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(54) SYSTEM AND METHOD FOR REMOTE UPDATES

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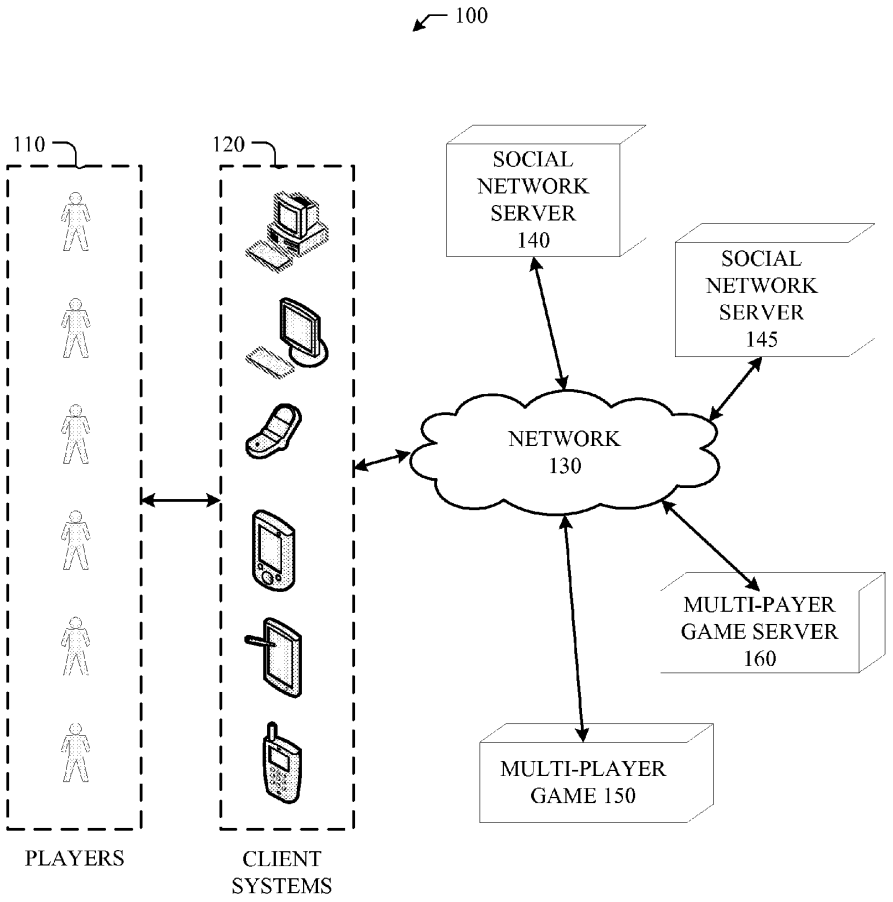
(57) **ABSTRACT**

In one embodiment, accessing, using a computing device, a batch file comprising a plurality of events generated by a remote game client application executing an instance of a computer-implemented game; accessing, in response to the batch file, a game state data object associated with the instance of the computer-implemented game, wherein the game state data object includes one or more game state parameters formatted as serialized unstructured data; parsing the game state data object to identify the one or more game state parameters; processing the plurality of events in the batch file against game logic to update one or more of the game state parameters; re-serializing the one or more game state parameters into an updated game state data object; and storing the game state data object in a memory cache.



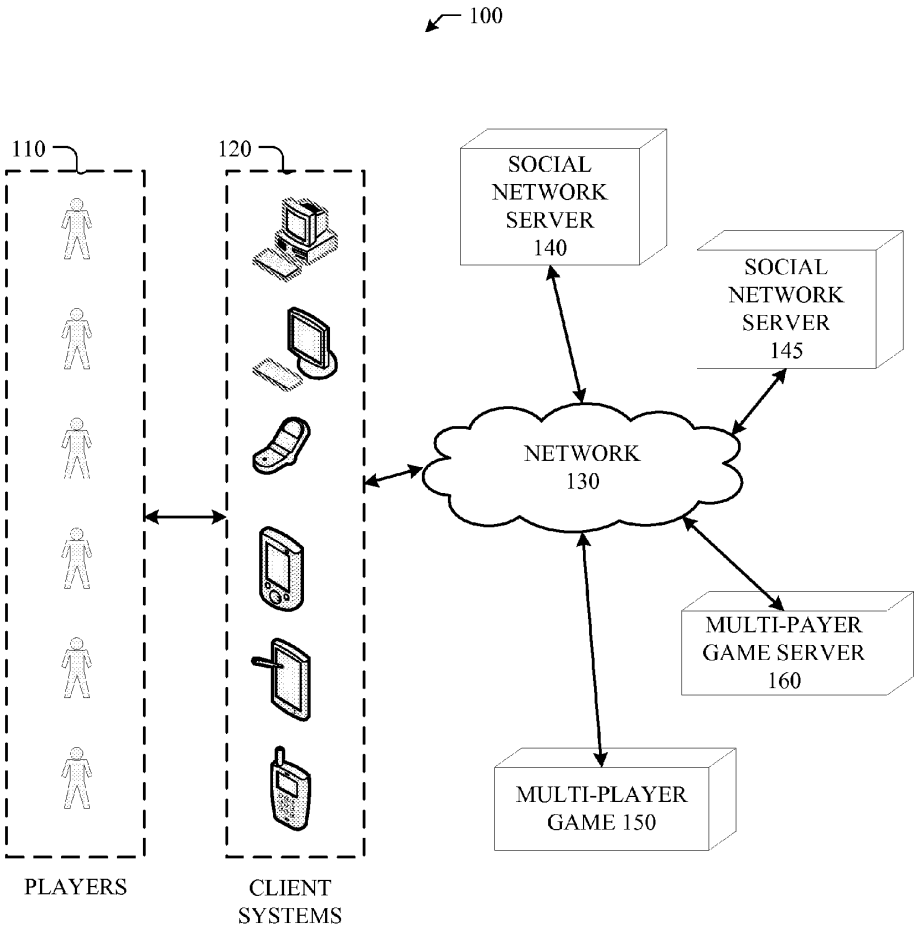

100
110
120
SOCIAL NETWORK SERVER 140
SOCIAL NETWORK SERVER 145
NETWORK 130
MULTI-PAYER GAME SERVER 160
MULTI-PLAYER GAME 150
PLAYERS
CLIENT SYSTEMS

FIGURE 1

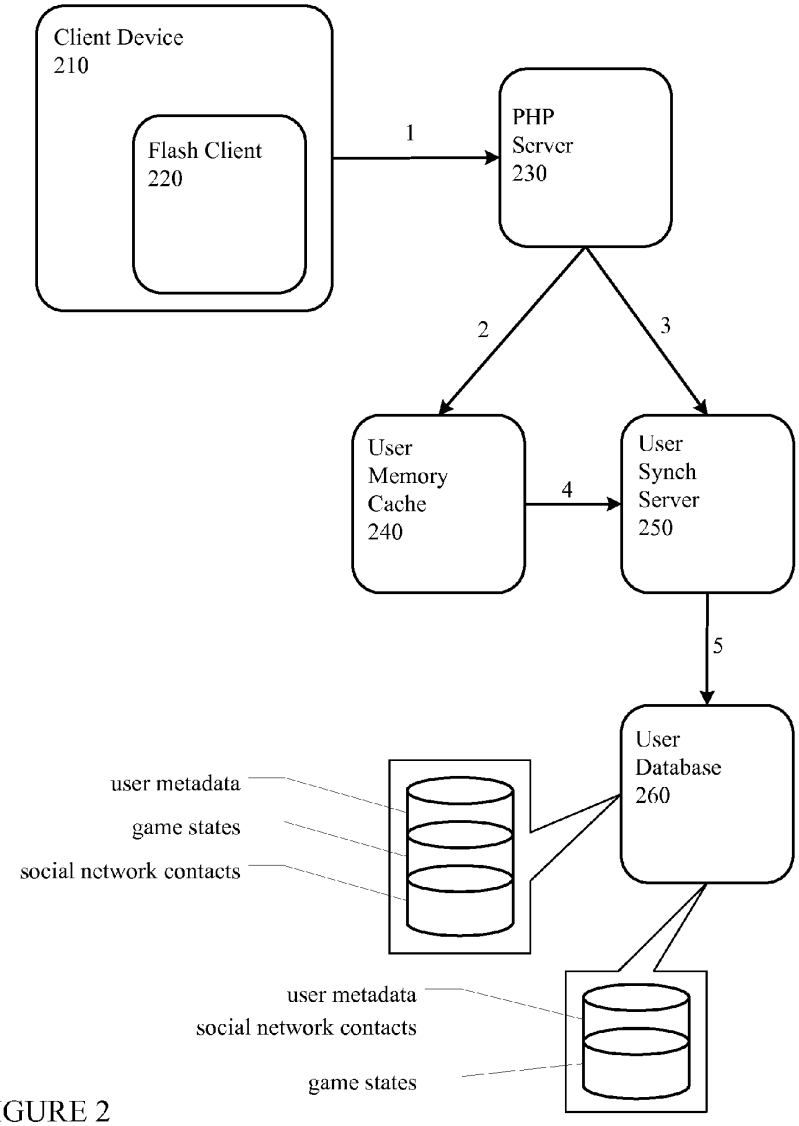

Client Device
210
Flash Client
220
1
PHP
Server
230
2
3
User
Memory
Cache
240
4
User
Synch
Server
250
5
User
Database
260
user metadata
game states
social network contacts
user metadata
social network contacts
game states

