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(71) Applicants *(for all designated States except US)*: **ZTE (USA) INC.** [US/US]; 2425 N. Central Expressway, Suite 323, Richardson, TX 75080 (US). **ZTE CORPORATION** [CN/CN]; ZTE Plaza, Keji Road South, Hi-tech Industrial Park, Nanshan District, Guangdong, Shenzhen, 518057 (CN).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **KHASNABISH, Bhumip** [US/US]; 18 Patterson Road, Lexington, MA 02421 (US).

(74) Agent: **LU, Zhun**; Connolly Bove Lodge & Hutz LLP, 1007 North Orange Street, P.O. Box 2207, Wilmington, DE 19899-2207 (US).

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(54) **Title**: SYSTEM AND METHOD FOR CLOUD-BASED SESSION BORDER GATEWAY IMPLEMENTATION

(57) **Abstract**: A system and method for implementing distributed virtual-resource-based (cloud-based) session border gateway (SBG) functions are presented. Because no dedicated physical resources need to be committed for implementation of the SBG features and functions, as in traditional border gateway functions implementations, the invention has significant cost, resource allocation, integration, and operational advantages over traditional methods. In addition, new features and functions can be easily developed and integrated with the Cloud-Based SBG (CB-SBG) implementations very cost- effectively.

# SYSTEM AND METHOD FOR CLOUD-BASED SESSION BORDER GATEWAY IMPLEMENTATION

## Field of the Invention

**This invention pertains to a system and method for session border gateway functions using distributed virtualized computing and communications resources.**

## Background

**[01]** A session border gateway (SBG) can be logically split into two entities, namely a signaling path function and a data path function. This split provides clarity when trying to narrow the functions addressed by different SBG types. These two functions may co-reside within the same physical element or may be separated with a protocol acting as the interface between them.

**[02]** Traditionally, SBG features and functions are implemented in different ways:

a) Stand-alone devices called session border controllers (SBCs);

b) Integrated in the network infrastructure elements such as routers, gateways, switches, optical line termination (OLT) equipment, and Internet protocol based Digital Subscriber Line Access Multiplexer (IP-DSLAM); or

c) A device at the border of wireless access and wireline core transport network.

**[03]** A list of SBG features and functions can be found in, for example, MSF Session Border Gateway Requirements specification that is available at http://www.msforum.org/techinfo/approved/MSF-PS-SBG-001.00-FINAL.pdf. Moreover, an example of an infrastructure element-based implementation of SBG features and functions can be found in US patent No. 7,656,797 entitled, "Method, Computer Program Product, And Apparatus For Providing A Distributed Router Architecture."

**[04]** Certain drawbacks of utilizing infrastructure element-based implementation of SBG features and functions include:

a) Costs;

b) Time required for testing and integration with network;

c) Static allocation of resources;

d) Less flexibility in repositioning the resources; and

e) Tighter coupling of computing and communications resources with pre-designed border features and functions.

**[05]** Service providers in a dynamic and continuously-evolving networking and service development environment need:

a) Protection of investment, i.e., investment in the resources that can be rapidly repurposed for different revenue generating applications and services; and/or

b) Agility and flexibility, i.e., deploying emerging features and functions utilizing the computing and communications resources that already exist in the network.

## Summary of the Invention

**[06]** The present invention addresses these issues and, for example, enables service providers to allocate their budget for computing, communications, and control infrastructure development rather than creating and installing silos of computing and networking gears which very often either remain underutilized or become obsolete before reaching the full potential (or providing the full return on investment).

**[07]** In one aspect, there is provided a method that includes obtaining resource blocks for a signaling part of a session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to applications and services communicating with the signaling part of the session border gateway; controlling allocation of resources from a media part of the session border

gateway via instructions over virtual private network links; obtaining resource blocks for the media part of the session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to the signaling part of the session border gateway; and using the resource blocks for the applications and services for a duration of time. The duration of time can range from a few seconds to tens or hundreds of hours.

