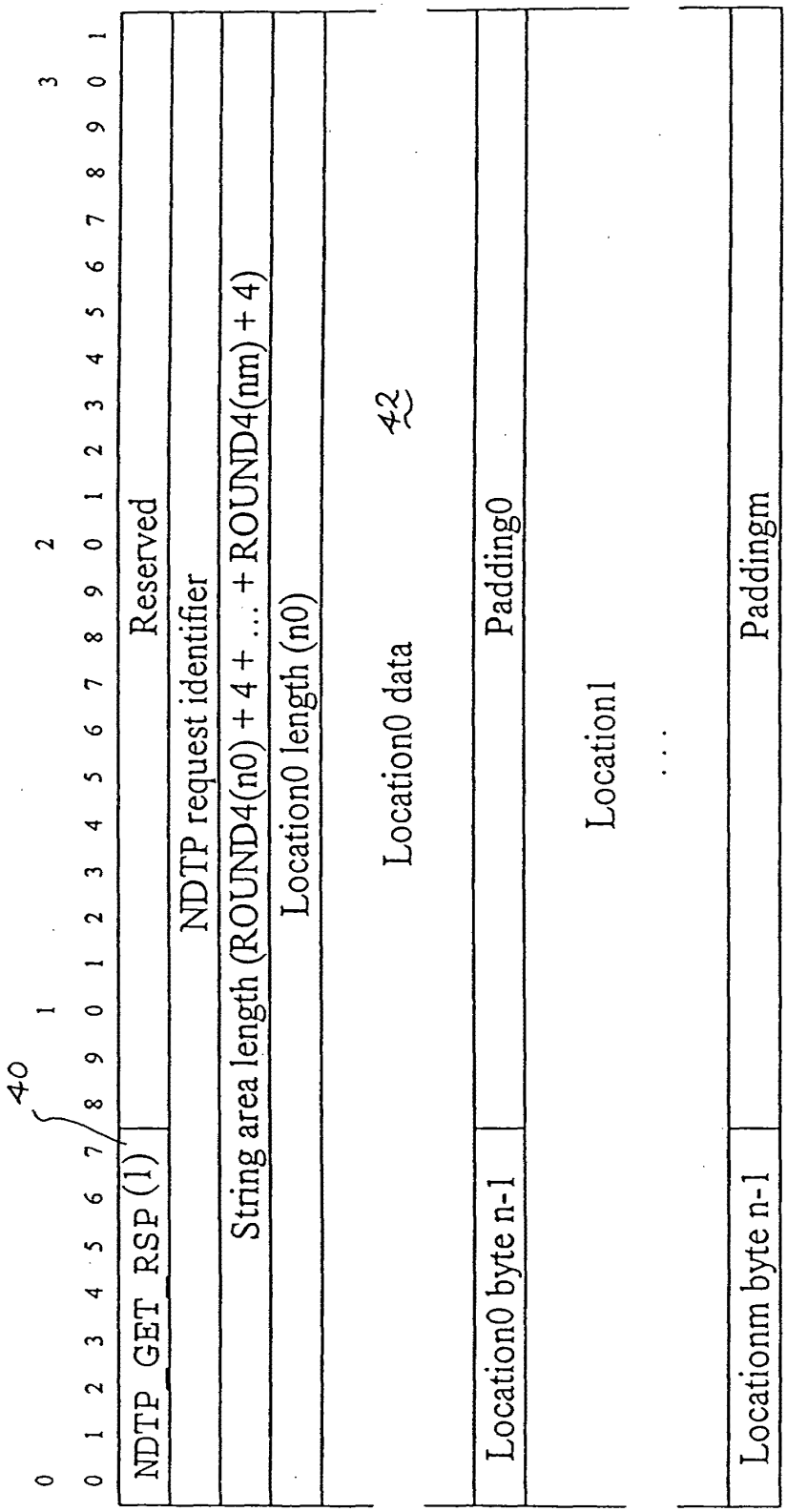
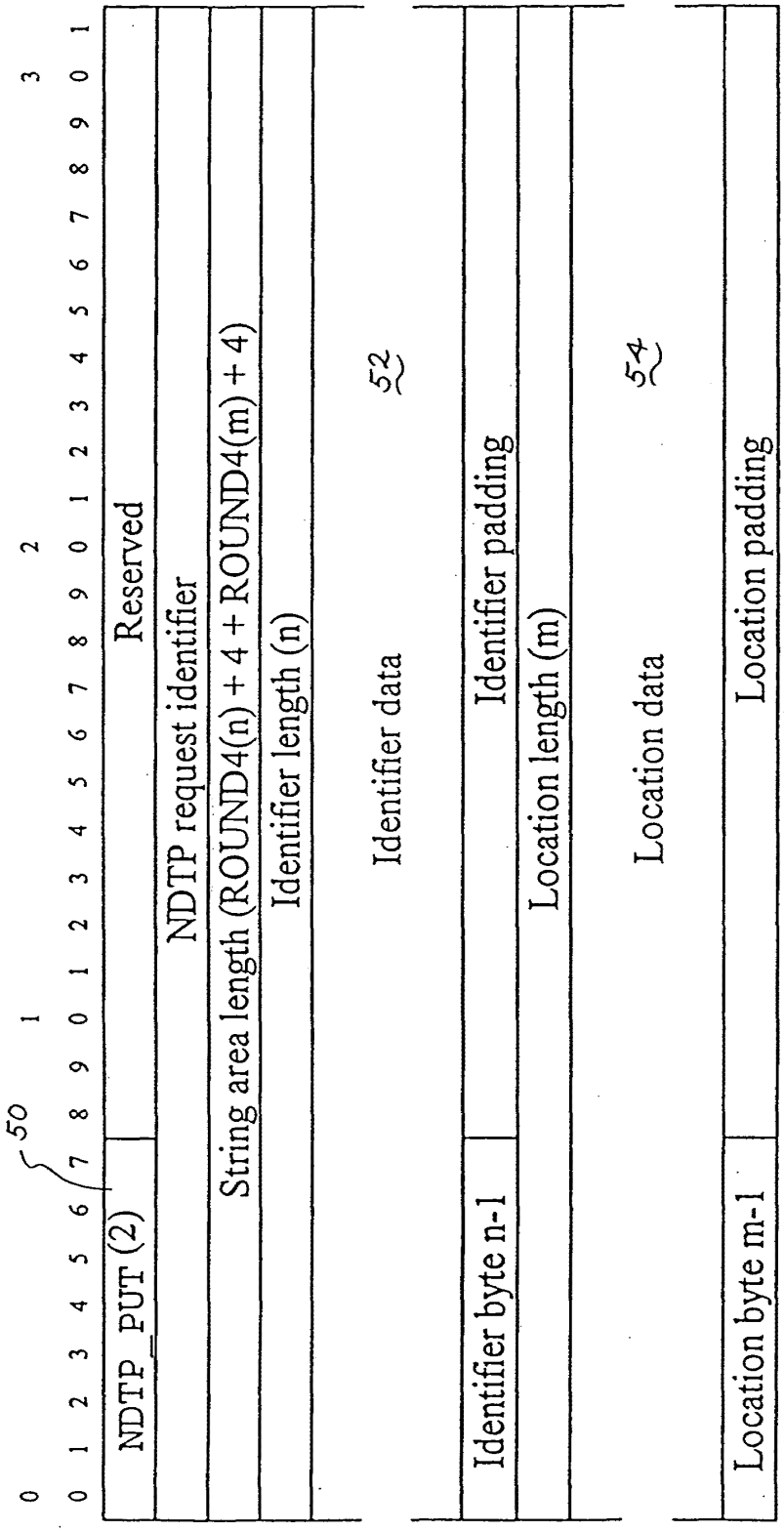