FIGURE 2

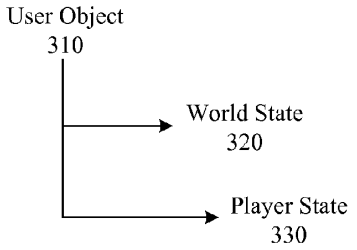


FIGURE 3A

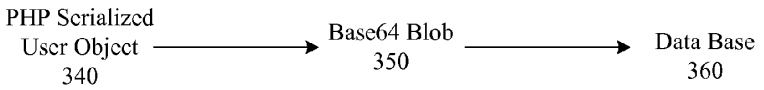


FIGURE 3B

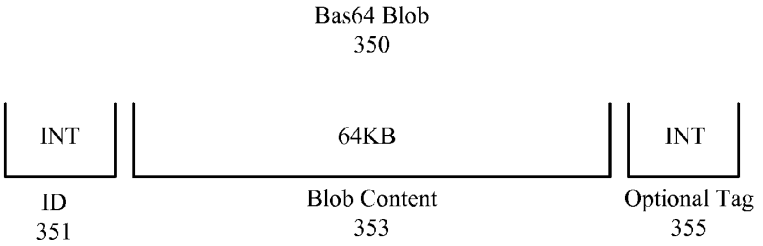


FIGURE 3C

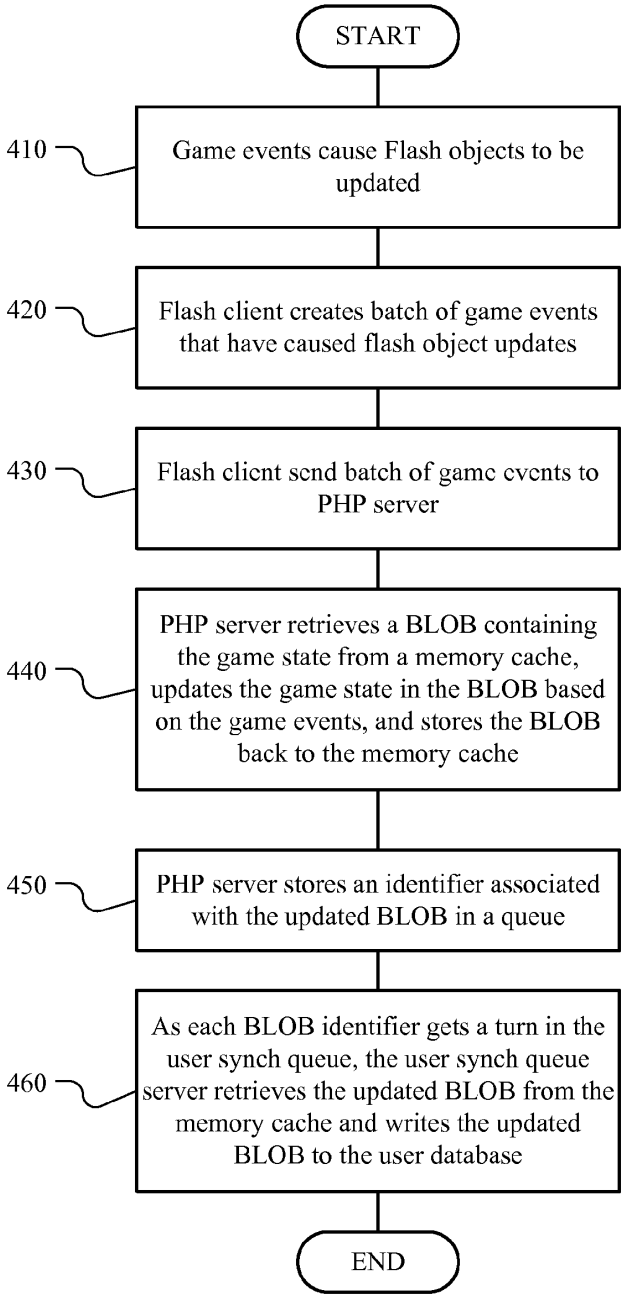

START
410
Game events cause Flash objects to be updated
420
Flash client creates batch of game events that have caused flash object updates
430
Flash client send batch of game events to PHP server
440
PHP server retrieves a BLOB containing the game state from a memory cache, updates the game state in the BLOB based on the game events, and stores the BLOB back to the memory cache
450
PHP server stores an identifier associated with the updated BLOB in a queue
460
As each BLOB identifier gets a turn in the user synch queue, the user synch queue server retrieves the updated BLOB from the memory cache and writes the updated BLOB to the user database
END

FIGURE 4

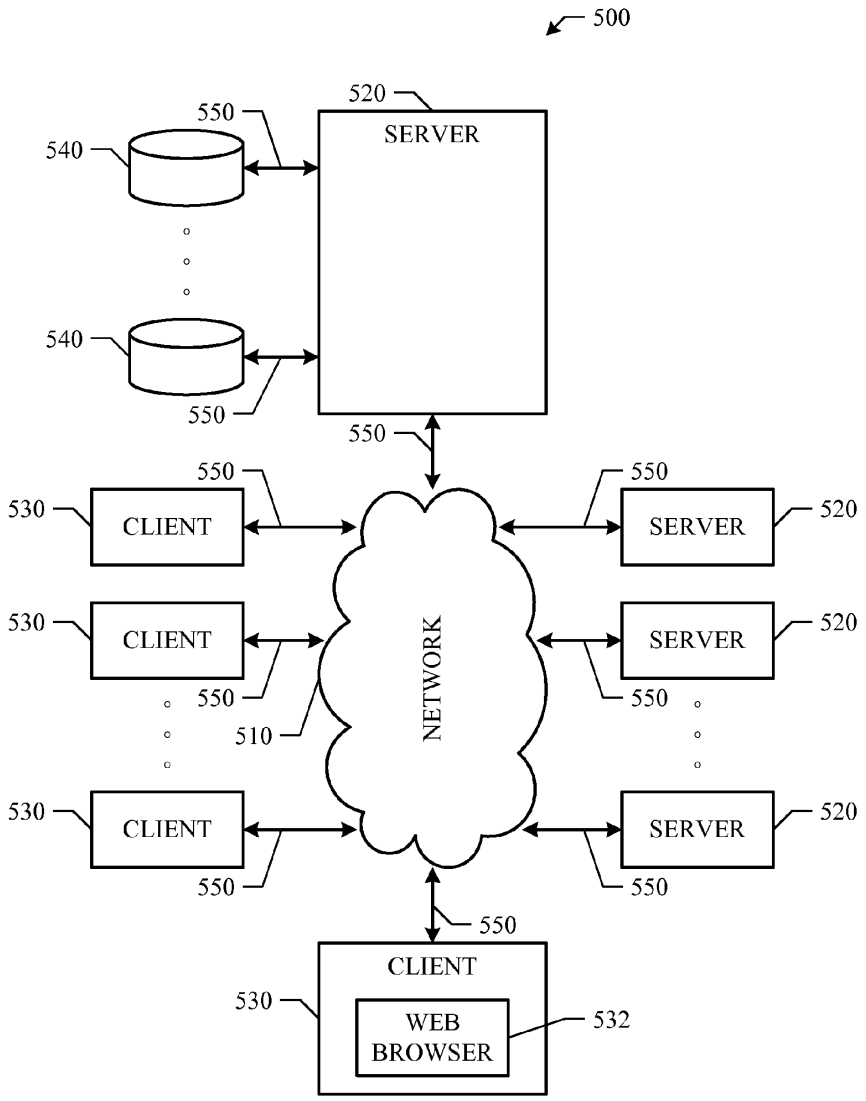

500
520
SERVER
550
540
540
550
550
550
530
CLIENT
550
SERVER
520
530
CLIENT
NETWORK
SERVER
520
550
550
510
530
CLIENT
SERVER
520
550
550
550
CLIENT
530
WEB
BROWSER
532