**[08]** Optionally, the virtual private network links run an open protocol with a standardized profile.

**[09]** Optionally, the resource blocks are obtained from public, private, or community networks through open application and resource programming interfaces.

**[10]** In another aspect, there is provided an apparatus that includes a signaling part of a session border gateway comprising resource blocks from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to applications and services that communicate with the signaling part of the session border gateway; a media part of the session border gateway comprising resource blocks from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to the signaling part of the session border gateway; wherein the signaling part of the session border gateway is further configured to control allocation of resources from the media part of the session border gateway via instructions over virtual private network links; and wherein the resource blocks for the applications and services are configured to be used for a duration of time. The duration of time can range from a few seconds to hundreds of hours, for example.

**[11]** Optionally, the virtual private network links run an open protocol with a standardized profile.

**[12]** Optionally, the resource blocks are from public, private, or community networks through open application and resource programming interfaces.

**[13]** In yet another aspect, there is provided a system that includes means for obtaining resource blocks for a signaling part of a session border gateway

from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to applications and services communicating with the signaling part of the session border gateway; means for controlling allocation of resources from a media part of the session border gateway; means for obtaining resource blocks for the media part of the session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to the signaling part of the session border gateway; and means for using the resource blocks for the applications and services for a duration of time. The duration of time can range from a few seconds to hundreds of hours, for example.

**[14]** Optionally, the virtual private network links run an open protocol with a standardized profile.

**[15]** Optionally, the resource blocks are obtained from public, private, or community networks through open application and resource programming interfaces.

**[16]** In a further aspect, there is provided an article of manufacture that includes instructions for obtaining resource blocks for a signaling part of a session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to applications and services communicating with the signaling part of the session border gateway; instructions for controlling allocation of resources from a media part of the session border gateway via instructions over virtual private network links; instructions for obtaining resource blocks for the media part of the session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to the signaling part of the session border gateway; and instructions for using the resource blocks for the applications and services for a duration of time. The duration of time can range from a few seconds to hundreds of hours.

**[17]** Optionally, the virtual private network links run an open protocol with a standardized profile.

**[18]** Optionally, the resource blocks are obtained from public, private, or community networks through open application and resource programming interfaces.

## Brief Description of the Drawings

**[19]** A more complete understanding of the present invention may be realized by reference to the accompanying drawings, which are not necessarily drawn to scale. In the drawings, well-known elements in the relevant art have been omitted so as not to obscure the present invention in unnecessary detail.

**[20]** FIG. 1 illustrates block diagrams of traditional models for SBG implementations; and

**[21]** FIG. 2 illustrates a Cloud-Based SBG implementation model.

## Detailed Description of the Preferred Embodiments of the Present Invention

**[22]** In traditional stand-alone or infrastructure element-based implementations of SBG functions, dedicated computing, memory, and communications resources are required. These resources need to be integrated with the network infrastructure and operated in a harmonious way both in terms of traffic management and privacy/authentication/security administration.

**[23]** As a result, the time required for making the network ready for supporting the SBG features/functions and the costs for successfully achieving the desired results become prohibitively high. For example, additional router cards, ports, firewall, and control/processing resources need to be allocated and integrated for supporting the desired SBG features/functions. The level of integration efforts depend on the architecture.

**[24]** According to embodiments of the present invention, Cloud-Based SBG (CB-SBG) implementation overcomes the aforementioned drawbacks of

traditional SBG implementation because there is no need to pre-allocate computing, memory, and communications resources — either stand-alone or in the infrastructure network elements — for the purpose of supporting the SBG features/functions. Instead, the resources are obtained from public, private, or community networks through open application and resource programming interfaces (APIs and RPIs).

