METHODS FOR ASSIGNING SUBSCRIBER UNITS TO VISITED GATEWAYS

TECHNICAL FIELD

This invention relates generally to mobile telecommunication systems and, in particular, to methods for assigning subscriber units to visited gateways.

BACKGROUND OF THE INVENTION

When a subscriber unit requests service in conventional space-based or terrestrial telecommunication systems, the method for assigning the subscriber unit to a gateway is typically based on which gateway is the closest to the subscriber unit. For a subscriber unit close to a border, the subscriber unit may be assigned to a gateway which is on the other side of a border, rather than to a gateway in the country in which the subscriber unit is currently located. Moreover, the subscriber unit may be assigned to a gateway which is down, overloaded or incapable of handling the call, and in which case, the call may be dropped.

Another problem in conventional methods for assigning subscriber units to gateways occurs when the subscriber unit's communication is to be intercepted. In most systems, subscriber traffic can only be intercepted at the gateway which is providing service to the subscriber unit. However, the information about which calls are to be intercepted usually reside in a gateway which is expected to provide service to the subscriber. Thus, if the subscriber unit is located in another country which contains another gateway, and the other gateway is not capable of intercepting the subscriber unit's call, the call would not be intercepted if the subscriber unit was assigned to this other gateway. In addition, the system would not know that the call was to be intercepted because it did not consult the subscriber unit's home gateway for the intercept status of the call.

Thus, there is a significant need for methods that assign a subscriber unit to a gateway that can best service it. There is also a significant need for a method that assigns a specific subscriber unit to a serving gateway based on whether the call is to be intercepted or whether the call is to be routed around disabled or congested gateways.

In addition, there is significant need for a method that assigns subscriber units that would have been dropped due to gateway congestion or failure to an alternate home or visited gateway.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a general view of a space-based mobile telecommunication system according to a preferred embodiment of the present invention;

FIG. **2** shows a general view of the components of a satellite, home and visited gateways according to preferred embodiment of the present invention; and

FIG. **3** shows a flowchart of a method for assigning a subscriber unit to a visited gateway according to a preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention has utility in that a home gateway assigns a subscriber unit to a visited (i.e., serving) gateway to service the subscriber unit's connection request and call. Moreover, the present invention allows a subscriber unit to be served by a gateway other than the gateway which is geographically closest based on factors such as whether the call is to be intercepted, for example.

A "satellite" as used throughout this description means a manmade object or vehicle intended to orbit the earth. A "satellite" comprises geostationary, low-earth and medium-earth orbiting satellites and/or combinations thereof. A "constellation" means a number of satellites arranged in orbits for providing specified coverage (e.g., radio communication, remote sensing, etc.) of a portion, portions or all of the earth. A constellation typically includes multiple rings (or planes) of satellites and may have an equal number of satellites in each plane, although this is not essential. The terms "cell", "beam" and "antenna pattern" are not intended to be limited to any particular mode of generation and include those created by either terrestrial or space-based telecommunication systems and/or combinations thereof.

FIG. **1** shows a general view of space-based telecommunication system **10** according to a preferred embodiment of the present invention. Although FIG. **1** illustrates a highly simplified diagram of mobile telecommunication system **10**, system **10** comprises at least one satellite **20**, any number of subscriber units **30** and at least two gateways **40**. Generally, telecommunication system **10** may be viewed as a network of nodes. All nodes of communication system **10** are or may be in data communication with other nodes of communication system **10** through communication links. In addition, all nodes of telecommunication system **10** are or may be in data communication with other telephonic devices dispersed throughout the world through public service telephone networks (PSTNs) and/or conventional terrestrial communication devices coupled to a PSTN through conventional terrestrial base stations.

The present invention is applicable to space-based telecommunication systems that assign particular regions on the earth to specific cells on the earth, and preferably to systems that move cells across the surface of the earth. Although the present invention is applicable to space-based telecommunication systems **10** having at least one satellite **20** in low-earth, medium-earth or geosynchronous orbit, satellite **20**, is preferably in low-earth orbit around earth. Satellite **20** may be a single satellite or one of many satellites in a constellation of satellites orbiting earth. The present invention is also applicable to space-based telecommunication systems **10** having satellites **20** which orbit earth at any angle of inclination including polar, equatorial, inclined or other orbital patterns. The present invention is applicable to systems **10** where full coverage of the earth is not achieved (i.e., where there are "holes" in the telecommunication coverage provided by the constellation) and to systems **10** where plural coverage of portions of the earth occur (i.e., more than one satellite is in view of a particular point on the earth's surface).

Each satellite **20** communicates with other nearby satellites **20** through cross-links. These cross-links form a backbone of space-based mobile telecommunication system **10**. Thus, a call or communication from one subscriber unit located at any point on or near the surface of the earth may be routed through a satellite or a constellation of satellites to within range of substantially any other point on the surface of the earth. A communication may be routed down to a subscriber unit (which is receiving the call) on or near the surface of the earth from another satellite **20**. How satellite **20** physically communicates (e.g., spread spectrum technology) with subscriber units **30** and gateway **40** is well known to those of ordinary skill in the art.

Subscriber units **30** may be located anywhere on the surface of earth or in the atmosphere above earth. Mobile