IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Sun Cheul KIM et al. Application No.: Unassigned Filed: Unassigned For: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT Customer No.: 83220	Confirmation No.: Unassigned Examiner: Unassigned Art Unit: Unassigned INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §1.97 and §1.98

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The references cited on attached form PTO/SB/08A and PTO/SB/08B are being called to the attention of the Examiner. Copies of the references are enclosed in compliance with the requirements of 37 CFR §1.98(a)(2).

It is respectfully requested that the cited references be expressly considered during the prosecution of this application, and the references be made of record therein and appear among the "references cited" on any patent to issue therefrom.

As provided for by 37 CFR §1.97(g) and (h), no inference should be made that the information and references cited are prior art merely because they are in this statement and no representation is being made that a search has been conducted or that this statement encompasses all the possible relevant information.

Applicant believes that no fee is required for submission of this statement. However, if a fee is required, the Commissioner is authorized to deduct such fee from the undersigned's Deposit Account No. 50-4713. Please deduct any additional fees from, or credit any overpayment to, the above-noted Deposit Account.

Respectfully submitted,

/Steve Y. Cho/
Steve Y. Cho
Reg. No. 44,612

AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043
Tel: 425-348-3500
Fax: 425-968-9795

Substitute for form 1449B/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				*Application Number*	Unassigned
				Filing Date	Unassigned
				First Named Inventor	Sun Cheul KIM
				Art Unit	Unassigned
(Use as many sheets as necessary)				*Examiner Name*	Unassigned
Sheet	1	of	1	*Attorney Docket Number*	110PK-074000US

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No.[1]	Document Number Number Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US-2011/0082941 A1 (Family of KR 1020110037833A)	04-07-2011	Sun Cheul KIM et al.	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS							
Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] (if known)			Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	1	KR	1020080059900	A	07-01-2008	KOREA INSTITUTE OF SCIENCE & TECHNOLOGY INFORMATION		☐
								☐
								☐
								☐
								☐

Examiner Signature		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.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

KR Examined Patent Publication(B1)

Bibliographic Data

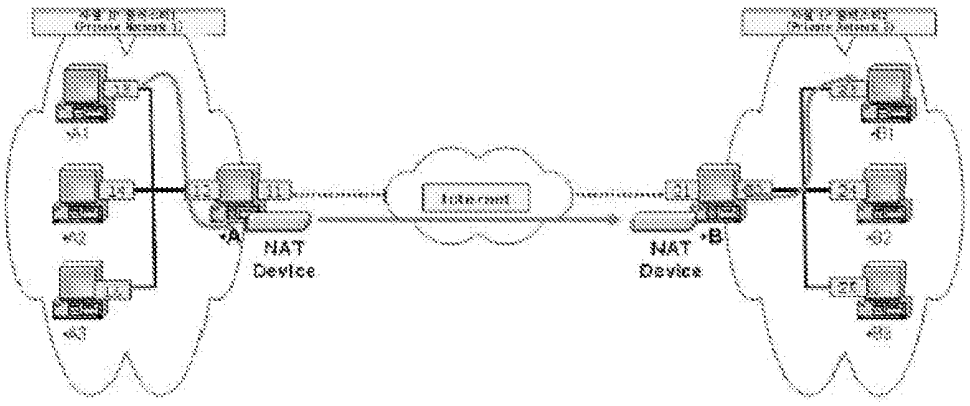
Int.Cl.	H04L 12/28 (2006.01) ¦ H04L 12/66 (2006.01) ¦ H04L 29/02 (2006.01) ¦ H04L 29/06 (2006.01)
Published Date	2008-07-04
Registration No	10-0843761
Registration Date	2008-06-27
Application No	10-2006-0133821
Application Date	2006-12-26
Unexamined Publication No	10-2008-0059900
Unexamined Publication Date	2008-07-01
Requested Date of Examination	2006-12-26
Agent	Cho, Hyeon Seog
Inventor	KWON,Oh Kyoung ¦ CHO, In Soon ¦ LEE,Jong Suk ¦ HAN, Hyuck ¦ YEOM, Heon Young
Right Holder	KOREA INSTITUTE OF SCIENCE & TECHNOLOGY INFORMATION
Examiner	Yong-Hae Jeon
Title of Invention	A PRIVATE-IP-ENABLED MPI COMMUNICATION METHOD IN SYSTEM LEVEL OVER GRID ENVIRONMENTS THROUGH REVISED HOLE PUNCHING

Abstract

The present invention discloses the communications translation method of the mode which the hole punching is applied to be proceed the MPI communications as the communications method of the MPI (Message Passing Interface) program operating on the representative grid middleware Globus in the grid environment including the private internet protocol cluster, betters.

The operating efficiency without difference can be offered when the MPI program it can communicate according to the communications translation method of the present invention with the MPI program operating in the private internet protocol cluster it can be steadily included and it does not troubled by the cluster environment are compared with case, it can be proceed, and the range of the resources which is available because of constituting the little more abundant computing environment by including many private internet protocol clusters excluded in existing in the grid environment since the private internet protocol cluster including in the MPI task, can be enlarged.

Representative drawing



Keyword(s)

The grid, MPI, private internet protocol, network address translation, hole punching.

Description

■ Background Art

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0004

(19) 대한민국특허청(KR)
(12) 등록특허공보(B1)

(45) 공고일자 2008년07월04일
(11) 등록번호 10-0843761
(24) 등록일자 2008년06월27일

(51) Int. Cl.
H04L 12/28 (2006.01) *H04L 12/66* (2006.01)
H04L 29/02 (2006.01) *H04L 29/06* (2006.01)
(21) 출원번호 10-2006-0133821
(22) 출원일자 2006년12월26일
심사청구일자 2006년12월26일
(65) 공개번호 10-2008-0059900
(43) 공개일자 2008년07월01일
(56) 선행기술조사문헌
KR1020060075799 A
(뒷면에 계속)
전체 청구항 수 : 총 8 항

(73) 특허권자
한국과학기술정보연구원
대전광역시 유성구 어은동 52번지
(72) 발명자
권오경
대전 서구 월평2동 주공아파트 201동 1105호
조인순
서울 관악구 봉천동 1679-5 403호
(뒷면에 계속)
(74) 대리인
조현석

심사관 : 전용해

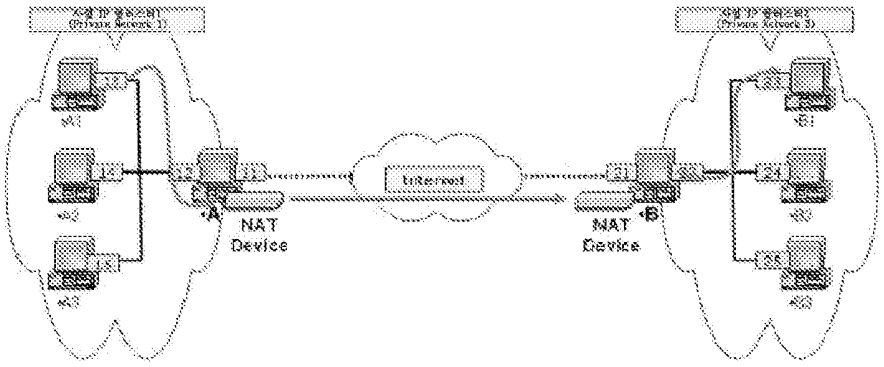
(54) 수정된 홀 펀칭을 통해 그리드 환경에서 사설 IP를지원하는 시스템 수준의 MPI 통신방법

(57) 요 약

본 발명은 대표적인 그리드 미들웨어(Grid Middleware)인 글로버스(Globus)상에서 수행되는 MPI(Message Passing Interface) 프로그램의 통신방법에 관한 것으로, 보다 구체적으로는 사설 IP 클러스터를 포함한 그리드 환경에서 MPI 통신을 수행하는데 홀 펀칭(Hole Punching)을 적용하여 보다 개선된 방식의 통신중계방법을 개시한다.

본 발명의 통신중계방법에 의하면, 사설 IP클러스터에서 수행되는 MPI 프로그램과 통신할 수 있을 뿐만 아니라, 이러한 통신이 신속하고 안정적으로 이루어질 수 있고 클러스터 환경에 구애받지 않고 MPI 프로그램을 수행할 수 있어, 사설 IP 클러스터도 MPI 작업에 포함시킬 수 있으므로 기존에는 제외되었던 많은 사설 IP 클러스터들을 그리드 환경에 포함시킴으로써 좀더 풍부한 컴퓨팅 환경을 구성할 수 있기 때문에 가용한 자원의 범위를 확대시킬 수 있는 동시에, 사설 IP 클러스터의 사용으로 인해 발생하는 성능의 저하도 최소화해서 공인 IP 클러스터만을 사용하는 경우와 비교해서 거의 차이가 없는 작업 성능을 제공할 수 있다.

대표도



Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0005

(72) 발명자
이종숙
대전 유성구 지족동 열매마을 407동 1704호
한혁
서울 강북구 수유2동 벽산아파트 13동 903호
염현영
서울 강남구 도곡동 삼성래미안 106동 1101호

(56) 선행기술조사문헌
논문(2006.06.)
논문(2003.10.)
논문(2004.12.)
US20050198104 A1
KR1020050078395 A
논문(2006.08.)

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0006

특허청구의 범위

청구항 1

그리드 미들웨어(Grid Middleware)를 기반으로 다수개의 클러스터에서 각각 수행되는 MPI(Message Passing Interface) 프로그램을 이용한 통신방법에 있어서,

상기 MPI프로그램마다 사설 IP와 공인 IP를 부여하는 수정된 홀 펀칭 단계는

각각의 사설 IP 클러스터에 속한 MPI 프로그램들이 각 관리노드의 NAT 서비스로부터 자신의 공인 IP를 획득하는 과정;

상기 공인 IP를 획득한 MPI 프로그램들이 자신의 사설 IP와 상기 획득된 공인 IP를 포함하는 채널정보를 다른 MPI프로그램들에 전달하는 과정; 및

상기 전달된 채널정보를 각각 대응시켜 인식테이블로 저장하는 상기 MPI프로그램들의 초기화과정을 포함하고,

상기 수정된 홀 펀칭 단계를 통해 상기 각각의 사설 IP 클러스터에서 수행되는 MPI프로그램간의 직접통신이 이루어지는 것을 특징으로 하는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법.

청구항 2

제1항에 있어서, 상기 다수개의 클러스터는 모든 클러스터환경을 포함하는 것을 특징으로 하는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법.

청구항 3

삭제

청구항 4

제1항 또는 제2항에 있어서, 상기 다수개의 클러스터에서 각각 수행되는 MPI프로그램들 중 하나의 MPI 프로그램인 출발지 MPI프로그램이 작업을 진행하기 위해 필요한 다른 MPI프로그램인 목적지 MPI 프로그램과 통신하고자 하는 경우, 기저장된 인식테이블을 통해 상기 출발지 MPI 프로그램과 상기 목적지 MPI 프로그램의 위치에 따라 각각 다른 방법으로 연결하는 MPI프로그램간의 통신단계를 포함하는 것을 특징으로 하는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법.

청구항 5

제4항에 있어서, 상기 채널정보는 공인 IP, 사설 IP, 관리노드의 이름, 포트, 및 인터도메인에 속하는지 여부를 판단하는 인식자를 포함하는 것을 특징으로 하는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법.

청구항 6

제5항에 있어서, 상기 출발지 MPI프로그램은 상기 목적지 MPI 프로그램의 위치를 관리노드의 이름의 동일성을 통해 판단하는 것을 특징으로 하는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법.

청구항 7

제4항에 있어서, 상기 MPI프로그램간의 통신단계는 상기 출발지 MPI프로그램이 사설 IP 클러스터에 속하고, 상기 목적지 MPI프로그램이 공인 IP 클러스터에 속하는 경우, 상기 출발지 MPI프로그램이 존재하는 클러스터의 관리노드에 있는 NAT서버스를 거쳐서 상기 목적지 MPI프로그램이 존재하는 계산노드와 연결되는 것을 특징으로 하는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법.

청구항 8

제4항에 있어서, 상기 MPI프로그램간의 통신단계는 상기 출발지 MPI프로그램 및 상기 목적지 MPI프로그램이 서로 다른 사설 IP 클러스터에 속하는 경우, 상기 출발지 MPI프로그램이 존재하는 클러스터의 관리노드에 있는 NAT서버스를 거쳐서 상기 목적지 MPI프로그램의 공인 IP주소를 통해 상기 목적지 MPI프로그램이 존재하는 클러

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0007

스터의 관리노드에 있는 NAT서버스를 거쳐서 목적지 MPI프로그램이 존재하는 계산노드와 연결되는 것을 특징으로 하는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법.

청구항 9

제4항에 있어서, 상기 MPI프로그램간의 통신단계는 상기 출발지 MPI프로그램 및 상기 목적지 MPI프로그램이 모두 동일 사설 IP 클러스터에 속하거나, 동일 공인 IP클러스터에 속하는 경우, 상기 출발지 MPI프로그램과 상기 목적지 MPI프로그램이 직접 연결되는 것을 특징으로 하는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법.

명 세 서

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

<8> 본 발명은 네트워크로 연결된 다수의 컴퓨팅 자원으로 구성되는 그리드 환경즉 대표적인 그리드 미들웨어(Grid Middleware)인 글로버스(Globus)상에서, 사설 IP 클러스터를 포함하여 MPI(Message Passing Interface)프로그램을 수행시킬 수 있도록 하는 통신방법에 관한 것이다.

<9> 그리드미들웨어는 지역적으로 광범위하게 분산되어 있는 처리 장치 (CPU), 데이터베이스, 파일 저장 장치 (File Storage)등 다수의 컴퓨팅 자원을 네트워크로 연결하여, 사용자의 위치에 상관없이 어디서나 접근해서 사용할 수 있도록 하는 컴퓨팅 기반구조 환경이며, 실제로 이러한 환경을 구축하기 위해 사용되는 대표적인 미들웨어 중의 하나가 글로버스이다.

<10> 일반적으로 글로버스 상에서 처리되는 작업들은 단일 시스템으로는 처리하기 어려운 것들, 즉 고도의 처리 능력을 필요로 하거나 단일 시스템으로 처리하면 너무 오랜 시간이 소요되는 작업이다. 이러한 작업들을 그리드에 속한 다수의 컴퓨팅 자원들을 활용하여 처리함으로써 처리 효율을 높이고 처리 시간을 단축시킬 수 있는 것이다. 보통 그리드 위에서 수행되는 작업들은 하나의 작업이 여러 개로 나뉘어 다수의 시스템에서 실행된다. 따라서 같은 작업에 속한 시스템 간에 통신할 수 있는 방법이 필요하고, 이를 위해 MPI가 사용되는데, MPI는 병렬 응용 프로그램을 수행하는 프로그램 간에 메시지를 주고받을 수 있는 표준적인 인터페이스로서 글로버스 상에서 수행하는 대표적인 분산 병렬 처리 프로그램이다.

<11> 그리드 사용자들은 그리드에 속한 각종 컴퓨팅 자원을 사용해서 작업을 수행할 수 있으므로, 가능한 한 많은 자원들을 그리드 자원으로 통합시킨다면 더욱 풍부한 컴퓨팅 환경을 제공할 수 있을 것이다. 그러나 기존의 글로버스에서는 그리드 자원을 IP를 사용해서 구별하기 때문에 사설 IP를 가진 시스템에 속한 자원들은 그리드 자원으로 포함시킬 수가 없었고, 글로버스를 기반으로 수행되는 MPI 프로그램들도 이러한 자원들을 사용할 수가 없었다.

<12> 즉 글로버스는 IP를 가지고 네트워크를 이루는 각각의 그리드 자원들을 구별하기 때문에, 전 세계 어디서나 접근할 수 있도록 하기 위해서는 각각의 그리드 자원이 속한 시스템이 공인 IP를 가지고 있어야 한다. 따라서 MPI 프로그램을 수행하는 각각의 시스템 역시 공인 IP를 가지고 있어야 무리 없는 통신이 가능하므로, 사설 IP(Private IP)를 가진 시스템들로 구성된 사설 IP 클러스터에서는 MPI 프로그램을 수행할 수 없다는 제약점이 있었다. 사설 IP 클러스터를 이용하면 공인 IP의 낭비를 줄일 수 있을 뿐만 아니라 보안상의 위험도 줄일 수 있으므로, 사설 IP 클러스터를 포함하더라도 프로그램 사이의 통신을 수행할 수 있는 방법에 대한 연구가 계속되었다.

<13> 일반적으로 하나의 클러스터는 작업을 수행하는 계산 노드(Compute Node)와 이러한 계산 노드들을 관리하는 관리 노드(Head Node)로 구성되는데, MPI를 사용해 작업을 수행할 수 있도록 하려면 계산 노드와 관리 노드 모두에 공인 IP를 할당해야 한다. 그러나 이러한 방식으로 클러스터를 구성하는 경우, 계산 노드의 수에 비례하여 필요한 공인 IP의 수도 늘어나는데 공인 IP는 매우 희소한 자원이기 때문에 충분히 확보하기가 어렵다는 문제점이 있으며 외부에서 직접 계산 노드에 접근할 수 있기 때문에 보안의 측면에서도 위험의 소지가 높다. 따라서 현재 존재하는 대부분의 클러스터들은 관리 노드에만 공인 IP를 할당하고 나머지 계산 노드에는 사설 IP를 할당하는 방식을 사용하고 있다. 따라서 기존의 사설 IP 클러스터 자원을 활용하기 위해서는 사설 IP 클러스터에 속한 MPI 프로그램과 통신할 수 있는 방법이 반드시 필요하다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0008

<14> 사설 IP를 가진 시스템과의 통신 문제는 MPI 프로그램뿐만 아니라, P2P, 게임 등과 같은 다양한 종류의 프로그램에서 문제가 되어 왔으며, 해결 방법으로 제시된 것이 중계이다. 즉 사설 IP를 가진 시스템이 수신자라면 송신자와 수신자 사이에 중계 시스템 (공인 IP를 할당받은 시스템)이 존재해서 송신자가 중계자에게 전송하면, 중계자가 원래의 수신자에게 전달하는 방식을 취하게 된다. 이러한 중계는 두 가지 방법이 있는데 별도의 응용 프로그램을 통한 사용자 수준의 방법과 게이트웨이나 NAT 같은 시스템 수준의 방법이 있다.

<15> 먼저, 사용자 수준의 중계는 별도의 프로그램을 사용하여, 사설 IP 클러스터 내부의 시스템들과 외부와의 통신을 중개하는 방법이다. 이러한 중계 프로그램은 공인 IP를 할당받은 시스템에서 실행하고 시스템의 주소는 미리 알려져 있으므로 어떤 시스템이라도 접근해서 메시지 중계를 요청할 수 있다. 또한 중계 프로그램을 실행하는 시스템은 이러한 중계 프로그램을 사용하는 모든 사설 IP 클러스터에 접근할 수 있다.

<16> 예를 들어 도 1에 도시된 바와 같이, 서로 다른 사설 IP 클러스터에 속한 HostA와 HostB, 그리고 중계 프로그램을 실행하고 있는 HostS가 있을 때, HostA가 HostB와의 통신을 원한다면 HostS를 이용하게 된다. 즉, HostB의 IP로는 연결이 안되므로, HostS에게 메시지를 전송해서 HostB로의 중계를 요청한다. HostS는 HostB가 속한 사설 IP 클러스터에 접근할 수 있으므로, HostB에게 HostA가 보낸 메시지를 전달하게 된다. HostB가 HostA와의 통신을 원하는 경우는 반대의 과정이 이루어진다.

<17> 이러한 사용자 수준 중계의 경우, 구현이 간단하고, 중계 프로그램을 실행시킬 시스템만 있다면 어떤 메시지도 중계가 가능하다는 장점이 있다. 그러나 원래는 수신자에게 직접 전달되었어야 할 메시지가 중간에 별도의 프로그램을 한 번 더 거쳐 전달되기 때문에 전송 시간이 길어지고, 중계 프로그램이 클러스터간의 통신에 커다란 영향을 미치게 된다는 문제점이 있다. 다시 말해, 클러스터 내부로 향하는 모든 통신이 상기 프로그램을 거치게 되기 때문에, 통신량이 많아지는 경우 상기 프로그램이 이를 적절히 처리하지 못한다면 엄청난 통신 지연으로 이어질 수 있고, 중계 프로그램에 문제가 발생해서 동작하지 않는다면 클러스터 내부와의 통신이 완전히 중단되는 문제점이 존재하고 있었다.

<18> 다음으로, 시스템 수준의 중계는 프로그램이 아니라 시스템 수준에서 메시지 중계 기능을 제공하는 방법으로서, 가장 대표적인 방법은 NAT(Network Address Translator)의 기능을 이용하는 것이다.

<19> NAT는 IP 고갈을 완화하기 위한 방법 중의 한 가지로서, 사설 네트워크(Private Network)를 글로벌 네트워크(Global Network)로 사용할 수 있게 해주는 주소 변환 기능이다. 즉 인터넷의 공인 IP는 한정되어 있기 때문에 가급적 이를 공유할 수 있도록 하는 방법이 필요한데, 평상시에는 사설 IP를 사용하다가 필요한 경우에만 NAT를 이용해서 사설 IP를 공인 IP로 변환해서 사용함으로써 공인 IP를 공유할 수 있게 되는 것이다. 실제로 사설 IP 클러스터 안의 시스템들은 일반적인 경우에는 사설 IP를 사용하여 통신하다가, 글로벌 네트워크에 접속할 필요가 생길 때, NAT를 통해 자신의 사설 IP를 NAT가 미리 확보하고 있던 공인 IP 중 하나로 변환시킴으로써, 사설 네트워크의 상태를 유지하면서 글로벌 네트워크와도 통신할 수 있는 방법을 제공받는 것이다.

<20> 이와 같은 시스템 수준의 중계는 구현하기가 어려우며, 시스템에 따라 구현이 달라질 수 있어서 이식성(Portability)이 좋지 않다는 문제점이 있다. 즉 사용자 수준 중계의 장점이 제공되지 않는다. 그러나 시스템 수준의 중계를 사용할 수만 있다면, 시스템 수준에서 바로 메시지가 전달되기 때문에 별도의 전송 지연이 없고, 통신량의 변화에도 적절히 대응할 수 있다는 장점이 있다. 다시 말하면 통신량이 많아져도 시스템 수준에서 처리하게 되기 때문에 훨씬 유연하게 대처할 수 있고, 시스템에 문제가 발생할 가능성은 프로그램에 문제가 발생할 가능성보다는 훨씬 적기 때문에 안정적인 중계가 이루어질 수 있다.

<21> 따라서, 시스템 수준의 중계가 훨씬 좋은 성능을 보여줄 수 있음에도 불구하고 기피되었던 이유는 구현이 어렵고 이식성이 떨어졌기 때문이었는데, 근래에 이러한 문제점을 해결한 시스템 수준의 중계 방법인 홀 펀칭(Hole Punching)이 제안되었다.

<22> 홀 펀칭은 단순히 NAT를 이용하는 것보다 훨씬 적극적인 방법의 시스템 수준 중계이다. 앞에서 언급한 NAT를 이용하는 시스템 수준의 중계는 사설 IP 클러스터 내부의 시스템에서 시작된 연결에 대해서만 유효하다. 일반적으로 NAT는 클러스터 내부로부터의 요청은 허용해도, 외부로부터의 연결 요청은 무시하기 때문이다. 그러나 홀 펀칭을 이용하면 외부 시스템들도 클러스터 내부의 시스템에 바로 접근할 수 있다.

<23> 우선 홀 펀칭을 위해서는 각 사설 IP 클러스터에 속한 시스템들의 주소를 관리하는 주소 서버(Address Server)가 존재해야 하며, 이 서버는 공인 IP를 할당받은 시스템에서 작동되고, 이 시스템의 주소는 미리 알려져 있어야 한다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0009

<24> 도 2는 홀 펀칭이 이루어지는 과정을 도시한 그림인데, 서로 다른 사설 IP 클러스터에 속한 HostA와 HostB, 주소 서버인 S가 있을 때, 우선 HostA와 HostB는 자신이 속한 클러스터의 NAT에게 홀 펀칭을 요구하게 된다. 여기서 말하는 홀 펀칭이란 사설 IP를 공인 IP로 변환시켜 주는 작업을 지칭한다. 즉 사설 IP를 가진 시스템이 임의의 포트 번호를 정해서 (사설 IP, 포트)의 쌍을 가지고 NAT에게 홀 펀칭을 요구하면, NAT는 사용 가능한 공인 IP 주소중의 하나를 이 사설 주소와 연결시킨 후, 연결된 공인 주소, 즉 (공인 IP, 포트)의 쌍을 요청 시스템에게 전달한다. 이 연결된 공인 주소만 안다면 외부의 어떤 시스템도 이 공인 주소와 연결된 사설 IP 시스템에 바로 접근할 수 있기 때문에 외부에서의 접근을 원한다면 주소를 공개하기만 하면 되는데, 홀 펀칭에서는 이러한 주소 관리를 위해 주소 서버를 사용한다.

<25> 따라서 HostA와 HostB는 자신이 속한 사설 IP 클러스터의 NAT를 통해 사설 주소와 연결된 공인 주소를 얻어낸 뒤, 주소 서버에 사설 주소와 공인 주소 모두를 등록한다. 이제 HostA가 HostB와의 통신을 원하는 경우, 우선 HostB의 주소를 알아내기 위해 주소 서버 S에게 요청하면, S는 HostA에게 HostB의 주소 2개를 알려주게 된다. 이제 HostA는 이 주소 각각에 대해 연결을 시도해서, 빨리 성공하는 연결을 사용함으로써 통신을 할 수 있게 된다. 만약 두 시스템이 같은 사설 IP 클러스터 상에 존재한다면 사설 IP를 통한 연결이 먼저 이루어지게 되기 때문에 속도가 빠른 사설 네트워크 연결을 사용하면 되고, 서로 다른 사설 IP 클러스터 상에 있다면 사설 주소를 통한 연결은 실패하겠지만 공인 주소를 통한 연결은 성공할 것이기 때문에 어떤 경우에라도 통신이 가능하다.

<26> 홀 펀칭은 이상에서 설명한 것처럼 구현이 간단할 뿐 아니라, NAT의 기능을 이용하기 때문에 성능이나 안정성의 측면에서도 뛰어나다. 홀 펀칭을 구현하기 위해서 필요한 것은 홀 펀칭이 가능한 NAT와 주소를 관리할 수 있는 주소 서버뿐이다. 동작 과정도 NAT를 통해 홀 펀칭된 공인 IP 주소를 얻어낸 후 주소 서버에 등록해 두면, 접속을 원하는 시스템은 2개의 주소 모두를 가지고 연결을 시도해서 빨리 성공하는 연결을 선택하고, 이후에는 이러한 연결을 통해 직접 통신할 수 있다.

<27> 그래서 최근 시스템 수준 중계방법 중에 하나인 홀 펀칭(Hole Punching) 기법을 사용하고 있는데 이것은 구현이 간단할 뿐만 아니라 NAT를 지원하는 시스템이면 사용가능하므로 온라인 게임과 같은 P2P 통신에서 이용을 한다. 그러나 MPI 프로그램은 온라인 게임과 같은 P2P 통신과는 통신 방법이 다르므로 일반적인 홀 펀칭 방법을 적용할 수 없었다.

<28> 한편, 상술한 바와 같이 시스템 수준의 중계를 사용한다면 사용자 수준에서 발생하는 문제점들을 해결할 수 있지만 기존의 시스템 중계 방법은 구현이 복잡하고 특정 시스템을 대상으로 하기 때문에 이식성이 떨어진다는 문제점으로 인해, 지금까지는 주로 국내특허 출원번호 제10-2004-0114699 호에 개시되고 있는 것과 같이, 사용자 수준의 응용 프로그램을 사용하여 사설 IP 클러스터 내부의 시스템들과 외부와의 통신을 중개하는 방법이 주로 사용되고 있어, 상술한 바와 같은 전송 시간이 길어지고, 중계 프로그램이 클러스터간의 통신에 커다란 영향을 미치게 된다는 문제점이 존재하고 있었다.

발명이 이루고자 하는 기술적 과제

<29> 본 출원인은 상술한 문제점을 해결하기 위해 연구 노력한 결과 홀 펀칭(Hole Punching)을 MPI 프로그램에서 수행 가능하도록 수정하여 사설 IP를 지원하는 MPI 통신방법에 적용하게 되면, 그리드 환경에서 구현이 단순하면서도 이식성이 사용자 수준의 중계에 비해 떨어지지 않는 시스템 수준의 중계가 구현됨을 알게 되어 본 발명을 완성하였다.

<30> 따라서, 본 발명의 목적은 홀 펀칭(Hole Punching)을 MPI 프로그램에서 수행 가능하도록 수정하여 기존의 MPI 프로그램이 사설 IP 클러스터 상에서는 수행될 수 없다는 문제점을 해결할 뿐 아니라, 기존의 해결책보다 훨씬 성능이 좋으면서도 안정적인 사설 IP를 지원하는 시스템 수준의 MPI 통신방법을 제공하는 것이다.

<31> 또한, 본 발명의 다른 목적은 사설 IP 클러스터 상에서도 MPI 프로그램을 수행할 수 있도록 할 뿐 아니라, 사설 IP 클러스터를 사용함으로 발생하는 성능저하를 최소화할 수 있는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법을 제공하는 것이다.

<32> 또한, 본 발명의 다른 목적은 별도의 사용자 수준의 프로그램을 요하지 않고 시스템 수준에서 바로 통신이 중계되도록 함으로써 중계로 인한 부하를 최소화시켜 사설 IP 클러스터 상에서 수행되는 MPI 프로그램과 가장 효율적으로 통신할 수 있는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법을 제공하는 것이다.

<33> 또한, 본 발명의 다른 목적은 클러스터 환경에 구애받지 않고 MPI 프로그램을 수행할 수 있어 사설 IP 클러스터도 MPI 작업에 포함시킬 수 있으므로, 기존에는 제외되었던 많은 사설 IP 클러스터들을 그리드 환경에 포함시킴

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0010

으로써 좀더 풍부한 컴퓨팅 환경을 구성할 수 있기 때문에 가용한 자원의 범위를 확대시킬 수 있는 동시에, 사설 IP 클러스터의 사용으로 인해 발생하는 성능의 저하도 최소화해서 공인 IP 클러스터만을 사용하는 경우와 비교해서 거의 차이가 없는 작업 성능을 제공할 수 있는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법을 제공하는 것이다.

발명의 구성 및 작용

<34> 상기와 같은 목적을 달성하기 위하여, 본 발명은 그리드 미들웨어(Grid Middleware)를 기반으로 다수개의 클러스터에서 각각 수행되는 MPI(Message Passing Interface) 프로그램간의 통신방법에 있어서, 상기 MPI프로그램마다 사설 IP와 공인 IP를 부여하는 수정된 홀 펀칭 단계를 포함하여 각각의 사설 IP 클러스터에서 수행되는 MPI 프로그램들 간의 직접통신이 이루어지는 것을 특징으로 하는 사설 IP를 지원하는 시스템 수준의 MPI 통신방법을 제공한다.

<35> 상기 다수개의 클러스터는 모든 클러스터환경을 포함하는 것을 특징으로 한다.

<36> 상기 수정된 홀 펀칭 단계는 각각의 사설 IP 클러스터에 속한 MPI 프로그램들이 각 관리노드의 NAT 서비스로부터 자신의 공인 IP를 획득하는 과정; 상기 공인 IP를 획득한 MPI 프로그램들이 자신의 사설 IP와 상기 획득된 공인 IP를 포함하는 채널정보를 다른 MPI프로그램들에 전달하는 과정; 및 상기 전달된 채널정보를 각각 대응시켜 인식테이블로 저장하는 상기 MPI프로그램들의 초기화과정을 포함하는 것을 특징으로 한다.

<37> 상기 다수개의 클러스터에서 각각 수행되는 MPI프로그램들 중 하나의 MPI 프로그램인 출발지 MPI프로그램이 작업을 진행하기 위해 필요한 다른 MPI프로그램인 목적지 MPI 프로그램과 통신하고자 하는 경우, 기저장된 인식테이블을 통해 상기 출발지 MPI 프로그램과 상기 목적지 MPI 프로그램의 위치에 따라 각각 다른 방법으로 연결하는 MPI프로그램간의 통신단계를 포함하는 것을 특징으로 한다.

<38> 상기 채널정보는 공인 IP, 사설 IP, 관리노드의 이름, 포트, 및 인터도메인에 속하는지 여부를 판단하는 인식자를 포함하는 것을 특징으로 한다.

<39> 상기 출발지 MPI프로그램은 상기 목적지 MPI 프로그램의 위치를 관리노드의 이름의 동일성을 통해 판단하는 것을 특징으로 한다.

<40> 상기 MPI프로그램간의 통신단계는 상기 출발지 MPI프로그램이 사설 IP 클러스터에 속하고, 상기 목적지 MPI프로그램이 공인 IP 클러스터에 속하는 경우, 상기 출발지 MPI프로그램이 존재하는 클러스터의 관리노드에 있는 NAT 서비스를 거쳐서 상기 목적지 MPI프로그램이 존재하는 계산노드와 연결되는 것을 특징으로 한다.

<41> 상기 MPI프로그램간의 통신단계는 상기 출발지 MPI프로그램 및 상기 목적지 MPI프로그램이 서로 다른 사설 IP 클러스터에 속하는 경우, 상기 출발지 MPI프로그램이 존재하는 클러스터의 관리노드에 있는 NAT서비스를 거쳐서 상기 목적지 MPI프로그램의 공인 IP주소를 통해 상기 목적지 MPI프로그램이 존재하는 클러스터의 관리노드에 있는 NAT서비스를 거쳐서 목적지 MPI프로그램이 존재하는 계산노드와 연결되는 것을 특징으로 한다.