**[25]** These AIPs/RPIs can use any one or more of the following: SOAP, XML, WSDL, Parlay/Parlay-X, HTTP, CORBA, and the like. The details of the API/RPI design and profiling are beyond the scope of this patent application. It is notable that these APIs/RPIs not only simplify access to the desired resources, but also guarantee rapid integration and interoperability with the existing network/infrastructure, security, availability, service continuity, and the like. This is due to the fact that the desired SBG features/functions are obtained by selectively searching the available networked resources through open APIs/RPIs and fetching them so that they can be utilized per the requirements of the applications and services for the duration of the service. For example, real-time availability of firewalling and DSP resources is mandatory for real-time Enterprise voice communications services over the public Internet.

**[26]** In sum, any application or service that needs to utilize SBG features/functions can obtain those resources through open API/RPI from the network (e.g., the Internet) and then can use those resources for the duration of the session with guaranteed security and reliability. In other aspects, the invention provides a system and a computer program having features and advantages corresponding to those discussed above.

**[27]** Exemplary embodiments are described hereinafter with reference to the accompanying drawings, in which exemplary embodiments and examples are shown. The embodiments of the invention may be in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided by way of example so that this disclosure will satisfy applicable legal requirements.

**[28]** FIG. 1 schematically shows block diagrams of traditional models for SBG implementations. The *Signaling part of SBG* receives a request for resources from the applications and services for allocating the resources in the *Media part of SBG,* and allocates the resources blocks accordingly. In some implementations, policy, quality of service, and security requirements dictate these allocations. The interface between the *Signaling part of SBG* and the *Media part of SBG* can be open (standard protocol) or proprietary protocol, and the interface can be point to point or point to multi-point in order to support reliability through distribution of the resource requests.

**[29]** The details of Cloud framework reference model can be found at https://tools.ietf.org/html/draft-khasnabish-cloud-reference-framework-00, which is incorporated by reference in its entirety.

**[30]** Basically, the Cloud framework can be divided into four horizontal layers:

a) Application/Service Layer (ASL);

b) Resource Control Layer (RCL);

c) Resource Abstract and Virtualization Layer (RAVL);

d) Physical Resource Layer (PRL).

And one stacked vertical layer to support configuration management, registry, logging and auditing, security management, and service level agreement (SLA) management.

**[31]** FIG. 2 shows a CB-SBG implementation model according to an embodiment of the present invention. In this implementation, the resources that constitute the *Signaling part of SBG* (the "Virtual Blocks of Signaling SBGs") are obtained from a set of networked resources, and utilized for the duration of the requirements. This duration can vary from a few seconds to tens or hundreds of hours.

**[32]** The resource blocks for *Signaling part of SBG* can be obtained from a variety of networked resources and these blocks must be integrated into a pool of *Signaling part of SBG* resources so that a unified view can be presented to the applications and services that are communicating with the

*Signaling part of SBG* block. The *Signaling part of SBG* controls the allocation of resources from the *Media part of SBG* with instructions over virtual private network links that run open protocol with standardized profile.

**[33]** The resources that constitute the *Media part of SBG* (the "Virtual Blocks of Media SBGs") are obtained from a set of networked resources, and utilized for the duration of the requirements. This duration can vary from a few seconds to tens or hundreds of hours. The resource blocks for *Media part of SBG* can be obtained from a variety of networked sources and these blocks must be integrated into a pool of *Media part of SBG* resources so that a unified view can be presented to the *Signaling part of SBG*.

**[34]** It should be understood that the methods and systems of the present invention are executed employing machines and apparatus including simple and complex computers. Moreover, the architecture and methods described above can be stored, in part or in full, on forms of machine-readable media. For example, the operations of the present invention could be stored on machine-readable media, such as magnetic disks or optical disks, which are accessible via a disk drive (or computer-readable medium drive). Alternatively, the logic to perform the operations as discussed above, could be implemented in additional computer and/or machine readable media, such as discrete hardware components as large-scale integrated circuits (LSI's), application-specific integrated circuits (ASIC's), firmware such as electrically erasable programmable read-only only memory (EEPROM's); and the like. Implementations of certain embodiments may further take the form of machine-implemented, including web-implemented, computer software.