FIGURE 5

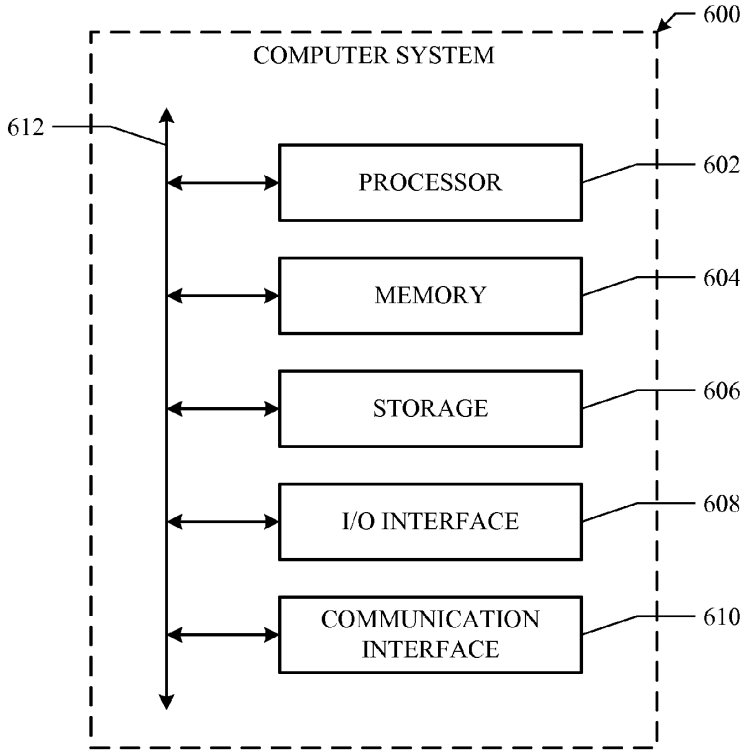

600
COMPUTER SYSTEM
612
PROCESSOR
602
MEMORY
604
STORAGE
606
I/O INTERFACE
608
COMMUNICATION INTERFACE
610

FIGURE 6

SYSTEM AND METHOD FOR REMOTE UPDATES

RELATED APPLICATION

[0001] The application claims benefit under 35 U.S.C. §119(e) of U.S. Provisional Patent Application No. 61/247,492, entitled "System and Method for Remote Updates", filed 30 Sep. 2009, which is hereby incorporated by reference in its entirety and for all purposes.

TECHNICAL FIELD

[0002] The present disclosure generally relates to synchronizing application state data between one or more client applications and a backend system that persistently stores the application state data.

BACKGROUND

[0003] A client-server computing or networking environment provides a distributed application architecture that partitions tasks or work loads between service providers, often referred to as "servers", and service requesters, often referred to as "clients". Typically, the clients and the servers operate over a computer network on separate hardware. Individual clients and servers may perform different tasks but in a coordinated manner so that together they may accomplish specific objectives or results that are desirable to both the clients and the servers. As high-speed network connections become more prevalent, an ever-increasing number of computer-implemented applications are being run on remote server systems at locations different from those where clients controlling the applications are located. While an application is running, data relevant to the application may need to be shared between the clients and the servers involved with the application from time to time, which may be achieved by transmitting the data between the individual clients and servers over a computer network. For example, suppose an application is running on a client device associated with a user but the application data are stored in a database managed by a server system. Each time the user makes a change to an application datum at the client device, the client device needs to send an update notice to the server system so that the server system may update the corresponding application datum stored in the database accordingly. However, despite the increased bandwidth connecting the servers and the clients, it can still be undesirably slow to transmit application data between a server and a client to update to the remote server, which in turn will update an application state in a database, each time a user makes a change the application on a client computer.

[0004] The problem described in the above example is further multiplied by environments in which large numbers of users are all making many application updates at the same time, which causes many client devices to send update notices to the same server system at the same time. This particular problem is typified by multi-player online games that are run on a remote game server or a social network server. Receiving, processing, and saving each application update as the updates are received is not scalable when a server is servicing the many users of a multi-player online game.

SUMMARY

[0005] The present disclosure generally relates to updating data stored in memory and more specifically relates to receiving updates for the data from remote computing systems, generating serialized binary objects for the updates, and updating the data stored in the memory using the serialized binary objects.

[0006] In particular embodiments, accessing, using a computing device, a batch file comprising a plurality of events generated by a remote game client application executing an instance of a computer-implemented game; accessing, in response to the batch file, a game state data object associated with the instance of the computer-implemented game, wherein the game state data object includes one or more game state parameters formatted as serialized unstructured data; parsing the game state data object to identify the one or more game state parameters; processing the plurality of events in the batch file against game logic to update one or more of the game state parameters; re-serializing the one or more game state parameters into an updated game state data object; and storing the game state data object in a memory cache.

[0007] These and other features, aspects, and advantages of the disclosure are described in more detail below in the detailed description and in conjunction with the following figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** illustrates a schematic of an example system that may be used to implement various embodiments of the present disclosure.

[0009] FIG. **2** illustrates an example system for processing remote Flash® object updates according to embodiments of the present disclosure.

[0010] FIGS. **3**A-**3**C illustrate various data structures according to embodiments of the present disclosure.

[0011] FIG. **4** illustrates an example method for updating remote Flash® objects according to embodiments of the present disclosure.

[0012] FIG. **5** illustrates an example network environment.

[0013] FIG. **6** illustrates an example computer system.

DESCRIPTION OF EXAMPLE EMBODIMENT(S)

[0014] The present disclosure is now described in detail with reference to a few embodiments thereof as illustrated in the accompanying drawings. In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. It is apparent, however, to one skilled in the art, that the present disclosure may be practiced without some or all of these specific details. In other instances, well known process steps and/or structures have not been described in detail in order not to unnecessarily obscure the present disclosure. In addition, while the disclosure is described in conjunction with the particular embodiments, it should be understood that this description is not intended to limit the disclosure to the described embodiments. To the contrary, the description is intended to cover alternatives, modifications, and equivalents as may be included within the spirit and scope of the disclosure as defined by the appended claims.

[0015] Computer-implemented games are a popular form of entertainment. Some games are desktop-based that may be run on individual computing devices as standalone applications. Some games are network-based. A network-based game typically includes one or more server components that may be run on a server system and one or more client components that may be run on a client device associated with a player of the game. In particular embodiments, a player of the

network-based game may control the game's progress at the client device (e.g., by inputting commands to the game at the client device). The client components may be responsible for receiving inputs from the player, executing game logic, changing the state of one or more world or player state parameters, transmitting user inputs or other events to the server components running on the server system, receiving instructions from the server components, and displaying outputs of the game on the client device. The server components may provide backend support for the client components and may be responsible for maintaining application data of the game, processing the inputs from the player, updating and/or synchronizing the game state based on the game logic and each input from the player, and transmitting instructions to the client components. As a result, a network-based game may require its server and client components to communicate with each other frequently in order to coordinate their respective functionalities. For example, each time a player provides an input to the game through the client components at the client device (e.g., the player types on the keyboard or clicks the mouse of the client device), the client components of the game may need to transmit the player's input to the server components running on the server system. With some games, a player may provide many such inputs every second (e.g., the player of a war game continuously fires a weapon at his enemies by continuously clicking on the mouse of the client device, or a player of a harvest-mechanic game repeatedly clicks on objects to be harvested, etc.).

[0016] In one implementation described herein, an instance of a given game can be persistently stored as a set of game state parameters that characterize the state of various game objects, such as player character state parameters, non-player character parameters, and world state parameters. In one implementation, game state is maintained in a database as a serialized, unstructured string of text data as a so-called Binary Large Object (BLOB). When a player accesses a server to play a game, the BLOB containing the game state for the instance corresponding to the user is transmitted to a client device for use by a client-side executed object to process. In one implementation, the client-side executable may be a FLASH(r)-based game, which can de-serialize the game state data in the BLOB. As the user plays the game, the game logic implemented at the client maintain and modifies the various game state parameters locally. As discussed above, the client-side game logic may also batch game events, such as mouse clicks, and transmit these events to a remote server. The remote server may itself operate by retrieving a copy of the BLOB from a database or an intermediate memory cache (memcache) layer. The remote server can also de-serialize the BLOB to resolve the game state parameters and execute its own game logic based on the events in the batch file of events transmitted by the client to synchronize the game state on the server side. The remote server may then re-serialize the game state, now modified, into a BLOB and pass this to a memory cache layer for lazy updates to a persistent database.