<42> 상기 MPI프로그램간의 통신단계는 상기 출발지 MPI프로그램 및 상기 목적지 MPI프로그램이 모두 동일 사설 IP 클러스터에 속하거나, 동일 공인 IP클러스터에 속하는 경우, 상기 출발지 MPI프로그램과 상기 목적지 MPI프로그램이 직접 연결되는 것을 특징으로 한다.

<43> 본 발명은 공인 IP 클러스터에서만 수행 가능한 기존의 MPI를 수정한 것으로서 사설 IP 클러스터가 포함된 환경을 지원할 뿐 아니라, 사설 IP 클러스터의 사용으로 인해 야기되는 통신 성능의 저하를 최소화시킨다.

<44> 따라서 본 발명을 사용하면 클러스터 환경에 구애받지 않고 MPI 프로그램을 수행할 수 있다. 즉 다음과 같이 세 가지 컴퓨팅 환경을 모두 지원한다. 모두 공인 IP 클러스터로 구성되어 있는 환경, 모두 사설 IP로 구성되어 있는 환경, 그리고 공인 IP 클러스터와 사설 IP 클러스터가 혼재해 있는 환경이다. 이러한 각 컴퓨팅 환경에 관계없이 최적화된 성능으로 작업을 수행시킬 수 있다. 다시 말하면 사설 IP 클러스터를 작업에 포함시킨다고 해도, NAT를 거치는 것 외에는 특별히 추가되는 부하가 없다. NAT를 경유로 인한 통신 지연은 거의 무시할 만한 수준이므로, 공인 IP 클러스터만을 이용하여 작업을 수행하는 경우와 비교해도 성능저하가 거의 없다.

<45> 이하에서는 도면을 참조로 본 발명을 보다 구체적으로 설명한다.

<46> 도 3은 사설 IP 클러스터만으로 구성된 컴퓨팅 환경의 구성도이고, 도 4는 도3과 같은 컴퓨팅 환경에서 별도의 응용 프로그램을 사용하여 각 사설 IP 클러스터에서 실행되는 MPI 프로그램간의 통신을 중계하는 방법의 모식도이며, 도 5는 도3과 같은 컴퓨팅 환경에서 본 발명의 바람직한 일 실시예를 사용하여 사설 IP 클러스터에서 실

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0011

행되는 MPI 프로그램간의 통신을 중계하는 방법의 모식도이다.

<47> 본 발명이 지원하는 세 가지 컴퓨팅 환경 중 사설 IP 클러스터들로만 구성된 시스템은 일반적으로 도 3과 같다.

<48> 도 3을 참조하면, 사설 IP 클러스터1은 다수개의 컴퓨팅 자원들인 A1, A2, A3가 연결된 로컬 네트워크로서, 상기 A1, A2, A3는 각각 계산노드(13,14, 15)를 갖는 구조이고, 사설 IP 클러스터2 또한 다수개의 컴퓨팅 자원들인 B1, B2, B3가 연결된 로컬 네트워크로서, 상기 B1, B2, B3는 각각 계산노드(23,24,25)를 갖는 구조로서, 상기 사설 IP 클러스터1과 사설 IP 클러스터2가 인터넷을 통해 연결된 상태를 나타낸다.

<49> 도 3에 도시된 바와 같이 사설 IP로 구성되는 클러스터1,2는 외부에 보이는 관리 노드A와 관리노드B를 각각 포함하는데, 상기 관리 노드A 및 관리노드 B는 사설 IP가 할당된 네트워크 인터페이스 카드(12, 22)와 공인 IP가 할당된 네트워크 인터페이스 카드(11,21) 모두를 가지게 되는데, 이 때 상기 공인 IP가 할당된 네트워크 인터페이스 카드(11,21)는 외부의 그리드 네트워크와 연결되어 있다.

<50> 이와 같이 사설 IP로 구성되는 클러스터 시스템의 경우, 각 사설 IP 클러스터마다 존재하여 외부에 보이는 관리 노드는 사설 IP가 할당된 네트워크 인터페이스 카드와 공인 IP가 할당된 네트워크 인터페이스 카드 모두를 가지게 된다. 따라서 예를 들어 사설 IP 클러스터1의 로컬 네트워크에 존재하는 계산노드들(13, 14, 15)는 공인 IP를 가지고 있지 않기 때문에 외부에 존재하는 노드(예를 들어, 사설 IP 클러스터2의 계산노드 B1)에서는 볼 수도 없으며 직접 접근할 수도 없다.

<51> 도 3과 같이 구성된 사설 IP 클러스터에서 MPI 프로그램을 실행시키기 위해 지금까지 제안된 방법은 이미 상술한 바와 같이 별도의 사용자 수준의 프로그램을 사용하여 프로그램간의 메시지를 중계하는 방식이다. 즉 각 사설 IP 클러스터1, 2의 관리노드A, B는 중요한 역할을 담당하게 되는데, 각 사설 IP 클러스터에 연결된 계산 노드들은 사설 IP를 통해 통신하며, 외부의 네트워크로 연결하려 할 경우에는 관리 노드에서 제공하는 NAT 서비스뿐만 아니라 별도의 사용자수준의 프로그램을 실행시켜서, 외부로 나가거나 외부에서 들어오는 메시지를 중계하게 된다.

<52> 도 4는 이러한 통신 과정을 나타내는 그림인데, 관리 노드 A와 B가 중계를 위한 프로그램을 실행시키고 있는 상황에서 사설 IP 클러스터 1에 속하는 컴퓨팅자원 A1이 사설 IP 클러스터 2에 속하는 컴퓨팅자원 B1과의 통신을 원하는 경우, 우선 관리노드 A에 위치하는 중계 프로그램에게 메시지를 전송하게 된다. 이 메시지는 도 4에서 볼 수 있듯이 중계 프로그램에서 글로버스를 통해 시스템 수준까지 전달한다. 그 후에 글로벌 네트워크를 통해 관리노드 B에서 실행되는 중계 프로그램에게 전달되고, 관리노드 B의 중계 프로그램은 다시 글로버스를 통해 시스템 수준으로 메시지를 전달해서 결국 컴퓨팅자원 B1에게 전달된다.

<53> 앞에서 상술한 것처럼 별도의 프로그램을 사용해 메시지를 중계함으로써, 송신자에서 수신자에 이르는 단계가 길어지고, 사용자 수준까지 올라갔다가 다시 시스템 수준으로 내려가서 전달되기 때문에 통신 지연이 현저하게 증가한다. 따라서 사설 IP 클러스터를 작업에 사용할 수는 있지만, 공인 IP 클러스터만을 이용해서 작업을 수행하는 경우의 성능과 비교하면 현저하게 성능이 감소하는 경우가 발생한다.

<54> 본 발명은 도3과 같은 컴퓨팅환경에서 일어나는 상술한 바와 같은 도4와 같은 사용자수준의 별도의 응용프로그램을 사용하는 통신방법의 문제점을 해결하기 위해 안출된 것으로 도5에 도시된 바와 같이 수정된 홀 펀칭을 통해 사용자 수준의 별도의 응용프로그램을 사용하지 않고 상기 사설 IP 클러스터1 및 사설 IP 클러스터2의 계산노드들에서 각각 수행되는 MPI 프로그램간의 통신을 시스템 수준에서 직접 중계하는 것이 가능한 통신방법을 제공한다.

<55> 즉, 본 발명은 그리드 미들웨어(Grid Middleware)를 기반으로 다수개의 클러스터에서 각각 수행되는 MPI(Message Passing Interface) 프로그램을 이용한 통신방법에 있어서, 상기 MPI프로그램마다 사설 IP와 공인 IP를 부여하는 수정된 홀 펀칭 단계를 포함하여 각각의 사설 IP 클러스터에서 수행되는 MPI 프로그램들 간의 직접통신이 이루어지는 것을 특징으로 하는 사설 IP를 지원하는 MPI를 이용한 시스템 수준의 통신방법을 제공한다.

<56> 이 때, 상기 다수개의 클러스터는 모든 클러스터환경 즉 모두 공인 IP 클러스터로 구성되어 있는 환경, 모두 사설 IP로 구성되어 있는 환경, 그리고 공인 IP 클러스터와 사설 IP 클러스터가 혼재해 있는 환경을 포함 한다.

<57> 이와 같은 그리드 컴퓨팅 환경에서 실행되는 MPI 프로그램은 온라인 게임과 같은 일반적인 P2P 통신에서 사용하는 통신과 달리, 초기화에서부터 종료까지 다른 방법을 사용한다. 그 결과 상술한 일반적으로 현재까지 알려진 홀 펀칭을 그대로 이용할 수 없기 때문에, 본 발명은 하기와 같이 MPI 프로그램간의 통신이 가능할 뿐만 아니라

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0012

그 성능이 보다 최적화되도록 수정하였다.

<58> 즉, 기존의 홀 펀칭은 사설 IP 클러스터에 속한 각 컴퓨팅자원이 주소 서버에 자신의 주소를 등록하고, 각 컴퓨팅자원은 주소 서버를 통해서 접속을 원하는 상대방의 주소를 알아내야만 하는 구성을 가지고 있었다.

<59> 그런데, 본 발명에서는 주소의 등록이나 문의가 필요 없도록 수정해서, 별도의 주소 서버가 없어도 되는 구성을 갖는다.

<60> 또한 연결을 시도하는 방식도 최적화시켰다. 기존의 홀 펀칭은 2개의 IP를 사용하여 연결을 시도한 후, 접속이 빨리 이뤄지는 연결을 통해 통신하게 되는데, 이는 상대방에 대한 정보가 전혀 없기 때문이다. 즉 상대방이 같은 사설 IP 클러스터에 속해 있는지, 공인 IP를 사용하고 있는지, 다른 사설 IP 클러스터에 속해있는지 전혀 모른다. 그래서 무조건 2개의 연결을 시도하는 것이며, 늦게 이뤄지는 연결은 사용도 하지 않고 바로 닫게 되는데, 이러한 연결을 시도하는 방식을 최적화하기 위해 본 발명에서는 각 MPI 프로그램들이 자신이 속한 클러스터 환경에 대한 약간의 정보를 가지게 함으로써, 하나의 연결만 시도해도 통신할 수 있도록 변경하였다.

<61> 이와 같이 수정된 홀 펀칭 단계는 각각의 사설 IP 클러스터에 속한 MPI 프로그램들이 각 관리노드의 NAT 서비스로부터 자신의 공인 IP를 획득하는 과정; 상기 공인 IP를 획득한 MPI 프로그램들이 자신의 사설 IP와 상기 획득된 공인 IP를 포함하는 채널정보를 다른 MPI프로그램들에 전달하는 과정; 및 상기 전달된 채널정보를 각각 대응시켜 인식테이블로 저장하는 상기 MPI프로그램들의 초기화과정을 포함한다.

<62> 다시 말해, 수정된 홀 펀칭 단계는 사설 IP 클러스터를 지원하기 위해 기존의 MPICH-G2에서 통신 초기화에 관련된 과정을 변경한 것으로, 원래의 MPICH-G2에서는 각각의 MPI 프로그램들은 초기화 과정에서 자신의 IP와 포트를 포함하는 통신 채널 정보를 전달한 뒤, 현재 작업에 참여하고 있는 모든 프로그램들의 통신 채널 정보를 전달받게 되는데, 이 후 이 정보를 통해 현재 같은 작업에 참여하고 있는 다른 프로그램의 IP와 포트를 알아내서 통신하게 된다. 그런데 이러한 과정을 그대로 사용한다면, 사설 IP를 사용하는 MPI프로그램이 전달한 채널 정보에는 사설 IP와 포트가 들어가 있기 때문에, 같은 클러스터에 속하지 않은 프로그램이 이 정보를 사용하여 해당 프로그램과 연결하는 일은 불가능하다.

<63> 따라서 사설 IP 클러스터 내의 MPI 프로그램이 상술한 바와 같이 관리 노드의 NAT 서비스에게 요청하여 공인 IP를 얻어낸 후, 사설 IP와 공인 IP 모두를 포함하는 채널 정보를 다른 MPI프로그램들에 전달하도록 하였다. 여기서, 상기 채널정보는 공인 IP, 사설 IP, 관리노드의 이름, 포트, 및 인터도메인에 속하는지 여부를 판단하는 인식자를 포함한다.

<64> 이러한 본 발명의 구성에 의하면 각 MPI 프로그램들은 자신이 속한 클러스터의 관리 노드의 이름을 알고 있으며, 작업을 시작할 때 작업할당과 관리를 위한 별도의 관리 시스템에게 전달하는 채널정보에 주소 뿐 아니라 관리 노드의 이름도 포함시킨다. 따라서 각 MPI 프로그램은 다른 MPI 프로그램의 사설 IP와 공인 IP뿐 아니라 관리 노드의 이름, 포트 및 인터도메인에 속하는지 여부를 판단하는 인식자도 모두 알 수 있다.

<65> 그 결과, 출발지 MPI 프로그램이 연결하려는 목적지 MPI 프로그램의 관리 노드의 이름이 자신의 관리 노드의 이름과 일치한다면, 같은 사설 IP 클러스터에 속한 것이므로 사설 IP를 이용하는 편이 훨씬 효율적이지만, 관리 노드의 이름이 다르다면, 공인 IP를 사용하고 있거나 다른 사설 IP 클러스터에 속한 것이므로, 분명히 실패하게 될 사설 IP 연결은 시도하지 않고 공인 IP를 통한 연결만 시도하게 된다.

<66> 도 5는 본 발명의 바람직한 일 실시예에 의한 사설 IP 클러스터에서 실행되는 MPI 프로그램간의 통신을 중계하는 방법의 모식도로서, 출발지 MPI 프로그램과 목적지 MPI 프로그램이 각각 다른 사설 IP 클러스터에 속해 있는 상황에서 통신하는 과정을 나타낸 것이다. 즉 사설 IP 클러스터1에 속하는 컴퓨팅자원 A1이 사설 IP 클러스터2에 속하는 컴퓨팅자원 B1과의 통신을 원하는 경우, 상기 A1에서 수행되는 출발지 MPI 프로그램과 상기 B1에서 수행되는 목적지 MPI 프로그램이 서로 다른 사설 IP 클러스터에 속해 있으므로 B1의 목적지 MPI 프로그램의 공인 IP 주소를 사용해서 연결해야 한다. 이와 같은 A1의 연결 요청은 관리노드A의 NAT 서비스를 통해 나가서, 관리노드 B에게 전달되며, 관리노드 B의 NAT 서비스를 통해 다시 B1에게 전달된다. 이후의 모든 메시지는 같은 과정을 거쳐 전달된다.

<67> 이와 같이 본 발명의 통신방법에 의하면 출발지 MPI프로그램이 목적지 MPI 프로그램에 대한 사설 IP 주소와 공인 IP 주소를 포함한 채널정보를 모두 알고 있으므로, 가장 최적의 방법을 사용하여 연결하면 된다. 즉 같은 클러스터 안에 속한 프로그램이라면 사설 IP를 사용하여 연결하고, 아니라면 공인 IP를 사용해서 접속하면 된다. 만약 공인 IP 주소가 NAT를 통해 변환된 것이라면, NAT를 통해 시스템 수준에서 서로간의 통신이 중계된다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0013

<68> 그리고 일단 목적지 MPI프로그램의 위치를 알아내서, 공인 IP로 연결할 것인지 사설 IP로 연결한 것인지를 결정해서 연결이 성공하게 되면, 그 연결을 사용해서 계속 통신하면 된다. 다시 말하면 상대방이 같은 클러스터에 속해 있는지, 공인 IP를 사용하는지, 아니면 다른 사설 IP 클러스터에 속해 있는지는 신경 쓰지 않아도 된다.

<69> 하기 표1은 출발지 MPI 프로그램과 목적지 MPI 프로그램이 처할 수 있는 다양한 환경에서의 연결 방법을 나타낸 것이다.

표 1

출발지 MPI 프로그램	목적지 MPI 프로그램	연결 종류
사설IP클러스터(클러스터 A)	출발지 프로그램과 동일한 클러스터(클러스터 A) 내의 프로그램	직접 연결
사설IP클러스터(클러스터 A)	사설 IP 클러스터(클러스터 B)내의 프로그램	● 출발지 MPI프로그램이 존재하는 클러스터(클러스터 A)의 관리 노드에 있는 NAT 서비스를 거쳐서 나간다. ● 목적지 MPI프로그램이 존재하는 클러스터(클러스터 B)의 관리노드에 있는 NAT 서비스를 통해 원래 목적지 노드로 연결
사설IP클러스터(클러스터 A)	공인 IP 클러스터(클러스터 C)	● 출발지 프로그램이 존재하는 클러스터(클러스터 A)의 관리 노드에 있는 NAT 서비스를 거쳐서 나간다. ● 목적지 노드와 연결을 맺는다.
공인IP클러스터(클러스터 C)	사설 IP 클러스터(클러스터 A)	● 목적지 노드가 존재하는 클러스터의 NAT 서비스를 통해 목적지 노드로 연결
공인IP클러스터(클러스터 C)	공인 IP 클러스터(클러스터 D)	직접 연결

<70>

<71> 상기 표로부터, 상기 출발지 MPI프로그램이 사설 IP 클러스터에 속하고, 상기 목적지 MPI프로그램이 공인 IP 클러스터에 속하는 경우, 상기 출발지 MPI프로그램이 존재하는 클러스터의 관리노드에 있는 NAT서비스를 거쳐서 상기 목적지 MPI프로그램이 존재하는 계산노드와 연결되고, 상기 출발지 MPI프로그램 및 상기 목적지 MPI프로그램이 서로 다른 사설 IP 클러스터에 속하는 경우, 상기 출발지 MPI프로그램이 존재하는 클러스터의 관리노드에 있는 NAT서비스를 거쳐서 상기 목적지 MPI프로그램의 공인 IP주소를 통해 상기 목적지 MPI프로그램이 존재하는 클러스터의 관리노드에 있는 NAT서비스를 거쳐서 목적지 MPI프로그램이 존재하는 계산노드와 연결되며, 상기 출발지 MPI프로그램 및 상기 목적지 MPI프로그램이 모두 동일 사설 IP 클러스터에 속하거나, 동일 공인 IP클러스터에 속하는 경우, 상기 출발지 MPI프로그램과 상기 목적지 MPI프로그램이 직접 연결되는 것을 알 수 있다.

<72> 이와 같이 본 발명의 통신방법은 모든 컴퓨팅 환경에서 적용 가능하고, 적용되는 컴퓨팅환경에 따라 시스템수준에서 최적의 통신중계를 수행하는 것을 알 수 있다.

<73> 실험예

<74> 본 발명에 따른 MPI 통신 방법이 그리드 환경의 실제 사설 IP 클러스터에서 적용가능한지를 보여주기 위한 실험을 수행하였는데, 보다 상세히 말하면 사설 IP클러스터가 포함된 그리드 환경과 공인 IP 클러스터만을 포함한 그리드 환경에서 본 발명에 따른 통신방법에 따른 비교 실험을 함으로써 본 발명이 사설 IP 클러스터가 포함된 환경에서도 효율적으로 통신이 가능한지 여부를 실험하였다. 이 때 실험 대상이 되는 응용 프로그램은 하나의 MPI 프로그램에 참여하고 있는 모든 프로세스사이에 메시지를 전송하는 핑퐁(Ping-pong) 프로그램이다. 모든 프로세스사이에 메시지 전송을 20번 반복하면서 다양한 메시지 크기에 대해서 소요되는 시간을 측정하였고 그 결과를 도 6 및 도 7에 도시하였다.

<75> 도 6으로부터, 사설 IP 클러스터를 포함한 경우와 공인 IP클러스터만 포함한 경우의 통신지연시간이 큰 차이가 없는 것을 알 수 있다. 특히 도 7은 전송되는 메시지 크기가 클수록 그 차이가 감소하는 것을 보여준다. 즉 40KB의 메시지 크기에 대해서는 사설 IP 클러스터를 포함한 경우가 12.5% 더 걸리지만, 80MB인 경우는 거의 차

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0014

이가 없다.

<76> 이상의 결과로부터 본 발명의 통신방법은 사설 IP 클러스터를 포함하는 그리드환경에서도 공인 IP 클러스터만으로 구성된 그리드환경과 거의 동일한 수준으로 MPI 프로그램을 수행할 수 있도록 할 뿐 아니라, 사설 IP 클러스터를 사용함으로 발생하는 성능저하를 최소화할 수 있는 것을 알 수 있다.

<77> 이상에서는 본 발명의 바람직한 실시예에 대해서만 설명하였지만, 본 발명이 속하는 기술분야에 있어서 통상의 지식을 가진 자라면 본 발명의 사상과 범위 안에서 다양한 수정, 변경, 부가 등이 가능할 것인데, 이러한 수정 변경 등에 의해 실시할 경우도 모두 이하의 특허청구범위에 속하는 것으로 보아야 할 것이다.

발명의 효과

<78> 지금까지 설명된 본 발명은 다음과 같은 효과를 가진다.

<79> 본 발명의 통신방법에 의하면, 홀 펀칭(Hole Punching)을 MPI 프로그램에서 수행 가능하도록 수정하여 기존의 MPI 프로그램이 사설 IP 클러스터 상에서는 수행될 수 없다는 문제점을 해결할 뿐 아니라, 기존의 해결책보다 훨씬 성능이 좋으면서도 안정적인 사설 IP를 지원한다. 즉 본 발명은 홀 펀칭 기법을 응용한 시스템 수준의 중계를 통해, 사용자 수준의 중계에서 발생하는 문제점들을 모두 해결하여 사설 IP 클러스터에서 수행되는 MPI 프로그램과 통신할 수 있을 뿐 아니라, 이러한 통신이 신속하고 안정적으로 이루어질 수 있다.

<80> 또한, 본 발명의 통신방법에 의하면 사설 IP 클러스터 상에서도 MPI 프로그램을 수행할 수 있도록 할 뿐 아니라, 사설 IP 클러스터를 사용함으로 발생하는 성능저하를 최소화할 수 있다.

<81> 또한, 본 발명의 통신방법에 의하면 별도의 사용자 수준의 프로그램을 요하지 않고 시스템 수준에서 바로 통신이 중계되도록 함으로써 중계로 인한 부하를 최소화시켜 사설 IP 클러스터 상에서 수행되는 MPI 프로그램과 가장 효율적으로 통신할 수 있다.

<82> 또한, 본 발명의 통신방법을 사용하면 클러스터 환경에 구애받지 않고 MPI 프로그램을 수행할 수 있어 사설 IP 클러스터도 MPI 작업에 포함시킬 수 있으므로, 기존에는 제외되었던 많은 사설 IP 클러스터들을 그리드 환경에 포함시킴으로써 좀더 풍부한 컴퓨팅 환경을 구성할 수 있어, 가용한 자원의 범위를 확대시킬 수 있을 뿐 아니라, 사설 IP 클러스터의 사용으로 인해 발생하는 성능의 저하도 최소화해서, 공인 IP 클러스터만을 사용하는 경우와 비교해서 거의 차이가 없는 작업 성능을 제공할 수 있다.

도면의 간단한 설명

<1> 도 1은 종래에 알려진 별도의 프로그램을 사용하여 사설 IP 클러스터에서 실행되는 프로그램간의 통신을 중계하는 방법.

<2> 도 2는 종래에 알려진 홀 펀칭을 사용하여 사설 IP 클러스터에서 실행되는 프로그램간의 통신을 중계하는 방법.

<3> 도 3은 사설 IP 클러스터만으로 구성된 컴퓨팅 환경의 구성도.

<4> 도 4는 도3과 같은 컴퓨팅 환경에서 별도의 응용 프로그램을 사용하여 각 사설 IP 클러스터에서 실행되는 MPI 프로그램간의 통신을 중계하는 방법의 모식도.

<5> 도 5는 도3과 같은 컴퓨팅 환경에서 본 발명의 바람직한 일 실시예를 사용하여 사설 IP 클러스터에서 실행되는 MPI 프로그램간의 통신을 중계하는 방법의 모식도.

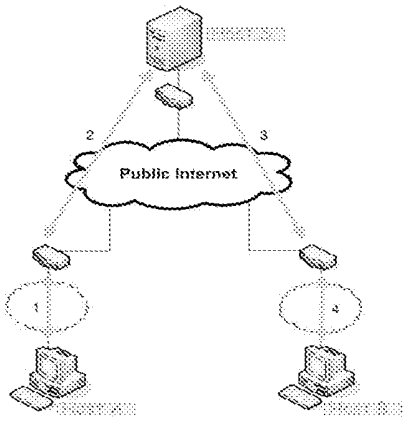
<6> 도 6은 사설 IP클러스터가 포함된 그리드 환경과 공인 IP 클러스터만을 포함한 그리드 환경에서 다양한 메시지 크기에 대해서 소요되는 시간을 측정한 결과를 각각 도시한 그래프.

<7> 도 7은 사설 IP클러스터가 포함된 그리드 환경과 공인 IP 클러스터만을 포함한 그리드 환경에서 다양한 메시지 크기에 대해서 각각 소요되는 시간의 비를 나타낸 막대그래프.

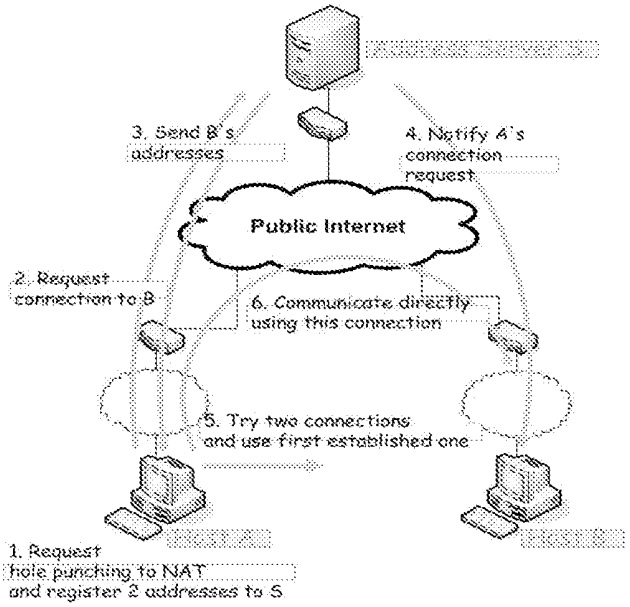
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0015

도면

도면1

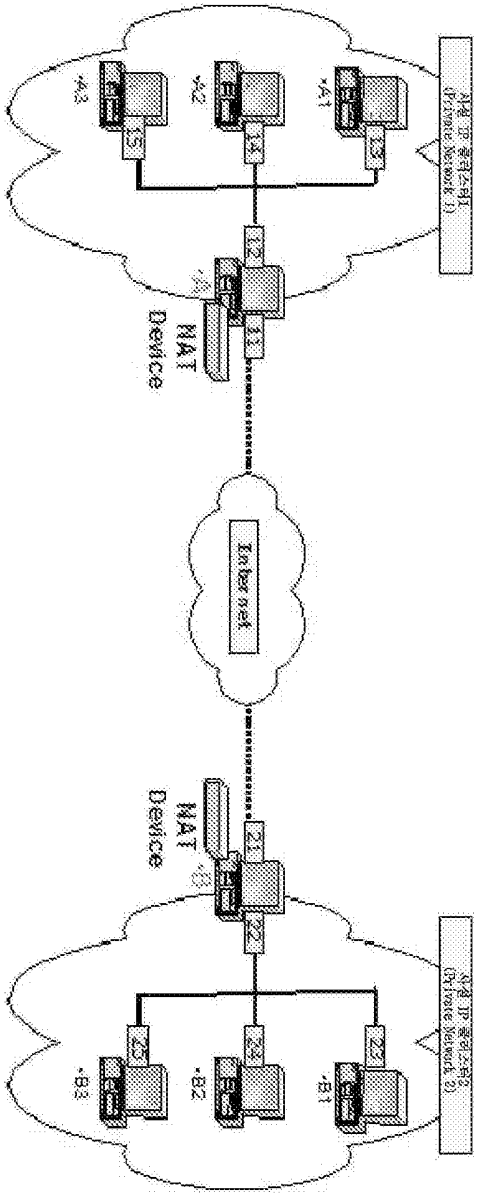


도면2



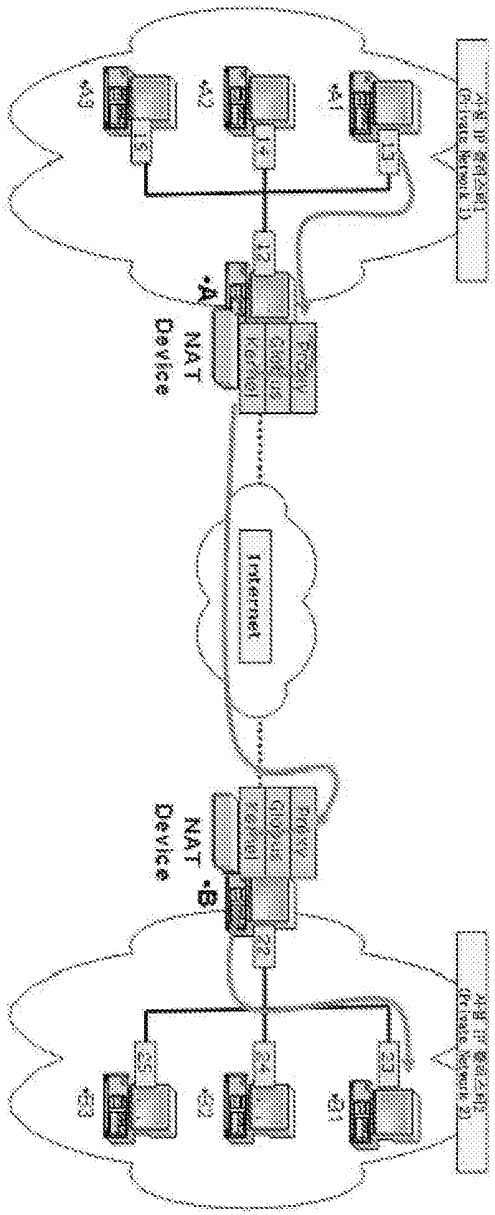
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0016

도면3



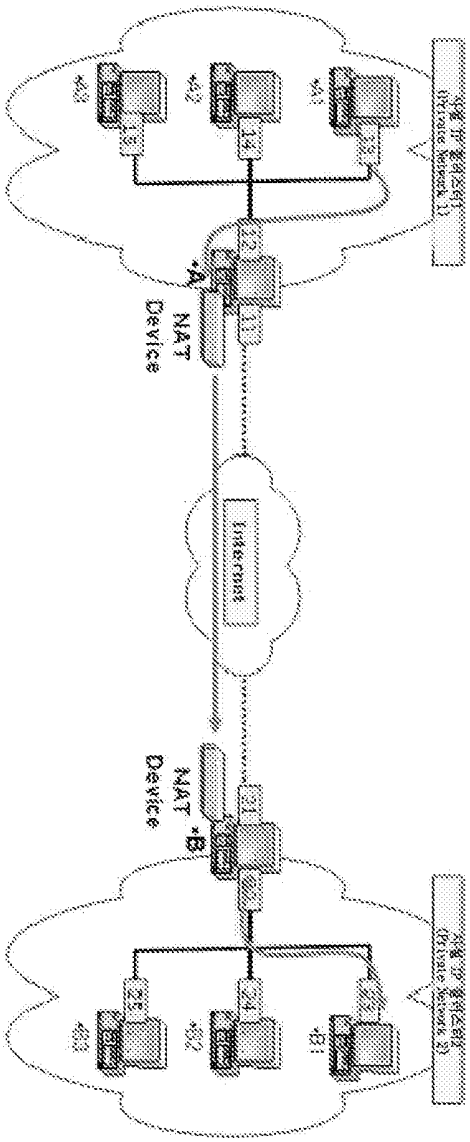
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0017

도면4



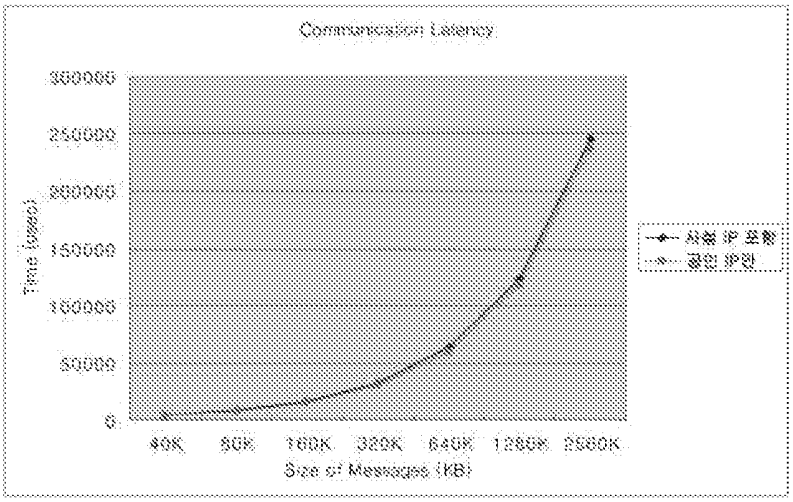
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0018

도면5

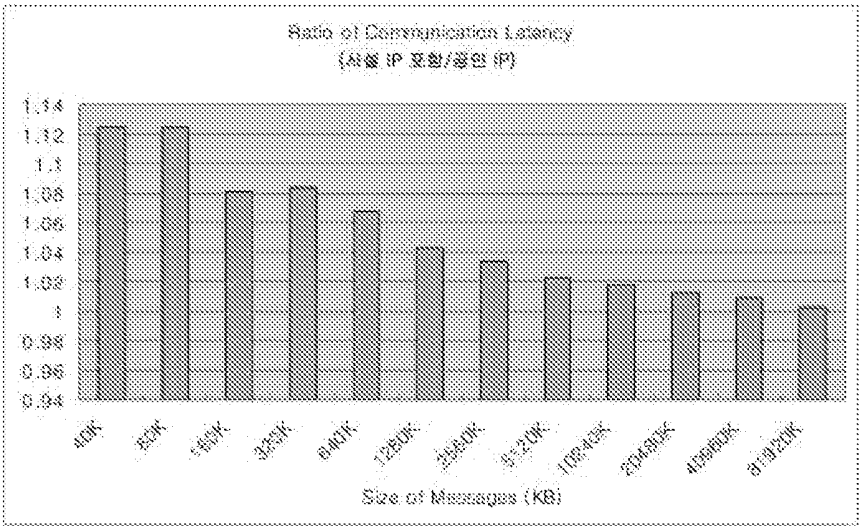


Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0019

도면6



도면7



Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0020

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Sun Cheul KIM
Filer:	Steve Yong Soo Cho
Attorney Docket Number:	110PK-074000US

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	82	82
Utility Search Fee	2111	1	270	270
Utility Examination Fee	2311	1	110	110
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**462**

Electronic Acknowledgement Receipt

EFS ID:	10927841
Application Number:	13234425
International Application Number:	
Confirmation Number:	6384
Title of Invention:	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Sun Cheul KIM
Customer Number:	83220
Filer:	Steve Yong Soo Cho
Filer Authorized By:	
Attorney Docket Number:	110PK-074000US
Receipt Date:	16-SEP-2011
Filing Date:	
Time Stamp:	13:10:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$462
RAM confirmation Number	10473
Deposit Account	504713
Authorized User	CHO,STEVE Y.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2011_09_12_SPEC_DWGS_110PK-074000US.pdf	23668898 70e283c7731b9f39103af48490425c53c2a66342	yes	42

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	25
Claims	26	32
Abstract	33	33
Drawings-only black and white line drawings	34	42

Warnings:

Information:

2	Oath or Declaration filed	2011_09_12_DEC_110PK-074000US.pdf	323331 b00343601e4a45ccba88f8e54995e99c92e609d7	no	2

Warnings:

Information:

3	Application Data Sheet	2011_09_12_ADS_110PK-074000US.pdf	71228 c516b1c583d78b6ac654b813719a66ecd9732567	no	5

Warnings:

Information:

This is not an USPTO supplied ADS fillable form

4		2011_09_15_IDS_110PK-074000US.pdf	166072 0bb40f700e4a3e25f9b3375e17deab517c9fbe06	yes	3

Multipart Description/PDF files in .zip description

Document Description	Start	End
Information Disclosure Statement (IDS) Form (SB08)	1	2
Transmittal Letter	3	3

Warnings:

Information:					
5	Foreign Reference	2011_09_15_IDS_REF1_110PK-074000US.pdf	11818864 f0609ad61b6e4f008a0b32945785186e6f177d2b	no	17
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	33080 c84d561cdf11df0620bbd243674a345a2b94e320	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	36081473	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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.