Fig. 4

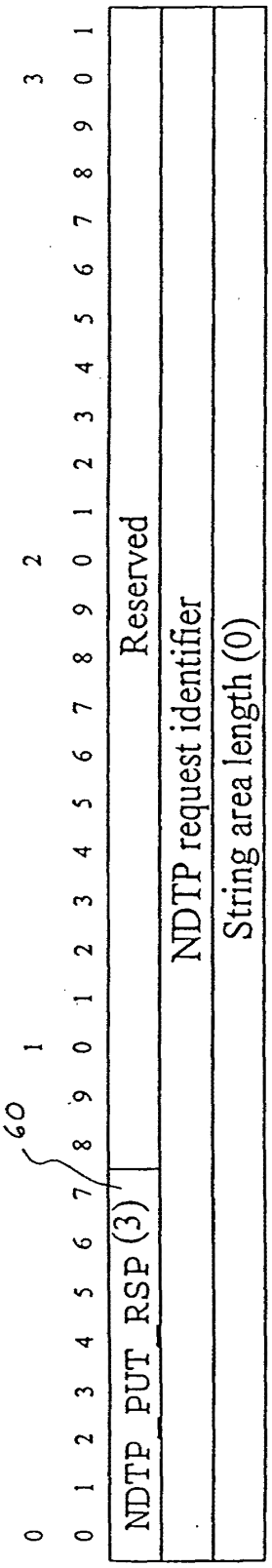
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PATENT & TRADEMARK OFFICE



NDTP_PUT Format

Fig. 5

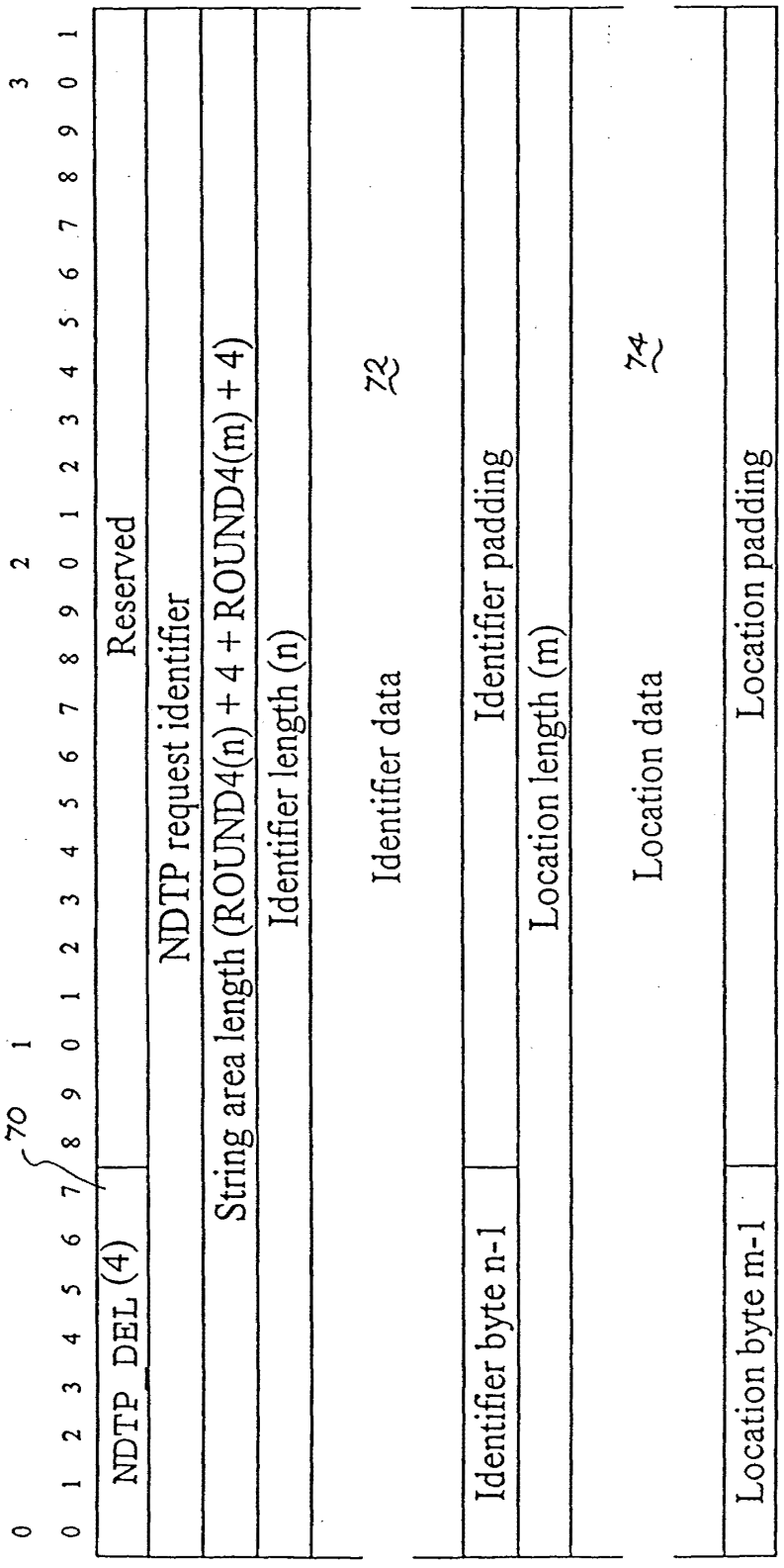
OIPE IAP12
JAN 0.9 2006
PATENT & TRADEMARK OFFICE