[0017] With a client-server environment in which the network-based games may run, one server system may support multiple client devices. At any given time, there may be multiple players at multiple client devices all playing the same game. In practice, the number of players playing the same game at the same time may be very large. As the game progresses with each player, multiple players may provide different inputs to the game at their respective client devices, and multiple client devices may transmit multiple player inputs and/or game events to the server system for further processing at the same time. In addition, multiple client devices may transmit other types of application data to the server system. The performance of the server system may suffer as a result of receiving a great number of application data, including player inputs and game events, from a great number of client devices simultaneously.

[0018] In particular embodiments, to improve performance of the server system, especially a server system that supports multiple client devices concurrently, instead of having a client device sending a separate transmission to the server system each and every time an application datum is updated or an event is generated, the client components of a network-based game may accumulate the application data updates and the player inputs at the client device for a period of time. When there is a sufficient amount of application data updates and player inputs accumulated, the client device may transmit one message to the server system including all the accumulated application data updates and player inputs thus far. In particular embodiments, the application data updates and the player inputs may be accumulated into batch files at the client device so that each time the client device transmits a batch file to the server system, the batch file contains multiple application data updates and player inputs. In particular embodiments, the server system, which is operative to execute the game logic may then parse each batch file received from a client device into individual data updates and events and then update its own version of the game set by applying these events to the game logic. After the events in the batch have been processed, the synchronized game state data may be converted into a serialized binary objects or a serialized binary large object (BLOB) associated with a corresponding identifier. In particular embodiments, the server system may cache the application data of a game while the game is running on a client device and also store the application data in a database on a more permanent basis. In this case, each serialized BLOB corresponding to a particular game instance may then be sent to the memory cache and eventually be used to update the database. For example, in particular embodiments, the identifier may be sent to a synchronization (sync) server where it is entered into a sync queue. In particular embodiments, the sync server monitors the sync queue and processes the identifiers and the corresponding BLOBs from the memory cache to write the updated BLOBs to the database.

[0019] By collecting multiple game or player updates into update batch files at the client device, the client device may send a single batch file that includes many application event data updates to a server system, thus reducing the number of transmissions needed between the client device and the server system. As used herein, the term "application event data" may refer to any data relevant to a computer-implemented game application that may affect one or more game state parameters, including, for example and without limitation, changes to player data or metadata, changes to player social connections or contacts, player inputs to the game, and events generated by the game logic. In particular embodiments, each application datum may have a name and a value. The value of an application datum may change at any time, either by a player of the game or by the game itself (e.g., based on the game logic). In particular embodiments, an application data update occurs when the value of a specific application datum is changed.

[0020] Various features of the present disclosure may be implemented with an example system **100** shown in FIG. **1**. For instance, system **100** depicted in FIG. **1** may be used to facilitate or operate a multi-player game. In particular embodiments, multiple players **110** using corresponding client devices **120** may connect to and communicate via a network **130**. Client devices **120** may be any device capable of connecting to network **130** such as, for example and without limitation, a personal computer, a smart phone, a mobile phone, a net book, a handheld gaming device, etc. Through network **130**, client devices **120** may communicate with a first social network server **140**, a second social network server **145**, a first multi-player game server **150** and a second multi-player game server **160**. In some embodiments, first and second social network servers **140** and **145** may include an internal multi-player game server. Similarly, multi-player game servers **150** or **160** may also include an internal social network server. In other embodiments, social network servers **140** and **145** and multi-player game servers **150** and **160** may communicate with one another over network **130**. In particular embodiments, multi-player game servers **150** and **160** may each include a PHP (Hypertext Preprocessor) server. Each multi-player game server in system **100** may also include a game engine for any and all multi-player games hosted or operated thereon. Network **130** may be any appropriate electronics communication medium including, but not limited to, the Internet, a wireless network, or a closed proprietary network.

[0021] In various embodiments, multi-player game servers **150** and **160** may include computer readable code stored on a computer readable media configured to be executed on a processor in the multi-player game server to implement multi-player games including various features described herein. Multi-player game servers may load individual games from the computer readable medium in memory and then execute the games. It is possible for multi-player game servers **150** and **160** to run a plurality of multi-player games simultaneously. In particular embodiments, multi-player game servers **150** and **160** may also be configured to access social graphs for players **110** stored on social network servers **140** and **145**. Information extracted from such social graphs (e.g., a player's social contacts) may be used incorporated in the game logic of specific games and may be used to determine the current state of a game. In some embodiments, multi-player game server **150** and multi-player game server **160** may be configured to access social graphs for players **110** stored on the each other.

[0022] Players **110** may use client devices **120** to access, send data to, and receive data from social network server **110** and multi-player game servers **150** and **160** over network **130**. In some embodiments, client devices **120** may download and store game data from the various servers. Game data downloaded to client devices **120** may include information to enable various levels of off-line game play.

[0023] In particular embodiments, a computed-implemented game may be a text-based or turn-based game implemented as a series of web pages that are generated after a player selects one or more actions to perform. The web pages may be displayed in the web browsers executed on client devices **120**. In one such implementation, a client application downloaded to client devices **120** may operate to serve a set of web pages to a user. In other implementations, a computer-implemented game may be an animated or rendered game executable as a stand-alone application or within the context of a web page or other structured document. In some implementations, the computer-implemented game may be implemented using Adobe Flash-based technologies. For example, a game may be fully or partially implemented as a SWF object that is embedded in a web page and executable by a Flash® media player plug-in. In various example embodiments, one or more described web pages may be associated with a networking system or networking service. However, alternative embodiments may have applications to the retrieval and rendering of structured documents hosted by any type of network addressable resource or web site. Additionally, as used herein, a "player" of the game may be an individual, a group, or an entity (such as a business or third party application).

[0024] FIG. **2** is a schematic of an example system for handling application event data updates to a remote server. As described above, the application event data of a game are any data relevant to the game (e.g., player inputs). In particular embodiments, each application datum may have a name and a value, and the value of the application datum may change (i.e., be updated) at any time. When an update to an application datum occurs at a client device, either caused by an action of a game player or by the game logic itself, the client device may need to inform a corresponding game server of the update. For example, if the game is a farming game with a harvest mechanic (such as Zynga Farmville™), an event can correspond to a user clicking on a parcel of land to harvest a crop. In such an instance, the application event data may identify an event or action (e.g., harvest) and an object in the game to which the event or action applies. For purposes of illustration only, the system shown in FIG. **2** will be discussed in reference to updating a multi-player online game hosted on a game server or social network server, where an instance of the game logic is executed remotely on a client device, which then transmits application event data to the remote game server such that the remote game server synchronizes game state associated with the instance executed by the client device.

[0025] In particular embodiment, one or more objects of a game may be represented as a Adobe Flash® object. Flash® is a multimedia platform originally acquired by Macromedia and currently developed and distributed by Adobe Systems. Since its introduction in 1996, Flash® has become a popular method for adding animation and interactivity to web pages. Flash® is commonly used to create animation, advertisements, and various web page components, to integrate video into web pages, and more recently, to develop rich Internet applications and games. Flash® may manipulate vector and raster graphics, and supports bidirectional streaming of audio and video. Several software products, systems and devices are able to create or display Flash® content, including Adobe Flash® Player®, which is available free for most common web browsers, some mobile phones and for other electronic devices (using Flash® Lite®). Adobe Flash®, or simply Flash®, refers to both a multimedia authoring program and the Adobe Flash® Player®. Strictly speaking, Adobe Flash® is the authoring environment and Flash® Player® is the virtual machine used to run the Flash® files, but in colloquial language, these have become mixed: "Flash®" may mean the authoring environment, the player or the application files.