TITLE OF THE INVENTION

METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to and the benefit of Korean Patent Application No. 10-2010-0107107 filed in the Korean Intellectual Property Office on October 29, 2010, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

(a) Field of the Invention

The present invention relates to a method of network-based communication in a virtual network environment.

(b) Description of the Related Art

An Internet protocol (IP) network uses a firewall or network address translation (NAT) in order to block external access or due to a shortage of IPs. In this environment, the communication market is striving to apply peer-to-peer (P2P) technology into services for games, messengers, etc.

An IP network including a NAT or firewall provides direct communication of P2P L4 (Layer 4) level with help from a server.

For P2P direct communication, each terminal needs to determine its own network connection type. If a terminal is connected to a public network, the terminal needs to detect the presence of a firewall. Otherwise, if the

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0026

terminal is connected to a network using an NAT, the terminal needs to determine the type of the NAT. When no firewall exists, this is called Open. Examples of NAT types include Full Cone, Restricted Cone, Port Restricted Cone, and Symmetric.

Table 1 shows the possibility of direct communication between a receiver and a sender without help from a server in a conventional IP network. In Table 1, "Open" refers to being open, and "Firewall" refers to a firewall.

(Table 1)

Sender / Receiver		Public		NAT			
Sender / Receiver		Open	Firewall	Full Cone	Restricted Cone	Port Restricted Cone	Symmetric
Public	Open	○	○	○	○	○	○
Public	Firewall	×	×	×	×	×	×
NAT	Full Cone	×	×	×	×	×	×
NAT	Restricted Cone	×	×	×	×	×	×
NAT	Port Restricted Cone	×	×	×	×	×	×
NAT	Symmetric	×	×	×	×	×	×

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0027

As shown in Table 1, if the receiver is in an open public network (Public-Open), direct communication between the sender and the receiver is possible.

However, if an NAT or firewall is incorporated, the sender and the receiver have to obtain a changed IP and port information of the opposing terminal with help from the server to perform communication.

Table 2 shows the possibility of direct communication between the receiver and the sender when changed IP and port information of the opposing terminal is obtained from the server.

(Table 2)

Sender / Receiver		Public		NAT			
Sender / Receiver		Open	Firewall	Full Cone	Restricted Cone	Port Restricted Cone	Symmetric
Public	Open	○	○	○	○	○	○
Public	Firewall	×	×	×	×	×	×
NAT	Full Cone	○	○	○	○	○	○
NAT	Restricted Cone	×	×	×	×	×	×
NAT	Port Restricted Cone	×	×	×	×	×	×

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0028

NAT	Symmetric	×	×	×	×	×	×

In Table 2, even if the receiver and the sender have obtained changed IP and port information of the opposing terminal with help from the server, direct communication between the sender and the receiver is possible only when the receiver is in an open public network (Public-Open) and uses Full Cone NAT (Nat-Full Cone).

Moreover, either TCP or UDP punching is done for direct communication between the sender and the receiver. Table 3 shows the possibility of direct communication between the receiver and the sender after hole punching is done using the changed IP and port information of the opposing terminal from the server. In Table 3, ▲ indicates that, when either the sender or the receiver uses symmetric NAT (NAT-Symmetric), direct communication is possible only when the IP is not changed but only the port is changed, and direct communication is impossible if the other node uses restricted cone NAT (NAT-Restricted Cone) even when the IP is changed.

(Table 3)

Sender Receiver		Public		NAT			
Sender Receiver		Open	Firewall	Full Cone	Restricted Cone	Port Restricted Cone	Symmetric
Public	Open	○	○	○	○	○	○

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0029

Public	Firewall	○	○	○	○	○	×
NAT	Full Cone	○	○	○	○	○	○
NAT	Restricted Cone	○	○	○	○	○	▲
NAT	Port Restricted Cone	○	○	○	○	○	×
NAT	Symmetric	○	×	○	▲	×	×

As shown in Table 3, even if hole punching is done, direct communication between the sender and the receiver is not always possible for all types of connections between the sender and the receiver.

That is, it is clear that direct communication is impossible between symmetric NAT (NAT-Symmetric) and symmetric NAT (NAT-Symmetric), between symmetric NAT (NAT-Symmetric) and a common network with a firewall (Public-Firewall), and between symmetric NAT (NAT-Symmetric) and port restricted cone NAT (NAT-Port Restricted Cone).

However, in this case as well, direct communication can be made possible using TURN (Traversal Using Relay NAT). TURN enables direct communication via a device connected to an open public network (Public-Open). That is, the sender and the receiver respectively transmit data to the device connected to the open public network (Public-Open) for communication with the opposing terminal, and this device enables direct communication by modifying

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0030

the packets and transmitting the data to the opposing terminal.

In this way, the method of enabling direct communication between the sender and the receiver has to be performed for each service, i.e., each L4 (Layer 4) session. Thus, when one terminal runs multiple sessions for direct communication, a handling procedure has to be frequently repeated. Such a direct communication method is a technology that is applied only to P2P. Therefore, a virtualized networking environment capable of Virtual IP (VIP)-based direct communication and a virtual network connection method for network-based movement are required.

That is, there are some cases where a direct communication environment is not provided between terminals because the terminals are connected to an NAT or firewall in most cases in an internet consisting of routers in the prior art. Accordingly, most of the current internet services are being provided in a web-based way or in a centralized way.

Further, although the internet with the feature of an open architecture has to be able to provide various communication services between terminals, as well as centralized services, there are many restrictions due to an NAT/firewall incorporated in the current internet architecture. Moreover, in the conventional internet architecture, a new IP is assigned to a network each time a terminal is connected to the internet. It is difficult to provide mobility to the terminal since the assigned IP always changes in each network. Subsequently, there is a need for a method of supporting mobility in a virtual network environment that introduces a new ID concept.

The above information disclosed in this Background section is only for

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0031

enhancement of understanding of the background of the invention and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY OF THE INVENTION

The present invention has been made in an effort to provide a method of network-based communication in a virtual network environment capable of direction communication based on a virtual address.

An exemplary embodiment of the present invention provides a communication method that provides end-to-end communication in a virtual network environment, the method including:

a plurality of virtual tunnel routers including a first virtual tunnel router and a second virtual tunnel router receiving a message containing virtual network prefix information from a tunnel mapping controller; determining whether the first virtual tunnel router has received a hole punching message from the second virtual tunnel router; if the first virtual tunnel router has received a hole punching message, the first virtual tunnel router establishing a tunnel with the second virtual tunnel router based on the virtual network prefix information; and the first virtual tunnel router performing direct communication with the second virtual tunnel router through the established tunnel.

Another exemplary embodiment of the present invention provides a communication method that provides end-to-end communication in a virtual network environment, the method including:

a tunnel mapping controller receiving a registration request message from a plurality of virtual tunnel routers; checking whether information of the

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0032

virtual tunnel router having transmitted the registration request message is pre-stored; if the information of the virtual tunnel router is not stored, registering the information of the virtual tunnel router contained in the registration request message; receiving a request from the virtual tunnel router to provide virtual network prefix information; and creating a virtual network prefix for the virtual tunnel router having requested the virtual network prefix information and transmitting the same to enable direct communication between the virtual tunnel routers.

Still another exemplary embodiment of the present invention provides a communication method that enables direct communication between a plurality of virtual tunnel routers including a first virtual tunnel router and a second virtual tunnel router by working in conjunction with a tunnel mapping controller, the method including:

the first virtual tunnel router and the second virtual tunnel router requesting virtual network prefix information from the tunnel mapping controller; the tunnel mapping controller generating virtual network prefix information of the first virtual tunnel router and second virtual tunnel router, respectively, and transmitting the same along with information of a list of adjacent virtual tunnel routers; the first virtual tunnel router and the second virtual tunnel router creating a tunnel; and performing direct communication between the first virtual tunnel router and the second virtual tunnel router by linking the virtual network prefix information received by the first virtual tunnel router and the second virtual tunnel router, respectively.

BRIEF DESCRIPTION OF THE DRAWINGS

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0033

FIG. 1 is an illustration of a virtualized network according to an exemplary embodiment of the present invention.

FIG. 2 is a view showing a structure of the virtualized network according to an exemplary embodiment of the present invention.

FIG. 3 is a flowchart showing a method of managing and assigning virtual network prefixes according to an exemplary embodiment of the present invention.

FIG. 4 is a flowchart showing a tunneling procedure of virtual TRs according to an exemplary embodiment of the present invention.

FIG. 5 is a flowchart showing a tunneling procedure through a tunnel relay according to an exemplary embodiment of the present invention.

FIG. 6 is a flowchart showing a virtualized network connection procedure after the movement of a virtual TR according to an exemplary embodiment of the present invention.

FIG. 7 is a flowchart showing a procedure for notifying a virtual TR of connection change information according to another exemplary embodiment of the present invention.

FIGS. 8A and 8B are flowcharts showing a method of communication between a terminal inside a virtualized network and a terminal outside the virtualized network according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

In the following detailed description, only certain exemplary embodiments of the present invention have been shown and described, simply

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0034

by way of illustration. As those skilled in the art would realize, the described embodiments may be modified in various different ways, all without departing from the spirit or scope of the present invention. Accordingly, the drawings and description are to be regarded as illustrative in nature and not restrictive. Like reference numerals designate like elements throughout the specification.

Throughout the specification, unless explicitly described to the contrary, the word "comprise" and variations such as "comprises" or "comprising" will be understood to imply the inclusion of stated elements but not the exclusion of any other elements.

In this specification, a terminal (UE) may designate a mobile station (MS), a mobile terminal (MT), a subscriber station (SS), a portable subscriber station (PSS), user equipment (UE), an access terminal (AT), etc., and may include the entire or partial functions of the mobile terminal, the subscriber station, the portable subscriber station, the user equipment, etc.

In this specification, a base station (BS) may designate an access point (AP), a radio access station (RAS), a Node B, a base transceiver station (BTS), a mobile multihop relay (MMR)-BS, etc., and may include the entire or partial functions of the access point, the radio access station, the node B, the base transceiver station, the MMR-BS, etc.

Hereinafter, a method of supporting network-based mobility in a virtual network environment according to an exemplary embodiment of the present invention will be described with reference to the accompanying drawings.

FIG. 1 is an illustration of a virtualized network according to an exemplary embodiment of the present invention.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0035

As shown in FIG. 1, a virtualized network providing a direct communication environment based on a virtual IP includes virtual tunnel routers (hereinafter, "virtual TR") 100-1 to 100-5. The virtual TRs 100-1 to 100-5 may be connected to a conventional general router, and may be connected to a switch, ethernet port, or radio signal network (e.g., WiFi, WiMax, 3G network, etc.) to which a terminal is connected. Moreover, they may be connected to a network with an NAT or firewall incorporated therein.

The virtual TRs 100-1 to 100-5 operate as network components which form one or more virtual networks 200-1 to 200-3. An IP-UDP/TCP-IP tunnel (hereinafter referred to as "IP tunnel") is established between the virtual TRs 100-1 to 100-5. Then, by exchanging information of a virtual network prefix of each virtual network between the virtual TRs, a terminal located on each virtual network may be in direct communication with a terminal on a virtual network at a remote location connected via the internet.

In the exemplary embodiment of the present invention, a virtual IP is an IP address used in the inner header of an IP tunnel, which will be described taking an IPv4 or IPv6 address as an example. A virtual IP has the meaning as an unchangeable identifier on the virtualized network, like identifying respective virtual networks and identifying terminals located in a virtual network area.

Although both an IPv4 network and an IPv6 network currently exist on the internet, it is considerably difficult to link the two different networks, and such a linking operation is rare. In the exemplary embodiment of the present invention, a virtual IP and a network IP are used separately, and both IPv4 and

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0036

IPv6 can be used as the virtual IP. Therefore, a consistent and systematical virtualized network can be generated by introducing the concept of virtual TRs and a virtual network in the conventional internet, which is divided by region and uses a different IP structure for each region.

A network structure for supporting mobility by configuring such a virtualized network will be described with reference to FIG. 2.

FIG. 2 is a view showing a structure of the virtualized network according to an exemplary embodiment of the present invention.

As shown in FIG. 2, the virtualized network includes a tunnel mapping controller 200 and a tunnel relay 300 located on the network so that the virtual TRs 100-1 to 100-3 located outside the network can communicate with each other.

The tunnel mapping controller 200 serves to process and control tunneling between a plurality of virtual TRs and various signaling messages. That is, the tunnel mapping controller 200 establishes an IP tunnel in conjunction with each of the virtual TRs 100-1 to 100-3, and connects each virtual IP prefix to the established tunnel, thus enabling direct communication between virtual networks.

To this end, the tunnel mapping controller 200 includes a virtual network prefix information table. When the virtual TRs 100-1 to 100-3 request virtual network prefix information after registering themselves, the tunnel mapping controller 200 allocates and forwards virtual network prefixes to the virtual TRs 100-1 to 100-3, respectively.

The tunnel relay 300 performs tunneling at the center in case no tunnel

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0037

is established between the virtual TRs, and performs the function of forwarding tunneled data. When the virtual TRs 100-1 to 100-3 are connected to the internet, they may be connected to a public network or an NAT, or a firewall may be incorporated.

Accordingly, the tunnel relay 300 establishes a tunnel of the virtual TRs 100-1 to 100-3 if it is impossible to establish a tunnel between the virtual TRs 100-1 to 100-3. The tunnel relay 300 may be included in a component such as the tunnel mapping controller 200, or included in a different component at a physically different location.

As such, a direct communication environment may be provided to terminals in the network area among a first virtual network 200-1, a second virtual network 200-2, and a third virtual network 200-3 through the tunnel mapping controller 200 and the tunnel relay 300. A procedure of managing and assigning virtual network prefixes in order to support network-based mobility in this structure will be described with reference to FIG. 3. Prior to the description, an explanation will be given in the exemplary embodiment of the present invention by taking an example of two virtual networks (first virtual network and second virtual network) and two virtual TRs 100-1 and 100-2 for convenience of description.

FIG. 3 is a flowchart showing a method of managing and assigning virtual network prefixes according to an exemplary embodiment of the present invention.

Virtual network prefix information is addresses assigned to terminals or devices connected to respective virtual networks. For example, if a virtual

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0038

network has a prefix and length of 1.1.1.0/24, each terminal connected to the virtual network is assigned one IP in the range from 1.1.1.1 to 1.1.1.255, which is virtual network prefix information. Although an example will be given in which this information is generated by the tunnel mapping controller 200, provided to the virtual TRs 100-1 and 100-2, and then stored in a database referred to by the tunnel mapping controller 200 at a point of time when each of the virtual TRs 100-1 and 100-2 is registered in the tunnel mapping controller 200, this information may be predetermined by an administrator and assigned to the virtual TRs 100-1 and 100-2.

In the method in which the virtual TRs 100-1 and 100-2 each constituting a virtual network manage and assign virtual network prefix information in conjunction with the tunnel mapping controller 200, as shown in FIG. 3, the first virtual TR 100-1 of a first virtual network and the second virtual TR 100-2 of a second virtual network each transmit a registration request message in order to perform registration to the tunnel mapping controller 200 (S100 and S105).

When configuring a virtual network by a pre-planned method to configure multiple virtual networks, the process of registering each virtual TR in the tunnel mapping controller may be manually set and used. Otherwise, the registration process may be performed by running a server such as a portal site. Accordingly, in the process of registration through portal or the like, the registration request message contains ID information and password information assigned or determined in the registration process.

That is, supposing that, in the registration through portal, the ID is

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0039

"Virtual-Net-1" and the password is "2345", the corresponding information is stored in a specific DB. At this point, the tunnel mapping controller 200 is able to search the corresponding DB. Thus, when performing an authentication procedure required for a virtual TR to connect to the tunnel mapping controller 200 in order to configure a virtual network later, information for identifying the virtual TR, such as the corresponding ID "Virtual-Net-1" and the password "12345", is checked, and stored only when the virtual TR is a proper virtual TR.

As described above, when the first virtual TR 100-1 and the second virtual TR 100-2 perform registration to the tunnel mapping controller 200, the registration is performed through the web or other various methods, and the registration method is not limited to a specific one.

When the tunnel mapping controller 200 receives a registration request message from the virtual TRs 100-1 and 100-2, it determines whether the corresponding virtual TRs 100-1 and 100-2 having transmitted the registration request message are virtual TRs pre-stored in the database (S110). If they are existing stored virtual TRs, they are updated and managed with the information contained in the registration request message (S120), and if they are new virtual TRs, the information contained in the registration request message is newly registered (S130).

When the first virtual TR 100-1 and the second virtual TR 100-2 are registered in the tunnel mapping controller 200 by this procedure, the virtual TRs request virtual network prefix information to be used by themselves from the tunnel mapping controller 200 (S140 and S145). The tunnel mapping controller 200 generates virtual network prefix information to be provided to the

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0040

first virtual TR 100-1 and the second virtual TR 100-2 (S150), and then provides it to a virtual TR having requested the virtual network prefix information (S160 and S165). The virtual network prefix information supports both IPv4 and IPv6, and contains information such as network prefix, length, and network type.

In the process of registering the virtual TRs in the tunnel mapping controller 200 in step S130, an NAT traversal function or a STUN procedure is performed together to learn the incorporation of an NAT/firewall. The information learned through this procedure is used as information such as mapped IP/port and network connection type or network operation mode to be used later in a virtual TR tunneling process. The NAT traversal function or STUN procedure is a well-known technology, so a detailed description thereof will be omitted in the exemplary embodiment of the present invention.

A tunneling procedure to be performed after the virtual TRs are assigned virtual network prefixes through the aforementioned procedure will be described with reference to FIG. 4.

FIG. 4 is a flowchart showing a tunneling procedure of virtual TRs according to an exemplary embodiment of the present invention.

As shown in FIG. 4, when the first virtual TR 100-1 and the second virtual TR 100-2 are connected to the virtualized network, the tunnel mapping controller 200 creates information of a list of virtual TRs for tunneling and reports it in order to notify that the currently registered first virtual TR 100-1 and second virtual TR 100-2 are targets to be configured into the virtual network, i.e., to be tunneled for direct communication (S200 to S205). That is, the first virtual TR 100-1 is notified that it requires tunneling with the second virtual TR,

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0041

and the second virtual TR 100-2 is informed that it requires tunneling with the first virtual TR.

The information of a list of virtual TRs for tunneling contains information such as the mapped IP/port, network connection type, and operation mode of a connected network. This is to notify of information to be referred to for an STUN or UDP/TCP Hole Punching in the tunneling process because each virtual TR may be located in an NAT or firewall.

When each virtual TR receives the information of a list of virtual TRs for tunneling, a hole punching message for UDP/TCP Hole Punching is exchanged in order to establish a tunnel with the virtual TR (S210). Then, each virtual TR determines whether the transmission and reception of the hole punching message are successful (S220 and S225). If the message transmission and reception are successful, a tunnel establishment message is exchanged (S230).

When a tunnel is established between the first virtual TR 100-1 and the second virtual TR 100-2 through this procedure, virtual network prefix information of the opposing virtual network is linked to the tunnel (S240). Then, a direct communication environment is constructed between the first virtual TR 100-1 and the second virtual TR 100-2. That is, a first virtual network with a virtual IP of 1.1.1.0/24 can establish direct communication with a second virtual network with a virtual IP of 2.2.2.0/24. The virtual IP may be a private IP or public IP.

On the other hand, if the hole punching message transmission and reception in steps S220 and S225 fail, an environment capable of direct communication is constructed through another tunneling procedure. This will

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0042

be described with reference to FIG. 5.

FIG. 5 is a flowchart showing a tunneling procedure through a tunnel relay according to an exemplary embodiment of the present invention.

If the hole punching message transmission and reception in steps S220 and S225 of FIG. 4 fail, as shown in FIG. 5, the first virtual TR 100-1 and the second virtual TR 100-2 each perform a tunneling process with the tunnel mapping controller 200 in order to establish a tunnel with the tunnel relay 300 located at the center (S300 and S305).

When a tunnel is established between the first virtual TR 100-1 or second virtual TR 100-2 and the tunnel relay 300 through steps S300 and S305, the first virtual TR 100-1 and the second virtual TR 100-2 set the virtual network prefix information of the first virtual network and second virtual network, respectively, to the tunnel via the tunnel relay 300 (S315 and S315), thereby constructing a virtualized network capable of direct communication via the tunnel relay 300.

A method of connecting to a virtualized network if the second virtual TR 100-2 moves from one network to another network when the virtualized network capable of direct communication between the virtual TRs 100-1 and 100-2 or between the virtual TRs 100-1 and 100-2 and the tunnel relay 300 as shown in FIGs. 4 and 5 will be described with reference to FIG. 6. The virtual TRs may be large-scale devices such as routers/switches generally referred to in a network, or small-scale devices such as internet sharers or access points (APs) for WiFi.

FIG. 6 is a flowchart showing a virtualized network connection

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0043

procedure after the movement of a virtual TR according to an exemplary embodiment of the present invention.

When the second virtual TR 100-2 with an SrcIP/port of y.y.y.y/bbbb and a mapped IP/port of (y.y.y.y)"/(bbbb)" before movement as shown in FIG. 5, whose connection type, operation mode, etc. are registered as values, moves to a new network and performs a registration procedure as shown in FIG. 6 (S400), it receives an IP assigned from a virtual network (S410). It is assumed that the IP assigned and received from the virtual network is a value with an SrcIP/port of Y.Y.Y.Y/BBBB and a mapped IP/port of (Y.Y.Y.Y)"/(BBBB)". The new network connected by the second virtual TR 100-2 may be various networks, such as ethernet and IP-based wireless networks including WiFi, WiMAX, 3G, 4G, etc.

A registration request message containing this value is transmitted to the tunnel mapping controller 200 to perform the registration procedure (S420). The tunnel mapping controller 200 having received the registration request message determines whether information on the second virtual TR is stored (S430). If the information on the second virtual TR is already stored, the tunnel mapping controller 200 confirms that connection information of the second virtual TR 100-2' is changed, and updates it with the information on the second virtual TR contained in the registration request message received in step S420 (S440).

As a result of the determination in step S430, if the second virtual TR is a newly registered virtual TR, the second virtual TR information contained in the registration request message is registered (S445). However, the flow shown in

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0044

FIG. 6 according to the exemplary embodiment of the present invention is about a network connection procedure executed when a virtual TR moves. It is necessary to establish a new IP tunnel with the first virtual TR 100-1 of the virtualized network configured by a second virtual TR 100-2' and update existing tunnel information.

The tunnel mapping controller 200 having updated the information of the second virtual TR 100-2' searches for a list of virtual TRs associated with the second virtual TR 100-2' among the plurality of stored virtual TRs (S450). Then, the virtual TRs associated with the second virtual TR 100-2' are notified of the connection change of the newly connected second virtual TR 100-2' (S460). Although the exemplary embodiment of the present invention is described taking the first virtual TR 100-1 as an example of a virtual TR associated with the second virtual TR 100-2', the present invention is not necessarily limited thereto.

That is, the information, such as the SrcIP/port, mapped IP/port, connection type, and operation mode of the second virtual TR 100-2' is forwarded to the first virtual TR 100-1. At this point, the tunnel mapping controller 200 may notify the first virtual TR 100-1 of the connection, or the second virtual TR 100-2' whose connection is changed may receive a list of virtual TRs from the tunnel mapping controller 200 and notify the virtual TRs of the connection.

Moreover, the second virtual TR 100-2' may store previous connection information, i.e., information on adjacent virtual TRs, therein, and notify the virtual TRs of the connection based on the stored values. The exemplary

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0045

embodiment of the present invention will be described taking an example in which the tunnel mapping controller 200 notifies the first virtual TR 100-1 of the connection.

When the first virtual TR 100-1 receives changed information of the first virtual TR 100-1 from the tunnel mapping controller 200, it performs a hole punching message transmission and reception process with the moved second virtual TR 100-2' (S470). Next, each of the virtual TRs checks whether the message transmission and reception are successful (S480 and S485). An IP address for message transmission and reception to perform the S470 step is based on the mapped IP/port contained in the information that the first virtual TR 100-1 received from the tunnel mapping controller 200 in step S460.

Meanwhile, if exact values of the connection type and operation mode are contained in the information notified in step S460, it is determined whether the hole punching message transmission and reception process performed in step S470 either between the virtual TRs or by the tunnel mapping controller 200 can be omitted. If so, the corresponding process can be omitted. As the process of determining whether to omit the hole punching message transmission and reception process is well-known, a detailed description thereof will be omitted in the exemplary embodiment of the present invention.

Afterwards, if the hole punching message transmission and reception process is successful, or a message exchange using the mapped IP/port is always possible, for example, in a public/open relationship, a message exchange process for creating or updating a tunnel between the first virtual TR 100-1 and the second virtual TR 100-2' is performed (S490). At this time,

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0046

virtual network prefix information as well is exchanged and updated.

However, if the hole punching message transmission and reception process is not successful, an update message is exchanged through the procedure shown in FIG. 5. Further, the procedure is performed not with the second virtual TR 100-2 shown in FIG. 5 but with the moved second virtual TR 100-2'.

An example of the method of transmitting connection change information of the second virtual TR 100-2' to the first virtual TR 100-1 in step S460 of FIG. 6 includes a method in which the second virtual TR 100-2' receives a list from the tunnel mapping controller 200 and then the second virtual TR 100-2' autonomously exchanges an update message with the first virtual TR 100-1 as needed. This will be described with reference to FIG. 7.

FIG. 7 is a flowchart showing a procedure for notifying a virtual TR of connection change information according to another exemplary embodiment of the present invention.

As shown in FIG. 7, when the second virtual TR 100-2 moves and is connected and registered to a new network (S500), it is assigned a new IP from the network (S510). After connecting to a new network using the IP assigned in step S510, the moved second virtual TR 100-2' transmits a registration and information update request message to the tunnel mapping controller 200 in order to update its registration and connection information (S520).

The tunnel mapping controller 200 updates the information based on the registration and information update request message transmitted from the moved second virtual TR 100-2' (S530). Although the procedure of step S430

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0047

explained in FIG. 6 is performed between steps S520 and S530, this step can be omitted for convenience.

When the tunnel mapping controller 200 updates the information of the moved second virtual TR 100-2' through step S530, information on the first virtual TR 100-1 included in the virtualized network to which the second virtual TR 100-2' is connected is searched for (S540) and transmitted to the second virtual TR 100-2' (S550). The second virtual TR 100-2' having received the first virtual TR 100-1 performs a home punching message transmission and reception process with the first virtual TR 100-1 as needed, and exchanges a message for tunnel creation or update (S560). At this time, virtual network prefix information as well is exchanged and updated. The procedures subsequent to step S560 are consistent with steps S480 to S490 of FIG. 6, so detailed descriptions thereof will be omitted for FIG. 7.

Next, a method of communication between a terminal located inside a virtualized network area and a terminal or server existing outside the virtualized network area will be described with reference to FIGS. 8A and 8B. A virtual IP explained in the exemplary embodiment of the present invention may be a public IP or private IP. Also, the virtual IP may be IPv4 or IPv6.

FIGS. 8A and 8B are flowcharts showing a method of communication between a terminal inside a virtualized network and a terminal outside the virtualized network according to an exemplary embodiment of the present invention.

The method of communication from the virtualized network shown in FIGS. 8A and 8B to the internet corresponds to the case where the virtual IP

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0048

is actually a private IP. The virtualized network using a private IP is basically blocked from an external network, i.e., the internet. However, when nodes inside the virtualized network require communication to the internet, the communication is performed using the method shown in FIGS. 8A and 8B.

First, as shown in FIG. 8A, a virtual TR converts a network address for the virtual IP of a packet coming from the virtual TR toward the network, i.e., performs an NAT function. Accordingly, a virtual TR basically performs various operations associated with the tunnel mapping controller 200 and the functions of tunneling and virtual network prefix information exchange between associated virtual TRs, and additionally performs the function of NAT on the virtual IP toward the internet.

Meanwhile, as shown in FIG. 8B, when it is necessary to manage and control data transmitted to the internet for a particular purpose, an internet relay in charge of processing packets toward the internet is included in the virtualized network to perform the NAT function, rather than performing the NAT function by all the virtual TRs.

In this case, the respective virtual TRs establish a tunnel for an internet packet with the internet relay in order to process data via the internet. Also, to put a packet toward the internet on the established tunnel, a tunnel using an IP packet excluding a virtual network prefix segment established in a virtual network is used.

The internet relay performs the function of establishing a tunnel from each virtual TR. When a packet received by tunneling is forwarded to the internet, the outer header and the UDP header are deleted first, and then a

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0049

network transmission conversion function is performed based on the source IP/port (virtual IP/port) of the inner header. As a concrete method of conversion into NAT is already well-known, a detailed description thereof will be omitted in the exemplary embodiment of the present invention.

According to an exemplary embodiment of the present invention, a large-scale virtualized network capable of direct communication can be constructed, and network-based mobility can be supported.

While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0050

WHAT IS CLAIMED IS:

1. A communication method that provides end-to-end communication in a virtual network environment, the method comprising:

a plurality of virtual tunnel routers comprising a first virtual tunnel router and a second virtual tunnel router receiving a message containing virtual network prefix information from a tunnel mapping controller;

determining whether the first virtual tunnel router has received a hole punching message from the second virtual tunnel router;

if the first virtual tunnel router has received a hole punching message, the first virtual tunnel router establishing a tunnel with the second virtual tunnel router based on the virtual network prefix information; and

the first virtual tunnel router performing direct communication with the second virtual tunnel router through the established tunnel.

2. The method of claim 1, wherein the receiving of a message comprises:

the first virtual tunnel router transmitting a registration request message to the tunnel mapping controller; and

if the first virtual tunnel router is a virtual router not registered in the tunnel mapping controller, the first virtual tunnel router receiving a response message containing virtual network prefix information created from the first virtual tunnel router from the tunnel mapping controller.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0051

3. The method of claim 2, comprising:

if the first virtual tunnel router is a pre-stored virtual tunnel router and the first virtual tunnel router has moved,

receiving an IP from a new virtual network to which the first virtual tunnel router has moved and registered;

the first virtual tunnel router connecting to the new virtual network using the received IP;

the first virtual tunnel router connected to the new virtual network, transmitting a registration and information update request message to the tunnel mapping controller; and

performing a tunnel creation procedure with virtual tunnel routers adjacent to the first virtual tunnel router.

4. The method of claim 3, wherein the performing of the tunnel creation procedure comprises the first virtual tunnel router connected to the new virtual network receiving adjacent virtual tunnel router information from the tunnel mapping controller.

5. The method of claim 1, comprising:

if the first virtual tunnel router has not received a hole punching message from the second virtual tunnel router,

the first virtual tunnel router performing a tunneling process with the tunnel mapping controller; and

when a tunnel is established between the first virtual tunnel router and

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0052

the tunnel mapping controller, the first virtual tunnel router connecting the received virtual network prefix information to the tunnel.

