



LEO/GEO HYBRID SYSTEM
PROOF OF CONCEPT, DEMONSTRATION,
AND RESULTS

PACIFIC DATAPORT INC

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LEO/GEO Hybrid System – PDI Demonstration

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Purpose of This Demonstration

Pacific Dataport Inc. (PDI) believes that a LEO/GEO hybrid network solution will provide optimal broadband service to Alaska when new high-capacity broadband networks are deployed. Low-earth-orbit satellite networks offer low-latency solutions enabling a variety of latency sensitive applications. Geostationary satellite networks will allow high capacity and high throughput enabling large data applications and requirements for many industries. Combining these two types of systems will bring together new technology, enable new services, and lower costs to subscribers while providing broadband solutions tailored to each customers' needs.

PDI's LEO/GEO hybrid demonstration includes the following:

- Network design
- Proof of concept of a LEO solution being used in a hybrid network
- Proof of concept of a GEO solution being used in a hybrid network
- Demonstration of a LEO network in a specific industry application
- Demonstration of a GEO network in a specific industry application
- Running GEO and LEO systems through a dual WAN router to create an operational hybrid network
- Analysis on the viability of deploying GEO/LEO hybrid networks in Alaska

Network

Low-Earth-Orbit "LEO" Satellite Service

Iridium

PDI used the Iridium NEXT low-earth-orbit satellite system as the LEO component of this demonstration. A Thales MissionLink antenna and modem were used as the ground component connecting PDI's test equipment to the Iridium NEXT constellation. The Thales MissionLink provided a maximum of 700 Kbps downlink speed and an average of 300ms of latency.

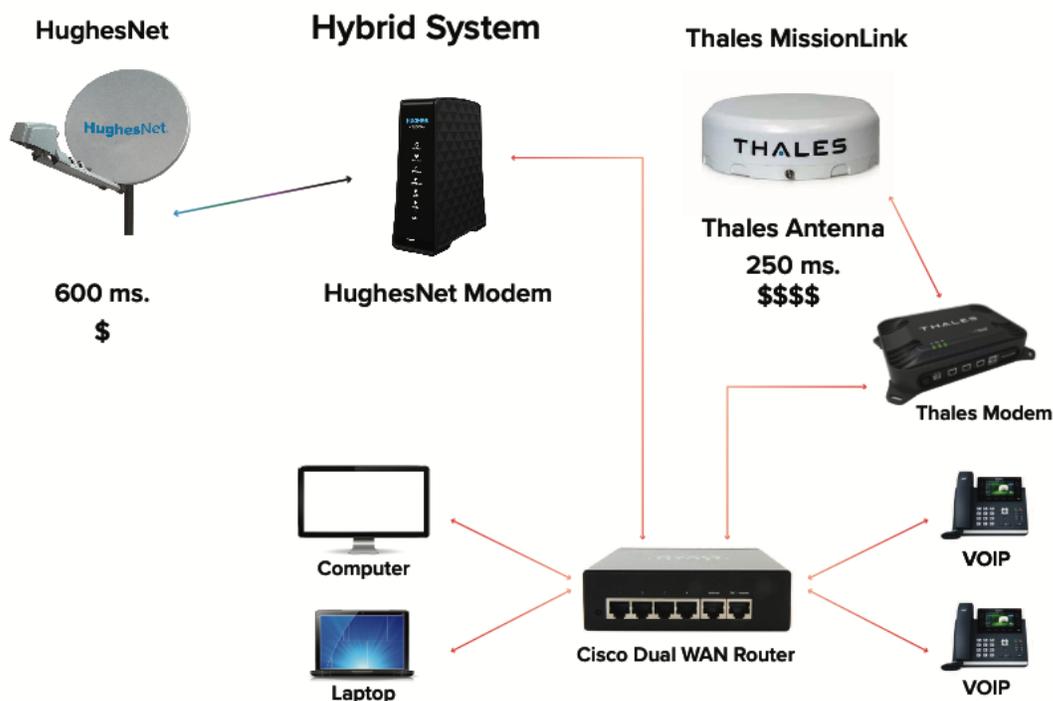
Geostationary "GEO" Satellite Service

Hughesnet

PDI used Hughesnet, a commercially available service on Hughes' Jupiter 2 high-throughput geostationary satellite, as the GEO component of this demonstration. A Hughesnet HT2000W modem connected to a 0.98m Ka-band antenna was used as the ground component connecting PDI's test equipment to the Hughesnet service. Hughesnet provided downlink speeds in excess of 25 Mbps and an average of 600ms of latency.

Type	System	Satellite	Speed	Latency
LEO	Thales MissionLink	Iridium NEXT	700 x 352 Kbps	300 ms
GEO	Hughesnet	Jupiter 2	25 x 3 Mbps	600 ms

Network Design



Set-up

PDI connected both the LEO service and GEO service to one dual-WAN router to manage the flow of traffic between services. The router was pre-configured to send all VOIP traffic over the low-latency LEO system while all other traffic was sent over the high-capacity GEO system.

Testing

Testing was completed individually on each system followed by both systems together simultaneously.

Test 1 – VOIP over LEO

VOIP calls were completed successfully over the ThalesMission Link unit.

Test 2 – Video over GEO

Video services were successfully streamed and downloaded over Hughesnet with multiple streams and downloads occurring simultaneously.

Test 3 – VOIP over LEO and Video over GEO

Video services were successfully streamed and downloaded on two different computers while VOIP calls were completed simultaneously. The video traffic was sent over the Hughesnet GEO system while the VOIP traffic was sent over the Iridium LEO network.

Analysis

LEO/GEO Hybrid Analysis

A LEO/GEO hybrid network provides a unique solution for customers looking to have low-latency service while also maintaining high-capacity throughput at the same time. Low-latency LEO networks can serve the voice and latency-sensitive data applications while GEO networks can provide low-cost and high-throughput simultaneously. To further clarify, simultaneous use of both systems allows for the most efficient use of each service. The GEO system can be used for video streaming, email, website navigation, and high capacity data transfer while at the same time the LEO system can be used for latency sensitive software, day trading, and video games. The Iridium LEO service in this demonstration is high-cost and low throughput. This service can only be used minimally or for voice-only traffic, otherwise it is a very high cost option. Allowing a router to manage traffic that sends high-data requirements and latency-tolerant services over a GEO network allows customers to make use of high-cost LEO services more efficiently. Efficient use of bandwidth and cost is crucial to providing the lowest cost and best service to all areas of rural Alaska. This hybrid network proved the concept that when used in tandem, LEO and GEO services can be used most efficiently and create the most economical solution for the customer. Hybrid systems, such as the one in this demonstration, provide data transfer efficiencies as well as economic efficiency maximizations that in turn result in direct increases in manpower efficiencies. LEO services are faster when a faster service is required, but are not used when they are not needed.

Future Services

With the upcoming deployment of new high-capacity and lower cost LEO and GEO networks in Alaska, hybrid networks will be the best solution for customers looking for the most efficient, high-capacity, low-latency, and lowest cost service. The Aurora Satellite System, developed by Pacific Dataport Inc, is bringing new GEO high-throughput satellite broadband service with complete coverage of Alaska. These new satellites will enable broadband service to all points in Alaska at much lower prices than currently available. OneWeb, a LEO provider, is also currently launching a new LEO constellation that will enable global broadband coverage (inherently covering Alaska as well). Merging these two new systems into a hybrid network will allow the most technical and economical solution for broadband service in rural Alaska.