NDTP_PUT_RSP Format

Fig. 6

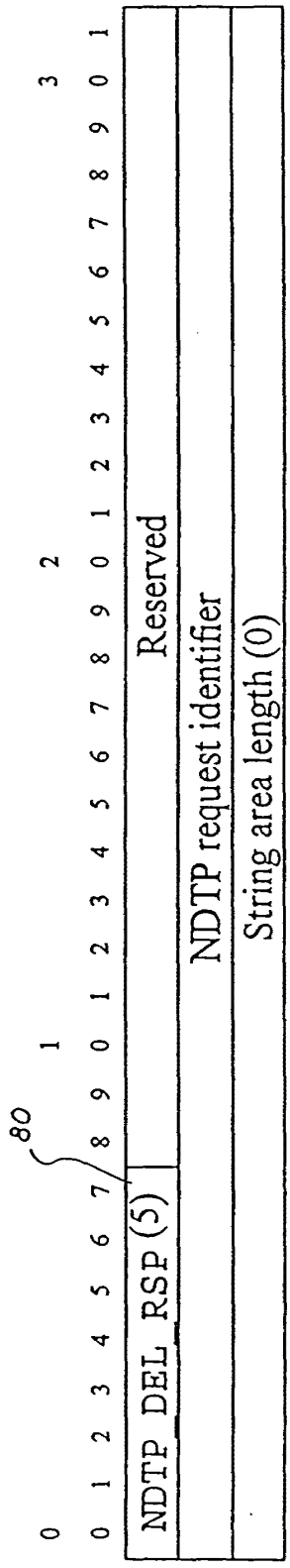
OIPE IAP12
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NDTP_DEL Format

Fig. 7

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NDTP_DEL_RSP Format

Fig. 8

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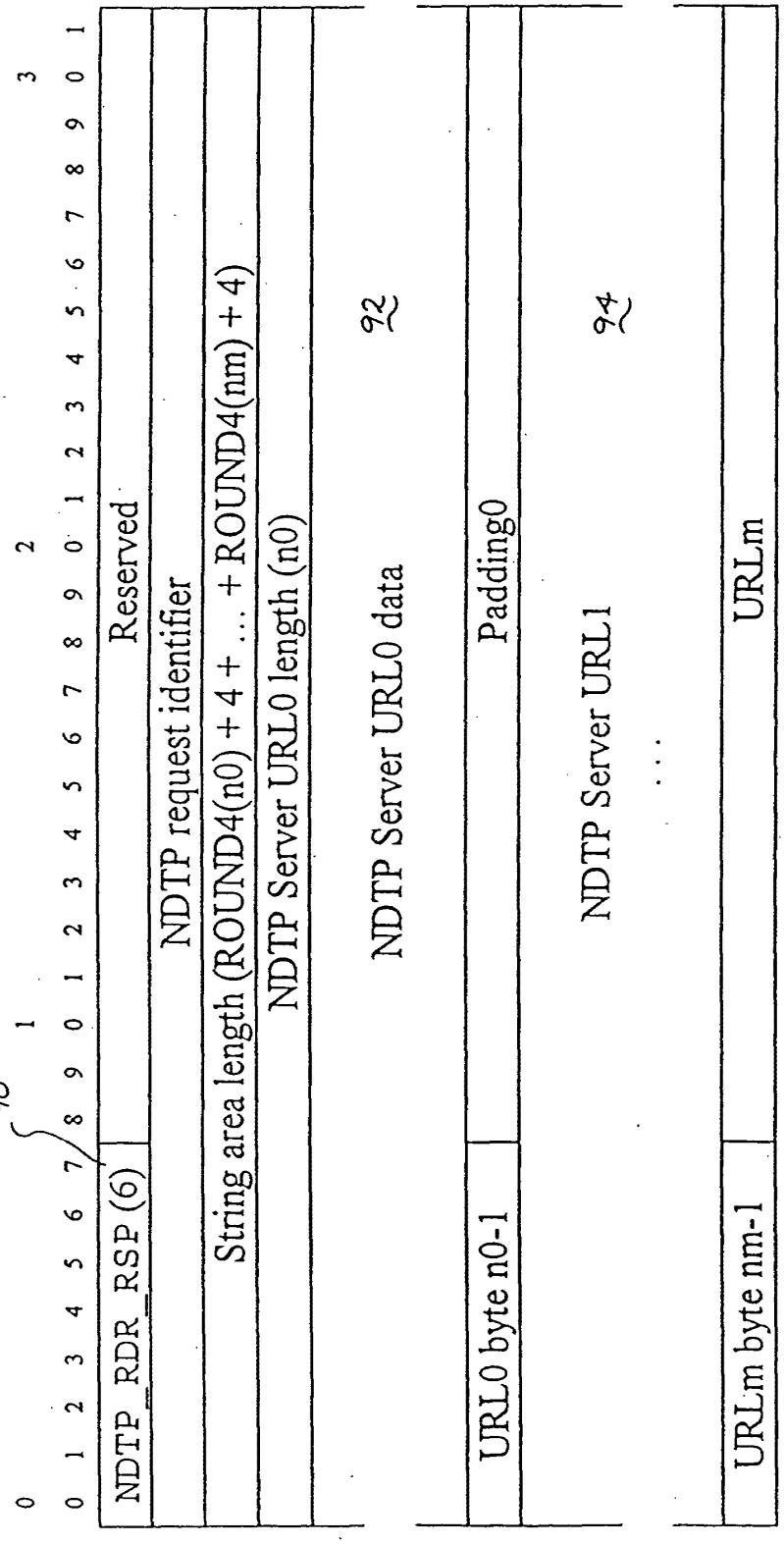
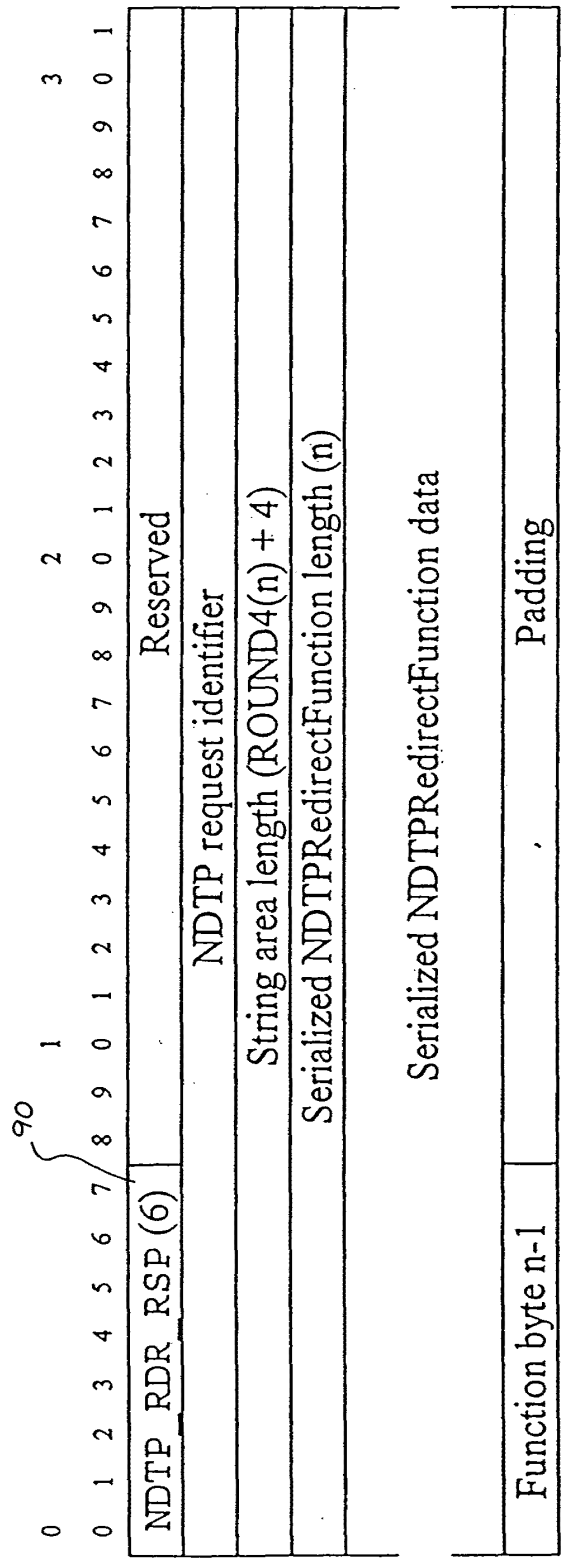