[0026] In particular embodiments, client device **210** may include Flash® client **220**. Flash® client **220** may be configured to receive and run Flash® application or game object code from any one or more of the servers shown in FIG. **1**. In particular embodiments, Flash® client **220** may be run in a

web browser executed on client device **210**. A user (e.g., a game player) interacts with the Flash® objects using client device **210** and Flash® client **220**. For example, the user may make various changes and updates to the Flash® object, such as moving an object within a virtual space, deleting an object, shooting an object, harvesting an object, and the like. Thus, when the user makes a change to a Flash object, the client-executed game logic may update one or more state parameters associated with the object. To ensure synchronization between the Flash® object shown to the user at the client device **210**, the Flash® client **220** may send the events that caused the object state changes to the remote server. However, to expedite the processing and hence the speed of the overall gaming experience, the Flash® client **220** may collect a batch of some number of events or updates into a batch file. The number of events or updates may be determined by the Flash® client dynamically or determined by the remote server based on server loads or other factors. For example, client device **210** may send a batch file to the remote server whenever **100** updates have been collected or after a threshold period of time, such as every minute.

[0027] As described above, in particular embodiments, each application event datum may include an action or event name and a value (such as an object identifier). Thus, each application datum may be represented as a name-value pair in the batch file. The batch file may include a collection of name-value pairs representing the application data that have been updated at client device **210**. In particular embodiments, the batch file may be a text file and the name-value pairs may be in string format.

[0028] When the batch file collects the requisite number of Flash® object updates (or a another threshold event occurs—such as the expiration of a timer), Flash® client **220** may send the batch file to a PHP server **230** in step **1**. In particular embodiments, client device **210** may compress the batch file before transmitting it to the remote server, thus further reducing the size of the data that need to be transmitted from client device **210** and the remote server. In one implementation, the batch file includes an identifier or set of identifiers (such as a user identifier and game type identifier, or a game instance identifier, etc.) that uniquely identifies or maps to the instance of the game executed on the client device **210**. Client device **210** and PHP server **230** may be connected by any suitable electronic medium such as the Internet, a wireless network, a proprietary network, etc. In particular embodiments, client device **210** and PHP server **230** may communicate using the HyperText Transfer Protocol (HTTP). The batch file may be sent from client device **210** to PHP server **230** as a HTTP message. PHP server **230** may receive the batch file and parse the batch file into its component events or updates. As each component update is parsed out of the batch file, the PHP server may retrieve the current game state parameters corresponding to the game instance, as discussed in more detail below, and process the updates, using the game logic, to synchronize the game state maintained on the back end with the game state at the client device **210**. After the batch file for a given game instance has been processed, the PHP server **230** may also serialize the Flash® object updates into machine-readable string or object (e.g., a BLOB) that may include a unique identifier and the corresponding Flash® object update. In some embodiments, it may be desirable to have one or more elements of the machine-readable string or object be searchable in a database report. For this purpose, an extra tag or piece of metadata may be included in machine-readable string or object. The machine-readable string or object may be a serialized binary large object, otherwise known as a BLOB, which is a collection of binary data stored as a single entity in a database.

[0029] In particular embodiments, when a user plays a network-based game on a client device (e.g., client device **210**) associated with the user, a server hosting the game (e.g., PHP server **230**) may serialize all the game-related data, including, for example and without limitation, game states, game events, user inputs, for this particular user and this particular game into a BLOB and stores the BLOB in a database (e.g., user database **260**) associated with the server. The BLOB may be associated with an identifier that indicates that the BLOB contains the serialized game-related data for this particular user and this particular game. In particular embodiments, while the user is not playing the game, the corresponding BLOB may be stored in the database. This enables the user to stop playing the game at any time without losing the current state of the game the user is in. When the user resumes playing the game next time, the server may retrieve the corresponding BLOB from the database to determine the most-recent values of the game-related data. In particular embodiments, while the user is playing the game, the server may also load the corresponding BLOB into a memory cache (e.g., user memory cache **240**) so that the server may have faster access to the BLOB and the game-related data contained therein, thus improving the performance of the game, since accessing data stored in a memory cache (e.g., user memory cache **240**) is much faster than accessing data stored in a database (e.g., user database **260**).

[0030] The BLOB may comprise the identifier section, a body section and one or more tag sections. The identifier section may be encoded as an INT or other 4 kB object. The body section of the BLOB may be encoded in base64 or other 64 kB object. The one more tag sections may also be encoded as an INT or other 4 kB object.

[0031] Each time a batch file has been received at PHP server **230**, PHP server **230** may process the batch file to extract the individual data updates. In particular embodiments, the PHP server **230** may retrieve the corresponding BLOB that contains the game-related information from user memory cache **240**, de-serialize the BLOB to extract the individual game-related data, and apply the data updates to the specific game-related data to update their values. Then, PHP server **230** may re-serialized the game-related information, now having the updated data values, again into a BLOB and store the BLOB in user memory cache, as illustrated in step **2** of FIG. **2**.

[0032] , Updating user memory cache **240** is much faster and more practical than updating user database **260**. At about the same time, PHP server **230** may send the corresponding unique identifier for each serialized BLOB to the user sync server **250**. The user sync server **250** enters the unique identifiers into a user sync queue to await processing and updating user database **260** in step **3**. In particular embodiments, updating the data stored in user database **260** may be performed in a lazy-update fashion (e.g., slower that updating the data stored in user memory cache **240**). For example, in some implementation, the data stored in user database **260** may be updated once every 30 minutes. In some embodiments, user sync server **250** processes the user sync queue on a first-in-first-out (FIFO) basis. As each unique identifier makes it way through the queue waiting for its turn to be processed, the user memory cache **240** may or may not have been updated several

times. To ensure continuity and consistency with the updates being made on Flash® client **220**, unique identifiers in the serialized BLOB are processed in the same order as they are executed at the Flash® client **220**.

[0033] When a unique identifier is processed by the user sync server **250**, in particular embodiments, user sync server **250** retrieves the serialized BLOB corresponding to the unique identifier from user memory cache **240** in step **4** and then processes the appropriate updated to user database **250** in step **5**. In one embodiment, user synch server **250** may replace the BLOB in user database **260** with the BLOB retrieved from user memory cache **240** and store the BLOB retrieved from user memory cache **240** in user database **260**. Alternatively, in other embodiments, user synch server **250** may de-serialize both the BLOB stored in user database **260** and the BLOB retrieved from user memory cache **240**, update the game-related data in user database **260** using the game-related data contained in the BLOB retrieved from user memory cache **240**, re-serialize the updated game-related data in user database **260** into a BLOB, and store the re-serialized BLOB back into user database **260**. In such embodiments, user database **260** may be slightly out of sync with user memory cache **240**. However, user memory cache **240** may be updated quickly enough using the serialized BLOBs provided by PHP server **230** to provide a game environment that may appear identical to a user at client device **210** using Flash® client **220** and other users at other locations.

[0034] FIGS. **3**A-**3**C show various aspects and structures of game updates, user objects, and serialized BLOBs according to various embodiments of the present disclosure. FIG. **3**A shows a user object **310** that may include a world state **320** and the player state **330** as they relate to a particular game. The world state **320** may include changes to the conditions of the game including level ups, change of mission, etc. The player state **330** may include changes to the player character including level, experience, damage, appearance, etc. User object **310** may be updated on the client device **210** using a Flash® client **220** with the change stored in an update file waiting to be collected into a batch to be sent to a PHP server **230**. User object **310** may be changed multiple times before the batch file is sent to the PHP server **230**. Such successive changes may be realized when each of the update files are processed in sequence by the PHP server **230** and the user sync server **250**.

[0035] FIG. **3**B shows the data flow of updating the database **260** according to various embodiments of the present disclosure. First, the PHP server **230** may create a PHP serialized user object **340**. The serialized version of the user object **310** may be a long single dimension data structure that may be converted into a suitable machine language or machine-readable code. In this example, the PHP serialized user object **340** is converted into a base64 BLOB **350**. As previously mentioned, the base64 BLOB **350** may include an identifier section and, optionally, a searchable tag section. Once base64 BLOB **350** is created, it may be used to update a memory cache **350** or a database **360** or both.

[0036] FIG. **3**C shows the sections of the base64 BLOB **350**. Base64BLOB **350** may include an ID section **351**, BLOB content section **353** and optional tag section **355**. The ID section **351** may be encoded as an integer or a 4 kB binary number. The ID section **351** may be used to correlate base64BLOB **350** to the original update file that the PHP server used to create the BLOB. The ID section **351** is important for later recall of the BLOB from memory cache to update the database **260**. The BLOB content section **353** may include a 64 kb of update information for user object **310** or any game or application state update. The BLOB content **353** may be encoded into any suitable machine-readable code. The optional tag section **355** may be encoded in a similar fashion as the ID section **351**.