6. A communication method that provides end-to-end communication in a virtual network environment, the method comprising:

a tunnel mapping controller receiving a registration request message from a plurality of virtual tunnel routers;

checking whether information of the virtual tunnel router having transmitted the registration request message is pre-stored;

if the information of the virtual tunnel router is not registered, registering the information of the virtual tunnel router contained in the registration request message;

receiving a request from the virtual tunnel router to provide virtual network prefix information; and

creating a virtual network prefix for the virtual tunnel router having requested the virtual network prefix information and transmitting the same to enable direct communication between the virtual tunnel routers.

7. The method of claim 6, comprising:

if the information of the virtual tunnel router is registered, updating with the information of the virtual tunnel router contained in the registration request message; and

transmitting the updated information to a virtual tunnel router adjacent to the virtual tunnel router having transmitted the registration request message.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0053

8. The method of claim 7, comprising,

after updating with the information of the virtual tunnel router,

transmitting information of the adjacent virtual tunnel router to the virtual tunnel router.

9. The method of claim 6, comprising:

after enabling direct communication,

upon receipt of a request for a tunneling procedure from any one of the plurality of virtual tunnel routers, performing a tunnel establishment procedure with the virtual tunnel router having requested the tunneling procedure; and

when a tunnel with the virtual tunnel router is established, controlling the virtual tunnel router and the adjacent virtual tunnel router to establish direct communication through the established tunnel.

10. A communication method that enables direct communication between a plurality of virtual tunnel routers including a first virtual tunnel router and a second virtual tunnel router by working in conjunction with a tunnel mapping controller, the method comprising:

the first virtual tunnel router and the second virtual tunnel router requesting virtual network prefix information from the tunnel mapping controller;

the tunnel mapping controller generating virtual network prefix information of the first virtual tunnel router and second virtual tunnel router, respectively, and transmitting the same along with information of a list of

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0054

adjacent virtual tunnel routers;

the first virtual tunnel router and the second virtual tunnel router creating a tunnel; and

performing direct communication between the first virtual tunnel router and the second virtual tunnel router by linking the virtual network prefix information received by the first virtual tunnel router and the second virtual tunnel router, respectively.

11. The method of claim 10, comprising:

before requesting for the virtual prefix information,

the first virtual tunnel router and the second virtual tunnel router transmitting a registration request message to the tunnel mapping controller;

the tunnel mapping controller determining whether the first and second virtual tunnel routers are pre-stored virtual tunnel routers based on the transmitted registration request message; and

if the first and second virtual tunnel routers are not pre-stored virtual tunnel routers, the tunnel mapping controller storing information contained in the registration request message and registering the first virtual tunnel router and the second virtual tunnel router.

12. The method of claim 10, wherein the creating of a tunnel comprises:

the first virtual tunnel router and the second virtual tunnel router transmitting and receiving a hole punching message based on the information

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0055

of a list of virtual tunnel routers;

determining whether the transmission and reception of the hole punching message between the first virtual tunnel router and the second virtual tunnel router are successful;

if any one of the virtual tunnel routers fails in the transmission and reception of the hole punching message, the first virtual tunnel router and the second virtual tunnel router each establishing a tunnel with the tunnel mapping controller; and

the first virtual tunnel router and the second virtual tunnel router each linking the received virtual network prefix information to the established tunnel.

13. The method of claim 10, comprising:

when the second virtual tunnel router moves after the performing of direct communication,

registering the second virtual tunnel router to a virtual network to which the second virtual tunnel router has moved, and receiving an IP from the virtual network;

the second virtual tunnel router transmitting a registration/information update request message containing the received IP to the tunnel mapping controller;

the tunnel mapping controller updating the information of the second virtual tunnel router with the virtual tunnel router information contained in the registration/information update request message;

the tunnel mapping controller searching for an adjacent virtual tunnel

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0056

router having a tunnel established with the second virtual tunnel router; and

the tunnel mapping controller transmitting the updated virtual tunnel router information to the searched adjacent virtual tunnel router.

14. The method of claim 13, comprising,

after the transmitting of the updated virtual tunnel router information,

creating a tunnel between the second virtual tunnel router and the adjacent virtual tunnel router.

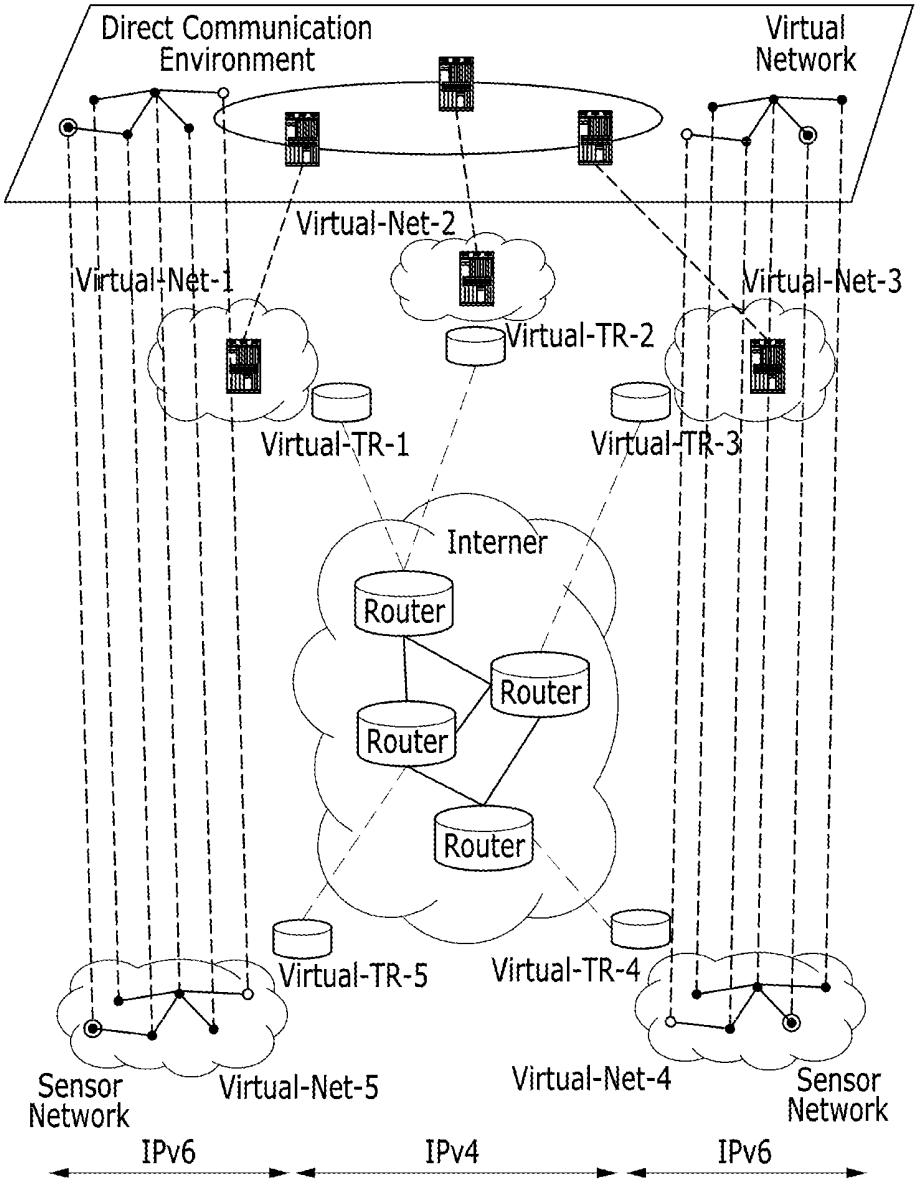
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0057

ABSTRACT

In a plurality of virtual tunnel routers including a first virtual tunnel router and a second virtual tunnel router, the first virtual tunnel router and the second virtual tunnel router request virtual network prefix information from a tunnel mapping controller. When the tunnel mapping controller generates virtual network prefix information of the first virtual tunnel router and the second virtual tunnel router, respectively, and transmits the same along with information of a list of adjacent virtual tunnel routers, the first virtual tunnel router and the second virtual tunnel router create a tunnel. With the tunnel established, the virtual network prefix information received by the first virtual tunnel router and second virtual tunnel router, respectively, is linked so that direct communication can be performed between the first virtual tunnel router and the second virtual tunnel router.

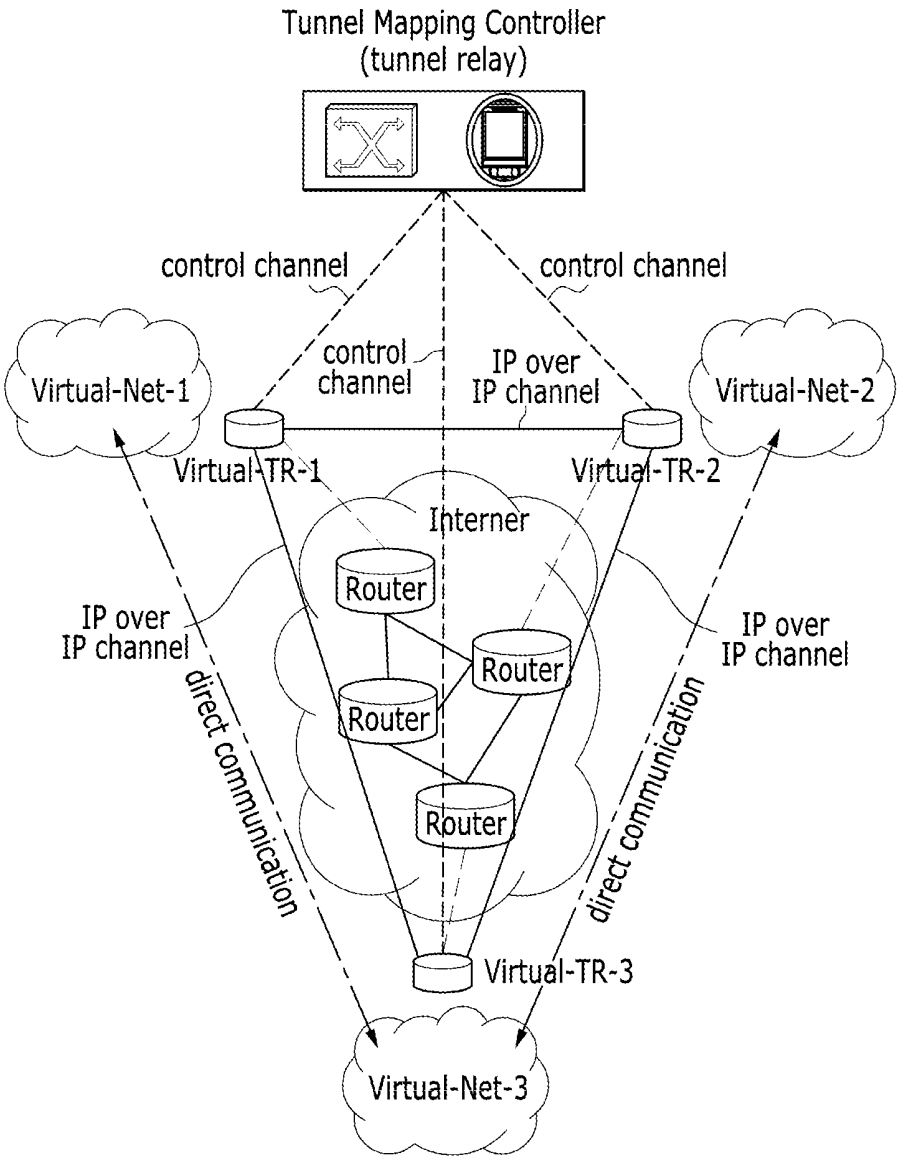
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0058

FIG. 1



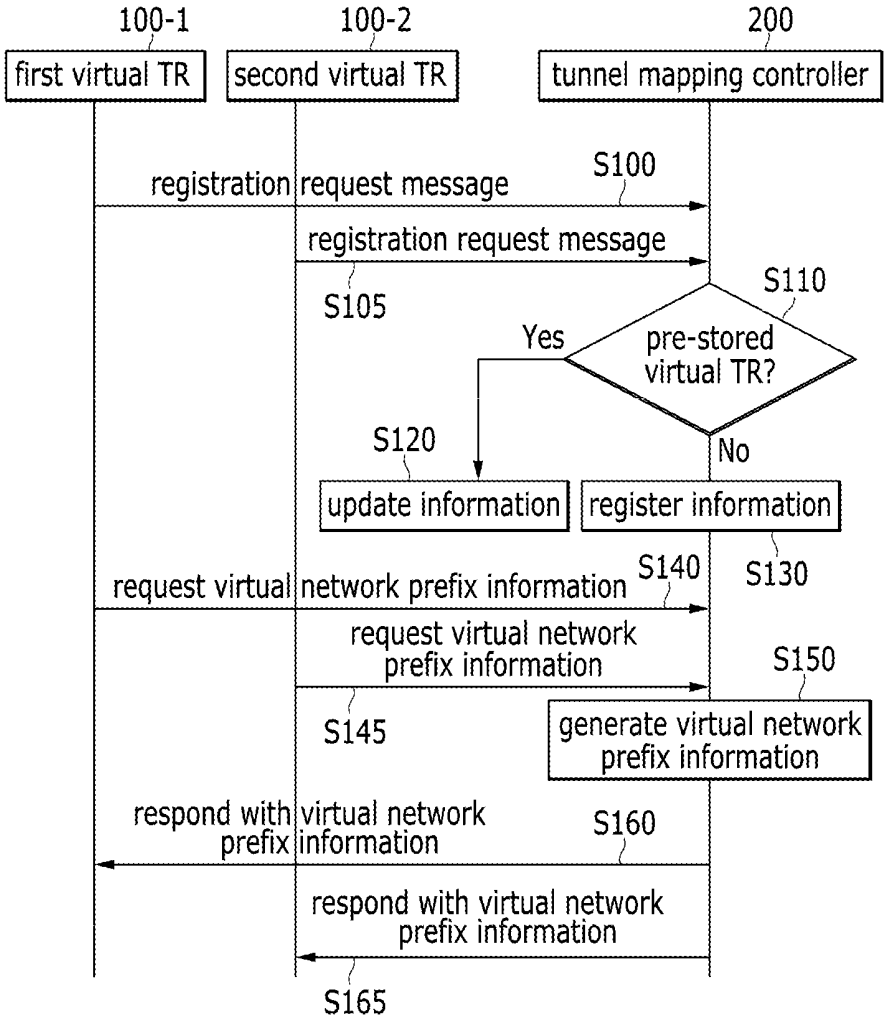
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0059

FIG. 2



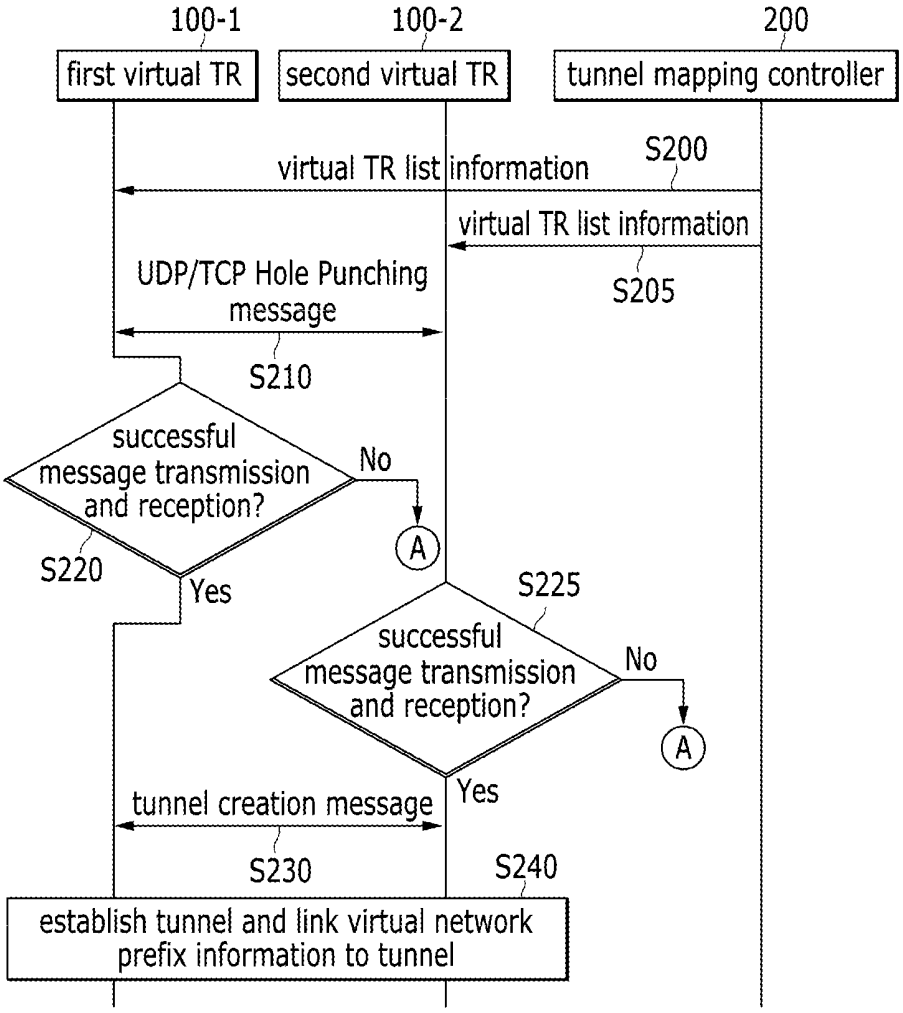
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0060

FIG. 3



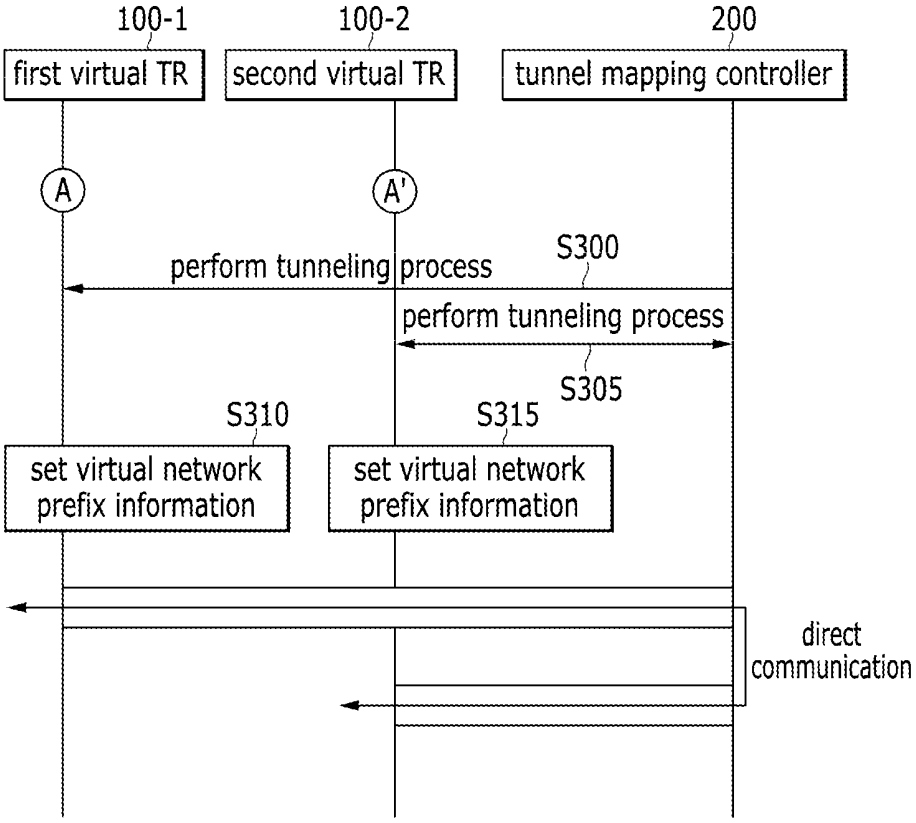
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0061

FIG. 4



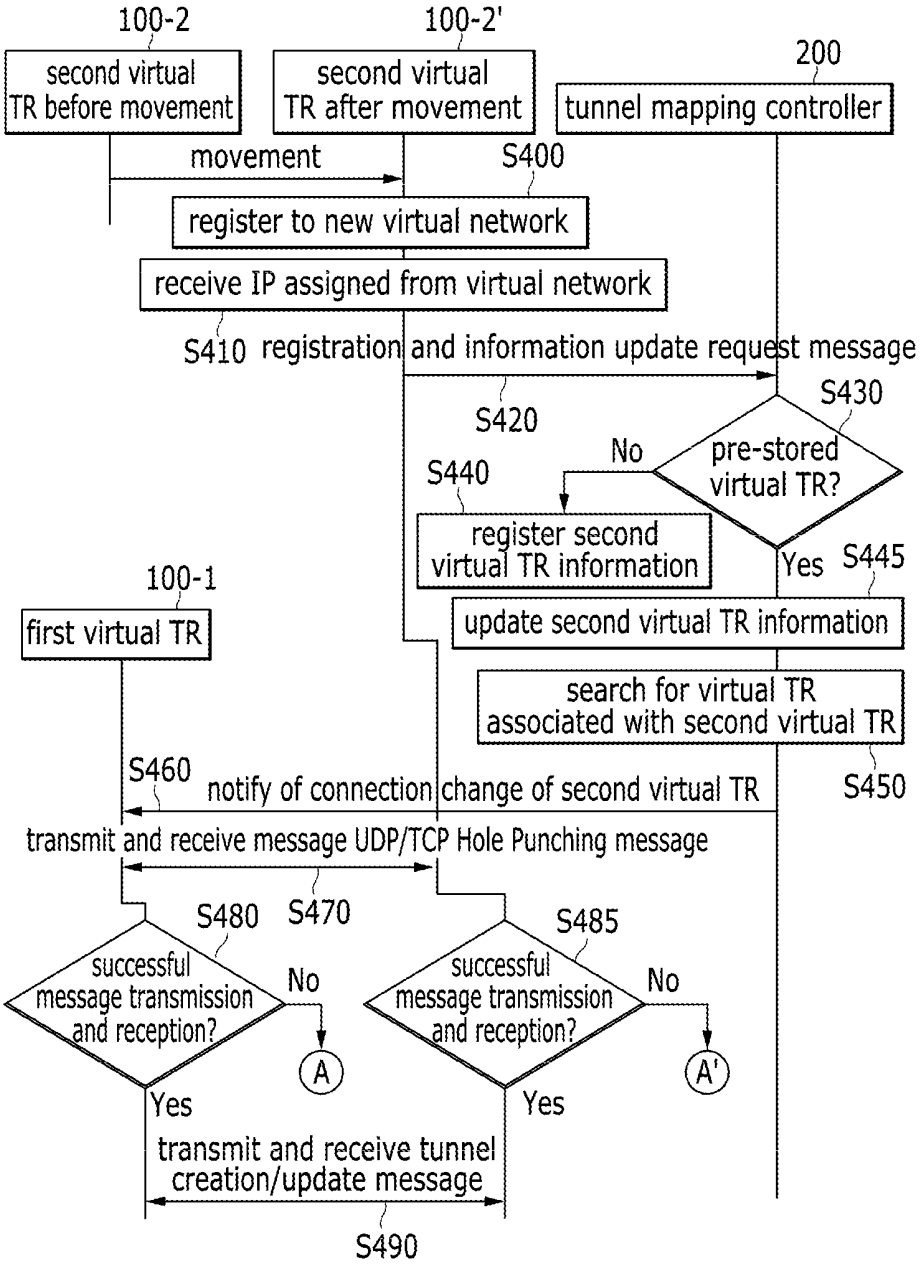
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0062

FIG. 5



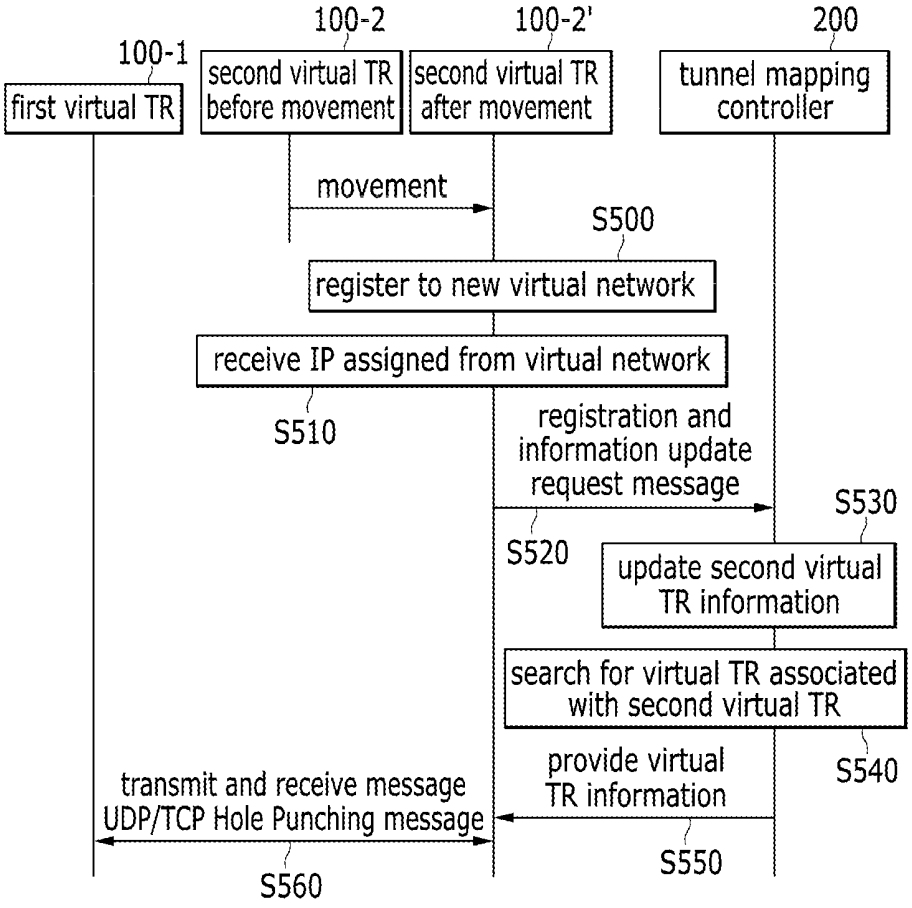
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0063

FIG. 6



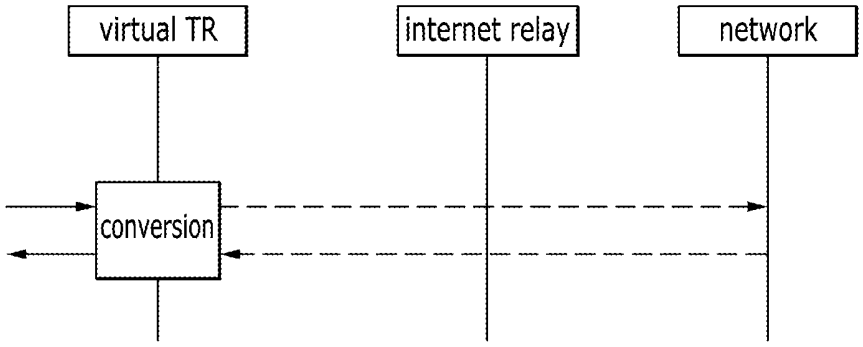
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0064

FIG. 7



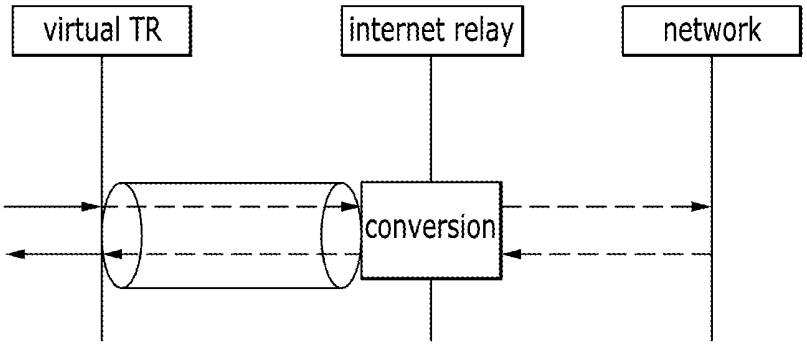
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0065

FIG. 8A



Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0066

FIG. 8B



Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0067

Attorney Docket No.: 110PK-074000US
Client Reference No.: IP20100490_Pan

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I 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:

METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

as described and claimed in the specification which

☒ is attached hereto

☐ was filed on _____, as Application Serial No. _____, and was amended on _____ (if applicable).

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 to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby appoint each practitioner at Customer No. 83220, my attorney(s) and/or agent(s) with full power of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Send all correspondence to:

Steve Cho, Reg. No. 44,612
Customer No. 83220

Send Correspondence to:	Direct Telephone Calls to:
Steve Y. Cho **AMPACC Law Group** **13024 Beverly Park Rd., Ste 205** **Mukilteo, WA 98275**	(Name, Reg. No., Telephone No.) Name: Steve Y. Cho Reg. No.: 44,612 Telephone: 425-348-3500

I hereby declare that I have reviewed and understand the contents of this Declaration, and 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.

Full Name of Inventor 1:	Last Name: **Kim**	Suffix:	First Name: **Sun Cheul**	Middle Name or Initial:	
Signature of Inventor 1				Date: 11. Aug. 2011	
Residence & Citizenship:	City: **Daejeon**		State/Foreign Country: **Republic of Korea**	Country of Citizenship: **Korean**	
Post Office Address:	Post Office Address: **410-1403, Yeolmaemaeul Apt., Jijok-dong, Yuseong-gu, Daejeon, 305-770, Republic of Korea**		City: **Daejeon**	State/Country: **Republic of Korea**	Postal Code:

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0068

Full Name of Inventor 2:	Last Name: **Moon**	Suffix:	First Name: **Seong**	Middle Name or Initial:	
Signature of Inventor 2	Seong Moon			Date: 11. Aug. 2011	
Residence & Citizenship:	City: **Daejeon**		State/Foreign Country: **Republic of Korea**	Country of Citizenship: **Korean**	
Post Office Address:	Post Office Address: **705-1803, Yeolmae Maeul 7-danji, Jijok-dong, Yuseong-gu, Daejeon, 305-770, Republic of Korea**		City: **Daejeon**	State/Country: **Republic of Korea**	Postal Code:

Full Name of Inventor 3:	Last Name: **Hong**	Suffix:	First Name: **Seungwoo**	Middle Name or Initial:	
Signature of Inventor 3	Hong Seungwoo			Date: 11. Aug. 2011	
Residence & Citizenship:	City: **Daejeon**		State/Foreign Country: **Republic of Korea**	Country of Citizenship: **Korean**	
Post Office Address:	Post Office Address: **1007-304, Techno Valley Apt., Gwanpyung-dong, Yuseong-gu, Daejeon, 305-509, Republic of Korea**		City: **Daejeon**	State/Country: **Republic of Korea**	Postal Code:

Full Name of Inventor 4:	Last Name: **Yoon**	Suffix:	First Name: **Ho Sun**	Middle Name or Initial:	
Signature of Inventor 4	H.S. Yoon			Date: 11. Aug. 2011	
Residence & Citizenship:	City: **Daejeon**		State/Foreign Country: **Republic of Korea**	Country of Citizenship: **Korean**	
Post Office Address:	Post Office Address: **706-703, Techno Valley, Gwanpyung-dong, Yuseong-gu, Daejeon, 305-756, Republic of Korea**		City: **Daejeon**	State/Country: **Republic of Korea**	Postal Code:

Full Name of Inventor 5:	Last Name: **Ryu**	Suffix:	First Name: **Ho Yong**	Middle Name or Initial:	
Signature of Inventor 4	Ryu Ho Yong			Date: 11. Aug. 2011	
Residence & Citizenship:	City: **Daejeon**		State/Foreign Country: **Republic of Korea**	Country of Citizenship: **Korean**	
Post Office Address:	Post Office Address: **101-1001, Mujigae Apt., Wolpyung 2-dong, Seo-gu, Daejeon, 302-750, Republic of Korea**		City: **Daejeon**	State/Country: **Republic of Korea**	Postal Code:

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0069

Application Data Sheet

Application Information

Application number::	Unassigned
Filing Date::	Herewith
Application Type::	Regular
Subject Matter::	Utility
Suggested classification::	
Suggested Group Art Unit::	
CD-ROM or CD-R??::	
Number of CD disks::	
Number of copies of CDs::	
Sequence Submission::	
Computer Readable Form (CRF)?::	
Number of copies of CRF::	
Title::	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT
Attorney Docket Number::	110PK-074000US
Request for Early Publication::	No
Request for Non-Publication::	No
Suggested Drawing Figure::	1
Total Drawing Sheets::	9
Small Entity?::	YES
Latin name::	
Variety denomination name::	
Petition included?::	No
Petition Type::	
Licensed US Govt. Agency::	
Contract or Grant Numbers One::	

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0070

Secrecy Order in Parent Appl.::	No

Applicant Information

Applicant Authority Type::	Inventor
Primary Citizenship Country::	Republic of Korea
Status::	Full Capacity
Given Name::	Sun Cheul
Middle Name::	
Family Name::	KIM
Name Suffix::	
City of Residence::	Daejeon
State or Province of Residence::	
Country of Residence::	Republic of Korea
Street of Mailing Address::	410-1403, Yeolmaemaeul Apt., Jijok-dong, Yuseong-gu
City of Mailing Address::	Daejeon
State or Province of mailing address::	
Country of mailing address::	Republic of Korea
Postal or Zip Code of mailing address::	305-770

Applicant Authority Type::	Inventor
Primary Citizenship Country::	Republic of Korea
Status::	Full Capacity
Given Name::	Seong
Middle Name::	
Family Name::	MOON
Name Suffix::	
City of Residence::	Daejeon
State or Province of Residence::	
Country of Residence::	Republic of Korea

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0071

Street of Mailing Address::	705-1803, Yeolmae Maeul 7-danji, Jijok-dong, Yuseong-gu
City of Mailing Address::	Daejeon
State or Province of mailing address::	
Country of mailing address::	Republic of Korea
Postal or Zip Code of mailing address::	305-770

Applicant Authority Type::	Inventor
Primary Citizenship Country::	Republic of Korea
Status::	Full Capacity
Given Name::	Seungwoo
Middle Name::	
Family Name::	HONG
Name Suffix::	
City of Residence::	Daejeon
State or Province of Residence::	
Country of Residence::	Republic of Korea
Street of Mailing Address::	1007-304, Techno Valley Apt., Gwanpyung-dong, Yuseong-gu
City of Mailing Address::	Daejeon
State or Province of mailing address::	
Country of mailing address::	Republic of Korea
Postal or Zip Code of mailing address::	305-509

Applicant Authority Type::	Inventor
Primary Citizenship Country::	Republic of Korea
Status::	Full Capacity
Given Name::	Ho Sun
Middle Name::	
Family Name::	YOON
Name Suffix::	

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0072

City of Residence::	Daejeon
State or Province of Residence::	
Country of Residence::	Republic of Korea
Street of Mailing Address::	706-703, Techno Valley, Gwanpyung-dong, Yuseong-gu
City of Mailing Address::	Daejeon
State or Province of mailing address::	
Country of mailing address::	Republic of Korea
Postal or Zip Code of mailing address::	305-756

Applicant Authority Type::	Inventor
Primary Citizenship Country::	Republic of Korea
Status::	Full Capacity
Given Name::	Ho Yong
Middle Name::	
Family Name::	RYU
Name Suffix::	
City of Residence::	Daejeon
State or Province of Residence::	
Country of Residence::	Republic of Korea
Street of Mailing Address::	101-1001, Mujigae Apt., Wolpyung 2-dong, Seo-gu
City of Mailing Address::	Daejeon
State or Province of mailing address::	
Country of mailing address::	Republic of Korea
Postal or Zip Code of mailing address::	302-750

Correspondence Information

Correspondence Customer Number::	83220

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0073

Representative Information

Representative Customer Number:: 83220

Domestic Priority Information

Application::	Continuity Type::	Parent Application::	Parent Filing Date::

Foreign Priority Information

Country::	Application number::	Filing Date::
Republic of Korea	10-2010-0107107	October 29, 2010

Assignee Information

Assignee Name::	Electronics and Telecommunications Research Institute
Street of mailing address::	161 Gajeong-dong, Yuseong-gu
City of mailing address::	Daejeon
State or Province of mailing address::	
Country of mailing address::	Republic of Korea
Postal or Zip Code of mailing address::	305-350

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0074

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 NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/234,425	09/16/2011	2465	462	110PK-074000US	14	3

CONFIRMATION NO. 6384

83220
AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

FILING RECEIPT



Date Mailed: 09/30/2011

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Sun Cheul KIM, Daejeon, KOREA, REPUBLIC OF;
Seong Moon, Daejeon, KOREA, REPUBLIC OF;
Seungwoo Hong, Daejeon, KOREA, REPUBLIC OF;
Ho Sun Yoon, Daejeon, KOREA, REPUBLIC OF;
Ho Yong Ryu, Daejeon, KOREA, REPUBLIC OF;

Assignment For Published Patent Application

Electronics and Telecommunications Research Institute, Daejeon, KOREA, REPUBLIC OF

Power of Attorney: The patent practitioners associated with Customer Number 83220

Domestic Priority data as claimed by applicant

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2010-0107107 10/29/2010

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

If Required, Foreign Filing License Granted: 09/28/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/234,425**

Projected Publication Date: 05/03/2012

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0075

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

Preliminary Class

370

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0076

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0077

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/234,425

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	95		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	310		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	125		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	14 minus 20 =	*	x 30 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*	x 125 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	530		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L 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 found in the appropriate box in column 1.