Fig. 9(a)

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NDTP_RDR_RSP With Redirection Function

Fig. 9(b)

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NETWORK DISTRIBUTED TRACKING
DISTRIBUTED RECORD RETRIEVAL

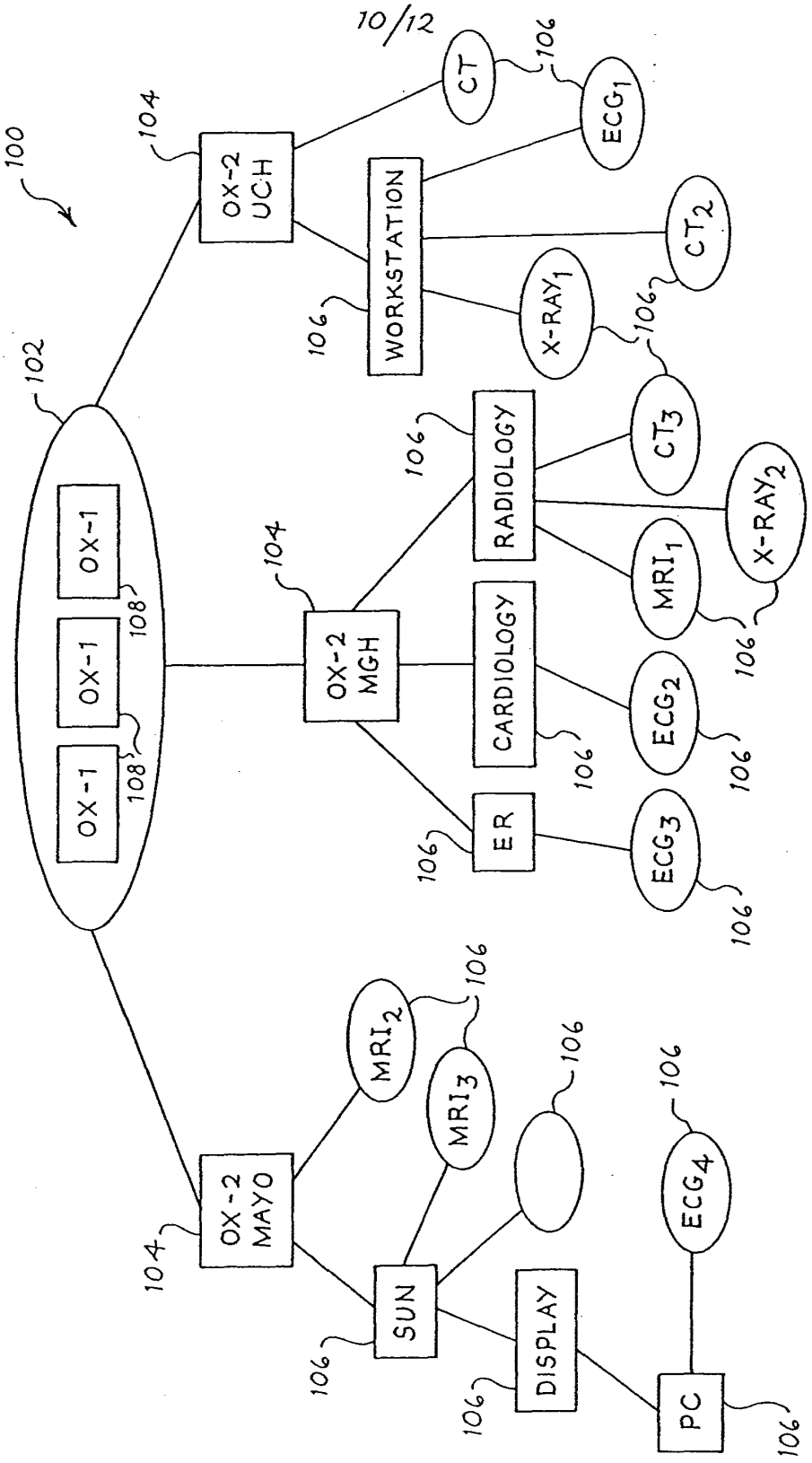


Fig. 10

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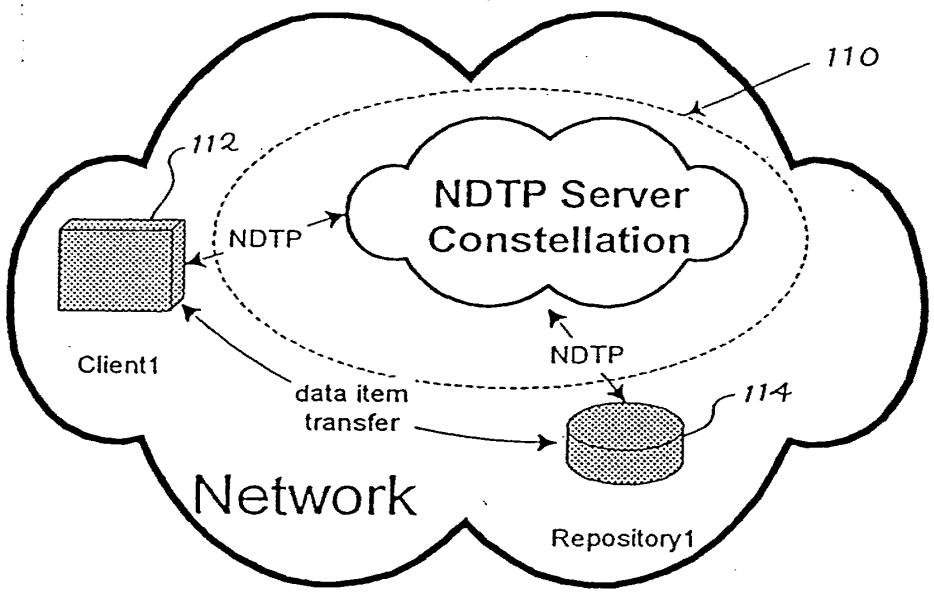
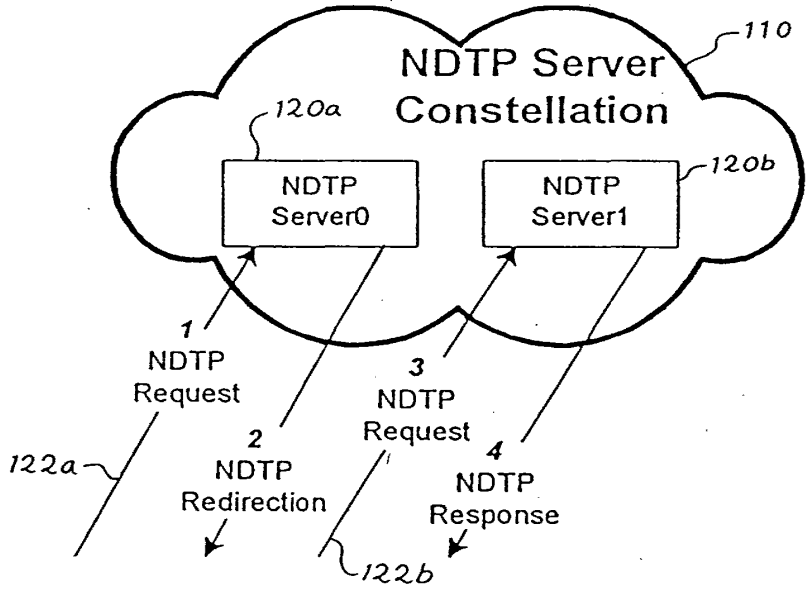


Fig. 11

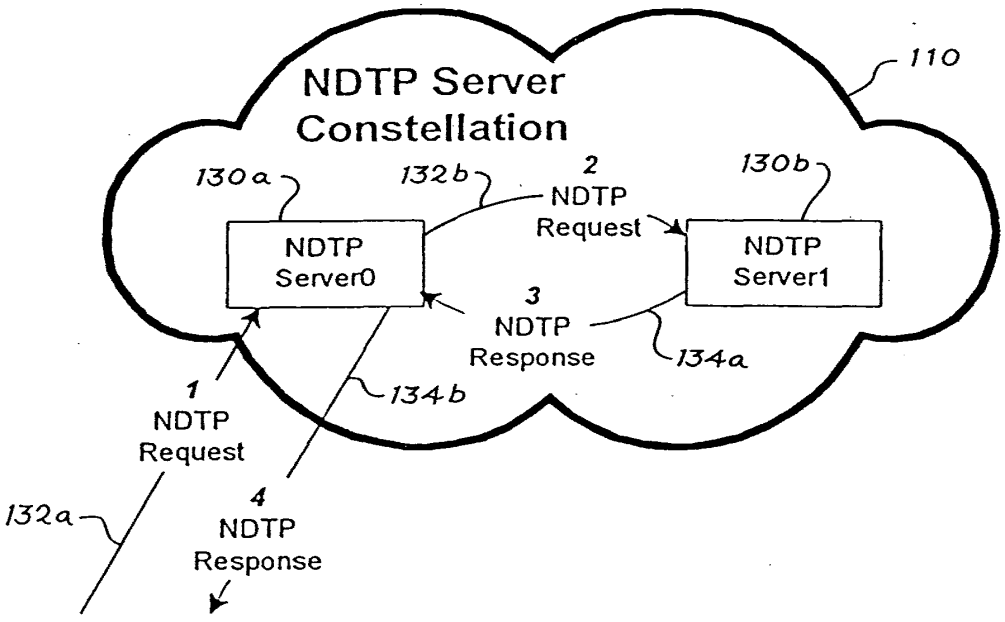
NDTP Server Constellation Context



NDTP Client-Centric Constellation

Fig. 12

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NDTP Server-Centric Constellation

Fig. 13

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AUG 0 1 2006

OFFICE OF PETITIONS

In re Application of	:	
Overton et al.	:	
Application No. 09/661,222	:	
Filed: September 13, 2000	:	LETTER REGARDING
Attorney Docket No. 10406/43	:	PATENT TERM ADJUSTMENT

This letter is in response to the "REQUEST FOR REVIEW OF PATENT TERM ADJUSTMENT," filed January 9, 2006, notifying the Office of an error in applicants' favor in the initial determination of patent term adjustment.

The request for correction of the initial determination of patent term adjustment (PTA) is **GRANTED**.