**[35]** The foregoing descriptions illustrate and describe certain embodiments of the present invention that are intended to explain best modes known of practicing the invention and to enable others skilled in the art to utilize the invention in such, or other, embodiments. It is to be understood that the invention is capable of use in various other combinations, modifications, and environments; and is capable of changes or modifications within the scope of the inventive concept as expressed herein, commensurate with the above teachings and/or skill or knowledge in the relevant art. Moreover, later-

invented or -developed equipment that carries out the methods and/or combination elements set forth in the claims are within the scope of the invention. Therefore, it is to be understood that the inventions are not to be limited to the specific examples of the embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims.

**WHAT IS CLAIMED:**

1. A method comprising:

obtaining resource blocks for a signaling part of a session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to applications and services communicating with the signaling part of the session border gateway;

controlling, by the signaling part of the session border gateway, allocation of resources from a media part of the session border gateway via instructions over virtual private network links;

obtaining resource blocks for the media part of the session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to the signaling part of the session border gateway; and

using the resource blocks for the applications and services for a duration of time.

2. The method of claim 1, wherein the duration of time is from a few seconds to hundreds of hours.

3. The method of claim 1, wherein the session border gateway is distributed and non-integrated.

4. The method of claim 1, wherein the virtual private network links run an open protocol with a standardized profile.

5. The method of claim 1, wherein the resource blocks are obtained from public, private, or community networks through open application and resource programming interfaces.

6. An apparatus comprising:

a signaling part of a session border gateway comprising resource blocks from a variety of networked resources, wherein the resource blocks are

integrated into a pool and a unified view is presented to applications and services that communicate with the signaling part of the session border gateway;

a media part of the session border gateway comprising resource blocks from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to the signaling part of the session border gateway;

wherein the signaling part of the session border gateway is further configured to control allocation of resources from the media part of the session border gateway via instructions over virtual private network links; and

wherein the resource blocks for the applications and services are configured to be used for a duration of time.

7. The apparatus of claim 6, wherein the duration of time is from a few seconds to tens or hundreds of hours.

8. The apparatus of claim 6, wherein the session border gateway is distributed and non-integrated.

9. The apparatus of claim 6, wherein the virtual private network links run an open protocol with a standardized profile.

10. The apparatus of claim 6, wherein the resource blocks are from public, private, or community networks through open application and resource programming interfaces.

11. An system comprising:

means for obtaining resource blocks for a signaling part of a session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to applications and services communicating with the signaling part of the session border gateway;

means for controlling allocation of resources from a media part of the session border gateway;

means for obtaining resource blocks for the media part of the session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to the signaling part of the session border gateway; and

means for using the resource blocks for the applications and services for a duration of time.

12. The system of claim 11, wherein the duration of time is from a few seconds to tens or hundreds of hours.

13. The system of claim 11, wherein the session border gateway is distributed and non-integrated.

14. The system of claim 11, wherein the virtual private network links run an open protocol with a standardized profile.

15. The system of claim 11, wherein the resource blocks are obtained from public, private, or community networks through open application and resource programming interfaces.

16. An article of manufacture including a computer-readable medium having instructions stored thereon, comprising:

instructions for obtaining resource blocks for a signaling part of a session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to applications and services communicating with the signaling part of the session border gateway;

instructions for controlling, by the signaling part of the session border gateway, allocation of resources from a media part of the session border gateway via instructions over virtual private network links;

instructions for obtaining resource blocks for the media part of the session border gateway from a variety of networked resources, wherein the resource blocks are integrated into a pool and a unified view is presented to the signaling part of the session border gateway; and

instructions for using the resource blocks for the applications and services for a duration of time.

17. The article of manufacture of claim 16, wherein the duration of time is from a few seconds to tens or hundreds of hours.