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/234,425	09/16/2011	Sun Cheul KIM	110PK-074000US

CONFIRMATION NO. 6384

83220
AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

PUBLICATION NOTICE



Title:METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

Publication No.US-2012-0106559-A1
Publication Date:05/03/2012

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0079



별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office

출 원 번 호 : 10-2010-0107107
Application Number

출 원 년 월 일 : 2010년 10월 29일
Filling Date OCT. 29, 2010

출 원 인 : 한국전자통신연구원
Applicant(s) Electronics and Telecommunications Research Institute

2012년 06월 01일

특 허 청
COMMISSIONER

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0080

제출 일자 : 2010-10-29

【서지사항】

【서류명】 특허출원서

【참조번호】 3429

【출원구분】 특허출원

【출원인】

【명칭】 한국전자통신연구원

【출원인코드】 3-1998-007763-8

【대리인】

【명칭】 유미특허법인

【대리인코드】 9-2001-100003-6

【지정된변리사】 이원일, 이석암

【포괄위임등록번호】 2008-052949-9

【발명의 국문명칭】 가상 네트워크 환경에서 네트워크 단위의 통신 방법

【발명의 영문명칭】 Method for supporting network-based mobility in virtual network environment that can be direct communication based on virtual IP

【발명자】

【성명】 김선철

【성명의 영문표기】 KIM, SUN CHEUL

【주민등록번호】 721112-1XXXXXX

【우편번호】 305-770

【주소】 대전 유성구 지족동 열매마을아파트 410동 1403호

【국적】 KR

【발명자】

【성명】 문성

【성명의 영문표기】 MOON, SEONG

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0081

제출 일자 : 2010-10-29

【주민등록번호】 711105-1XXXXXX

【우편번호】 305-770

【주소】 대전 유성구 지족동 열매마을7단지 705동 1803호

【국적】 KR

【발명자】

【성명】 홍승우

【성명의 영문표기】 HONG, SEUNGWOO

【주민등록번호】 730317-1XXXXXX

【우편번호】 305-509

【주소】 대전시 유성구 관평동 테크노밸리아파트 1007동 304호

【국적】 KR

【발명자】

【성명】 윤호선

【성명의 영문표기】 YOON, HO SUN

【주민등록번호】 710205-1XXXXXX

【우편번호】 305-790

【주소】 대전 유성구 관평동 테크노밸리 706동 703호

【국적】 KR

【발명자】

【성명】 류호용

【성명의 영문표기】 RYU, HO YONG

【주민등록번호】 680611-1XXXXXX

【우편번호】 302-750

【주소】 대전 서구 월평2동 무지개아파트 101동 1001호

【국적】 KR

【심사청구】 청구

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0082

제출 일자 : 2010-10-29

【유예희망시점】 심사청구일 후 18개월이 경과한 날부터 (18)개월

【기술이전희망】

【기술양도】 희망

【실시권허여】 희망

【기술지도】 희망

【이 발명을 지원한 국가연구개발사업】

【과제고유번호】 10035196

【부처명】 지식경제부/방송통신위원회

【연구사업명】 정보통신산업원천기술개발사업

【연구과제명】 All-IP 융합 네트워크를 위한 통합 시그널링 기술개발

【주관기관】 한국전자통신연구원

【연구기간】 2010.03.01~2011.02.28

【취지】 위와 같이 특허청장에게 제출합니다.

대리인 유미특허법인 (서명 또는 인)

【수수료】

【출원료】 0 면 38,000 원

【가산출원료】 40 면 0 원

【우선권주장료】 0 건 0 원

【심사청구료】 14 항 690,000 원

【합계】 728,000 원

【감면사유】 정부출연연구기관

【감면후 수수료】 364,000 원

【수수료 자동납부번호】 064-059182-01-018

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0083

제출 일자 : 2010-10-29

【명세서】

【발명의 명칭】

가상 네트워크 환경에서 네트워크 단위의 통신 방법{Method for supporting network-based mobility in virtual network environment that can be direct communication based on virtual IP}

【기술분야】

<1> 본 발명은 가상 네트워크 환경에서 네트워크 단위의 통신 방법에 관한 것이다.

【배경기술】

<2> IP(Internet Protocol) 네트워크는 외부로부터의 접근을 차단하거나 IP의 부족으로 인해 방화벽(Firewall)이나 네트워크 주소 변환 장치(Network Address Translation, NAT)를 사용하고 있다. 이러한 환경에서 통신 시장은 게임이나 메신저 등과 같은 서비스에서 피어 투 피어(Peer-to-peer, P2P) 기술을 적용하기 위한 많은 노력을 하고 있다.

<3> NAT나 방화벽이 포함되어 있는 IP 네트워크에서는 서버의 도움을 통하여 P2P L4(Layer 4) 수준의 직접 통신을 제공하고 있다.

<4> P2P 직접 통신을 위해서 각 단말은 자신의 네트워크 접속 유형을 확인해야 한다. 그리고 단말이 공용 네트워크(Public network)에 접속하였다면 단말은 방화벽의 유무를 확인해야 하며, 단말이 NAT를 사용하는 네트워크에 접속하였다면 NAT

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0084

의 유형을 확인해야 한다. 이때 방화벽이 없는 경우를 개방(open)이라 한다. NAT의 유형으로 풀콘(Full Cone), 제한적인 콘(Restricted Cone), 포트 제한적인 콘(Port Restricted Cone) 및 시메트릭(Symmetric)이 있을 수 있다.

<5> 표 1은 기존의 IP 네트워크에서 서버의 도움 없이 수신 단말(Receiver)과 송신 단말(Sender) 간 직접 통신 가능성을 나타낸다. 표 1에서, "open"은 개방을 의미하고, "Firewall"은 방화벽을 의미한다.

<6> 【표 1】

Sender / Receiver		Public		NAT			
		Open	Firewall	Full Cone	Restricted Cone	Port Restricted Cone	Symmetric
Public	Open	○	○	○	○	○	○
	Firewall	×	×	×	×	×	×
NAT	Full Cone	×	×	×	×	×	×
	Restricted Cone	×	×	×	×	×	×
	Port Restricted Cone	×	×	×	×	×	×
	Symmetric	×	×	×	×	×	×

<7> 표 1에 도시한 바와 같이, 수신 단말(Receiver)이 개방형 공용 네트워크(Public-Open)인 경우, 송신 단말(Sender)과 수신 단말(Receiver) 간 직접 통신이 가능하다.

<8> 그러나 NAT나 방화벽이 개입될 때, 송신 단말(Sender)과 수신 단말(Receiver)은 서버의 도움을 통하여 상대 단말의 변경된 IP 및 포트 정보를 획득하여야 통신을 수행할 수 있다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0085

<9> 표 2는 서버로부터 상대 단말의 변경된 IP 및 포트 정보를 획득한 경우의 수신 단말(Receiver)과 송신 단말(Sender) 간 직접 통신 가능성을 나타낸다.

<10> 【표 2】

Sender / Receiver		Public		NAT			
		Open	Firewall	Full Cone	Restricted Cone	Port Restricted Cone	Symmetric
Public	Open	○	○	○	○	○	○
	Firewall	×	×	×	×	×	×
NAT	Full Cone	○	○	○	○	○	○
	Restricted Cone	×	×	×	×	×	×
	Port Restricted Cone	×	×	×	×	×	×
	Symmetric	×	×	×	×	×	×

<11> 표 2를 보면, 수신 단말(Receiver)과 송신 단말(Sender)이 서버의 도움으로 상대 단말의 변경된 IP 및 포트 정보를 획득한 경우에도 수신 단말(Receiver)이 개방형 공용 네트워크(Public-Open)와 풀콘 NAT(NAT-Full Cone)인 경우에만 송신 단말(Sender)과 수신 단말(Receiver) 간 직접 통신이 가능하다.

<12> 또한, 송신 단말(Sender)과 수신 단말(Receiver) 간 직접 통신을 위해 TCP 또는 UDP 홀 펀칭(Hole Punching)이 수행되기도 한다. 표 3은 서버로부터 상대 단말의 변경된 IP 및 포트 정보를 이용하여 홀 펀칭을 수행한 후 수신 단말(Receiver)과 송신 단말(Sender) 간 직접 통신 가능성을 나타낸다. 표 3에서, ▲은 송신 단말(Sender)과 수신 단말(Receiver) 중 하나가 시메트릭 NAT(NAT-Symmetric)를 사용할 때 IP는 변경하지 않고 포트(port)만 변경하는 경우에만 직접

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0086

통신이 가능하고, IP를 변경한 경우에도 상대 노드가 제한적인 콘 NAT(NAT-Restricted Cone)인 경우에는 직접 통신이 불가능한 것을 나타낸다.

<13> 【표 3】

Sender / Receiver		Public		NAT			
		Open	Firewall	Full Cone	Restricted Cone	Port Restricted Cone	Symmetric
Public	Open	○	○	○	○	○	○
	Firewall	○	○	○	○	○	×
NAT	Full Cone	○	○	○	○	○	○
	Restricted Cone	○	○	○	○	○	▲
	Port Restricted Cone	○	○	○	○	○	×
	Symmetric	○	×	○	▲	×	×

<14> 표 3을 보면, 홀 펀칭(Hole Punching)이 수행되더라도 송신 단말(Sender)과 수신 단말(Receiver)의 모든 접속 유형에 대하여 송신 단말(Sender)과 수신 단말(Receiver) 간 직접 통신이 가능한 것은 아니다.

<15> 즉, 시메트릭 NAT(NAT-Symmetric)와 시메트릭 NAT(NAT-Symmetric), 시메트릭 NAT(NAT-Symmetric)와 방화벽이 있는 공용 네트워크(Public-Firewall), 시메트릭 NAT(NAT-Symmetric)와 포트 제한적인 콘 NAT(NAT-Port Restricted Cone)간은 직접 통신이 불가능함을 알 수 있다.

<16> 그러나, 이러한 경우에도 TURN(Traversal Using Relay NAT)을 사용하여 직접 통신을 가능하게 할 수 있다. TURN은 개방형 공용 네트워크(Public-Open)에 접속되어 있는 장치를 통해 직접 통신을 가능하게 한다. 즉, 송신 단말(Sender)과 수

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0087

신 단말(Receiver)은 각각 상대 단말과 통신을 위하여 개방형 공용 네트워크(Public-Open)에 접속되어 있는 장치로 데이터를 전송하고, 이 장치는 패킷을 변형하여 데이터를 상대 단말로 전송함으로써 직접 통신을 가능하게 한다.

<17> 이와 같이, 송신 단말(Sender)과 수신 단말(Receiver) 간 직접 통신을 가능하게 하는 방법은 서비스별 즉, L4(Layer 4) 세션 각각에 대해 수행되어야 하기 때문에, 하나의 단말에서 직접 통신을 위해 다수의 세션이 동작하는 경우에 빈번한 처리 절차가 발생하게 된다. 또한, 이러한 직접 통신 방법은 P2P에만 적용되고 있는 기술이기 때문에, VIP(Virtual IP) 기반의 직접 통신이 가능한 가상화 네트워킹 환경과 네트워크 단위로 이동하는 경우의 가상 네트워크 접속 방법이 필요하다.

<18> 즉, 라우터로 구성된 기존 인터넷에서 단말들은 NAT 또는 방화벽(Firewall)에 연결되어 있는 경우가 많기 때문에, 단말 간의 직접 통신 환경을 제공받지 못하는 경우가 있다. 따라서 현재 대부분의 인터넷 서비스는 웹 중심 또는 중앙 집중형 서비스 형태로 이루어지고 있다.

<19> 그러나 개방형이라는 특징을 갖는 인터넷은 웹이나 중앙 집중형 서비스뿐만 아니라 단말 간의 다양한 통신 서비스를 제공할 수 있어야 하나, 현재의 인터넷 구조에서는 NAT/방화벽 등의 개입 때문에 많은 한계점이 존재한다. 또한, 기존 인터넷 구조는 단말이 인터넷에 접속할 때마다 새로운 IP를 네트워크로 할당받는데, 할당된 IP는 네트워크마다 항상 변하기 때문에 단말에 이동성 부분을 제공하기 어렵다. 따라서 새로운 ID 개념을 도입하는 가상 네트워크 환경에서 이동성을 지원하는 방법이 요구된다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0088

【발명의 내용】

【해결하려는 과제】

<20> 따라서, 본 발명은 가상 주소 기반의 직접 통신이 가능한 가상 네트워크 환경에서 네트워크 단위의 통신 방법을 제공한다.

【과제의 해결 수단】

<21> 상기한 목적을 달성하기 위한 본 발명의 실시예에 따른 특징인 가상 네트워크 환경에서 종단 간 통신을 제공하는 통신 방법은,

<22> 제1 가상 터널 라우터 및 제2 가상 터널 라우터를 포함하는 복수의 가상 터널 라우터가 터널 매핑 제어부로부터 가상 네트워크 프리픽스 정보를 포함하는 메시지를 수신하는 단계; 상기 제1 가상 터널 라우터가 상기 제2 가상 터널 라우터로부터 홀펀칭 메시지를 수신하였는지 판단하는 단계; 상기 제1 가상 터널 라우터가 홀펀칭 메시지를 수신하였다면, 상기 제1 가상 터널 라우터는 상기 가상 네트워크 프리픽스 정보를 토대로 상기 제2 가상 터널 라우터와의 터널을 설정하는 단계; 및 상기 제1 가상 터널 라우터는 상기 설정한 터널을 통해 상기 제2 가상 터널 라우터와 직접 통신을 수행하는 단계를 포함한다.

<23> 상기한 목적을 달성하기 위한 본 발명의 또 다른 실시예에 따른 특징인 가상 네트워크 환경에서 종단 간 통신을 제공하는 통신 방법은,

<24> 터널 매핑 제어부가 복수의 가상 터널 라우터로부터 등록 요청 메시지를 수신하는 단계; 상기 등록 요청 메시지를 전송한 가상 터널 라우터의 정보가 미리 등

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0089

록되어 있는지 확인하는 단계; 가상 터널 라우터의 정보가 등록되어 있지 않다면, 상기 등록 요청 메시지에 포함되어 있는 가상 터널 라우터의 정보를 등록하는 단계; 가상 터널 라우터로부터 가상 네트워크 프리픽스 정보의 제공을 요청받는 단계; 및 가상 네트워크 프리픽스 정보를 요청한 가상 터널 라우터에 대한 가상 네트워크 프리픽스를 생성하여 전송하여 가상 터널 라우터 간 직접 통신이 가능하도록 하는 단계를 포함한다.

<25> 상기한 목적을 달성하기 위한 본 발명의 또 다른 실시예에 따른 특징인 제1 가상 터널 라우터와 제2 가상 터널 라우터를 포함하는 복수의 가상 터널 라우터가 터널 매핑 제어부와 연동하여 직접 통신이 가능하도록 하는 통신 방법은,

<26> 상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터가 상기 터널 매핑 제어부로 가상 네트워크 프리픽스 정보를 요청하는 단계; 상기 터널 매핑 제어부가 상기 제1 가상 터널 라우터 및 상기 제2 가상 터널 라우터에 대한 가상 네트워크 프리픽스 정보를 각각 생성하여 인접한 가상 터널 라우터 목록 정보와 함께 전송하는 단계; 및 상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터가 터널을 생성하는 단계; 및 상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터가 각각 수신한 상기 가상 네트워크 프리픽스 정보를 연결하여, 상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터 간 직접 통신을 수행하는 단계를 포함한다.

【발명의 효과】

<27> 본 발명의 실시예에 따르면, 대규모의 직접 통신이 가능한 가상화 네트워크

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0090

를 구축할 수 있고, 네트워크 단위로의 이동성을 지원할 수 있다.

【도면의 간단한 설명】

<28> 도 1은 본 발명의 실시예에 따른 가상화 네트워크의 예시도이다.

도 2는 본 발명의 실시예에 따른 가상화 네트워크의 구조도이다.

도 3은 본 발명의 실시예에 따른 가상 네트워크 프리픽스 관리 및 할당 방법을 나타낸 흐름도이다.

도 4는 본 발명의 실시예에 따른 가상 TR의 터널링 절차를 나타낸 흐름도이다.

도 5는 본 발명의 실시예에 따른 터널 중계부를 통한 터널링 절차를 나타낸 흐름도이다.

도 6은 본 발명의 실시예에 따른 가상 TR가 이동한 후의 가상화 네트워크 접속 절차를 나타낸 흐름도이다.

도 7은 본 발명의 또 다른 실시예에 따른 변경된 접속 정보를 가상 TR로 알려주기 위한 절차를 나타낸 흐름도이다.

도 8a 및 도 8b는 본 발명의 실시예에 따른 가상화 네트워크 내부의 단말이 외부의 단말과 통신하는 방법을 나타낸 흐름도이다.

【발명을 실시하기 위한 구체적인 내용】

<29> 아래에서는 첨부한 도면을 참고로 하여 본 발명의 실시예에 대하여 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자가 용이하게 실시할 수 있도록 상

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0091

세히 설명한다. 그러나 본 발명은 여러 가지 상이한 형태로 구현될 수 있으며 여기에서 설명하는 실시예에 한정되지 않는다. 그리고 도면에서 본 발명을 명확하게 설명하기 위해서 설명과 관계없는 부분은 생략하였으며, 명세서 전체를 통하여 유사한 부분에 대해서는 유사한 도면 부호를 붙였다.

<30> 명세서 전체에서, 어떤 부분이 어떤 구성요소를 "포함"한다고 할 때, 이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다.

<31> 본 명세서에서 단말(terminal)은, 이동국(Mobile Station, MS), 이동 단말(Mobile Terminal, MT), 가입자국(Subscriber Station, SS), 휴대 가입자국(Portable Subscriber Station, PSS), 사용자 장치(User Equipment, UE), 접근 단말(Access Terminal, AT) 등을 지칭할 수도 있고, 이동 단말, 가입자국, 휴대 가입자 국, 사용자 장치 등의 전부 또는 일부의 기능을 포함할 수도 있다.

<32> 본 명세서에서 기지국(Base Station, BS)은 접근점(Access Point, AP), 무선 접근국(Radio Access Station, RAS), 노드B(Node B), 송수신 기지국(Base Transceiver Station, BTS), MMR(Mobile Multihop Relay)-BS 등을 지칭할 수도 있고, 접근점, 무선 접근국, 노드B, 송수신 기지국, MMR-BS 등의 전부 또는 일부의 기능을 포함할 수도 있다.

<33> 이하 도면을 참조로 하여 본 발명의 실시예에 따른 가상 네트워크 환경에서 네트워크 단위의 이동성 지원 방법에 대하여 설명하기로 한다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0092

<34> 도 1은 본 발명의 실시예에 따른 가상화 네트워크의 예시도이다.

<35> 도 1에 도시된 바와 같이, 가상 IP를 기반으로 직접 통신 환경을 제공하는 가상화된 네트워크는 가상 터널 라우터(Virtual Tunnel Router, 이하 "가상 TR"이라 지칭함)(100-1 ~ 100-5)를 포함한다. 가상 TR(100-1 ~ 100-5)는 기존의 일반 라우터에 접속될 수 있으며, 단말이 접속하는 스위치나 이더넷 포트 또는 무선 신호 네트워크(예를 들어, WiFi, WiMax, 3G 네트워크 등)에 접속될 수도 있다. 또한, NAT나 방화벽이 개입되어 있는 네트워크에도 접속될 수 있다.

<36> 가상 TR(100-1 ~ 100-5)는 하나 또는 그 이상의 가상 네트워크(200-1 ~ 200-3)를 형성하는 네트워크 구성 요소로 동작한다. 각 가상 TR(100-1 ~ 100-5)간 IP-UDP/TCP-IP 터널(이하 "IP 터널"이라 지칭함)을 설정한다. 그리고 각 가상 네트워크를 구성하는 가상 네트워크 프리픽스(Prefix) 정보를 가상 TR간에 교환함으로써, 각 가상 네트워크에 위치하는 단말은 인터넷을 거쳐 연결되어 있는 원격지의 가상 네트워크의 단말과 직접 통신을 할 수 있다.

<37> 본 발명의 실시예에서는 가상 IP는 IP 터널의 이너 헤더(Inner header)에서 사용하는 IP주소로, IPv4 또는 IPv6 주소를 예로 하여 설명한다. 가상 IP는 가상화 네트워크상에서 각각의 가상 네트워크들을 식별할 수 있을 뿐만 아니라, 가상 네트워크 영역에 위치한 단말들을 식별할 수 있는 등, 변경되지 않는 구분자로서의 의미를 갖는다.

<38> 현재의 인터넷은 IPv4 네트워크와 IPv6 네트워크가 동시에 존재하지만, 두

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0093

상이한 네트워크 사이의 연계는 상당히 어려우며, 연계하여 운영하는 모습도 거의 볼 수 없는 상황이다. 본 발명의 실시예에서는 가상 IP와 네트워크 IP를 구분하여 사용하고, 가상 IP는 IPv4와 IPv6을 모두 사용할 수 있도록 한다. 따라서 지역적으로 분리되어 있고 사용되는 IP 구조도 상이한 기존 인터넷에 가상 TR와 가상 네트워크의 개념을 도입함으로써, 일관성 있고 체계적인 가상화 네트워크를 생성할 수 있다.

<39> 이러한 가상화 네트워크를 구성하여 이동성을 지원하기 위한 네트워크 구조에 대하여 도 2를 참조로 설명하기로 한다.

<40> 도 2는 본 발명의 실시예에 따른 가상화 네트워크의 구조도이다.

<41> 도 2에 도시된 바와 같이, 가상화 네트워크는 네트워크의 외부에 위치하고 있는 가상 TR(100-1 ~ 100-3)들이 서로 통신할 수 있도록, 네트워크상에 위치하는 터널 매핑 제어부(200)와 터널 중계부(300)를 포함하다.

<42> 터널 매핑 제어부(200)는 복수의 가상 TR들 간의 터널링 및 다양한 시그널링 메시지를 처리하고 제어하는 역할을 수행한다. 즉, 터널 매핑 제어부(200)는 각각의 가상 TR(100-1 ~ 100-3)들과의 연계 동작을 통해, IP 터널을 설정하고 각각의 가상 IP 프리픽스를 설정된 터널에 연결하여, 가상 네트워크들 간에 직접 통신이 가능하도록 한다.

<43> 이를 위해 터널 매핑 제어부(200)에는 가상 네트워크 프리픽스 정보 테이블이 포함되어 있다. 그리고 가상 TR(100-1 ~ 100-3)들이 자신들을 등록한 후 가상

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0094

네트워크 프리픽스 정보를 요청하면, 가상 네트워크 프리픽스를 할당하여 각각의 가상 TR(100-1 ~ 100-3)들에 전달한다.

<44> 터널 중계부(300)는 가상 TR들 간에 터널을 설정하지 못하는 경우를 대비하여 중앙에서 터널링을 수행하고, 터널링된 데이터를 포워딩하는 기능을 수행한다. 가상 TR(100-1 ~ 100-3)가 인터넷에 접속할 때 공용(Public)으로 접속할 수도 있고 NAT에 접속할 수도 있으며, 방화벽이 개입될 수도 있다.

<45> 따라서 터널 중계부(300)는 각각의 가상 TR(100-1 ~ 100-3)들간에 터널 설정이 불가능한 경우, 각 가상 TR(100-1 ~ 100-3)의 터널을 설정한다. 터널 중계부(300)는 터널 매핑 제어부(200)와 같은 구성 요소에 포함되어 구현될 수도 있고, 물리적으로 다른 위치의 다른 구성 요소에 포함되어 구현될 수도 있다.

<46> 이와 같이 터널 매핑 제어부(200)와 터널 중계부(300)를 통해 제1 가상 네트워크(200-1), 제2 가상 네트워크(200-2) 및 제3 가상 네트워크(200-3) 간에는, 네트워크 영역에 있는 단말들에 직접 통신 환경을 제공할 수 있다. 이러한 구조에서 네트워크 단위의 이동성을 지원하기 위해 가상 네트워크 프리픽스를 관리하고 할당하는 절차에 대해 도 3을 참조로 설명하기로 한다. 설명에 앞서, 본 발명의 실시예에서는 복수의 가상 네트워크 중 설명의 편의상 두 개의 가상 네트워크(제1 가상 네트워크, 제2 가상 네트워크)와 두 개의 가상 TR(100-1, 100-2)을 예로 하여 설명한다.

<47> 도 3은 본 발명의 실시예에 따른 가상 네트워크 프리픽스 관리 및 할당 방법을 나타낸 흐름도이다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0095

<48> 가상 네트워크 프리픽스 정보는 각각의 가상 네트워크들에 접속하고 있는 단말 또는 장치들에 할당되는 주소이다. 예를 들어, 가상 네트워크가 프리픽스와 길이를 1.1.1.0/24로 한다면, 가상 네트워크에 접속한 단말들은 1.1.1.1 ~ 1.1.1.255 구간 중에서 하나의 IP를 할당받게 되는데 이것이 가상 네트워크 프리픽스 정보이다. 이 정보는 각 가상 TR(100-1, 100-2)가 터널 매핑 제어부(200)에 등록하는 시점에, 터널 매핑 제어부(200)가 생성하여 가상 TR(100-1, 100-2)에 제공한 후 터널 매핑 제어부(200)가 참조하는 데이터베이스에 저장되는 것을 예로 하여 설명하나, 관리자에 의해 미리 결정되어 가상 TR(100-1, 100-2)에 할당될 수도 있다.

<49> 가상 네트워크를 구성하는 각각의 가상 TR(100-1, 100-2)가 터널 매핑 제어부(200)와 연계하여 가상 네트워크 프리픽스 정보를 관리하고 할당하는 방법은 도 3에 도시된 바와 같이, 제1 가상 네트워크의 제1 가상 TR(100-1)와 제2 가상 네트워크의 제2 가상 TR(100-2)가 각각 터널 매핑 제어부(200)로 등록을 수행하기 위하여 등록 요청 메시지를 전송한다(S100, S105).

<50> 이때, 각각의 가상 TR이 터널 매핑 제어부로 등록하는 과정은, 다수의 가상 네트워크를 구성하기 위해 사전에 계획된 방법으로 가상 네트워크를 구성할 경우, 수동으로 설정하여 사용할 수 있지만, 포털과 같은 서버를 운영하여 등록 과정을 수행할 수 있다. 따라서 포털 등을 통해 등록 과정을 수행할 경우에는 등록 요청 메시지는 등록 과정에서 할당 또는 결정된 ID 정보와 패스워드 정보를 포함한다.

<51> 즉, 포털을 통해 등록하는 과정에서의 ID를 'Virtual-Net-1'이라고 하고, 패

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0096

스워드를 '2345'라고 할 경우, 해당 정보는 특정 DB에 저장된다. 이때 터널 매핑 제어부(200)는 해당 DB를 검색할 수 있기 때문에, 이후 가상 TR이 가상 네트워크를 구성하기 위하여 터널 매핑 제어부(200)에 연결할 때 필요한 인증 절차를 수행할 때, 해당 ID인 'Virtual-Net-1'와 패스워드인 '12345'와 같은 가상 TR을 구분하는 정보를 확인하여 정당한 가상 TR인 경우에만 등록할 수 있도록 한다.

<52> 이와 같이 제1 가상 TR(100-1)와 제2 가상 TR(100-2)가 터널 매핑 제어부(200)로 등록을 수행할 때에는 웹 혹은 기타 여러 방법에 의해 등록을 수행하며, 등록 방법은 어느 하나로 한정하지는 않는다.

<53> 터널 매핑 제어부(200)는 가상 TR(100-1, 100-2)들로부터 등록 요청 메시지를 수신하면, 등록 요청 메시지를 전송한 해당 가상 TR(100-1, 100-2)들이 미리 데이터베이스에 저장되어 있는 가상 TR인지 아닌지 확인한다(S110). 만약 기존에 저장되어 있는 가상 TR라면 등록 요청 메시지에 포함되어 있는 정보로 갱신하여 관리하고(S120), 새로운 가상 TR라면 등록 요청 메시지에 포함되어 있는 정보를 새로 등록한다(S130).

<54> 이와 같은 절차에 따라 제1 가상 TR(100-1)와 제2 가상 TR(100-2)가 터널 매핑 제어부(200)에 등록되면, 가상 TR들은 자신이 사용할 가상 네트워크 프리픽스 정보를 터널 매핑 제어부(200)로 요청한다(S140, S145). 터널 매핑 제어부(200)는 제1 가상 TR(100-1)와 제2 가상 TR(100-2)로 제공할 가상 네트워크 프리픽스 정보를 생성한 후(S150), 가상 네트워크 프리픽스 정보를 요청한 가상 TR로 제공한다(S160, S165). 이때, 가상 네트워크 프리픽스 정보는 IPv4 기반 혹은 IPv6 기반 모

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0097

두 지원할 수 있으며, 네트워크 프리픽스, 길이, 네트워크 타입 등의 정보를 포함한다.

<55> 여기서, S130 단계의 가상 TR들이 터널 매핑 제어부(200)에 등록하는 과정에서, NAT/방화벽의 개입을 학습할 수 있도록 NAT traversal 기능이나 STUN 절차도 함께 수행한다. 이러한 절차를 통해 학습 된 정보는 향후 가상 TR의 터널링 과정에서 사용할 매핑된 IP/포트 및 네트워크 접속 유형, 네트워크 동작 유형 등의 정보로 사용된다. NAT traversal 기능이나 STUN 절차는 이미 알려진 기술로, 본 발명의 실시예에서는 상세한 설명을 생략하기로 한다.

<56> 이와 같은 절차를 통해 가상 TR들이 가상 네트워크 프리픽스를 할당받은 후 수행하는 터널링 절차에 대하여 도 4를 참조로 설명하기로 한다.

<57> 도 4는 본 발명의 실시예에 따른 가상 TR의 터널링 절차를 나타낸 흐름도이다.