The Office has updated the PAIR screen to reflect that the correct Patent Term Adjustment determination at the time of the mailing of the Notice of Allowance is **SIX HUNDRED FORTY-ONE (641)** days. A copy of the updated PAIR screen, showing the correct determination, is enclosed.

On November 14, 2005, the Office mailed the Determination of Patent Term Adjustment under 35 U.S.C. 154(b) in the above-identified application. The Notice stated that the patent term adjustment to date is 743 days. Applicants state that this may extend the term of this patent by too many days.

A review of the record reveals that the entry of zero days of applicant delay in connection with responding to the non-final Office action mailed February 25, 2004 is incorrect. Applicants' response after non-final was received on August 25, 2004, not February 25, 2004. Thus, the period of reduction is 92 days (not 0 days) for applicants' taking in excess of three

months to file a response to the Office action mailed February 25, 2004. See § 1.704(b).

As the response was filed on August 25, 2004, the IDS filed August 25, 2004 accompanied the response and thus, was not a supplemental paper. As such the reduction pursuant to § 1.704(c)(8) of 182 days is not warranted.

Moreover, as the response after non-final Office action was received on August 25, 2004, the Office's delay in not issuing a response until February 9, 2005 is 46 days (not 229 days). See § 1.703(a)(2).

In view thereof, the correct determination of PTA at the time of the mailing of the Notice of Allowance is SIX HUNDRED FORTY-ONE (641) days (834 + 46 days of Office delay reduced by 92 + 92 + 55 days of applicant delay).

This letter was submitted as an advisement to the Office of an error in Applicants' favor, the Office will not assess the $200.00 application fee under 37 CFR 1.705(b). The Office thanks applicants for their good faith and candor in bringing this to the attention of the Office.

The application is being forwarded to the Publications Division for issuance of a patent. The patent term adjustment indicated on the patent (as shown on the Issue Notification mailed about three weeks prior to patent issuance) will include any additional adjustment accrued both for Office delay in issuing the patent more than four months after payment of the issue fee and satisfaction of all outstanding requirements, and for the Office taking in excess of three years to issue the patent (to the extent that the three-year period does not overlap with periods already accorded).

Telephone inquiries specific to this matter should be directed to the undersigned at (571) 272-3219.

Nancy Johnson
Senior Petitions Attorney
Office of Petitions

Enclosure: Copy of revised PAIR screen

PTA Calculations for Application: 09/661222			
Application Filing Date:	09/13/2000	PTO Delay (PTO):	1063
Issue Date of Patent:		Three Years:	0
Pre-Issue Petitions:	0	Applicant Delay (APPL):	329
Post-Issue Petitions:	0	Total PTA (days):	641
PTO Delay Adjustment:	-93		

File Contents History

Number	Date	Contents Description	PTO	APPL	START
59	07/27/2006	ADJUSTMENT OF PTA CALCULATION BY PTO		92	
58	07/27/2006	ADJUSTMENT OF PTA CALCULATION BY PTO	182		
57	07/27/2006	ADJUSTMENT OF PTA CALCULATION BY PTO		229	
56	07/27/2006	ADJUSTMENT OF PTA CALCULATION BY PTO	46		
44	11/14/2005	MAIL NOTICE OF ALLOWANCE			
43	11/14/2005	MAIL EXAMINER'S AMENDMENT			
42	11/10/2005	ISSUE REVISION COMPLETED			
41	11/10/2005	NOTICE OF ALLOWANCE DATA VERIFICATION COMPLETED			
40	11/10/2005	CASE DOCKETED TO EXAMINER IN GAU			
38	10/31/2005	EXAMINER'S AMENDMENT COMMUNICATION			
37	10/31/2005	NOTICE OF ALLOWABILITY			
36	10/03/2005	REFERENCE CAPTURE ON IDS			
35	10/03/2005	INFORMATION DISCLOSURE STATEMENT (IDS) FILED		55	33
34	08/20/2005	DATE FORWARDED TO EXAMINER			
33	08/09/2005	RESPONSE AFTER NON-FINAL ACTION		92	29
32	08/09/2005	REQUEST FOR EXTENSION OF TIME - GRANTED			
31	06/17/2005	EXAMINER INTERVIEW SUMMARY RECORD (PTOL - 413)			
30	06/16/2005	MISCELLANEOUS INCOMING LETTER			
29	02/09/2005	MAIL NON-FINAL REJECTION	229		21
28	02/04/2005	NON-FINAL REJECTION			
27	11/23/2004	IFW TSS PROCESSING BY TECH CENTER COMPLETE			
26	08/25/2004	MISCELLANEOUS INCOMING LETTER			

25	08/25/2004	INFORMATION DISCLOSURE STATEMENT (IDS) FILED		182	21
24	08/25/2004	INFORMATION DISCLOSURE STATEMENT (IDS) FILED			
23	08/25/2004	INFORMATION DISCLOSURE STATEMENT (IDS) FILED			
22	11/22/2004	DATE FORWARDED TO EXAMINER			
21	02/25/2004	RESPONSE AFTER NON-FINAL ACTION			
20	02/19/2004	MISCELLANEOUS INCOMING LETTER			
19	08/25/2004	WORKFLOW INCOMING AMENDMENT IFW			
18	06/08/2004	CASE DOCKETED TO EXAMINER IN GAU			
17	05/19/2004	CASE DOCKETED TO EXAMINER IN GAU			
16	02/25/2004	MAIL NON-FINAL REJECTION	834		-1
15	02/21/2004	NON-FINAL REJECTION			
14	12/17/2003	CASE DOCKETED TO EXAMINER IN GAU			
13	11/04/2003	CASE DOCKETED TO EXAMINER IN GAU			
12	10/02/2003	CASE DOCKETED TO EXAMINER IN GAU			
11	04/28/2003	INFORMATION DISCLOSURE STATEMENT (IDS) FILED			
10	11/12/2002	CASE DOCKETED TO EXAMINER IN GAU			
9	10/04/2002	CASE DOCKETED TO EXAMINER IN GAU			
8	12/08/2000	INFORMATION DISCLOSURE STATEMENT (IDS) FILED			
7	08/06/2001	CASE DOCKETED TO EXAMINER IN GAU			
5	02/14/2001	APPLICATION DISPATCHED FROM OIPE			
4	11/13/2000	NOTICE MAILED--APPLICATION INCOMPLETE--FILING DATE ASSIGNED			
3	11/09/2000	CORRESPONDENCE ADDRESS CHANGE			
2	10/10/2000	IFW SCAN & PACR AUTO SECURITY REVIEW			
1	09/13/2000	INITIAL EXAM TEAM NN			

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EXPLANATION OF PTA CALCULATION

EXPLANATION OF PTE CALCULATION

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Date: January 30, 2007 Name: Scott W. Brim Signature: S.W.B.