18. The article of manufacture of claim 16, wherein the session border gateway is distributed and non-integrated.

19. The article of manufacture of claim 16, wherein the virtual private network links run an open protocol with a standardized profile.

20. The article of manufacture of claim 16, wherein the resource blocks are obtained from public, private, or community networks through open application and resource programming interfaces.

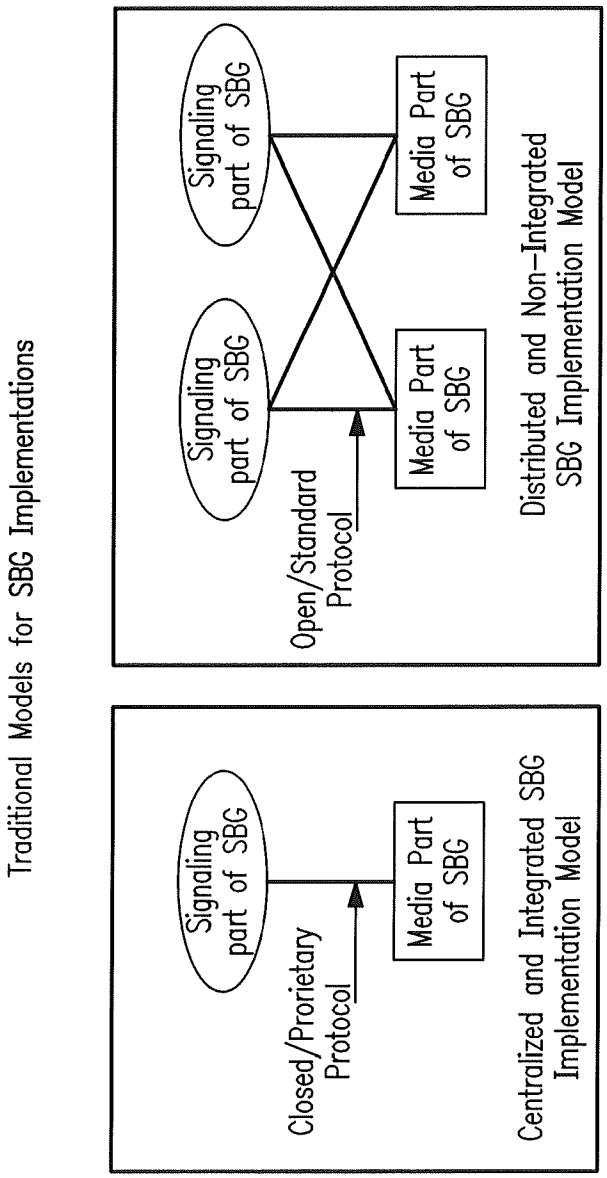
Traditional Models for SBG Implementations
Signaling part of SBG
Media Part of SBG
Closed/Prorietary Protocol
Centralized and Integrated SBG Implementation Model
Signaling part of SBG
Signaling part of SBG
Media Part of SBG
Media Part of SBG
Open/Standard Protocol
Distributed and Non-Integrated SBG Implementation Model