<58> 도 4에 도시된 바와 같이, 제1 가상 TR(100-1)와 제2 가상 TR(100-2)가 가상화 네트워크에 접속했을 때 터널 매핑 제어부(200)는 현재 등록되어 있는 제1 가상 TR(100-1)와 제2 가상 TR(100-2)가 가상화 네트워크를 구축해야 하는 즉, 직접 통신을 위하여 터널링을 수행해야 하는 대상임을 알리기 위하여 터널링 대상 가상 TR 목록 정보를 생성하여 알린다(S200, S205). 즉, 제1 가상 TR(100-1)에는 제2 가상 TR와 터널링을 수행해야 함을 알리고, 제2 가상 TR(100-2)에는 제1 가상 TR와 터널링을 수행해야 함을 알린다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0098

<59> 여기서 터널 매핑 제어부(200)는 터널링 대상 가상 TR 목록 정보에는 매핑된 IP/포트 및 네트워크 접속 유형 또는 접속된 네트워크의 동작 유형 등의 정보가 포함되어 있다. 이는 각각의 가상 TR가 NAT나 방화벽에 위치할 수 있기 때문에, 터널링 과정에서 STUN이나 UDP/TCP Hole Punching 과정 시 참조해야 할 정보를 알려주기 위함이다.

<60> 각각의 가상 TR가 터널링 대상 가상 TR 목록 정보를 수신하면, 상기 가상 TR로 터널을 설정하기 위하여, UDP/TCP Hole Punching을 위한 홀펀칭 메시지를 교환한다(S210). 그리고 각각의 가상 TR은 홀펀칭 메시지 송수신이 성공하였는지 여부를 판단하고(S220, S225), 메시지 송수신에 성공하면 터널 설정 메시지를 교환한다(S230).

<61> 이와 같은 절차를 통해 제1 가상 TR(100-1)과 제2 가상 TR(100-2) 사이에 터널이 설정되면, 터널에 상대 가상 네트워크의 가상 네트워크 프리픽스 정보를 연결한다(S240). 그러면, 제1 가상 TR(100-1)과 제2 가상 TR(100-2)은 직접 통신 환경이 구축된다. 즉, 가상 IP가 1.1.1.0/24 네트워크인 제1 가상 네트워크와 가상 IP가 2.2.2.0/24 네트워크인 제2 가상 네트워크는 직접 통신이 가능하다. 여기서 가상 IP는 사설 IP일 수도 있고, 공용 IP일 수도 있다.

<62> 한편, S220 및 S225단계에서 홀펀칭 메시지 송수신이 실패하였다면, 또 다른 터널링 절차를 통해 직접 통신이 가능한 환경을 구축한다. 이에 대해 도 5를 참조로 설명하기로 한다.

<63> 도 5는 본 발명의 실시예에 따른 터널 중계부를 통한 터널링 절차를 나타낸

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0099

흐름도이다.

<64> 상기 도 4의 S220 및 S225 단계에서 홀펀칭 메시지 송수신이 실패하였다면 도 5에 도시된 바와 같이, 제1 가상 TR(100-1)과 제2 가상 TR(100-2)은 중앙에 위치한 터널 중계부(300)와의 터널을 설정하기 위하여, 각각 터널 매핑 제어부(200)와 터널링 과정을 수행한다(S300, S305).

<65> S300 및 S305 단계를 통해 제1 가상 TR(100-1) 혹은 제2 가상 TR(100-2)과 터널 중계부(300) 사이에 터널이 설정되면, 제1 가상 TR(100-1)과 제2 가상 TR(100-2)은 각각 제1 가상 네트워크와 제2 가상 네트워크의 가상 네트워크 프리픽스 정보를 터널 중계부(300)로의 터널로 설정하여(S310, S315), 터널 중계부(300)를 통한 직접 통신이 가능한 가상화 네트워크가 구축되도록 한다.

<66> 상기 도 4 또는 도 5와 같이 가상 TR(100-1, 100-2)간 혹은 가상 TR(100-1, 100-2)들과 터널 중계부(300)를 통한 직접 통신이 가능한 가상화 네트워크가 구축된 상태에서, 제2 가상 TR(100-2)이 하나의 네트워크에서 다른 네트워크로 이동할 경우 가상화 네트워크를 접속하는 방법에 대하여 도 6을 참조로 설명하기로 한다. 이때, 가상 TR은 네트워크에서 일반적으로 말하는 라우터/스위치와 같은 대규모 장치일 수도 있고, 인터넷 공유기나 WiFi를 위한 AP(Access Point)와 같은 소규모 장치일 수도 있다.

<67> 도 6은 본 발명의 실시예에 따른 가상 TR이 이동한 후의 가상화 네트워크 접속 절차를 나타낸 흐름도이다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0100

<68> 상기 도 5에 나타낸 바와 같이 이동하기 전에 SrcIP/포트가 y.y.y.y/bbbb이고 매핑된 IP/포트가 (y.y.y.y)"/(bbbb)"이고 접속 유형과 동작 유형 등이 값으로 등록되어 있던 제2 가상 TR(100-2)이, 도 6에 나타낸 바와 같이 새로운 네트워크로 이동하여 등록 절차를 수행하면(S400), 가상 네트워크로부터 할당된 IP를 수신한다(S410). 이때 가상 네트워크로부터 할당되어 수신한 IP는 SrcIP/포트가 Y.Y.Y.Y/BBBB이고 매핑된 IP/포트가 (Y.Y.Y.Y)"/(BBBB)"의 값이라고 가정한다. 그리고 제2 가상 TR(100-2 ')이 새롭게 접속하는 네트워크는 이더넷뿐만 아니라, IP 기반의 무선 네트워크 즉, WiFI, WiMAx, 3G, 4G 등 다양한 네트워크가 될 수 있다.

<69> 그리고 이 값을 포함하여 등록 요청 메시지를 터널 매핑 제어부(200)로 전송하여 등록 절차를 수행한다(S420). 등록 요청 메시지를 수신한 터널 매핑 제어부(200)는 제2 가상 TR에 대한 정보가 사전에 저장되어 있는지 판단하는데(S430), 이미 제2 가상 TR에 대한 정보가 저장되어 있기 때문에, 터널 매핑 제어부(200)는 제2 가상 TR(100-2')의 접속 정보가 변경되었음을 확인하고, S420 단계에서 수신한 등록 요청 메시지에 포함되어 있는 제2 가상 TR에 대한 정보로 갱신한다(S440).

<70> 만약 S430 단계에서 판단한 결과 제2 가상 TR이 새로 등록되는 가상 TR이라면, 등록 요청 메시지에 포함되어 있는 제2 가상 TR 정보를 등록한다(S445). 그러나, 본 발명의 실시예에 따라 도 6에 도시된 사항은 가상 TR이 이동한 경우의 네트워크 접속 절차에 관한 것이기 때문에, 제2 가상 TR(100-2')이 구성하고 있는 가상화 네트워크의 제1 가상 TR(100-1)과 IP 터널을 새로 설정하거나 기존 터널 정보를 갱신하여야만 한다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0101

<71> 이와 같이 제2 가상 TR(100-2')의 정보를 갱신한 터널 매핑 제어부(200)는 저장되어 있는 다수의 가상 TR 중 제2 가상 TR(100-2')과 관련된 가상 TR의 목록을 검색한다(S450). 그리고 제2 가상 TR(100-2')과 관련되는 가상 TR로 새롭게 접속한 제2 가상 TR(100-2')의 변경된 접속 내용을 통지한다(S460). 본 발명의 실시예에서는 제2 가상 TR(100-2')과 관련된 가상 TR로 제1 가상 TR(100-1)을 예로 하여 설명하나, 반드시 이와 같이 한정되는 것은 아니다.

<72> 즉, 제1 가상 TR(100-1)로 제2 가상 TR(100-2')의 SrcIP/포트, 매핑된 IP/포트, 접속 유형 및 동작 유형 등의 정보가 전달된다. 이때, 제1 가상 TR(100-1)로 접속 내용을 통지하기 위하여 터널 매핑 제어부(200)가 터널 매핑 제어부(200)를 기반으로 통지할 수도 있고, 접속이 변경된 제2 가상 TR(100-2')이 터널 매핑 제어부(200)로부터 가상 TR들의 목록을 받아 접속 내용을 통지할 수도 있다.

<73> 또한, 이전에 접속된 정보 즉, 인접한 가상 TR들에 대한 정보를 제2 가상 TR(100-2')이 자체적으로 저장하고 있다가, 저장했던 값을 기반으로 접속 내용을 통지할 수도 있다. 본 발명의 실시예에서는 설명의 편의를 위하여 터널 매핑 제어부(200)가 제1 가상 TR(100-1)로 접속 내용을 통지하는 것을 예로 하여 설명한다.

<74> 제1 가상 TR(100-1)이 터널 매핑 제어부(200)로부터 제1 가상 TR(100-1)의 변경된 정보를 수신하면, 이동한 제2 가상 TR(100-2')과 홀펀칭 메시지 송수신 과정을 수행한다(S470). 그리고 나서 각각의 가상 TR들은 메시지 송수신이 성공적으로 이루어졌는지 확인한다(S480, S485). 이때 S470 과정을 수행하기 위한 메시지를 송수신하기 위한 IP 주소는 S460 단계에서 제1 가상 TR(100-1)이 터널 매핑 제어부

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0102

(200)로부터 수신한 정보 내에 포함되어 있는 매핑된 IP/포트를 기반으로 한다.

<75> 한편, 만약 접속 유형과 동작 유형의 정확한 값이 S460 단계에서 통지된 정보 내에 포함되어 있다면, 가상 TR간 혹은 터널 매핑 제어부(200) 중 어느 하나가 S470 단계에서 수행하는 홀펀칭 메시지 송수신 과정을 생략해도 되는지 여부를 판단하고, 생략해도 되는 경우에는 해당 과정을 생략할 수 있다. 여기서 홀펀칭 메시지 송수신 과정을 생략해도 되는지 여부를 판단하는 과정은 이미 알려진 사항으로, 본 발명의 실시예에서는 상세한 설명을 생략하기로 한다.

<76> 이후, 홀펀칭 메시지 송수신 과정이 성공하거나, 매핑된 IP/포트를 이용하여 항상 메시지 교환이 가능한 경우 예를 들어, 공용/개방(Public/Open)과 공용/개방의 관계에 있는 경우, 제1 가상 TR(100-1)과 제2 가상 TR(100-2') 간에 터널을 생성 또는 갱신하는 메시지 교환 과정을 수행한다(S490). 이때, 가상 네트워크 프리픽스 정보도 함께 교환하여 갱신한다.

<77> 그러나 홀펀칭 메시지 송수신 과정이 성공하지 못한다면 상기 도 5에 나타낸 바와 같은 절차를 통해 갱신 메시지를 교환한다. 다만, 도 5에 도시한 제2 가상 TR(100-2)과의 절차가 아닌, 이동된 제2 가상 TR(100-2')과 절차를 수행한다.

<78> 한편, 상기 도 6의 S460 단계에서 제2 가상 TR(100-2')의 변경된 접속 정보를 제1 가상 TR(100-1)로 전송하는 방법 중에서, 제2 가상 TR(100-2')이 터널 매핑 제어부(200)로부터 목록을 받아온 후 제2 가상 TR(100-2')이 주체적으로 제1 가상 TR(100-1)과 필요에 따라 갱신 메시지를 교환하는 방법도 있다. 이에 대하여 도 7을 참조로 설명하기로 한다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0103

<79> 도 7은 본 발명의 또 다른 실시예에 따른 변경된 접속 정보를 가상 TR로 알려주기 위한 절차를 나타낸 흐름도이다.

<80> 도 7에 도시된 바와 같이, 제2 가상 TR(100-2)이 이동하여 새로운 네트워크에 접속하여 등록하면(S500), 네트워크로부터 새로운 IP를 할당받는다(S510). S510 단계에서 할당받은 IP를 이용하여 새로운 네트워크로 접속한 후, 이동한 제2 가상 TR(100-2')이 터널 매핑 제어부(200)에 등록 및 접속 정보를 갱신하기 위하여 터널 매핑 제어부(200)로 등록 및 정보 갱신 요청 메시지를 전송한다(S520).

<81> 터널 매핑 제어부(200)는 이동한 제2 가상 TR(100-2')로부터 전송된 등록 및 정보 갱신 요청 메시지를 토대로 정보를 갱신한다(S530). 이때, S520 단계와 S530 단계 사이에는 상기 도 6에서 설명한 S430의 절차도 수행하나, 설명의 편의상 이 부분을 생략하기로 한다.

<82> S530 단계를 통해 터널 매핑 제어부(200)가 이동한 제2 가상 TR(100-2')의 정보를 갱신하면, 제2 가상 TR(100-2')이 접속되어 있던 가상화 네트워크에 포함되어 있는 제1 가상 TR(100-1)에 대한 정보를 검색하여(S540) 제2 가상 TR(100-2')로 전송한다(S550). 제1 가상 TR(100-1) 정보를 수신한 제2 가상 TR(100-2')은 필요에 따라 제1 가상 TR(100-1)과 홀펀칭 메시지 송수신 과정을 수행하여, 터널을 생성 또는 갱신하는 메시지를 교환한다(S560). 이때, 가상 네트워크 프리픽스 정보도 함께 교환하여 갱신한다. 그리고 S560 단계 이후의 절차는 상기 도 6의 S480 단계 내지 S490 단계와 일치하며, 도 7에서는 상세한 설명을 생략하기로 한다.

<83> 다음은 가상화 네트워크 영역 내부에 위치한 단말이 가상화된 네트워크 영역

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0104

의 외부 즉, 인터넷에 존재하는 단말 또는 서버와 통신하는 방법에 대하여 도 8a 및 도 8b를 참조로 설명하기로 한다. 본 발명의 실시예에서 설명하는 가상 IP는 공용 IP가 될 수도 있고 사설 IP가 될 수도 있다. 또한, IPv4 형식이 될 수도 있고, IPv6 형식이 될 수도 있다.

<84> 도 8a 및 도 8b는 본 발명의 실시예에 따른 가상화 네트워크 내부의 단말이 외부의 단말과 통신하는 방법을 나타낸 흐름도이다.

<85> 도 8a 및 도 8b에 도시된 가상화 네트워크로부터 인터넷으로의 통신 방법은 실제 가상 IP를 사설로 이용하는 경우에 해당한다고 볼 수 있다. 사설 IP를 사용하는 가상화 네트워크는 외부 네트워크 즉, 인터넷으로부터 근본적으로 차단된다. 그러나 가상화 네트워크 내부의 노드들은 인터넷으로의 통신이 필요하게 되면, 도 8a 및 도 8b에 나타낸 방법을 이용하여 통신을 수행하도록 한다.

<86> 먼저 도 8a에 도시된 바와 같이, 가상 TR에서 네트워크 방향으로의 패킷에 대하여, 가상 TR은 가상 IP에 대한 네트워크 주소를 변환 즉, NAT 기능을 동작한다. 따라서 가상 TR의 경우 터널 매핑 제어부(200)와의 각종 연계 동작 기능과, 관련 가상 TR간 터널링 및 가상 네트워크 프리픽스 정보 교환 등의 기능을 기본적으로 수행하고, 인터넷 접속을 위하여 가상 IP에 대한 인터넷 방향으로의 NAT 기능을 추가적으로 수행한다.

<87> 한편, 도 8b에 도시된 바와 같이, 특정 목적을 위하여 인터넷으로 전송되는 데이터에 대하여 관리 및 제어가 필요한 경우, 모든 가상 TR이 NAT 기능을 수행하지 않고 인터넷으로 향하는 패킷을 전담하여 처리하는 인터넷 중계부를 가상화 네

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0105

트워크에 포함하여 NAT 기능을 수행하도록 한다.

<88> 이 경우, 각각의 가상 TR들은 인터넷으로의 데이터 처리를 위해 인터넷 중계부와 인터넷 패킷 전용 터널을 설정한다. 그리고 설정한 터널에 인터넷으로 향하는 패킷을 올리기 위하여, 가상 네트워크에서 설정하고 있는 가상 네트워크 프리픽스 정보 구간 외의 IP 패킷이 사용되는 터널을 이용한다.

<89> 여기서 인터넷 중계부는 각각의 가상 TR로부터의 터널을 설정하는 기능을 수행한다. 그리고 터널링되어 수신된 패킷을 인터넷으로 전달할 때 먼저 아우터 헤더(Outer Header)와 UDP 헤더(UDP Header)를 제거한 후, 이너 헤더(Inner Header)의 소스 IP/포트(가상 IP/포트)를 기반으로 네트워크 전송 변환 기능을 수행한다. NAT로의 변환 과정에 대한 구체적인 방법은 이미 알려진 사항으로, 본 발명의 실시예에서는 상세한 설명을 생략하기로 한다.

<90> 이상에서 본 발명의 실시예에 대하여 상세하게 설명하였지만 본 발명의 권리범위는 이에 한정되는 것은 아니고 다음의 청구범위에서 정의하고 있는 본 발명의 기본 개념을 이용한 당업자의 여러 변형 및 개량 형태 또한 본 발명의 권리범위에 속하는 것이다.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0106

【특허청구범위】

【청구항 1】

가상 네트워크 환경에서 종단간 통신을 제공하는 통신 방법에 있어서,

제1 가상 터널 라우터 및 제2 가상 터널 라우터를 포함하는 복수의 가상 터널 라우터가 터널 매핑 제어부로부터 가상 네트워크 프리픽스 정보를 포함하는 메시지를 수신하는 단계;

상기 제1 가상 터널 라우터가 상기 제2 가상 터널 라우터로부터 홀펀칭 메시지를 수신하였는지 판단하는 단계;

상기 제1 가상 터널 라우터가 홀펀칭 메시지를 수신하였다면, 상기 제1 가상 터널 라우터는 상기 가상 네트워크 프리픽스 정보를 토대로 상기 제2 가상 터널 라우터와의 터널을 설정하는 단계; 및

상기 제1 가상 터널 라우터는 상기 설정한 터널을 통해 상기 제2 가상 터널 라우터와 직접 통신을 수행하는 단계

를 포함하는 통신 방법.

【청구항 2】

제1항에 있어서,

상기 메시지를 수신하는 단계는,

상기 제1 가상 터널 라우터가 상기 터널 매핑 제어부로 등록 요청 메시지를 전송하는 단계; 및

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0107

상기 제1 가상 터널 라우터가 상기 터널 매핑 제어부에 등록되어 있지 않은 가상 라우터인 경우, 상기 제1 가상 터널 라우터는 상기 터널 매핑 제어부로부터 상기 제1 가상 터널 라우터에 대해 생성된 가상 네트워크 프리픽스 정보를 포함하는 응답 메시지를 수신하는 단계

를 포함하는 통신 방법.

【청구항 3】

제2항에 있어서,

상기 제1 가상 터널 라우터가 미리 저장되어 있는 가상 터널 라우터이고, 상기 제1 가상 터널 라우터가 이동한 경우,

상기 제1 가상 터널 라우터가 이동하여 등록한 새로운 가상 네트워크로부터 IP를 수신하는 단계;

상기 제1 가상 터널 라우터가 수신한 상기 IP를 이용하여 상기 새로운 가상 네트워크로 접속하는 단계;

상기 새로운 가상 네트워크로 접속한 상기 제1 가상 터널 라우터가 상기 터널 매핑 제어부로 등록 및 정보 갱신 요청 메시지를 전송하는 단계; 및

상기 제1 가상 터널 라우터의 인접한 가상 터널 라우터들과 터널 생성 절차를 수행하는 단계

를 포함하는 통신 방법.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0108

【청구항 4】

제3항에 있어서,

상기 터널 생성 절차를 수행하는 단계는,

상기 새로운 가상 네트워크로 접속한 상기 제1 가상 터널 라우터가 상기 터널 매핑 제어부로부터 인접한 가상 터널 라우터 정보를 수신하는 단계

를 포함하는 통신 방법.

【청구항 5】

제1항에 있어서,

상기 제1 가상 터널 라우터가 상기 제2 가상 터널 라우터로부터 홀펀칭 메시지를 수신하지 못하였다면,

상기 제1 가상 터널 라우터는 상기 터널 매핑 제어부와 터널링 과정을 수행하는 단계; 및

상기 제1 가상 터널 라우터와 상기 터널 매핑 제어부 사이에 터널이 설정되면, 상기 제1 가상 터널 라우터는 상기 수신한 가상 네트워크 프리픽스 정보를 상기 터널로 연결하는 단계

를 포함하는 통신 방법.

【청구항 6】

가상 네트워크 환경에서 종단간 통신을 제공하는 통신 방법에 있어서,

터널 매핑 제어부가 복수의 가상 터널 라우터로부터 등록 요청 메시지를 수

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0109

신하는 단계;

상기 등록 요청 메시지를 전송한 가상 터널 라우터의 정보가 미리 등록되어 있는지 확인하는 단계;

가상 터널 라우터의 정보가 등록되어 있지 않다면, 상기 등록 요청 메시지에 포함되어 있는 가상 터널 라우터의 정보를 등록하는 단계;

가상 터널 라우터로부터 가상 네트워크 프리픽스 정보의 제공을 요청받는 단계; 및

가상 네트워크 프리픽스 정보를 요청한 가상 터널 라우터에 대한 가상 네트워크 프리픽스를 생성하여 전송하여 가상 터널 라우터간 직접 통신이 가능하도록 하는 단계

를 포함하는 통신 방법.

【청구항 7】

제6항에 있어서,

상기 가상 터널 라우터의 정보가 등록되어 있다면, 상기 등록 요청 메시지에 포함되어 있는 가상 터널 라우터의 정보로 갱신하는 단계; 및

상기 등록 요청 메시지를 전송한 가상 터널 라우터 주변의 가상 터널 라우터에, 상기 갱신한 정보를 전송하는 단계

를 포함하는 통신 방법.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0110

【청구항 8】

제7항에 있어서,

상기 가상 터널 라우터의 정보로 갱신하는 단계 이후에,

상기 가상 터널 라우터로 상기 주변의 가상 터널 라우터에 대한 정보를 전송하는 단계

를 포함하는 통신 방법.

【청구항 9】

제6항에 있어서,

상기 직접 통신이 가능하도록 하는 단계 이후에,

상기 복수의 가상 터널 라우터 중 어느 하나의 가상 터널 라우터로부터 터널링 절차를 요청 받으면, 상기 터널링 절차를 요청한 가상 터널 라우터와 터널 설정 절차를 수행하는 단계; 및

상기 가상 터널 라우터와 터널이 설정되면, 상기 가상 터널 라우터 및 상기 가상 터널 라우터의 인접한 가상 터널 라우터가 상기 설정된 터널을 통해 직접 통신이 가능하도록 제어하는 단계

를 포함하는 통신 방법.

【청구항 10】

제1 가상 터널 라우터와 제2 가상 터널 라우터를 포함하는 복수의 가상 터널 라우터가 터널 매핑 제어부와 연동하여 직접 통신이 가능하도록 하는 통신 방법에

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0111

있어서,

상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터가 상기 터널 매핑 제어부로 가상 네트워크 프리픽스 정보를 요청하는 단계;

상기 터널 매핑 제어부가 상기 제1 가상 터널 라우터 및 상기 제2 가상 터널 라우터에 대한 가상 네트워크 프리픽스 정보를 각각 생성하여 인접한 가상 터널 라우터 목록 정보와 함께 전송하는 단계; 및

상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터가 터널을 생성하는 단계; 및

상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터가 각각 수신한 상기 가상 네트워크 프리픽스 정보를 연결하여, 상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터간 직접 통신을 수행하는 단계

를 포함하는 통신 방법.

【청구항 11】

제10항에 있어서,

상기 가상 네트워크 프리픽스 정보를 요청하는 단계 이전에,

상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터가 상기 터널 매핑 제어부로 등록 요청 메시지를 전송하는 단계;

상기 터널 매핑 제어부가 상기 전송한 등록 요청 메시지를 토대로 미리 등록되어 있는 가상 터널 라우터인지 여부를 판단하는 단계; 및

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0112

미리 등록된 가상 터널 라우터가 아니면, 상기 터널 매핑 제어부는 상기 등록 요청 메시지에 포함된 정보를 저장하여 상기 상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터를 등록하는 단계

를 포함하는 통신 방법.

【청구항 12】

제10항에 있어서,

상기 터널을 생성하는 단계는,

상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터가 상기 가상 터널 라우터 목록 정보를 토대로, 홀펀칭 메시지를 송수신하는 단계;

상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터가 상기 홀펀칭 메시지의 송수신이 성공하였는지 각각 판단하는 단계;

어느 하나의 가상 터널 라우터가 상기 홀펀칭 메시지의 송수신에 실패하면, 상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터는 각각 상기 터널 매핑 제어부와 각각 터널을 설정하는 단계; 및

상기 제1 가상 터널 라우터와 상기 제2 가상 터널 라우터는 상기 수신한 가상 네트워크 프리픽스 정보를 상기 각각 설정한 터널에 연결하는 단계

를 포함하는 통신 방법.

【청구항 13】

제10항에 있어서,

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0113

상기 직접 통신을 수행하는 단계 이후에, 상기 제2 가상 터널 라우터가 이동하면,

제2 가상 터널 라우터가 이동한 가상 네트워크에 등록하고, 상기 가상 네트워크로부터 IP를 수신하는 단계;

상기 제2 가상 터널 라우터가 상기 터널 매핑 제어부로 상기 수신한 IP를 포함하여 등록 /정보 갱신 요청 메시지를 전송하는 단계;

상기 터널 매핑 제어부는 상기 제2 가상 터널 라우터의 정보를 상기 등록/정보 갱신 요청 메시지 내에 포함되어 있는 가상 터널 라우터 정보로 갱신하는 단계;

상기 터널 매핑 제어부는 상기 제2 가상 터널 라우터와 터널이 설정된 인접 가상 터널 라우터를 검색하는 단계; 및

상기 터널 매핑 제어부는 상기 검색한 인접 가상 터널 라우터로 상기 갱신한 가상 터널 라우터 정보를 전송하는 단계

를 포함하는 통신 방법.

【청구항 14】

제13항에 있어서,

상기 갱신한 가상 터널 라우터 정보를 전송하는 단계 이후에,

상기 제2 가상 터널 라우터와 상기 인접 가상 터널 라우터간 터널을 생성하는 단계

를 포함하는 통신 방법.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0114

제출 일자 : 2010-10-29

【요약서】

【요약】

제1 가상 터널 라우터와 제2 가상 터널 라우터를 포함하는 복수의 가상 터널 라우터가 터널 매핑 제어부와 연동하여 직접 통신이 가능하도록 하기 위하여, 제1 가상 터널 라우터와 제2 가상 터널 라우터가 터널 매핑 제어부로 가상 네트워크 프리픽스 정보를 요청한다. 터널 매핑 제어부가 제1 가상 터널 라우터 및 제2 가상 터널 라우터에 대한 가상 네트워크 프리픽스 정보를 각각 생성하여 인접한 가상 터널 라우터 목록 정보와 함께 전송하면, 제1 가상 터널 라우터와 제2 가상 터널 라우터가 터널을 생성한다. 이렇게 터널이 생성되면, 제1 가상 터널 라우터와 제2 가상 터널 라우터가 각각 수신한 가상 네트워크 프리픽스 정보를 연결하여, 제1 가상 터널 라우터와 제2 가상 터널 라우터간 직접 통신을 수행할 수 있도록 한다.

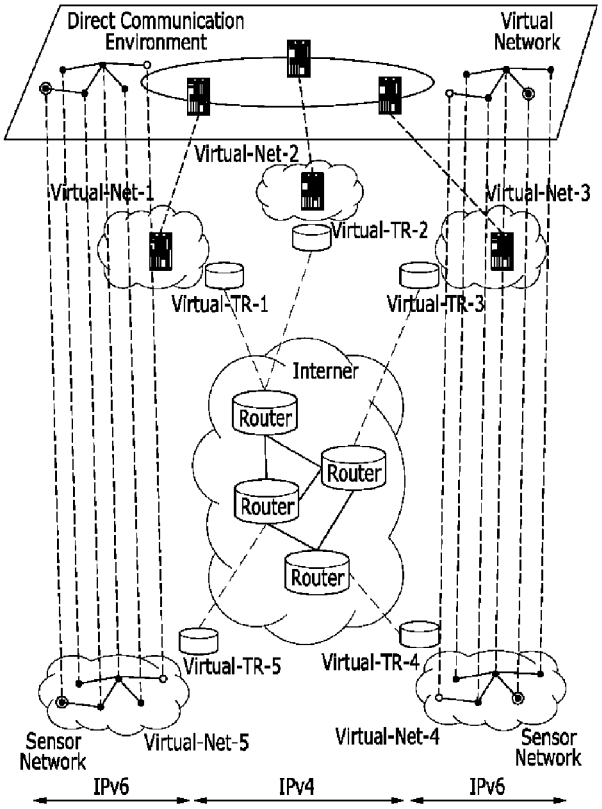
【대표도】

도 2

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0115

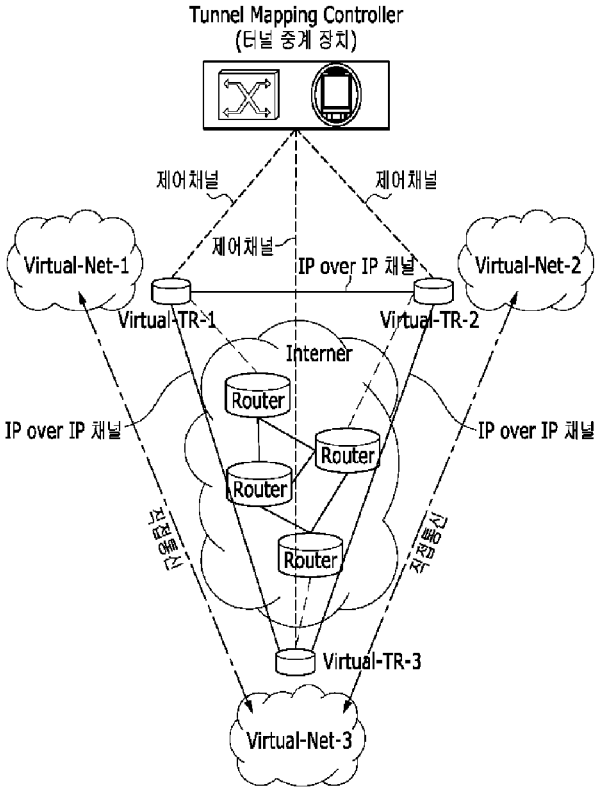
【도면】

【도 1】



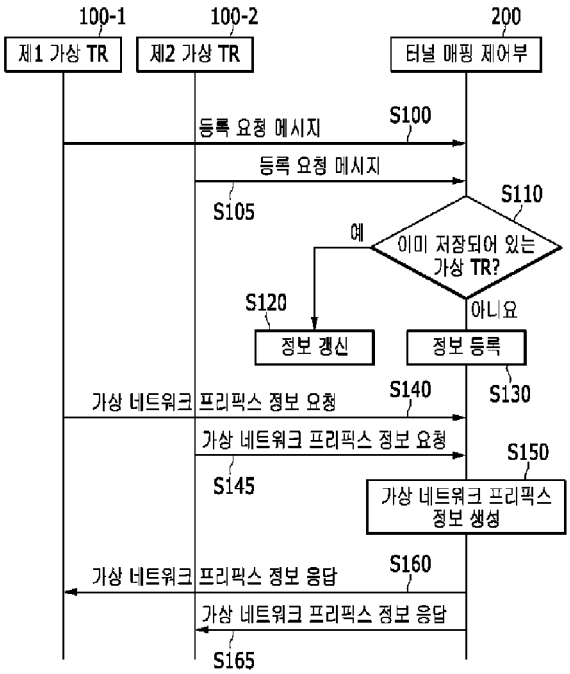
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0116

【도 2】

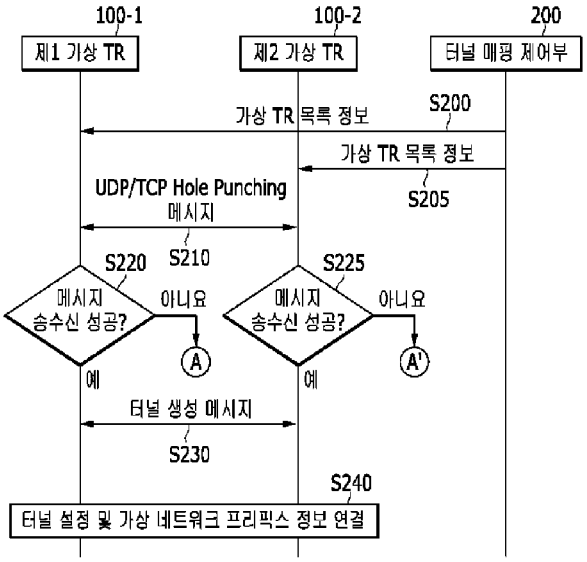


Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0117

【도 3】

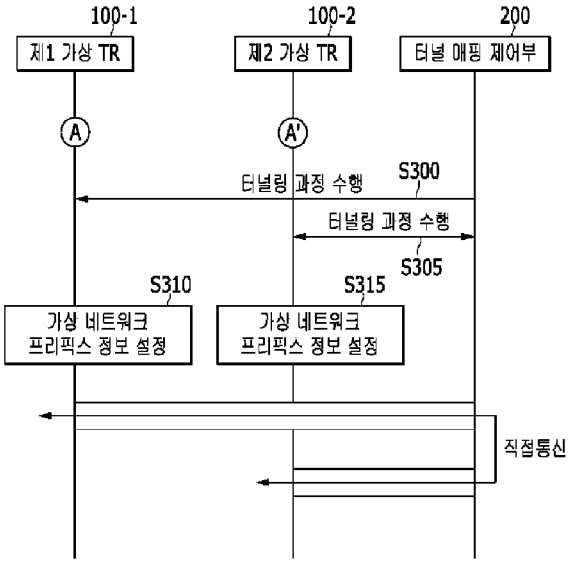


【도 4】



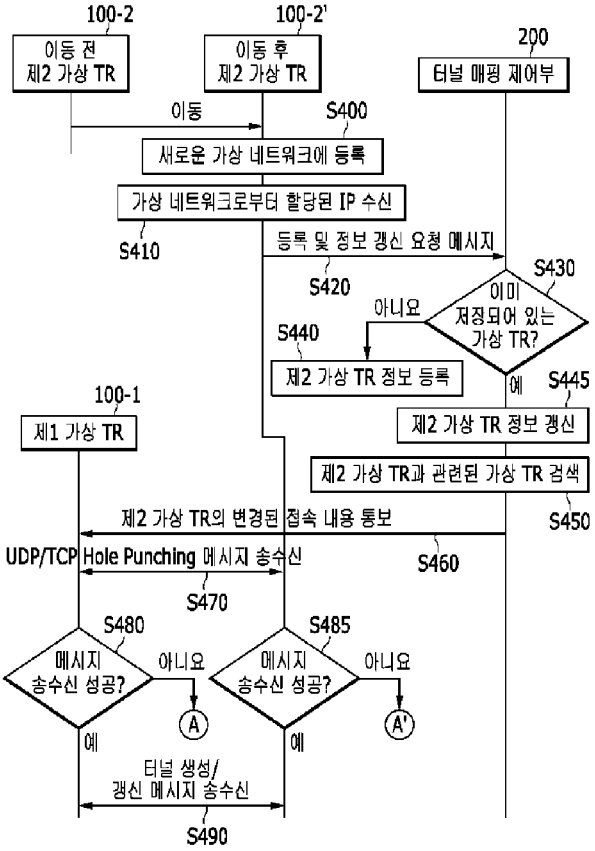
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0118

【도 5】



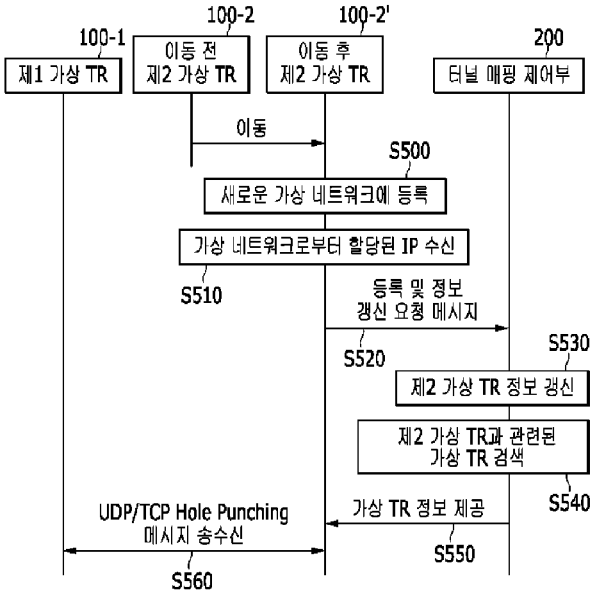
Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0119

【도 6】

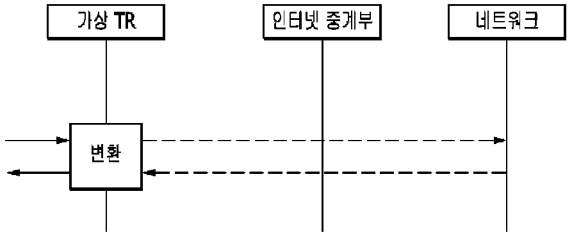


Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0120

【도 7】

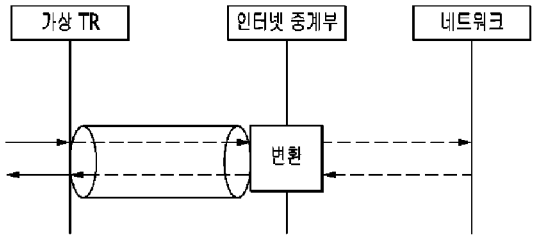


【도 8a】



Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0121

【도 8b】



Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0122

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.
13/234,425	09/16/2011	Sun Cheul KIM	110PK-074000US	6384

83220 7590 05/29/2013

AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

EXAMINER	
LEVITAN, DMITRY	
ART UNIT	PAPER NUMBER
2461	

NOTIFICATION DATE	DELIVERY MODE
05/29/2013	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@ampacc.com
scho@ampacc.com

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0123

Office Action Summary	Application No. 13/234,425	Applicant(s) KIM ET AL.	
	Examiner Dmitry H. Levitan	Art Unit 2461	AIA (First Inventor to File) Status No

-- 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) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, 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 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 *16 September 2011*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ 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

5)☒ Claim(s) *1-14* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-14* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☒ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *16 September 2011* 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).