[0037] FIG. **4** is a flowchart of a method for updating a remote server according to various embodiments of the present disclosure. As described above, in particular embodiments, a network-based computer-implemented game may includes a number of server components and a number of client components. While a user plays the game, the server components may be executed on a server hosing the game and the client components may be executed on a client associated with the user. The user may interact with the game via the client components. While the user plays the game, the server components and the client components may exchange game-related data from time to time over, for example, a computer network. In addition, application data of the game specifically associated with this particular user may be serialized into a BLOB and stored in a database associated with the server. The BLOB may be assigned a unique identifier (e.g., an identifier that identifies with which user and which game the game-related data contained in the BLOB are associated) to distinguish one BLOB associated with one user and one game with another BLOB associated with another user or another game. While the user plays the game, the game-related data associated with the user may be loaded into a memory cache associated with the server.

[0038] In particular embodiments, the application data of the game may include a number of objects representing various aspects of the game, including player characters, non-player characters, in-game assets, and the like. The user interacts with the game by providing user inputs (e.g., mouse clicks, keyboard typing, joy stick movements) through the client components executing on the client associated with the user. In response to each user input, the game logic may change the game-state accordingly. In general, each user input, game-state change, or other type of game-related action may be referred to as a game event. In particular embodiments, each game event may cause one or more application data of the game (e.g., one or more objects of the game) to be updated. At step **410**, a game event (e.g., a user input) may cause an object in a Flash® client to be updated using a client device. Multiple game events may cause multiple objects to be updated or an object to be updated multiple times. For example, the user may repeatedly generate game events by repeatedly clicking on a mouse. In particular embodiments, the Flash® client may collect these game events that cause the game objects to be updated. At step **420**, the Flash® client may create a batch of game events that have caused the Flash® objects to be updated at the client device and compile them in a batch file. Once the batch file has reached a sufficient size (e.g., a threshold number of game events) or predetermined amount of time has passed, the Flash® client may send the batch file of the game events to a PHP server in step **430**. In some embodiments, the PHP server may be included in a game server, a social networking server or may be configured as a standalone separate server.

[0039] Since the game is currently running, in particular embodiments, the BLOB containing the game-related data associated with this particular user and this particular game has been loaded into a memory cache. At step **440**, the PHP

server retrieves the BLOB containing the game-related data associated with this particular user and this particular game from the memory cache (e.g., using the identifier assigned to the BLOB), de-serializes the BLOB by parsing the data, and updates the game-related data contained in the BLOB using the game events contained in the batch file received from the Flash® client. In particular embodiments, the PHP server may parse the batch file to extract the individual game events, and de-serialize the BLOB to extract the state parameters of the objects that represent the game-related data. Since the game events causes specific objects to be updated according to the game logic of the game, the PHP server may similarly update the game objects extracted from the BLOB by applying the game logic to each game event extracted from the batch file. Once all the game events in the batch file have been processed and all the game objects have been updated based on the game events and the game logic, the PHP server may re-serialize all the game objects back into a BLOB and store the BLOB back to the memory cache. In particular embodiments, the re-serialized BLOB may have the same identifier as the original BLOB.

[0040] Either in a parallel or serial manner, PHP server may also send the unique BLOB identifier to the user sync queue hosted and monitored on the user sync server in step **450**. The unique BLOB identifiers may be stored in a queue and may be processed in a FIFO manner such that the updates to the memory cache or the database are processed in the same order in which the user makes the changes at the client device.

[0041] At step **460**, each unique BLOB identifier may make its way through the user sync queue and the user sync server may retrieve the BLOB identified by the BLOB identifier, which now contains the updated game objects, from the memory cache and writes the updated BLOB corresponding to the unique BLOB identifier to a user database. In some embodiments, the entire BLOB retrieved from the memory cache may be stored in the user database as a single object. In other embodiments, the synch server may de-serialize the BLOB retrieved from the memory cache to extract the individual game objects and store these game objects in the user database.

[0042] In particular embodiments, because the application data of a game may include different types of data (e.g., player metadata, player social network contacts, game states, etc.), user database **260** may be partitioned into multiple parts where each part is used to store one or more specific types of the game application data. For example, in one implementation, user database **260** may be partitioned into three parts for storing user metadata, game states, and social network contacts respectively. In another implementation, user database **260** may be partitioned into two parts, where user metadata and social network contacts are stored in one part and game states are stored in another part. While a game is running, some types of its application data may be updated more frequently than other types of application data. By storing different types of application data in different parts of user database **260**, accessing those types of data that are frequently updated may be performed more efficiently.

[0043] In one such implementation, the data stored in connection with a game instance corresponding to the user can be stored as two or more separate BLOBs. For example, in one implementation, a first BLOB type stores meta data of a user; a second BLOB type stores game state data of the game instance associated with the user, and a third blob type stores the social network contacts of the user. In an alternative implementation involving only two BLOB types, a first BLOB type stores meta data and social network contacts of the user; and a second BLOB type stores game state data of the game instance associated with the user. Partitioning of the game data in this manner achieves certain efficiencies. For example, in a social network game, retrieving the data for a given instance of a game associated with a first user often involves retrieving meta data (such as user names and profile pictures) of one or more in-game contacts or friends of the user. By partitioning the data as described above, the user of smaller BLOBs for more frequently accessed data, such as user meta data reduces memory and back-end bandwidth requirements—thereby improving the efficiency and costs of maintaining the system. In one implementation, each BLOB can be identified by a tuple including one or more of a game identifier, a user identifier and a blob type identifier. These identifiers may be concatenated and, optionally, hashed to generate a unique identifier for the BLOB.

[0044] Particular embodiments may be implemented in a network environment. FIG. **5** illustrates an example network environment **500** suitable for providing software validation as a service. Network environment **500** includes a network **510** coupling one or more servers **520** and one or more clients **530** to each other. In particular embodiments, network **510** is an intranet, an extranet, a virtual private network (VPN), a local area network (LAN), a wireless LAN (WLAN), a wide area network (WAN), a metropolitan area network (MAN), a portion of the Internet, or another network **510** or a combination of two or more such networks **510**. The present disclosure contemplates any suitable network **510**.

[0045] One or more links **550** couple a server **520** or a client **530** to network **510**. In particular embodiments, one or more links **550** each includes one or more wireline, wireless, or optical links **550**. In particular embodiments, one or more links **550** each includes an intranet, an extranet, a VPN, a LAN, a WLAN, a WAN, a MAN, a portion of the Internet, or another link **550** or a combination of two or more such links **550**. The present disclosure contemplates any suitable links **550** coupling servers **520** and clients **530** to network **510**.

[0046] In particular embodiments, each server **520** may be a unitary server or may be a distributed server spanning multiple computers or multiple datacenters. Servers **520** may be of various types, such as, for example and without limitation, web server, news server, mail server, message server, advertising server, file server, application server, exchange server, database server, or proxy server. In particular embodiments, each server **520** may include hardware, software, or embedded logic components or a combination of two or more such components for carrying out the appropriate functionalities implemented or supported by server **520**. For example, a web server is generally capable of hosting websites containing web pages or particular elements of web pages. More specifically, a web server may host HTML files or other file types, or may dynamically create or constitute files upon a request, and communicate them to clients **530** in response to HTTP or other requests from clients **530**. A mail server is generally capable of providing electronic mail services to various clients **530**. A database server is generally capable of providing an interface for managing data stored in one or more data stores.

[0047] In particular embodiments, one or more data storages **540** may be communicatively linked to one or more severs **520** via one or more links **550**. In particular embodiments, data storages **540** may be used to store various types of

information. In particular embodiments, the information stored in data storages **540** may be organized according to specific data structures. In particular embodiment, each data storage **540** may be a relational database. Particular embodiments may provide interfaces that enable servers **520** or clients **530** to manage, e.g., retrieve, modify, add, or delete, the information stored in data storage **540**.

[0048] In particular embodiments, each client **530** may be an electronic device including hardware, software, or embedded logic components or a combination of two or more such components and capable of carrying out the appropriate functionalities implemented or supported by client **530**. For example and without limitation, a client **530** may be a desktop computer system, a notebook computer system, a netbook computer system, a handheld electronic device, or a mobile telephone. The present disclosure contemplates any suitable clients **530**. A client **530** may enable a network user at client **530** to access network **530**. A client **530** may enable its user to communicate with other users at other clients **530**.