FIG. 1

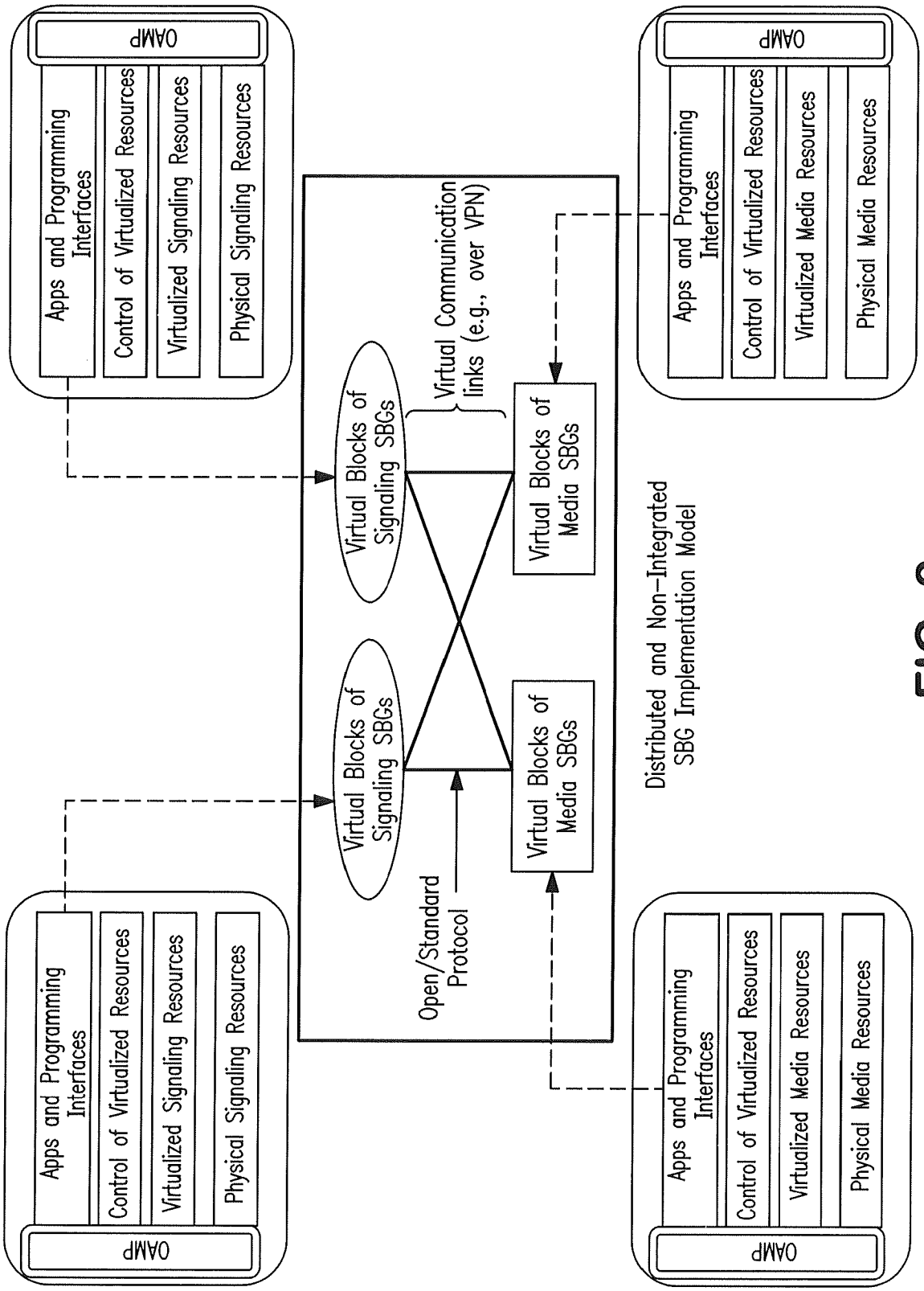
OAMP
Apps and Programming Interfaces
Control of Virtualized Resources
Virtualized Signaling Resources
Physical Signaling Resources
OAMP
Apps and Programming Interfaces
Control of Virtualized Resources
Virtualized Media Resources
Physical Media Resources
Virtual Communication links (e.g., over VPN)
Virtual Blocks of Signaling SBGs
Virtual Blocks of Media SBGs
Virtual Blocks of Signaling SBGs
Virtual Blocks of Media SBGs
Open/Standard Protocol
Distributed and Non-Integrated SBG Implementation Model
OAMP
Apps and Programming Interfaces
Control of Virtualized Resources
Virtualized Signaling Resources
Physical Signaling Resources
OAMP
Apps and Programming Interfaces
Control of Virtualized Resources
Virtualized Media Resources
Physical Media Resources

FIG. 2