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).

Certified copies:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Interim copies:

a)☐ All b)☐ Some c)☐ None of the: Interim copies of the priority documents have been received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0124

Drawings

1. The drawings Fig. 1 and 2 are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 100-1, 100-5, 200-1, 200-3, 200 and 300, mentioned on [0041]-[0051]. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to, because abbreviations or acronyms DB, STUN and SrcIP are cited throughout the specification without explanation. Applicant should provide a full explanation for the acronyms at least at their first occurrence in the specification.

Claim Rejections - 35 USC § 112

3. Claims 1-14 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claims 1 and 12 limitations, directed to "a hole punching message" are unclear, because they are incomplete by omitting essential elements, as a firewall or a NAT box, associated with the hole punching operation, is missing.

Therefore, it is unclear, which elements/steps are involved in the generation of a hole punching message.

Claims 1, 6 and 10, directed to "direct" communications are unclear, because it is not understood which communications between the first router and the second router are considered "direct" and which are not, as any criteria for "direct" communications is missing.

Claim 6 limitations, directed to "end-to-end communication" are unclear, because the claims limitations do not identify the end points of the claimed communication.

In addition, it is unclear, if a single registration request message is received from a plurality of virtual tunnel routers, as claim 6 limitations contradict the corresponding portion of the disclosure on [0056].

Claim 7 limitations, directed to "a virtual tunnel router adjacent to the virtual tunnel router having transmitted the registration request message" are unclear, because it is not understood which routers are considered adjacent to the registered router: other routers available for the end user in the neighborhood, or the routers connected (one hop) to the registered router.

Claim 9 recites the limitation "the adjacent virtual router" in line 7. There is insufficient antecedent basis for this limitation in the claim.

Claims 10 limitations, directed to “a list of adjacent virtual tunnel routers” are unclear, because it is not understood if the list of adjacent routers comprise the routers adjacent to the first router, to the second router or the list includes the routers on the path between the first and the second routers.

Other claims are rejected as the claims depending on the claims rejected above.

Claim Rejections - 35 USC § 102

4. Claims 6-9 are rejected (as best understood) under 35 U.S.C. 102(b) as being anticipated by Deutsh (US 2010/0235481).

5. Regarding claim 6, Deutsh teaches a communication method that provides end-to-end communication in a virtual network environment (communication between virtual local devices, which belong to two different local networks, as shown on Fig. 1 and 2, described on [0043]-[0046]), the method comprising:

a tunnel mapping controller receiving a registration request message from a plurality of virtual tunnel routers (tunnel mapping controller, shown as Device Service Manager/DSM 210 on Fig. 2 and 6, comprises a Tunnel Manager and database with registry, as described on [0048] and [0059], as the DSM receives registrations from virtual devices DCSs, as described on [0041]-[0044], wherein DSCs are described as routers on [0068]) ;

checking whether information of the virtual tunnel router having transmitted the registration request message is pre-stored (DSM receives a connection request from a DCS and checks if the connection was already established, as described on [0045]);

if the information of the virtual tunnel router is not registered, registering the information of the virtual tunnel router contained in the registration request message (the local DSC router registers the destination device information for establishing a connection, as described on [0059]);

receiving a request from the virtual tunnel router to provide virtual network prefix information (The DSM receives a request from the DSC to provide a real IP address, as described on [0059]); and

creating a virtual network prefix for the virtual tunnel router having requested the virtual network prefix information and transmitting the same to enable direct communication between the virtual tunnel routers (providing real IP address to the destination DSC, as described on [0059] and using the same Virtual IP Address/VIP with a corresponding identifier, as described on [0017]-[0021]).

6. Regarding claims 7 and 8, Deutsh teaches DSM 210 updating information on all virtual tunnel routers by registration, including the information on the adjacent virtual tunnel router, which is involved in the establishing a the connection, as described on [0047] and [0048].

7. Regarding claim 9, Deutsh teaches DSM 210 enabling direct communication between the end devices using tunneling procedures, as shown on Fig. 2 and described on [0045], wherein the virtual tunnel router DSC 212 and the adjacent virtual tunnel router DSC 202 establish the direct communication tunnel, as described on [0045]-[0047].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dmitry H. Levitan whose telephone number is (571)272-3093. The examiner can normally be reached on 8:30 to 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy Vu can be reached on (571) 272-3155. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Dmitry H Levitan
Primary Examiner
Art Unit 2461

/Dmitry H Levitan/
Primary Examiner, Art Unit 2461

Notice of References Cited	Application/Control No. 13/234,425	Applicant(s)/Patent Under Reexamination KIM ET AL.	
	Examiner Dmitry H. Levitan	Art Unit 2461	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2010/0235481 A1	09-2010	Deutsch et al.	709/222
*	B	US-2008/0307519 A1	12-2008	Curcio et al.	726/15
*	C	US-2007/0174436 A1	07-2007	Maekawa et al.	709/223
*	D	US-8,014,421 B2	09-2011	Rao et al.	370/470
*	E	US-7,237,260 B2	06-2007	Yu et al.	726/11
*	F	US-7,843,918 B2	11-2010	Osborne, Eric W.	370/389
*	G	US-2006/0130136 A1	06-2006	Devarapalli et al.	726/015
	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.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0130

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	Art Unit
	DMITRY H LEVITAN	2461

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	351, 389, 392, 395.3, 422	5/22/13	DL
709	227, 230-232, 238-242, 244	5/22/13	DL

SEARCH NOTES		
Search Notes	Date	Examiner
IEEE, EAST	5/22/13	DL

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Substitute for form 1449B/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				*Application Number*	Unassigned 13/234,425
				Filing Date	Unassigned
				First Named Inventor	Sun Cheul KIM
				Art Unit	Unassigned
(Use as many sheets as necessary)				*Examiner Name*	Unassigned
Sheet	1	of	1	*Attorney Docket Number*	110PK-074000US

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US-2011/0082941 A1 (Family of KR 1020110037833A)	04-07-2011	Sun Cheul KIM et al.	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US- ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.L./			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]	Number[4]	Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	1	KR	1020080059900	A	07-01-2008	KOREA INSTITUTE OF SCIENCE & TECHNOLOGY INFORMATION		☐
								☐
								☐
								☐
								☐

Examiner Signature	/Dmitry Levitan/	Date Considered	05/22/2013

*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.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	27	(virtual adj2 network) and (tunnel near4 (control$4 or manag$5 or center)) and ((list) near3 routers)	US-PGPUB; USPAT	OR	ON	2013/05/22 12:37
L11	4	(virtual near4 network) and (((tunnel$4) near4 (control$4 or manag$5 or center or map$4)) with (registra$5)) and ((common or shared or "same") near4 (prefix or (IP adj2 addresses)))	US-PGPUB; USPAT	OR	ON	2013/05/22 13:27
L15	25	(virtual near4 network) and (((tunnel$4) near4 (control$4 or manag$5 or center or map$4 or administra$5)) with (regist$8)) and ((common or shared or "same") near4 (prefix or (IP adj2 address)))	US-PGPUB; USPAT	OR	ON	2013/05/22 13:39
L17	108	(virtual near4 network) and ((tunnel$4) near4 (control$4 or manag$5 or center or map$4 or administra$6)) and (registra$5) and ((common or shared or "same") near2 (prefix or (IP adj2 addresses))) and (NAT or firewall)	US-PGPUB; USPAT	OR	ON	2013/05/22 13:41
L19	48	(virtual near4 tunnel) and ((tunnel$4) near4 (control$4 or manag$5 or center or map$4 or administra$6)) and (registra$5) and ((common or shared or "same") near2 (prefix or (IP adj2 addresses))) and (NAT or firewall)	US-PGPUB; USPAT	OR	ON	2013/05/22 13:45
L20	5	(virtual near4 tunnel) and ((tunnel$4) near4 (control$4 or manag$5 or center or map$4 or administra$6)) and (registra$5) and ((common or shared or "same") near2 (prefix or (ID))) and (NAT or firewall)	US-PGPUB; USPAT	OR	ON	2013/05/22 13:52

5/ 22/ 2013 3:56:44 PM
C:\ Users\ dlevitan\ Documents\ EAST\ Workspaces\ 13234425.wsp

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0133

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

BIB DATA SHEET

CONFIRMATION NO. 6384

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/234,425	09/16/2011	370	2461	110PK-074000US

APPLICANTS

Sun Cheul KIM, Daejeon, KOREA, REPUBLIC OF;
Seong Moon, Daejeon, KOREA, REPUBLIC OF;
Seungwoo Hong, Daejeon, KOREA, REPUBLIC OF;
Ho Sun Yoon, Daejeon, KOREA, REPUBLIC OF;
Ho Yong Ryu, Daejeon, KOREA, REPUBLIC OF;

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

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

REPUBLIC OF KOREA 10-2010-0107107 10/29/2010

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** ** SMALL ENTITY **

09/28/2011

Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /DMITRY LEVITAN/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		KOREA, REPUBLIC OF	9	14	3

ADDRESS

AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043
UNITED STATES

TITLE

METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

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

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	**Art Unit**
	DMITRY H LEVITAN	2461

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	05/22/2013								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	✓								
	13	✓								
	14	✓								

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0135

PATENT
Attorney Docket No.: K110PK-074000US
Client Ref. No.: OPP20103346US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Sun Cheul KIM et al. Application No.: 13/234,425 Filed: September 16, 2011 For: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT Customer No.: 83220	Confirmation No. 6384 Examiner: LEVITAN, Dmitry H. Technology Center/Art Unit: 2461 AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action mailed May 29, 2013, please enter the following amendments and remarks:

Amendments to the Specification begin on page **2** of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page **4** of this paper.

Amendments to the Drawings begin on page **8** of this paper and include two attached replacement sheets.

Remarks/Arguments begin on page **9** of this paper.

An **Appendix** including amended drawing figures is attached following page **11** of this paper.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0136

Amendments to the Specification:

Please replace the paragraph beginning on page 14, line 24, with the following amended paragraph:

> That is, supposing that, in the registration through portal, the ID is "Virtual-Net-1" and the password is "2345", the corresponding information is stored in a specific [[DB]] database (DB). At this point, the tunnel mapping controller 200 is able to search the corresponding DB. Thus, when performing an authentication procedure required for a virtual TR to connect to the tunnel mapping controller 200 in order to configure a virtual network later, information for identifying the virtual TR, such as the corresponding ID "Virtual-Net-1" and the password "12345", is checked, and stored only when the virtual TR is a proper virtual TR.

Please replace the paragraph beginning on p. 16 line 5, with the following amended paragraph:

> In the process of registering the virtual TRs in the tunnel mapping controller 200 in step S130, an NAT traversal function or a [[STUN]] Session Traversal Utilities for NAT (STUN) procedure is performed together to learn the incorporation of an NAT /firewall. The information learned through this procedure is used as information such as mapped IP/port and network connection type or network operation mode to be JO used later in a virtual TR tunneling process. The NAT traversal function or STUN procedure is a well-known technology, so a detailed description thereof will be omitted in the exemplary embodiment of the present invention.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0137

Please replace the paragraph beginning on p. 19 line 2, with the following amended paragraph:

When the second virtual TR 100-2 with ~~an SrcIP/port~~ a source IP/port (SrcIP/port) of y.y.y.y/bbbb and a mapped IP/port of (y.y.y.y)"/(bbbb)" before movement as shown in FIG. 5, whose connection type, operation mode, etc. are registered as values, moves to a new network and performs a registration procedure as shown in FIG. 6 (S400), it receives an IP assigned from a virtual network (S410). It is assumed that the IP assigned and received from the virtual network is a value with an SrcIP/port of Y.Y.Y.Y/BBBB and a mapped IP/port of (Y.Y.Y.Y)"/(BBBB)". The new network connected by the second virtual TR 100-2 may be various networks, such as ethernet and IP-based wireless networks including WiFi, WiMAX, 3G, 4G, etc.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0138

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (Original) A communication method that provides end-to-end communication in a virtual network environment, the method comprising:

a plurality of virtual tunnel routers comprising a first virtual tunnel router and a second virtual tunnel router receiving a message containing virtual network prefix information from a tunnel mapping controller;

determining whether the first virtual tunnel router has received a hole punching message from the second virtual tunnel router;

if the first virtual tunnel router has received a hole punching message, the first virtual tunnel router establishing a tunnel with the second virtual tunnel router based on the virtual network prefix information; and

the first virtual tunnel router performing direct communication with the second virtual tunnel router through the established tunnel.

2. (Original) The method of claim 1, wherein the receiving of a message comprises:

the first virtual tunnel router transmitting a registration request message to the tunnel mapping controller; and

if the first virtual tunnel router is a virtual router not registered in the tunnel mapping controller, the first virtual tunnel router receiving a response message containing virtual network prefix information created from the first virtual tunnel router from the tunnel mapping controller.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0139

3. (Original) The method of claim 2, comprising:

if the first virtual tunnel router is a pre-stored virtual tunnel router and the first virtual tunnel router has moved, receiving an IP from a new virtual network to which the first virtual tunnel router has moved and registered;

the first virtual tunnel router connecting to the new virtual network using the received IP;

the first virtual tunnel router connected to the new virtual network, transmitting a registration and information update request message to the tunnel mapping controller; and

performing a tunnel creation procedure with virtual tunnel routers adjacent to the first virtual tunnel router.

4. (Original) The method of claim 3, wherein the performing of the tunnel creation procedure comprises the first virtual tunnel router connected to the new virtual network receiving adjacent virtual tunnel router information from the tunnel mapping controller.

5. (Original) The method of claim 1, comprising:

if the first virtual tunnel router has not received a hole punching message from the second virtual tunnel router,

the first virtual tunnel router performing a tunneling process with the tunnel mapping controller; and

when a tunnel is established between the first virtual tunnel router and the tunnel mapping controller, the first virtual tunnel router connecting the received virtual network prefix information to the tunnel.

Claims 6-9. (Cancelled)

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0140

10. (Currently amended) A communication method that enables direct communication between a plurality of virtual tunnel routers including a first virtual tunnel router and a second virtual tunnel router by working in conjunction with a tunnel mapping controller, the method comprising:

the first virtual tunnel router and the second virtual tunnel router requesting virtual network prefix information from the tunnel mapping controller;

the tunnel mapping controller generating virtual network prefix information of the first virtual tunnel router and second virtual tunnel router, respectively, and transmitting the same along with information of a list of ~~adjacent~~ virtual tunnel routers for which previous connection information has been stored;

the first virtual tunnel router and the second virtual tunnel router creating a tunnel; and

performing direct communication between the first virtual tunnel router and the second virtual tunnel router by linking the virtual network prefix information received by the first virtual tunnel router and the second virtual tunnel router, respectively.

11. (Original) The method of claim 10, comprising:

before requesting for the virtual prefix information,

the first virtual tunnel router and the second virtual tunnel router transmitting a registration request message to the tunnel mapping controller;

the tunnel mapping controller determining whether the first and second virtual tunnel routers are pre-stored virtual tunnel routers based on the transmitted registration request message; and

if the first and second virtual tunnel routers are not pre-stored virtual tunnel routers, the tunnel mapping controller storing information contained in the registration request message and registering the first virtual tunnel router and the second virtual tunnel router.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0141

12. (Original) The method of claim 10, wherein the creating of a tunnel comprises:

the first virtual tunnel router and the second virtual tunnel router transmitting and receiving a hole punching message based on the information of a list of virtual tunnel routers;

determining whether the transmission and reception of the hole punching message between the first virtual tunnel router and the second virtual tunnel router are successful;

if anyone of the virtual tunnel routers fails in the transmission and reception of the hole punching message, the first virtual tunnel router and the second virtual tunnel router each establishing a tunnel with the tunnel mapping controller; and

the first virtual tunnel router and the second virtual tunnel router each linking the received virtual network prefix information to the established tunnel.

13. (Original) The method of claim 10, comprising:

when the second virtual tunnel router moves after the performing of direct communication,

registering the second virtual tunnel router to a virtual network to which the second virtual tunnel router has moved, and receiving an IP from the virtual network;

the second virtual tunnel router transmitting a registration/information update request message containing the received IP to the tunnel mapping controller;

the tunnel mapping controller updating the information of the second virtual tunnel router with the virtual tunnel router information contained in the registration/information update request message;

the tunnel mapping controller searching for an adjacent virtual tunnel router having a tunnel established with the second virtual tunnel router; and

the tunnel mapping controller transmitting the updated virtual tunnel router information to the searched adjacent virtual tunnel router.

14. (Original) The method of claim 13, comprising,

after the transmitting of the updated virtual tunnel router information, creating a tunnel between the second virtual tunnel router and the adjacent virtual tunnel router.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0142

Amendment(s) to the Drawings:

An attached sheet of drawings includes changes to Fig. 1, and replaces the original sheet including Fig. 1.

A second attached sheet of drawings includes changes to Fig. 2, and replaces the original sheet including Fig. 2.

All changes to the drawings are explained in detail in the remarks section of this amendment paper, pursuant to 37 C.F.R. 1.121 (d).

Attachment: Replacement Sheets

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0143

REMARKS/ARGUMENTS

The claims are amended as indicated above. Claim 6-9 are cancelled. No claims are added. Thus upon entry of this paper, claims 1-5 and 10-14 will be pending.

In the latest Office Action, FIGs. 1 and 2 were objected as lacking reference signs 100-1, 100-5, 200-1, 200-3, 200 and 300. The figures are now amended to overcome the objections.

Specifically, FIG. 1 is amended to add references characters "100-1" through "100-5" along with appropriate lead lines indicating the elements previously labeled "Virtual TR-1" through "Virtual TR-5," respectively, and to add reference characters "200-1" through "200-3" along with appropriate lead lines indicating the elements labeled "Virtual-Net-1" through "Virtual-Net-3," respectively. The amendments are supported by at least, for example, p. 11, ll. 1-9. The text "Virtual TR-1" through "Virtual TR-3" and "Virtual-Net-2" have been removed to provide space for the new reference characters.

FIG. 2 has been amended to include references characters "100-1" through "100-3" along with appropriate lead lines indicating the elements previously labeled "Virtual TR-1" through "Virtual TR-3," respectively, and reference characters "200-1" through "200-3" along with appropriate lead lines indicating the elements labeled "Virtual-Net-1" through "Virtual-Net-3," respectively. The amendments are supported by at least, for example, p. 11, ll. 1-9. FIG. 2 has also been amended to replace the text "Tunnel Mapping Controller" with the reference character 200 and an appropriate lead line, and the text "(tunnel relay)" with the reference character 300 and an appropriate lead line. The amendment is supported by at least, for example, p. 12, ll. 9-12. The text "Virtual TR-1" through "Virtual TR-3" have been removed from FIG. 2 to provide space for the new reference characters.

Also in the latest office action, the specification was objected to. By this response, the specification is amended to specify the meaning of the well-known acronyms DB, STUN, and SrcIP, thereby overcoming the objection.

Turning to the rejections, claim 10 stands rejected under § 112 as indefinite because of alleged lack of clarity of the term "adjacent." Claim 10 is now amended to overcome the rejection.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0144

Regarding the remaining rejections of the pending claims, the latest office action recited a litany of additional instances of purported indefiniteness. As a threshold matter, Applicants note that the Examiner appears to be placing undue emphasis on technical, non-prior art rejections.

> The primary object of the examination of an application is to determine whether or not the claims are patentable over the prior art. This consideration should not be relegated to a secondary position while undue emphasis is given to nonprior art or "technical" rejections. Effort in examining should be concentrated on truly essential matters, minimizing or eliminating effort on technical rejections which are not really critical. MPEP §706.03 (emphasis added).

For example, the Examiner alleged lack of clarity of the term "direct" recited in claims 1 and 10.

The Examiner is respectfully reminded that "A patent need not teach, and preferably omits, what is well known in the art." MPEP § 2164 (emphasis added). Here, "direct" is a widely used and understood term of art in the art of network-based communication.

This understanding is only underscored by the art being relied upon in the Office Action. Definiteness of claim language must be analyzed in light of, among other things, "the teachings of the prior art." *Id.*

Here, the U.S. Publication No. 2012/0235481 to Deutsch ("the Deutsch Publication") is the primary reference being relied upon to reject the now-cancelled claims 6-9. The term "direct" is employed throughout the Deutsch Publication, such as, for example:

> [e]ach DSC . . . may have a conduit manager to create a direct communication tunnel to a DSM. . . . Both the first and second DSC create their own direct communication tunnel to the DSM . . . Deutsch, ¶ **[0041]** (emphasis added).

Given that the authors of the Deutsch Publication felt comfortable enough with the term "direct" to use it without elaboration, and given that the Examiner presumably understood the teachings of the Deutsch Publication well enough to rely upon that reference in rejecting the claims, it is respectfully asserted that Applicants' use of that term is sufficiently definite here. Applicants respectfully submit that continued maintenance of the claim rejection is improper, and this indefiniteness rejection should be withdrawn.

In the same vein, the Examiner rejected claims 1 and 12 as indefinite, alleging the claims are incomplete by omitting elements and steps "associated with the hole punching operation." The elements and steps associated with "hole punching" are well known in the art, as

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0145

demonstrated by U.S. Pub. No. 2011/0082941 to Kim et al. ("the Kim Publication") also relied upon by the Examiner. For example:

> Table 3 represents a direct communication possibility between a receiver and a sender after performing hole punching using a changed IP and port information of another terminal from a server. Kim, ¶ **[0013]** (emphasis added).

Accordingly, these well-known elements and steps need not be recited in claims 1 or 12.

It is noted that purported indefiniteness was the sole basis for the rejection of claims 1-5 and 10-14. In view of the above amendments and remarks, it is respectfully asserted that the indefiniteness rejections have been overcome, and that claims 1-5 and 10-14 are now in condition for allowance.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

The Commissioner is authorized to charge any deficiency in any fees required under 37 C.F.R. 1.16 and/or 1.17, including extension of time fees, and credit any overpayment to Deposit Account No. 50-4713.

If the Examiner believes a telephone conference would expedite prosecution of this Application, please telephone the undersigned at 425-348-3500.

Respectfully submitted,

/Dennis M. O'Connor/

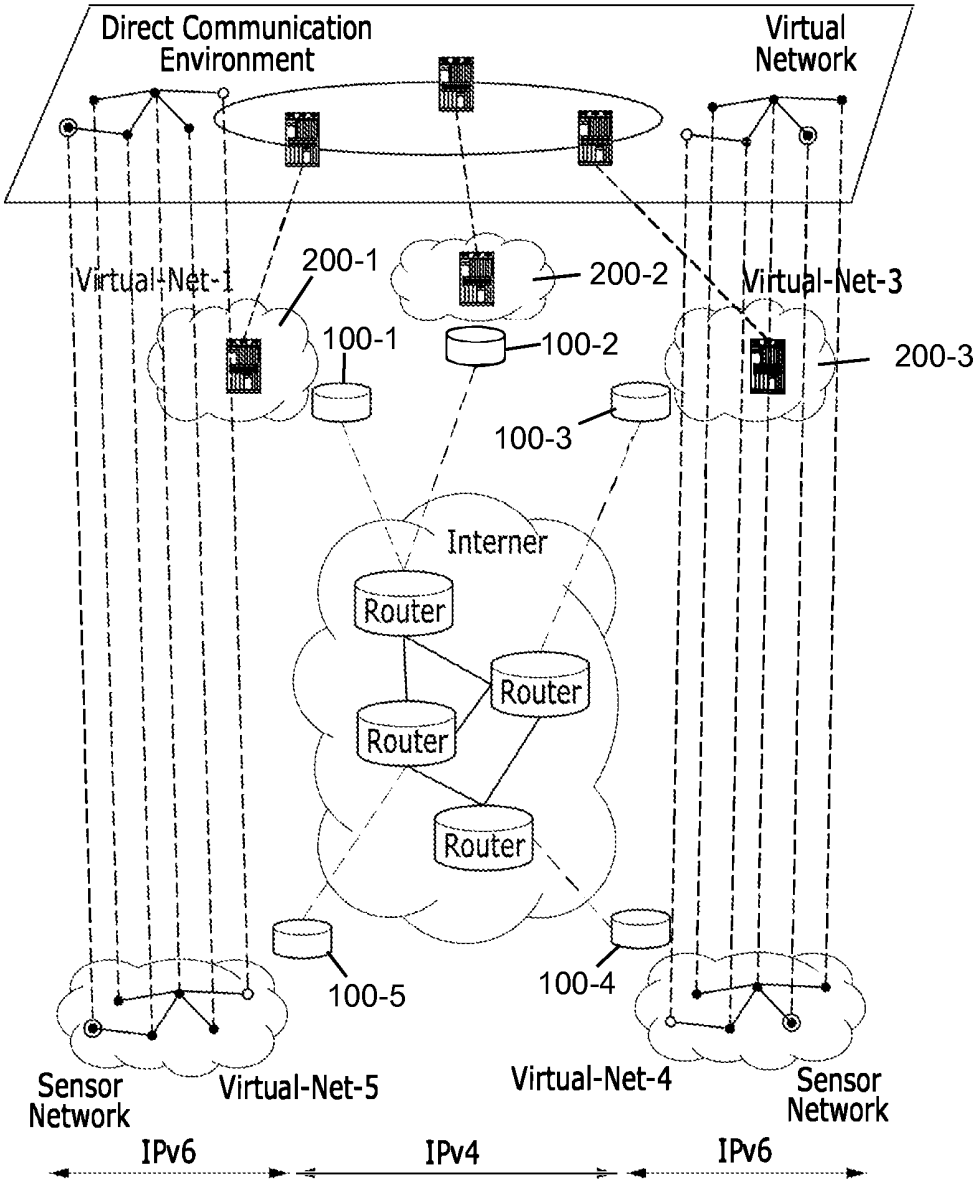
Dennis M. O'Connor
Reg. No. 65,215

AMPACC Law Group, PLLC
6100 219th St. SW, Suite 580
Mountlake Terrace, WA 98043
Tel: 425-348-3500
Fax: 425-348-3299
Attachments: Two replacement Sheets for FIGs. 1 and 2.
KJT/DOC

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0146

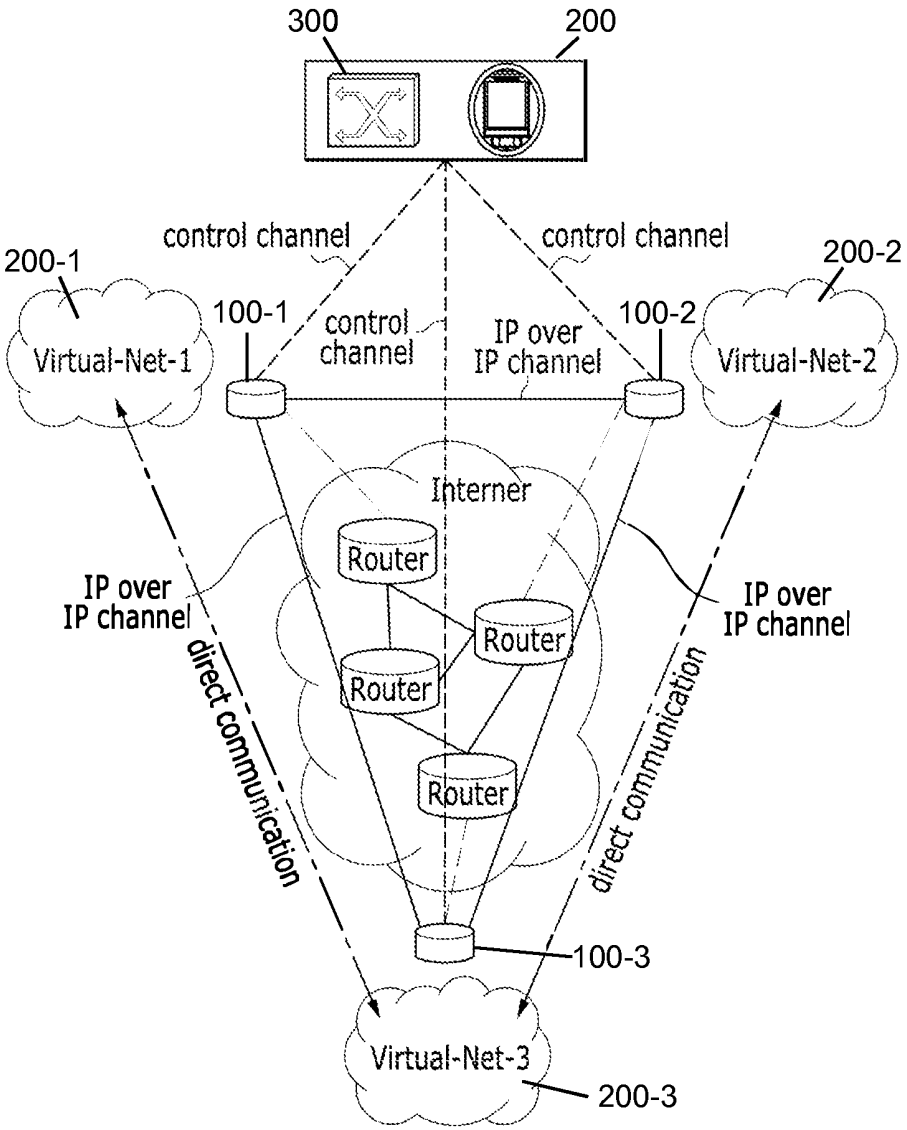
Replacement Sheet

FIG. 1



Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0147

FIG. 2



Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0148

Electronic Acknowledgement Receipt

EFS ID:	16727595
Application Number:	13234425
International Application Number:	
Confirmation Number:	6384
Title of Invention:	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Sun Cheul KIM
Customer Number:	83220
Filer:	Dennis Michael O'Connor
Filer Authorized By:	
Attorney Docket Number:	110PK-074000US
Receipt Date:	29-AUG-2013
Filing Date:	16-SEP-2011
Time Stamp:	20:07:14
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	Amendment/Req. Reconsideration-After Non-Final Reject	2013_8_16_AMD_K110PK-074000US_KJT_DOC.pdf	116165 122f6a4548705f65fd8ce93c4e135c6dc441432f	no	11

Warnings:	
Information:	

2	Drawings-only black and white line drawings	2013_8_16_K110PK-074000US_Repl_Sheets.pdf	538602 c6d78780a8f65ae0349e5608983353ba8b0d3ab8	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	654767	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/234,425	Filing Date 09/16/2011	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	08/29/2013	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 10	Minus	** 20	= 0	X $40 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $210 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L 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.