[0049] A client **530** may have a web browser **532**, such as MICROSOFT INTERNET EXPLORER, GOOGLE CHROME or MOZILLA FIREFOX, and may have one or more add-ons, plug-ins, or other extensions, such as TOOLBAR or YAHOO TOOLBAR. A user at client **530** may enter a Uniform Resource Locator (URL) or other address directing the web browser **532** to a server **520**, and the web browser **532** may generate a Hyper Text Transfer Protocol (HTTP) request and communicate the HTTP request to server **520**. Server **520** may accept the HTTP request and communicate to client **530** one or more Hyper Text Markup Language (HTML) files responsive to the HTTP request. Client **530** may render a web page based on the HTML files from server **520** for presentation to the user. The present disclosure contemplates any suitable web page files. As an example and not by way of limitation, web pages may render from HTML files, Extensible Hyper Text Markup Language (XHTML) files, or Extensible Markup Language (XML) files, according to particular needs. Such pages may also execute scripts such as, for example and without limitation, those written in JAVASCRIPT, JAVA, MICROSOFT SILVERLIGHT, combinations of markup language and scripts such as AJAX (Asynchronous JAVASCRIPT and XML), and the like. Herein, reference to a web page encompasses one or more corresponding web page files (which a browser may use to render the web page) and vice versa, where appropriate.

[0050] Particular embodiments may be implemented on one or more computer systems. FIG. **6** illustrates an example computer system **600**. In particular embodiments, one or more computer systems **600** perform one or more steps of one or more methods described or illustrated herein. In particular embodiments, one or more computer systems **600** provide functionality described or illustrated herein. In particular embodiments, software running on one or more computer systems **600** performs one or more steps of one or more methods described or illustrated herein or provides functionality described or illustrated herein. Particular embodiments include one or more portions of one or more computer systems **600**.

[0051] This disclosure contemplates any suitable number of computer systems **600**. This disclosure contemplates computer system **600** taking any suitable physical form. As example and not by way of limitation, computer system **600** may be an embedded computer system, a system-on-chip (SOC), a single-board computer system (SBC) (such as, for example, a computer-on-module (COM) or system-on-module (SOM)), a desktop computer system, a laptop or notebook computer system, an interactive kiosk, a mainframe, a mesh of computer systems, a mobile telephone, a personal digital assistant (PDA), a server, or a combination of two or more of these. Where appropriate, computer system **600** may include one or more computer systems **600**; be unitary or distributed; span multiple locations; span multiple machines; or reside in a cloud, which may include one or more cloud components in one or more networks. Where appropriate, one or more computer systems **600** may perform without substantial spatial or temporal limitation one or more steps of one or more methods described or illustrated herein. As an example and not by way of limitation, one or more computer systems **600** may perform in real time or in batch mode one or more steps of one or more methods described or illustrated herein. One or more computer systems **600** may perform at different times or at different locations one or more steps of one or more methods described or illustrated herein, where appropriate.

[0052] In particular embodiments, computer system **600** includes a processor **602**, memory **604**, storage **606**, an input/output (I/O) interface **608**, a communication interface **610**, and a bus **612**. Although this disclosure describes and illustrates a particular computer system having a particular number of particular components in a particular arrangement, this disclosure contemplates any suitable computer system having any suitable number of any suitable components in any suitable arrangement.

[0053] In particular embodiments, processor **602** includes hardware for executing instructions, such as those making up a computer program. As an example and not by way of limitation, to execute instructions, processor **602** may retrieve (or fetch) the instructions from an internal register, an internal cache, memory **604**, or storage **606**; decode and execute them; and then write one or more results to an internal register, an internal cache, memory **604**, or storage **606**. In particular embodiments, processor **602** may include one or more internal caches for data, instructions, or addresses. The present disclosure contemplates processor **602** including any suitable number of any suitable internal caches, where appropriate. As an example and not by way of limitation, processor **602** may include one or more instruction caches, one or more data caches, and one or more translation lookaside buffers (TLBs). Instructions in the instruction caches may be copies of instructions in memory **604** or storage **606**, and the instruction caches may speed up retrieval of those instructions by processor **602**. Data in the data caches may be copies of data in memory **604** or storage **606** for instructions executing at processor **602** to operate on; the results of previous instructions executed at processor **602** for access by subsequent instructions executing at processor **602** or for writing to memory **604** or storage **606**; or other suitable data. The data caches may speed up read or write operations by processor **602**. The TLBs may speed up virtual-address translation for processor **602**. In particular embodiments, processor **602** may include one or more internal registers for data, instructions, or addresses. The present disclosure contemplates processor **602** including any suitable number of any suitable internal registers, where appropriate. Where appropriate, processor **602** may include one or more arithmetic logic units (ALUs); be a multi-core processor; or include one or more processors **602**. Although this disclosure describes and illustrates a particular processor, this disclosure contemplates any suitable processor.

[0054] In particular embodiments, memory **604** includes main memory for storing instructions for processor **602** to execute or data for processor **602** to operate on. As an example and not by way of limitation, computer system **600** may load instructions from storage **606** or another source (such as, for example, another computer system **600**) to memory **604**. Processor **602** may then load the instructions from memory **604** to an internal register or internal cache. To execute the instructions, processor **602** may retrieve the instructions from the internal register or internal cache and decode them. During or after execution of the instructions, processor **602** may write one or more results (which may be intermediate or final results) to the internal register or internal cache. Processor **602** may then write one or more of those results to memory **604**. In particular embodiments, processor **602** executes only instructions in one or more internal registers or internal caches or in memory **604** (as opposed to storage **606** or elsewhere) and operates only on data in one or more internal registers or internal caches or in memory **604** (as opposed to storage **606** or elsewhere). One or more memory buses (which may each include an address bus and a data bus) may couple processor **602** to memory **604**. Bus **612** may include one or more memory buses, as described below. In particular embodiments, one or more memory management units (MMUs) reside between processor **602** and memory **604** and facilitate accesses to memory **604** requested by processor **602**. In particular embodiments, memory **604** includes random access memory (RAM). This RAM may be volatile memory, where appropriate Where appropriate, this RAM may be dynamic RAM (DRAM) or static RAM (SRAM). Moreover, where appropriate, this RAM may be single-ported or multi-ported RAM. The present disclosure contemplates any suitable RAM. Memory **604** may include one or more memories **604**, where appropriate. Although this disclosure describes and illustrates particular memory, this disclosure contemplates any suitable memory.

[0055] In particular embodiments, storage **606** includes mass storage for data or instructions. As an example and not by way of limitation, storage **606** may include an HDD, a floppy disk drive, flash memory, an optical disc, a magneto-optical disc, magnetic tape, or a Universal Serial Bus (USB) drive or a combination of two or more of these. Storage **606** may include removable or non-removable (or fixed) media, where appropriate. Storage **606** may be internal or external to computer system **600**, where appropriate. In particular embodiments, storage **606** is non-volatile, solid-state memory. In particular embodiments, storage **606** includes read-only memory (ROM). Where appropriate, this ROM may be mask-programmed ROM, programmable ROM (PROM), erasable PROM (EPROM), electrically erasable PROM (EEPROM), electrically alterable ROM (EAROM), or flash memory or a combination of two or more of these. This disclosure contemplates mass storage **606** taking any suitable physical form. Storage **606** may include one or more storage control units facilitating communication between processor **602** and storage **606**, where appropriate. Where appropriate, storage **606** may include one or more storages **606**. Although this disclosure describes and illustrates particular storage, this disclosure contemplates any suitable storage.

[0056] In particular embodiments, I/O interface **608** includes hardware, software, or both providing one or more interfaces for communication between computer system **600** and one or more I/O devices. Computer system **600** may include one or more of these I/O devices, where appropriate. One or more of these I/O devices may enable communication between a person and computer system **600**. As an example and not by way of limitation, an I/O device may include a keyboard, keypad, microphone, monitor, mouse, printer, scanner, speaker, still camera, stylus, tablet, touch screen, trackball, video camera, another suitable I/O device or a combination of two or more of these. An I/O device may include one or more sensors. This disclosure contemplates any suitable I/O devices and any suitable I/O interfaces **608** for them. Where appropriate, I/O interface **608** may include one or more device or software drivers enabling processor **602** to drive one or more of these I/O devices. I/O interface **608** may include one or more I/O interfaces **608**, where appropriate. Although this disclosure describes and illustrates a particular I/O interface, this disclosure contemplates any suitable I/O interface.