BRINKS HOFER GILSON &LIONE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of:	Overton et al.
Appln. No.:	09/661,222
Filed:	September 13, 2000
For:	NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL
Attorney Docket No:	11958/43

Examiner: Michael A. Delgado

Art Unit: 2144

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL

Certificate of Correction FEB 06 2007

Sir:

Attached is/are:

☒ Transmittal letter (1 pg. in dupl.); and Request for Certificate of Correction (2 pgs. in dupl.); A copy of the first page of U.S. Pat. App. No. 09/661,222 (now U.S. Pat. No. 7,103,640 B1) originally filed and a copy of the Declaration for U.S. Pat. App. No. 09/661,222 executed by the inventors, which both show that U.S. Pat. App. No. 09/661,122 claims priority to U.S. Provisional App. No. 60/153,709, filed Sept. 14, 1999, and U.S. Pat. App. No. 09/111,896, filed Jul. 8, 1998.

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Fee calculation:

☐ No additional fee is required.

☐ Small Entity.

☐ An extension fee in an amount of $_____ for a _____-month extension of time under 37 C.F.R. § 1.136(a).

☐ A petition or processing fee in an amount of $_____ under 37 C.F.R. § 1.17(_____).

☐ An additional filing fee has been calculated as shown below:

					Small Entity			Not a Small Entity	
	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Rate	Add'l Fee	or	Rate	Add'l Fee
Total		Minus			x $25=			x $50=	
Indep.		Minus			x 100=			x $200=	
First Presentation of Multiple Dep. Claim					+$180=			+ $360=	
					Total	$		Total	$

Fee payment:

☐ A check in the amount of $_____ is enclosed.

☐ Please charge Deposit Account No. 23-1925 in the amount of $. A copy of this Transmittal is enclosed for this purpose.

☐ Payment by credit card in the amount of $_____ (Form PTO-2038 is attached).

☒ The Director is hereby authorized to charge payment of any additional filing fees required under 37 CFR § 1.16 and any patent application processing fees under 37 CFR § 1.17 associated with this paper (including any extension fee required to ensure that this paper is timely filed), or to credit any overpayment, to Deposit Account No. 23-1925.

Respectfully submitted,

FEB 6 2007

January 30, 2007
Date

S.W.B.
Scott W. Brim (Reg. No. 51,500)

FEB - 6 2007

BRINKS HOFER GILSON &LIONE

BRINKS HOFER GILSON & LIONE
NBC Tower – Suite 3600, 455 N. Cityfront Plaza Drive, Chicago, IL 60611-5599

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Date: January 30, 2007 Name: Scott W. Brim Signature: S.W.B.

BRINKS HOFER GILSON &LIONE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of:	Overton et al.
Appln. No.:	09/661,222
Filed:	September 13, 2000
For:	NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL
Attorney Docket No:	11958/43

Examiner: Michael A. Delgado
Art Unit: 2144

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

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	Claims Remaining After Amendment		Highest No. Previously Paid For	Present Extra	Rate	Add'l Fee	or	Rate	Add'l Fee
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First Presentation of Multiple Dep. Claim					+$180=			+ $360=	
					Total	$		Total	$

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Respectfully submitted,

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Date

S.W.B.
Scott W. Brim (Reg. No. 51,500)

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on January 30, 2007
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Scott W. Brim, Reg. No. 51,500
Name of applicant, assignee or
Registered Representative

Signature
January 30, 2007
Date of Signature

Our Case No. 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Overton et al.
Serial No. 09/661,222
Filing Date: September 13, 2000

U.S. Pat. No. 7,103,640 B1
For NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

REQUEST FOR CERTIFICATE OF CORRECTION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attention: Certificate of Correction Branch

Sir:

Applicant requests the issuance of a Certificate of Correction for U.S. Pat. No. 7,103,640 B1, and in support of this request respectfully states:

FEB - 6 2007

On the face of U.S. Pat. No. 7,103,640 B1, Related U.S. Application Data should be changed from:

"Provisional application No. 60/153,709, filed on Sep. 14, 1999."; to

--U.S. Provisional App. No. 60/153,709, filed Sep. 14, 1999, and U.S. Pat. App. No. 09/111,896, filed Jul. 8, 1998.--

A copy of the first page of U.S. Pat. App. No. 09/661,222 (now U.S. Pat. No. 7,103,640 B1) originally filed and a copy of the Declaration for U.S. Pat. App. No. 09/661,222 executed by the inventors, which both show that U.S. Pat. App. No. 09/661,122 claims priority to U.S. Provisional App. No. 60/153,709, filed Sept. 14, 1999, and U.S. Pat. App. No. 09/111,896, filed Jul. 8, 1998, are enclosed.

The Commissioner is hereby authorized to charge any fees required to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Scott W. Brim
Registration No. 51,500
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

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on January 30, 2007
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Scott W. Brim, Reg. No. 51,500
Name of applicant, assignee or
Registered Representative

Signature
January 30, 2007
Date of Signature

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PATENT & TRADEMARK OFFICE

Our Case No. 11958/43

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Overton et al.
Serial No. 09/661,222
Filing Date: September 13, 2000

U.S. Pat. No. 7,103,640 B1
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The Commissioner is hereby authorized to charge any fees required to Deposit Account No. 23-1925. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Scott W. Brim
Registration No. 51,500
Attorney for Applicant

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200

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Case No. 10406/43

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL, the specification of which:

- ☐ is attached hereto.
- ☒ was filed on September 13, 2000 as Application Serial No. 09/661,222.
- ☐ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability as defined in Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	☐ Yes	☐ No

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

60/153,709	September 13, 1999
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

09/111,896	July 8, 1998	Pending
(Application Serial No.)	(Filing Date)	(Status-patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Inventor's Signature	_____ Date: 22 Jan 2001
Full name of sole or first inventor	JOHN K. OVERTON
Residence	CHICAGO, ILLINOIS
Citizenship	UNITED STATES OF AMERICA
Post Office Address	5825 South Blackstone, Chicago, Illinois 60637

FEB _ 8 2007

Case No. 10406/43

Inventor's Signature	Date: 25-JAN-2001
Full name of second joint inventor, if any	STEPHEN W. BAILEY
Residence	CHICAGO, ILLINOIS
Citizenship	UNITED STATES OF AMEICA
Post Office Address	5617 South Dorchester Avenue, 2N, Chicago, Illinois 60637

BRINKS HOFER GILSON & LIONE
P.O. Box 10395
Chicago, IL 60610
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FEB _ 6 2001

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NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL

RELATED APPLICATIONS

This application claims priority to provisional patent application serial no. 60/153,709, entitled SIMPLE DATA TRANSPORT PROTOCOL METHOD AND APPARATUS, filed on September 13, 1999, and to regular patent application no. 09/111,896, entitled SYSTEM AND METHOD FOR ESTABLISHING AND RETREIVING DATA BASED ON GLOBAL INDICES, filed on July 8, 1998.