LIE
/PAMELA v. THERATT/

This collection of information is required by 37 CFR 1.16. 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, 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.

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

83220 7590 09/19/2013

AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

EXAMINER
LEVITAN, DMITRY

ART UNIT	PAPER NUMBER
2461	

DATE MAILED: 09/19/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US	6384

TITLE OF INVENTION: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$890	$300	$0	$1190	12/19/2013

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 DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). 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. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

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. 02/11)

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0152

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)

83220 7590 09/19/2013
AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

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.
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US	6384

TITLE OF INVENTION: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$890	$300	$0	$1190	12/19/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
LEVITAN, DMITRY	2461	370-401000

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 submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0153

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29	NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
❑ Applicant asserting small entity status. See 37 CFR 1.27	NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
❑ Applicant changing to regular undiscounted fee status.	NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0154

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.
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US	6384

83220 7590 09/19/2013

AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

EXAMINER	
LEVITAN, DMITRY	

ART UNIT	PAPER NUMBER
2461	

DATE MAILED: 09/19/2013

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 194 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 194 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 1-(888)-786-0101 or (571)-272-4200.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0155

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.

Notice of Allowability	Application No. 13/234,425	Applicant(s) KIM ET AL.	
	Examiner Dmitry H. Levitan	Art Unit 2461	AIA (First Inventor to File) Status No

-- 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 *8/29/13*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-5 and 10-14, renumbered as 1-10*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   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.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ 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. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Dmitry H Levitan/
Primary Examiner, Art Unit 2461

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0157

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	Art Unit
	DMITRY H LEVITAN	2461

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	351, 389, 392, 395.3, 422	9/05/13	DL
709	227, 230-232, 238-242, 244	9/05/13	DL

SEARCH NOTES		
Search Notes	Date	Examiner
IEEE, EAST	9/05/13	DL

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
370	351	9/05/13	DL

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0158

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	**Art Unit**
	DMITRY H LEVITAN	2461

CPC		
Symbol	**Type**	**Version**

CPC Combination Sets				
Symbol	**Type**	**Set**	**Ranking**	**Version**

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	10	
/DMITRY H LEVITAN/ Primary Examiner.Art Unit 2461	9/05/13	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0159

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	**Art Unit**
	DMITRY H LEVITAN	2461

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
370	351	H	0	4	L	12 / 28 (2006.01.01)						

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	10	
/DMITRY H LEVITAN/ Primary Examiner.Art Unit 2461	9/05/13	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0160

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	**Art Unit**
	DMITRY H LEVITAN	2461

☒ **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	Final	Original
	1														
	2														
	3														
	4														
	5														
--	6														
--	7														
--	8														
--	9														
	10														
	11														
	12														
	13														
	14														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	10	
/DMITRY H LEVITAN/ Primary Examiner.Art Unit 2461	9/05/13	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0161

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	13	(network and (tunnel) and ((hole near2 punch$3) or STUN)).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/09/05 13:21
L4	27	(network and ((tunnel near3 (control$4 or manag$5 or map$5)) near4 (prefix or index or label or tag))).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/09/05 13:30
L10	4	(network and (hole near2 punch$4) and tunnel).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/09/05 13:39

9/5/2013 1:41:23 PM
C:\Users\dlevitan\Documents\EAST\Workspaces\13234425.wsp

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0162

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	**Art Unit**
	DMITRY H LEVITAN	2461

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	05/22/2013	09/05/2013							
	1	✓	=							
	2	✓	=							
	3	✓	=							
	4	✓	=							
	5	✓	=							
	6	✓	-							
	7	✓	-							
	8	✓	-							
	9	✓	-							
	10	✓	=							
	11	✓	=							
	12	✓	=							
	13	✓	=							
	14	✓	=							

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0163

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)

83220 7590 09/19/2013
AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

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.
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US	6384

TITLE OF INVENTION: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$890	$300	$0	$1190	12/19/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
LEVITAN, DMITRY	2461	370-401000

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)

ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE DAEJEON, REPUBLIC OF KOREA

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 submitted:
- ☒ Issue Fee
- ☒ Publication Fee (No small entity discount permitted)
- ☒ Advance Order - # of Copies 1

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☒ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-4713 (enclose an extra copy of this form).

PTOL-85 (Rev. 02/11)

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0164

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29	NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
❑ Applicant asserting small entity status. See 37 CFR 1.27	NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
❑ Applicant changing to regular undiscounted fee status.	NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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 /Steve Y. Cho/ Date November 11, 2013

Typed or printed name Steve Y. Cho Registration No. 44,612

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.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal

Application Number:	13234425
Filing Date:	16-Sep-2011
Title of Invention:	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Sun Cheul KIM
Filer:	Steve Yong Soo Cho
Attorney Docket Number:	K110PK-074000US

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	2501	1	890	890
Publ. Fee- Early, Voluntary, or Normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
Printed Copy of Patent - No Color	8001	1	3	3
		Total in USD ($)		**1193**

Electronic Acknowledgement Receipt

EFS ID:	17359261
Application Number:	13234425
International Application Number:	
Confirmation Number:	6384
Title of Invention:	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Sun Cheul KIM
Customer Number:	83220
Filer:	Steve Yong Soo Cho
Filer Authorized By:	
Attorney Docket Number:	K110PK-074000US
Receipt Date:	11-NOV-2013
Filing Date:	16-SEP-2011
Time Stamp:	19:30:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1193
RAM confirmation Number	17213
Deposit Account	504713
Authorized User	CHO, STEVE Y.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	2013_11_11_FEE_TRNSMTL_K110PK-074000US.pdf	107168 bfbc71456d94ab362f8d1b1c83ff75e6706c3ebc	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	33645 503189e528b05c4de78ef0d4b61378c19a01fa1b	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	140813		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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.

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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/234,425	12/17/2013	8611336	K110PK-074000US	6384

83220 7590 11/26/2013

AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 194 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

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 Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Sun Cheul KIM, Daejeon, KOREA, REPUBLIC OF;
Seong Moon, Daejeon, KOREA, REPUBLIC OF;
Seungwoo Hong, Daejeon, KOREA, REPUBLIC OF;
Ho Sun Yoon, Daejeon, KOREA, REPUBLIC OF;
Ho Yong Ryu, Daejeon, KOREA, REPUBLIC OF;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0170

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13/234,425	Filing Date	2011-09-16	Docket Number (if applicable)	K110PK-074000US	Art Unit	2461
First Named Inventor	Sun Cheul KIM			Examiner Name	LEVITAN, DMITRY		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the orde in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☐ Amendment/Reply

☒ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 504713

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Steve Y. Cho/	Date (YYYY-MM-DD)	2013-11-27
Name	Steve Y. Cho	Registration Number	44612

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is t 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 estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Tim will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions fo 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.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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 informatio 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 the Freedom of Information Act requires disclosure of these records.

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 ma 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 inspections 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.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0173

Doc Code: PET.AUTO Document Description: Petition automatically granted by EFS-Web	PTO/SB/140 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**PETITION TO WITHDRAW AN APPLICATION FROM ISSUE AFTER PAYMENT OF THE ISSUE FEE UNDER 37 CFR 1.313(c)**
Application Number	13234425
Filing Date	16-Sep-2011
First Named Inventor	Sun Cheul KIM
Art Unit	2461
Examiner Name	DMITRY LEVITAN
Attorney Docket Number	K110PK-074000US
Title	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

An application may be withdrawn from issue for further action upon petition by the applicant. To request that the Office withdraw an application from issue, applicant must file a petition under this section including the fee set forth in § 1.17(h) and a showing of good and sufficient reasons why withdrawal of the application from issue is necessary.

APPLICANT HEREBY PETITIONS TO WITHDRAW THIS APPLICATION FROM ISSUE UNDER 37 CFR 1.313(c).

A grantable petition requires the following items:
(1) Petition fee; and
(2) One of the following reasons:
(a) Unpatentability of one or more claims, which must be accompanied by an unequivocal statement that one or more claims are unpatentable, an amendment to such claim or claims, and an explanation as to how the amendment causes such claim or claims to be patentable;
(b) Consideration of a request for continued examination in compliance with § 1.114 (for a utility or plant application only); or
(c) Express abandonment of the application. Such express abandonment may be in favor of a continuing application, but not a CPA under 37 CFR 1.53(d).

Petition Fee

(•)	Small Entity
( )	Micro Entity
( )	Regular Undiscounted

Reason for withdrawal from issue

◯ One or more claims are unpatentable ◉ Consideration of a request for continued examination (RCE) (List of Required Documents and Fees) ◯ Applicant hereby expressly abandons the instant application (any attorney/agent signing for this reason must have power of attorney pursuant to 37 CFR 1.32(b)).
RCE request,submission, and fee. ☐ I certify, in accordance with 37 CFR 1.4(d)(4) that : The RCE request ,submission, and fee have already been filed in the above-identified application on ☒ Are attached.
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application. ◯ An attorney or agent registered to practice before the Patent and Trademark Office, acting in a representative capacity. ◯ A sole inventor ◯ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors ◯ A joint inventor; all of whom are signing this e-petition ◯ The assignee of record of the entire interest that has properly made itself of record pursuant to 37 CFR 3.71

Signature	/Steve Y. Cho/
Name	Steve Y. Cho
Registration Number	44612

Electronic Patent Application Fee Transmittal

Application Number:	13234425
Filing Date:	16-Sep-2011
Title of Invention:	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Sun Cheul KIM
Filer:	Steve Yong Soo Cho
Attorney Docket Number:	K110PK-074000US

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Petition Fee-37CFR 1.17(h) (Group II)	2464	1	70	70
Request for Continued Examination	2801	1	600	600
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**670**

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Decision Date : November 29, 2013

In re Application of :

Sun Cheul KIM

DECISION ON PETITION

UNDER CFR 1.313(c)(2)

Application No : 13234425

Filed : 16-Sep-2011

Attorney Docket No : K110PK-074000US

This is an electronic decision on the petition under 37 CFR 1.313(c)(2), filed November 29, 2013, to withdraw the above-identified application from issue after payment of the issue fee.

The petition is **GRANTED.**

The above-identified application is withdrawn from issue for consideration of a submission under 37 CFR 1.114 (request for continued examination). See 37 CFR 1.313(c)(2).

Petitioner is advised that the issue fee paid in this application cannot be refunded. If, however, this application is again allowed, petitioner may request that it be applied towards the issue fee required by the new Notice of Allowance.

Telephone inquiries concerning this decision should be directed to the Patent Electronic Business Center (EBC) at 866-217-9197.

This application file is being referred to Technology Center AU 2461 for processing of the request for continuing examination under 37 CFR 1.114 .

Office of Petitions

Electronic Acknowledgement Receipt

EFS ID:	17525036
Application Number:	13234425
International Application Number:	
Confirmation Number:	6384
Title of Invention:	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Sun Cheul KIM
Customer Number:	83220
Filer:	Steve Yong Soo Cho
Filer Authorized By:	
Attorney Docket Number:	K110PK-074000US
Receipt Date:	29-NOV-2013
Filing Date:	16-SEP-2011
Time Stamp:	14:34:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$670
RAM confirmation Number	179
Deposit Account	504713
Authorized User	CHO, STEVE Y.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1	Request for Continued Examination (RCE)	2013_11_27_RCE_K110PK-074000US.pdf	697859 edeb47b3fd36a53ee31030e97ba1c9502e292ad3	no	3
Warnings:					
Information:					
2	Non Patent Literature	2013_11_27_IDS_REF1_NPL1_K110PK-074000US.pdf	6551088 572e93a7a69f6f5f6117b804ed8f019ebde761c2	no	5
Warnings:					
Information:					
3		2013_11_27_IDS_K110PK-074000US.pdf	178801 4ad841c3ab29b5184827f82598723eaa20cbcd4d	yes	3
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Form (SB08)		3	3	
Warnings:					
Information:					
4	Petition automatically granted by EFS	petition-request.pdf	31524 35037d95eeb384a6d5e79757145fd67c6e4ab71d	no	2
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	32274 46932c41797e5d7413b68aa02ef01ae77a371180	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	7491546		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/234,425	Filing Date 09/16/2011	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	11/29/2013	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 10	Minus	** 20	= 0	X $40 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $210 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L 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.

LIE
/DIANIECE JACOBS/

This collection of information is required by 37 CFR 1.16. 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, 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.

Substitute for form 1449B/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				*Application Number*	13/234,425
				Filing Date	September 16, 2011
				First Named Inventor	Sun Cheul KIM
				Art Unit	2461
(Use as many sheets as necessary)				*Examiner Name*	LEVITAN, DMITRY
Sheet	1	of	1	*Attorney Docket Number*	K110PK-074000US

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials *	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), 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.	T [2]
	1	BRYAN FORD et al., "Peer-to-peer Communication Across Network Address Translators", http://www.brynosaurus.com/pub/net/p2pnat/, Feb.17, 2005.	☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐

Examiner Signature		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.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Sun Cheul KIM et al. Application No.: 13/234,425 Filed: September 16, 2011 For: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT Customer No.: 83220	Confirmation No.: 6384 Examiner: LEVITAN, DMITRY Art Unit: 2461 SUPPLMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §1.97 and §1.98

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The references cited on attached form PTO/SB/08B are being called to the attention of the Examiner. Copies of the references are enclosed in compliance with the requirements of 37 CFR §1.98(a)(2).

It is respectfully requested that the cited references be expressly considered during the prosecution of this application, and the references be made of record therein and appear among the "references cited" on any patent to issue therefrom.

As provided for by 37 CFR §1.97(g) and (h), no inference should be made that the information and references cited are prior art merely because they are in this statement and no representation is being made that a search has been conducted or that this statement encompasses all the possible relevant information.

Applicant believes that no fee is required for submission of this statement. However, if a fee is required, the Commissioner is authorized to deduct such fee from the undersigned's Deposit Account No. 50-4713. Please deduct any additional fees from, or credit any overpayment to, the above-noted Deposit Account.

Respectfully submitted,

/Steve Y. Cho/
Steve Y. Cho
Reg. No. 44,612

AMPACC Law Group, PLLC
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043
Tel: 425-348-3500
Fax: 425-348-3299

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

PATENT WITHDRAWAL NOTICE

DATE WITHDRAWN	WITHDRAWAL NUMBER
12/3/2013	23711

The following application has been **WITHDRAWN** from the

12/17/2013 issue.

SERIAL NO.	PATENT NUMBER
13234425	8611336

TITLE

METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

NAME AND ADDRESS

SUN CHEUL KIM, ET AL
DAEJEON KOREA, REPUBLIC OF

REASON FOR WITHDRAWAL

Auto-petition to withdraw - Granted.

APPROVED

/Kimberly Terrell/, Manager

Patent Publication Branch
Office of Data Management

FORM PTO-302 -- (REV. 05-2009)

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

83220 7590 03/20/2014

AMPACC Law Group, PLLC
Steve Cho
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

EXAMINER
LEVITAN, DMITRY

ART UNIT	PAPER NUMBER
2461	

DATE MAILED: 03/20/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US	6384

TITLE OF INVENTION: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$0	$0	$890	$0	06/20/2014

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 DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). 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. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

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.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0187

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)

83220 7590 03/20/2014
AMPACC Law Group, PLLC
Steve Cho
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

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.
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US	6384

TITLE OF INVENTION: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$0	$0	$890	$0	06/20/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
LEVITAN, DMITRY	2461	370-351000

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 submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29
  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27
  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0188

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.
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US	6384

83220 7590 03/20/2014

AMPACC Law Group, PLLC
Steve Cho
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

EXAMINER	
LEVITAN, DMITRY	

ART UNIT	PAPER NUMBER
2461	

DATE MAILED: 03/20/2014

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 194 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 194 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 1-(888)-786-0101 or (571)-272-4200.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0189

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B 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. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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.

Notice of Allowability	Application No. 13/234,425	Applicant(s) KIM ET AL.	
	Examiner Dmitry H. Levitan	Art Unit 2461	AIA (First Inventor to File) Status No

-- 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 *11/29/14*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-5 and 10-14*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   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.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ 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. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Dmitry H Levitan/
Primary Examiner, Art Unit 2461

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0191

Notice of References Cited	Application/Control No. 13/234,425	Applicant(s)/Patent Under Reexamination KIM ET AL.	
	Examiner Dmitry H. Levitan	Art Unit 2461	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-8,296,437 B2	10-2012	Pankratov, Alexandre	709/227
*	B	US-7,609,701 B2	10-2009	Yang et al.	370/395.52
	C	US-			
	D	US-			
	E	US-			
	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	B. Ford, Peer-to-Peer communication across network address translators, MIT Lab, Feb. 17 2005, pages 1-14.
	V	P. Srisuresh, State of P2P communication across NATs, RFC 5128, RFC, March, 2008, pages 1-32.
	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.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S52	54	(network near2 virtual) and tunnel$4 and NAT and (hole near2 punch$3)	US-PGPUB; USPAT	OR	ON	2014/03/06 10:55

3/6/2014 1:56:21 PM
C:\Users\dlevitan\Documents\EAST\Workspaces\13234425.wsp

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0193

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	2	(network and virtual and tunnel and ((hole near2 punch$3))).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2014/03/06 13:10
L5	5	(network and tunnel$4 and ((hole near2 punch$3))).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2014/03/06 13:10
L7	3	(network and prefix and ((hole near2 punch$3))).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2014/03/06 13:12

3/6/2014 1:57:54 PM
C:\Users\dlevitan\Documents\EAST\Workspaces\13234425.wsp

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0194

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	Art Unit
	DMITRY H LEVITAN	2461

CPC- SEARCHED		
Symbol	Date	Examiner
H04L 63/0272, 63/029	3/06/14	DL

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	351, 389, 392, 395.3, 422	3/06/14	DL
709	227, 230-232, 238-242, 244	3/06/14	DL

SEARCH NOTES		
Search Notes	Date	Examiner
IEEE, EAST	3/06/14	DL

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
370	351	3/06/14	DL

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	Art Unit
	DMITRY H LEVITAN	2461

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	05/22/2013	09/05/2013	03/06/2014						
	1	✓	=	=						
	2	✓	=	=						
	3	✓	=	=						
	4	✓	=	=						
	5	✓	=	=						
	6	✓	-	-						
	7	✓	-	-						
	8	✓	-	-						
	9	✓	-	-						
	10	✓	=	=						
	11	✓	=	=						
	12	✓	=	=						
	13	✓	=	=						
	14	✓	=	=						

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0196

Substitute for form 1449B/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	13/234,425
				Filing Date	September 16, 2011
				First Named Inventor	Sun Cheul KIM
				Art Unit	2461
(Use as many sheets as necessary)				Examiner Name	LEVITAN, DMITRY
Sheet	1	of	1	Attorney Docket Number	K110PK-074000US

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials *	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), 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.	T[2]
	1	BRYAN FORD et al., "Peer-to-peer Communication Across Network Address Translators", http://www.brynosaurus.com/pub/net/p2pnat/, Feb.17, 2005.	☐
		The provided document is incomplete and low quality.	☐
		Examiner located and provided a proper copy of the document.	☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐

Examiner Signature	/Dmitry Levitan/	Date Considered	03/06/2014

*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.
[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	**Art Unit**
	DMITRY H LEVITAN	2461

CPC						
Symbol					**Type**	**Version**
H04L		63	/	029	F	20130101
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	10	
/DMITRY H LEVITAN/ Primary Examiner.Art Unit 2461	3/06/14	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0198

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	**Art Unit**
	DMITRY H LEVITAN	2461

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
370	351	H	0	4	L	12 / 28 (2006.01.01)						

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	10	
/DMITRY H LEVITAN/ Primary Examiner.Art Unit 2461	3/06/14	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0199

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13234425	KIM ET AL.
	Examiner	**Art Unit**
	DMITRY H LEVITAN	2461

☒ **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	Final	Original
	1														
	2														
	3														
	4														
	5														
--	6														
--	7														
--	8														
--	9														
	10														
	11														
	12														
	13														
	14														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 10	
/DMITRY H LEVITAN/ Primary Examiner.Art Unit 2461 (Primary Examiner)	3/06/14 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0200

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)

83220 7590 03/20/2014
AMPACC Law Group, PLLC
Steve Cho
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

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.
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US	6384

TITLE OF INVENTION: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$0	$0	$890	$0	06/20/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
LEVITAN, DMITRY	2461	370-351000

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: ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE

(B) RESIDENCE: (CITY and STATE OR COUNTRY): DAEJEON, REPUBLIC OF KOREA

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 submitted:
- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Steve Y. Cho/ Date June 5, 2014

Typed or printed name Steve Y. Cho Registration No. 44612

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0201

Electronic Acknowledgement Receipt

EFS ID:	19223593
Application Number:	13234425
International Application Number:	
Confirmation Number:	6384
Title of Invention:	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT
First Named Inventor/Applicant Name:	Sun Cheul KIM
Customer Number:	83220
Filer:	Steve Yong Soo Cho
Filer Authorized By:	
Attorney Docket Number:	K110PK-074000US
Receipt Date:	05-JUN-2014
Filing Date:	16-SEP-2011
Time Stamp:	18:25:23
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	Issue Fee Payment (PTO-85B)	2014_06_05_FEE_TRNSMTL_K110PK-074000US.pdf	986676 e49da487a3f2dd6c6e2f422c2f56077e01f1adf4	no	1
Warnings:					
Information:					

Total Files Size (in bytes):	986676

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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.

Best Available Copy

IFW

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)

83220 7590 03/20/2014
AMPACC Law Group, PLLC
Steve Cho
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043



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.
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US	6384

TITLE OF INVENTION: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

06/06/2014 CCHAU2 00000006 13234425
01 FC:2501 480.00 OP
02 FC:1504 410.00 OP

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$0	$0	$890	$0	06/20/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
LEVITAN, DMITRY	2461	370-351000

Adjustment date: 06/06/2014 CCHAU2
11712/2013 INTEFSW 00017213 13234425
01 FC:2501 -890.00 OP

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: ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE

(B) RESIDENCE: (CITY and STATE OR COUNTRY): DAEJEON, REPUBLIC OF KOREA

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 submitted:
☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ Applicant certifying micro entity status. See 37 CFR 1.29
NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
☐ Applicant asserting small entity status. See 37 CFR 1.27
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
☐ Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Steve Y. Cho/ Date June 5, 2014
Typed or printed name Steve Y. Cho Registration No. 44612

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0204

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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/234,425	07/15/2014	8780887	K110PK-074000US	6384

83220 7590 06/25/2014

AMPACC Law Group, PLLC
Steve Cho
6100 219th Street SW, Suite 580
Mountlake Terrace, WA 98043

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 194 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

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 Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Sun Cheul KIM, Daejeon, KOREA, REPUBLIC OF;
Seong Moon, Daejeon, KOREA, REPUBLIC OF;
Seungwoo Hong, Daejeon, KOREA, REPUBLIC OF;
Ho Sun Yoon, Daejeon, KOREA, REPUBLIC OF;
Ho Yong Ryu, Daejeon, KOREA, REPUBLIC OF;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0205

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	Docket No.: 432-0342
Sun Cheul KIM et al.	Confirmation No.: 6384
Patent No.: 8,780,887	Group Art Unit: 2461
Issued: July 15, 2014	Examiner: -

For: **METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT**

Commissioner for Patents
P.O. BOX 1450
Alexandria, VA 22313-1450

NOTIFICATION OF LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS

Sir:

It is respectfully requested that the status of this patent be changed from small entity to large entity. Small entity status was established in this application in good faith upon filing of this application. It has now been discovered that this application is no longer entitled to small entity status.

Prompt and favorable consideration of this submission is respectfully requested.

Respectfully Submitted,

/Steve H. Lam/

Steve H. Lam
Reg. No. 72,721

PARATUS LAW GROUP, PLLC
1765 Greensboro Station Place
Suite 320
Tysons Corner, Virginia 22102
Tel: 571-313-7556
Fax: 703-935-8473
SHL/SWL
Date: January 22, 2025

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
13/234,425	**01/22/2025 12:49:42 AM Z ET**	**K110PK-074000US**

Title of Invention

METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	8780887
CONFIRMATION #	6384	FILED BY	MIHARU SCULLY
PATENT CENTER #	68853735	FILING DATE	09/16/2011
CUSTOMER #	83220	FIRST NAMED INVENTOR	Sun Cheul KIM
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Lenny Jiang

Documents

TOTAL DOCUMENTS: 3

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
01_432-0342_Request_to_Change_Entity_Status.pdf	1	Notification of loss of entitlement to small entity status	15 KB
02_432-0342_3.73c_Statement.pdf	3	Assignee showing of ownership per 37 CFR 3.73	131 KB
03_432-0339_et_al._Executed_POA.pdf	3	Power of Attorney	2822 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)

01_432-0342_Request_to_Change_Entity_Status.pdf	18730F2ACBF1DF4A11A92619EF960FA25D06DC1C5766277F9198D6581ED227E2CF741408FED61074D824667C94EF26AA3FE1ECE4DF26864965D934F6B54AE00C
02_432-0342_3.73c_Statement.pdf	8033BF36AF0879252545A487A66D9D553A7467A03D8038B3C6CED396F9E9CDBF6A7FAB10AB13202871D6B0DFE22F1236821AB8F760D96629DD4C781C325FD841
03_432-0339_et_al._Executed_POA.pdf	F7C927D9EF99CE096311A79C38776112174A53F4591E13C119151547CCD89D93582B73B9BB54B04E1A0C4C408745D311792BFE1FEA87743FC7D4671670873D99

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for 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.

PTO/AIA/96 (11-23)
Approved for use through 05/31/2024. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

First Named Inventor/Patent Owner: Sun Cheul KIM

Application No./Patent No.: 8,780,887 Filed/Issue Date: July 15, 2014

Titled: METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT

ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE, a Research Institute

(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 026935, Frame 0450, 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: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached*.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached*.

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0031. Public burden for this form is estimated to average 12 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. 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.

PTO/AIA/96 (11-23)
Approved for use through 05/31/2024. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached*.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, 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.

/Steve H. Lam/	January 22, 2025
Signature	Date
Steve H. Lam	72,721
Printed or Typed Name	Title or Registration Number

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. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013). https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf

Routine uses of the information in this record may include disclosure to:

1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;

2) a federal, state, local, or international agency, in response to its request;

3) a contractor of the USPTO having need for the information in order to perform a contract;

4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;

5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;

6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;

7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;

8) 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));

9) the Office of Personnel Management (OPM) for personnel research purposes; and

10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

PTO/AIA/81A (Modified)
Approved for use through 08/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Patent Number	Identified in the Appendix
Issue Date	Identified in the Appendix
First Named Inventor	Identified in the Appendix
Title	Identified in the Appendix
Attorney Docket No.	Identified in the Appendix

I hereby revoke all previous powers of attorney given in the 21 patents identified in the Appendix.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) with respect to the 21 patents identified in the Appendix, and to transact all business in the United States Patent and Trademark Office connected therewith:

145742

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified patent to:

☒ The address associated with the above-identified Customer Number.

OR

☐ The address associated with the Customer Number identified in the box at right:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Applicant.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(c) (Form PTO/AIA/96) submitted herewith or filed on _____.

SIGNATURE of Applicant or Patent Owner

Signature		Date	January 20th, 2025
Name	Jang Sik Choi	Telephone	+82-42-860-3367
Title and Company	Director of ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE		

NOTE: Signatures of all the applicants or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☑ A total of 1 forms are submitted.

An Appendix listing 21 patents, spanning two pages, begins on the next page.

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 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: 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.

APPENDIX

No.	Patent No.	Issue Date	First Named Inventor	Title	Attorney Docket No.
1	8,689,085	April 1, 2014	Jong-Yoon SHIN	METHOD AND APPARATUS FOR TRANSMITTING DATA IN OPTICAL TRANSPORT NETWORK	432-0339
2	8,638,807	January 28, 2014	Dae Ub KIM	METHOD FOR MANAGING ETHERNET RING NETWORK OF VLAN-BASED BRIDGE	432-0340
3	9,030,925	May 12, 2015	Tae Sik Cheung	METHOD AND APPARATUS FOR SHARED MESH PROTECTION SWITCHING	432-0341
4	8,780,887	July 15, 2014	Sun Cheul KIM	METHOD OF NETWORK-BASED COMMUNICATION IN VIRTUAL NETWORK ENVIRONMENT	432-0342
5	8,788,846	July 22, 2014	Jong Youl PARK	CLOUD COMPUTING SYSTEM AND CLOUD SERVER MANAGING METHOD THEREOF	432-0343
6	9,319,241	April 19, 2016	Sachoon KANG	FLOW-BASED PACKET TRANSPORT DEVICE AND PACKET MANAGEMENT METHOD THEREOF	432-0344
7	9,313,101	April 12, 2016	SANG WAN KIM	METHOD OF CONTROLLING TRAFFIC BY TIME-BASED POLICY	432-0345
8	9,112,934	August 18, 2015	Tai-Won UM	APPARATUS AND METHOD FOR CONFIGURING ON-DEMAND CONTENT DELIVERING OVERLAY NETWORK	432-0346
9	9,621,469	April 11, 2017	Kang-Il CHOI	APPARATUS AND METHOD FOR MANAGING FLOW IN SERVER VIRTUALIZATION ENVIRONMENT, AND METHOD FOR APPLYING QOS	432-0347
10	9,136,968	September 15, 2015	Han-Hyub LEE	TIME AND WAVELENGTH DIVISION MULTIPLEXING - PASSIVE OPTICAL NETWORK (TWDM-PON) SYSTEM AND COMMUNICATION LINK METHOD THEREOF	432-0348
11	9,577,924	February 21, 2017	Nam-Seok KO	SDN-BASED NETWORK DEVICE WITH EXTENDED FUNCTION AND METHOD OF PROCESSING PACKET IN THE SAME DEVICE	432-0349
12	10,020,961	July 10, 2018	Sung Hyuk BYUN	METHOD AND APPARATUS FOR NETWORK VIRTUALIZATION	432-0350
13	9,825,710	November 21, 2017	Hark YOO	METHOD AND SYSTEM FOR DETERMINING AND CONTROLLING POWER OF OPTICAL TRANSMITTER OF OPTICAL NETWORK UNIT FOR TIME AND WAVELENGTH DIVISION MULTIPLEXING PASSIVE OPTICAL NETWORK	432-0351
14	10,248,433	April 2, 2019	Sung Won BYON	NETWORK MANAGEMENT APPARATUS AND METHOD FOR REMOTELY CONTROLLING STATE OF IT DEVICE	432-0352
15	11,088,774	August 10, 2021	Han Hyub LEE	METHOD AND APPARATUS FOR WAVELENGTH ALLOCATION FOR BIDIRECTIONAL OPTICAL ACCESS	432-0353
16	8,781,323	July 15, 2014	Yool KWON	PACKET TRANSPORT LAYER PASSIVE OPTICAL NETWORK (PTL-PON) PROVIDING SYSTEM AND METHOD	432-0365

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0213

Revocation of Power of Attorney with a New Power of Attorney and Change of Correspondence Address
Owner of Patents: ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE

No.	Patent No.	Issue Date	First Named Inventor	Title	Attorney Docket No.
17	9,197,351	November 24, 2015	Kyeong-Hwan DOO	METHOD OF SELECTING WAVELENGTH OF OPTICAL NETWORK UNIT IN PASSIVE OPTICAL NETWORK	432-0366
18	9,806,939	October 31, 2017	Dae Ub KIM	METHOD AND APPARATUS FOR LINEAR PROTECTION SWITCHING	432-0367
19	9,507,625	November 29, 2016	Byung Yun LEE	APPARATUS AND METHOD FOR GENERATING SOFTWARE DEFINED NETWORK (SDN)-BASED VIRTUAL NETWORK ACCORDING TO USER DEMAND	432-0368
20	10,827,240	November 3, 2020	Hwan Seok CHUNG	COOPERATIAVE DYNAMIC BANDWIDTH ALLOCATION METHOD IN MOBILE NETWORK WITH OPTICAL NETWORK, AND DEVICE OF PERFORMING THE COOPERATIAVE DYNAMIC BANDWIDTH ALLOCATION METHOD	432-0369
21	11,233,572	January 25, 2022	Han Hyub LEE	SLICE CONNECTION METHOD OF OPTICAL ACCESS NETWORK AND OPTICAL ACCESS NETWORK SYSTEM FOR SLICE CONNECTION	432-0370

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0214

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US

CONFIRMATION NO. 6384

145742
Paratus Law Group, PLLC
1765 Greensboro Station Place
Suite 320
Tysons Corner, VA 22102

POA ACCEPTANCE LETTER

OC000000083598148

Date Mailed: 01/28/2025

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/22/2025.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tawashington/

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0215

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/234,425	09/16/2011	Sun Cheul KIM	K110PK-074000US

CONFIRMATION NO. 6384

83220
AMPACC Law Group, PLLC
Steve Cho
3500 188th Street SW, Suite 103
Lynnwood, WA 98037

POWER OF ATTORNEY NOTICE

OC000000083598099

Date Mailed: 01/28/2025

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/22/2025.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tawashington/

Cisco Systems, Inc. v. OptimNet LLC
Exhibit 1002
0216