[0057] In particular embodiments, communication interface **610** includes hardware, software, or both providing one or more interfaces for communication (such as, for example, packet-based communication) between computer system **600** and one or more other computer systems **600** or one or more networks. As an example and not by way of limitation, communication interface **610** may include a network interface controller (NIC) or network adapter for communicating with an Ethernet or other wire-based network or a wireless NIC (WNIC) or wireless adapter for communicating with a wireless network, such as a WI-FI network. This disclosure contemplates any suitable network and any suitable communication interface **610** for it. As an example and not by way of limitation, computer system **600** may communicate with an ad hoc network, a personal area network (PAN), a local area network (LAN), a wide area network (WAN), a metropolitan area network (MAN), or one or more portions of the Internet or a combination of two or more of these. One or more portions of one or more of these networks may be wired or wireless. As an example, computer system **600** may communicate with a wireless PAN (WPAN) (such as, for example, a BLUETOOTH WPAN), a WI-FI network, a WI-MAX network, a cellular telephone network (such as, for example, a Global System for Mobile Communications (GSM) network), or other suitable wireless network or a combination of two or more of these. Computer system **600** may include any suitable communication interface **610** for any of these networks, where appropriate. Communication interface **610** may include one or more communication interfaces **610**, where appropriate. Although this disclosure describes and illustrates a particular communication interface, this disclosure contemplates any suitable communication interface.

[0058] In particular embodiments, bus **612** includes hardware, software, or both coupling components of computer system **600** to each other. As an example and not by way of limitation, bus **612** may include an Accelerated Graphics Port (AGP) or other graphics bus, an Enhanced Industry Standard Architecture (EISA) bus, a front-side bus (FSB), a HYPERTRANSPORT (HT) interconnect, an Industry Standard Architecture (ISA) bus, an INFINIBAND interconnect, a low-pin-count (LPC) bus, a memory bus, a Micro Channel Architecture (MCA) bus, a Peripheral Component Interconnect (PCI) bus, a PCI-Express (PCI-X) bus, a serial advanced technology attachment (SATA) bus, a Video Electronics Standards Association local (VLB) bus, or another suitable bus or a combination of two or more of these. Bus **612** may include one or more buses **612**, where appropriate. Although this

disclosure describes and illustrates a particular bus, this disclosure contemplates any suitable bus or interconnect.

[0059] Herein, reference to a computer-readable storage medium encompasses one or more non-transitory, tangible computer-readable storage media possessing structure. As an example and not by way of limitation, a computer-readable storage medium may include a semiconductor-based or other integrated circuit (IC) (such, as for example, a field-programmable gate array (FPGA) or an application-specific IC (ASIC)), a hard disk, an HDD, a hybrid hard drive (HHD), an optical disc, an optical disc drive (ODD), a magneto-optical disc, a magneto-optical drive, a floppy disk, a floppy disk drive (FDD), magnetic tape, a holographic storage medium, a solid-state drive (SSD), a RAM-drive, a SECURE DIGITAL card, a SECURE DIGITAL drive, or another suitable computer-readable storage medium or a combination of two or more of these, where appropriate. Herein, reference to a computer-readable storage medium excludes any medium that is not eligible for patent protection under 35 U.S.C. §101. Herein, reference to a computer-readable storage medium excludes transitory forms of signal transmission (such as a propagating electrical or electromagnetic signal per se) to the extent that they are not eligible for patent protection under 35 U.S.C. §101.

[0060] This disclosure contemplates one or more computer-readable storage media implementing any suitable storage. In particular embodiments, a computer-readable storage medium implements one or more portions of processor **602** (such as, for example, one or more internal registers or caches), one or more portions of memory **604**, one or more portions of storage **606**, or a combination of these, where appropriate. In particular embodiments, a computer-readable storage medium implements RAM or ROM. In particular embodiments, a computer-readable storage medium implements volatile or persistent memory. In particular embodiments, one or more computer-readable storage media embody software. Herein, reference to software may encompass one or more applications, bytecode, one or more computer programs, one or more executables, one or more instructions, logic, machine code, one or more scripts, or source code, and vice versa, where appropriate. In particular embodiments, software includes one or more application programming interfaces (APIs). This disclosure contemplates any suitable software written or otherwise expressed in any suitable programming language or combination of programming languages. In particular embodiments, software is expressed as source code or object code. In particular embodiments, software is expressed in a higher-level programming language, such as, for example, C, Perl, or a suitable extension thereof. In particular embodiments, software is expressed in a lower-level programming language, such as assembly language (or machine code). In particular embodiments, software is expressed in JAVA. In particular embodiments, software is expressed in Hyper Text Markup Language (HTML), Extensible Markup Language (XML), or other suitable markup language.

[0061] The present disclosure encompasses all changes, substitutions, variations, alterations, and modifications to the example embodiments herein that a person having ordinary skill in the art would comprehend. Similarly, where appropriate, the appended claims encompass all changes, substitutions, variations, alterations, and modifications to the example embodiments herein that a person having ordinary skill in the art would comprehend.

What is claimed is:

1. A method, comprising:

accessing, using a computing device, a batch file comprising a plurality of events generated by a remote game client application executing an instance of a computer-implemented game;

accessing, in response to the batch file, a game state data object associated with the instance of the computer-implemented game, wherein the game state data object includes one or more game state parameters formatted as serialized unstructured data;

parsing the game state data object to identify the one or more game state parameters;

processing the plurality of events in the batch file against game logic to update one or more of the game state parameters;

re-serializing the one or more game state parameters into an updated game state data object; and

storing the game state data object in a memory cache.

2. The method recited in claim **1**, further comprising:

assigning a unique identifier to the updated game state data object;

storing the unique identifiers in a queue associated with a database;

asynchronously processing each of the identifiers in the queue to update data stored in the database, wherein processing one of the identifiers comprises:

retrieving the updated game state data object identified by the identifier from the memory cache; and

storing the updated game state data object in the database.

3. The method recited in claim **2**, wherein:

the database is partitioned into a plurality of sections;

the data stored in the database are divided into a plurality of groups; and

each of the sections of the database is used to store one or more of the groups of data.

4. The method recited in claim **1**, wherein:

the batch file is compressed; and

parsing the batch file comprises uncompressing the batch file.

5. A system, comprising:

a memory comprising instructions executable by one or more processors; and

one or more processors coupled to the memory and operable to execute the instructions, the one or more processors being operable when executing the instructions to:

access a batch file comprising a plurality of events generated by a remote game client application executing an instance of a computer-implemented game;

access, in response to the batch file, a game state data object associated with the instance of the computer-implemented game, wherein the game state data object includes one or more game state parameters formatted as serialized unstructured data;

parse the game state data object to identify the one or more game state parameters;

process the plurality of events in the batch file against game logic to update one or more of the game state parameters;

re-serialize the one or more game state parameters into an updated game state data object; and

store the game state data object in a memory cache.

6. The system of claim **5**, further comprising instructions operable to, when executed, cause the one or more processors to:

assign a unique identifier to the updated game state data object;

store the unique identifiers in a queue associated with a database;

asynchronously process each of the identifiers in the queue to update data stored in the database, wherein processing one of the identifiers comprises:

retrieve the updated game state data object identified by the identifier from the memory cache; and

store the updated game state data object in the database.

7. The system of claim **6**, wherein:

the database is partitioned into a plurality of sections;

the data stored in the database are divided into a plurality of groups; and

each of the sections of the database is used to store one or more of the groups of data.

8. The system of claim **5**, wherein:

the batch file is compressed; and

parsing the batch file comprises uncompressing the batch file.

9. One or more computer-readable tangible storage media embodying software operable when executed by one or more computing devices to:

access a batch file comprising a plurality of events generated by a remote game client application executing an instance of a computer-implemented game;

access, in response to the batch file, a game state data object associated with the instance of the computer-implemented game, wherein the game state data object includes one or more game state parameters formatted as serialized unstructured data;

parse the game state data object to identify the one or more game state parameters;

process the plurality of events in the batch file against game logic to update one or more of the game state parameters;

re-serialize the one or more game state parameters into an updated game state data object; and

store the game state data object in a memory cache.

10. The media of claim **9**, further comprising software operable when executed by the one or more computing devices to:

assign a unique identifier to the updated game state data object;

store the unique identifiers in a queue associated with a database;

asynchronously process each of the identifiers in the queue to update data stored in the database, wherein processing one of the identifiers comprises:

retrieve the updated game state data object identified by the identifier from the memory cache; and

store the updated game state data object in the database.

11. The media of claim **10**, wherein:

the database is partitioned into a plurality of sections;

the data stored in the database are divided into a plurality of groups; and

each of the sections of the database is used to store one or more of the groups of data.

12. The media of claim **9**, wherein:

the batch file is compressed; and

parsing the batch file comprises uncompressing the batch file.

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