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A Microfiche Appendix (143 frames, 2 sheets) is included in this application that contains material which is subject to copyright protection. The copyright owner has no objection to the facsimile reproduction by anyone of the Microfiche Appendix, as it appears in the Patent and Trademark Office patent files or records, but otherwise reserves all copyright rights whatsoever.

FIELD OF THE INVENTION

This invention relates generally to the storage and retrieval of information, and in particular, to a protocol for dynamic and spontaneous global search and retrieval of information across a distributed network regardless of the data format.

BACKGROUND OF THE INVENTION

Data can reside in many different places. In existing retrieval systems and methods, a client seeking information sends a request to a server. Typically, only data that are statically associated with that server are returned. Disadvantageously, the search is also usually restricted to previously known systems. The search is thus conducted only where the server knows in advance to look.

Another disadvantage of known retrieval systems is the difficulty in accessing data in different forms. Known retrieval systems are typically

FEB - 6 2007

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,103,640 B1
APPLICATION NO. : 09/661222
DATED : September 5, 2006
INVENTOR(S) : John K. Overton and Stephen W. Bailey

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

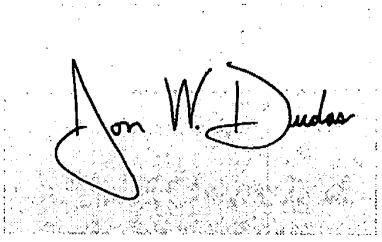
On Title Page, Item (60) Pat No. 7,103,640 B1, Related to U.S. Application Data should be changed from:

"Provisional application No. 60/153,709, filed on Sep. 14, 1999."; to

--U.S. Provisional App. No. 60/153,709, filed Sep. 14, 1999, and U.S. Pat. App. No. 09/111,896, filed Jul 8, 1998.--

Signed and Sealed this

Third Day of April, 2007



JON W. DUDAS
Director of the United States Patent and Trademark Office

PTO/AIA/123 (08-12)
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CHANGE OF CORRESPONDENCE ADDRESS
Patent

Address to:
Mail Stop Post Issue
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Patent Number	7103640
Issue Date	September 5, 2006
Application Number	09661222
Filing Date	September 13, 2000
First Named Inventor	John K. Overton
Attorney Docket Number	KOVE-640EPR036

Please change the Correspondence Address for the above-identified patent to:

☑ The address associated with Customer Number: 184647

OR

☐ **Firm *or* Individual Name**

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This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).

This form will not affect any "fee address" provided for the above-identified patent. To change a "fee address" use the "Fee Address Indication Form" (PTO/SB/47).

I am the:

☑ Patentee.

☑ If the Patentee was not the applicant for patent (37 CFR 1.42), then a Statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is enclosed or was filed on _____. See 37 CFR 3.71.

☐ Attorney or agent of record. Registration Number _____.

☐ Patent practitioner acting in a representative capacity whose correspondence address is the correspondence address of record. Notice has been given to the patentee or owner. Registration Number _____.

Signature

Typed or Printed Name John Overton

Date 2022-01-11 | Telephone 312-850-3147

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop Post Issue, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Kove IO, Inc.

Application No./Patent No.: 7103640 Filed/Issue Date: September 5, 2006

Titled: Network Distributed Tracking Wire Transfer Protocol

Kove IO, Inc., a Delaware corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: the inventors To: OVERX, INC.

   The document was recorded in the United States Patent and Trademark Office at

   Reel 011489, Frame 0619, or for which a copy thereof is attached.

2. From: OVERX, INC. To: ECONNECTIX, LLC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 014254, Frame 0043, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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STATEMENT UNDER 37 CFR 3.73(c)

3. From: ECONNECTIX, LLC To: ECONNECTIX, CORPORATION

The document was recorded in the United States Patent and Trademark Office at
Reel 022634, Frame 0360, or for which a copy thereof is attached.

4. From: ECONNECTIX, CORPORATION To: KOVE CORPORATION

The document was recorded in the United States Patent and Trademark Office at
Reel 036886, Frame 0111, or for which a copy thereof is attached.

5. From: KOVE CORPORATION To: KOVE IO, INC.

The document was recorded in the United States Patent and Trademark Office at
Reel 036888, Frame 0700, or for which a copy thereof is attached.

6. From: KOVE IO, INC. To: ARCTIDE, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 036831, Frame 0804, or for which a copy thereof is attached.

☑ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature	Date: 2021-12-17
John K. Overton	CEO
Printed or Typed Name	Title or Registration Number

STATEMENT UNDER 37 CFR 3.73(c) – SUPPLEMENTAL SHEET

7. From: ARCTIDE, LLC To: KOVE IO, INC.

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt	
EFS ID:	44719209
Application Number:	09661222
International Application Number:	
Confirmation Number:	7777
Title of Invention:	NETWORK DISTRIBUTED TRACKING WIRE TRANSFER PROTOCOL
First Named Inventor/Applicant Name:	John K. Overton
Customer Number:	757
Filer:	Philip Joseph Eklem
Filer Authorized By:	
Attorney Docket Number:	10406/43
Receipt Date:	11-JAN-2022
Filing Date:	13-SEP-2000
Time Stamp:	15:44:18
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Change of Address	2022-01-11--SIGNED--CoA--640.pdf	1761607 c1d9a45430842378 6bbda5298545765f60c2526b	no	2

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	90019036_7103640_37CFR373c_w_Supp.pdf	2645327 bbaa131093e26a0fd1c5143dc605f7fa4d6381e5	no	4
Warnings:					
Information:					
		Total Files Size (in bytes):	4406934		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.