The Space-Based Internet

Editor's note:
In the previous chapter, Michael Simpson discussed the Cisco IRIS project as an example of spin-in. To provide more information on IRIS, the following was compiled from materials that were downloaded from a number of Cisco web sites. It was also reviewed by Cisco for accuracy. Figure 1 & 2 are reproduced here courtesy of and with the permission of Cisco Systems, Inc.

Overview

As commercial endeavors expand into space, the need to communicate goes with them. Most of the entrepreneurs, scientists, explorers, and tourists who journey to space will expect to remain in more or less constant contact with the rest of human civilization, which will require a significant communications infrastructure.

Businesses will require constant exchange of data, while space-inhabitants will want their YouTube videos, and live feeds from Earth's critical elections or its great sporting spectacles. They'll also want immediate access to the latest tweets from their favorite celebrities, and the latest news from their parents, children or grandchildren.

Increasing the capability of Earth and space-based communications networks therefore becomes a significant enabler of space commerce. A modest but perhaps important step forward is the recent development of a radiation-tolerant internet router that, for the first time, implements internet-protocol-based network services directly onboard a satellite.

Cisco's prototype router, Internet Routing in Space (IRIS) is a hosted payload on Intelsat 14 (IS-14), launched on November 23, 2010 and operating since then in GEO orbit.

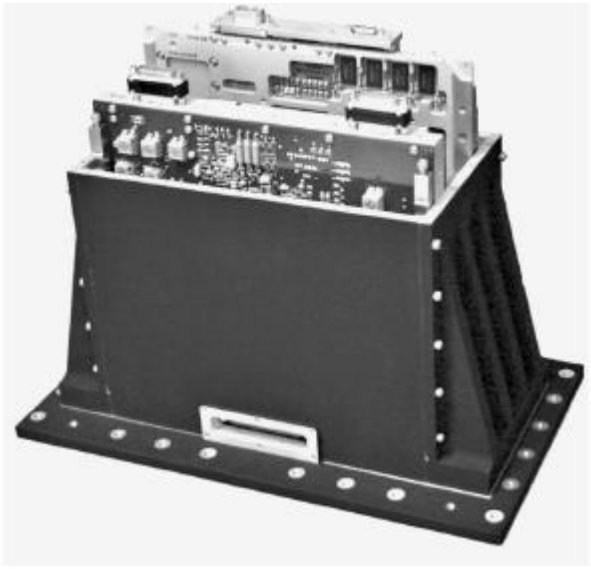

Figure 1
Cisco IRIS Router
IRIS is a radiation-tolerant router that implements network services directly onboard a satellite.

The IRIS router is a technology demonstration created by Cisco at the request of the U.S. Department of Defense to validate the feasibility of locating internet switching equipment in space in order to seamlessly converge space and ground communication networks.

The DoD tests have been completed, and a report on test results is pending, but was not issued as of the publication of this book. Following the completion of testing, Cisco has been providing access to IRIS to commercial and government customers to help them understand how it may impact their needs in the future.

Switching in Space

Before it was possible to locate a router in space, all internet switching gear was located on the ground, so all internet transmissions were of necessity routed through ground-based stations, increasing transmission delays and reducing network flexibility. The purpose of IRIS is to enable satellite transmissions to be routed directly from one satellite to another, thereby increasing the efficiency of both on and off-Earth communication networks, and making additional capabilities available to all space travelers and inhabitants.

IRIS also has the potential to make existing satellite networks more efficient by reducing the extra communications steps that must presently be used with non-internet-protocol satellite systems. Further, many currently existing satellite networks were designed to operate only with one type of communications signal, and thus satellite networks designed for television signals typically do not interoperate with those designed for telephone. However, as communications media are converging on internet protocol standards, the ability of different satellite networks to communicate directly with one another offers the possibility of improving the efficiency of network operations.

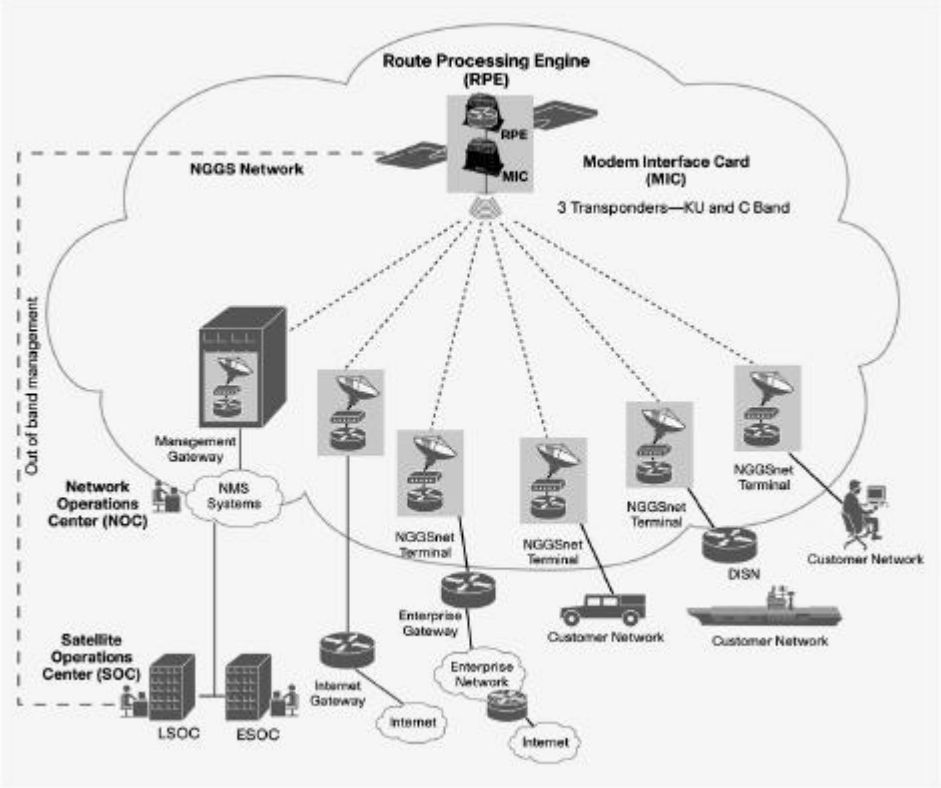

Figure 2
Cisco Space Architecture, referred to as "Next Generation Global Services" (NGGS) links a variety of sites through satellite ground terminals to increase communication efficiency and reduce costs.

IRIS creates a converged space-ground network that ensures every voice, video or data session travels on the most efficient path, whether through space or on the terrestrial network or a combination of both. This is intended to optimize the end user experience while reducing the volume of bandwidth needed to accomplish communication tasks.

In many space commerce scenarios, space-based routers will enable manned and unmanned spacecraft, space stations, and satellites to be in direct communication with each other, offering increased communications

capability to commercial operators by extending the point-to-point communications network beyond Earth. They will also enable telecommunications, video, and data to be transmitted by a single satellite.

To manage costs for end users, Cisco uses its standard software tools, called IOS, which are already deployed on millions of ground-based routers throughout the world.

Using IOS for space applications should make it easier for commercial teams to design and develop systems and equipment destined for space, and perhaps the resulting cost savings will further enable the emerging commercial space sector by reducing or entirely eliminating what might otherwise be a significant development cost for new space hardware. It's also expected to reduce in-space operating costs.

More information on Cisco's space initiative can be found at http://www.cisco.com/web/strategy/government/space-routing.html.

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