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Exploring satellite for deploying effective real-time network services for oil & gas industry demands

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In today's hyper-connected world, high bandwidth, low latency terrestrial networks supporting Real-Time (RT) or Near Real-Time (NRT) applications have become the accepted norm by well-connected users. But, network services delivered over satellites in geostationary orbits (GEOSATs) present a viable solution for the rural and offshore environments in which the oil and gas industry operates.

The suitability of satellite-based transport solutions for latency-dependent applications comes down to understanding the physics behind the latency, closed- loop operations and the applications. First, let's look at the physics. Due to the finite speed of propagation of an electromagnetic wave in free space, the Round-Trip Time (RTT) of an Internet Control Message Protocol (ICMP) echo request and reply, also known as a ping, between two ground terminals over a GEOSAT ranges from 480 ms to 570 ms.

When transferring files over an Internet Protocol (IP) based network, the impact of nearly 500 ms latency is felt in closed-loop operations associated with everything from flow control to file transfers. Within IP's Transmission Control Protocol (TCP), flow control is handled by a 16-bit Receiver Window Buffer. The buffer keeps track of the number of bytes that can be sent, without acknowledgement, up to a maximum value of approximately 216 bytes, or 64 kB.

For the communications protocol to be efficient, the ether between the ground stations must be kept full of data over the period of time it takes for the receiving station to receive and process the first tranche of data, then acknowledge receipt of data back to the sending station.

The exact number of bits in transit is given by the product of bandwidth and RTT, also known as the Bandwidth Delay Product (BDP). In the case of a standard implementation of TCP, BDPs greater than 64 kiB value for the receiver window will reduce the effective throughput of the link. The approximate formula is: Effective_Throughput = (Receive_Window / BDP) * bandwidth

Options

A common solution to this bandwidth limiting effect involves installing a network appliance, to remove the constraint imposed by the small receive window buffer, by swapping out the TCP protocol with a proprietary one. These appliances are known as TCP Accelerators, WAN Optimizers, or Application Accelerators. They can also transform the sequential transfer of a set of small files into one where the files are transferred in parallel, to minimize the impact of waiting for the individual file open and close operations as data is written.

Encryption protocols suites, such as IPsec, may require a full 6-message handshake (e.g. IKE Main Mode). Web based cryptographic protocols such as TLS will also require multiple handshakes that will also involve a X.509 Certificate Server. The result of the multiple handshakes required to setup an encrypted link is an operational pause of approximately 1.5 to 3.0 seconds before any user data flows across a newly established encrypted link.

Remote drilling applications in the oil and gas industry can be modeled as a Proportional-Integral-Differential (PID) controller, where the increased latency appears as a phase shift in the error value in the control loop. Of course, an engineering analysis must be performed to determine its ultimate suitability, but in many RT applications, such as piloting drones in aviation, the latency experienced over a GEOSAT can be accommodated by careful tuning of the PID parameters, making the system responsive and stable.

In all but the most demanding RT application, network services delivered over GEOSATs can still meet user requirements with a carefully engineered, end-to-end system. Satellite-based network services still provide the desired bandwidth and expected performance at a great value.

flash new builds contracts Q1 2015

Client	Vendor	Details	Date
ESVAGT	Havyard Ship Technology AS	Contracted to build a 60-man service vessel for Dudgeon wind farm operated by Statoil	Dec-14
Keppel AmFELS LLC	Undisclosed/Confidential	Deal worth +US$100m to build one of the world's largest land drilling rigs for delivery mid-2016	Jan-15
Keppel Shipyard Ltd	Golar Gimi Corporation (Golar Gimi)	Contract for conversion of LNG carrier, the GIMI, into a FLNGV worth approx US$705m	Jan-15
Seaways International Pte Ltd	Keppel Singmarine PTE Ltd	Agreement to contract multi-task AHT vessel for offshore activities	Jan-15
Nakilat-Keppel Offshore & Marine	Keppel Singmarine PTE Ltd	Joint venture to provide technical services for new lifeboat	Jan-15
Bernhard Schulte	ULSTEIN	Contract to build 2 x SOVs with accommodation for up to 109 persons for WINDEA Offshore GbbH & Co KG	Jan-15
New Orient Marine PTE	Keppel Singmarine Pte Ltd	Contract for an ice-class multi-purpose vessel worth cUS$265m	Jan-15
Van Oord	Damen	Elected to supply FCS 1605 vessel to commence operations April 2015	Jan-15
ULSTEIN	CBO	Contract for design & equipment package for a PSV PX105 type; includes option for 2 more vessels	Feb-15
Esvagt	Havyard	Agreement to deliver 2nd windfarm service vessel as part of a 5yr contract for Siemens	Mar-15
OEG Offshore	Oilfield & Resource Rentals (ORR) & Offshore Cryogenic Services (OCS)	Acquisitions of West Australian Oilfield Service Providers	Mar-15

KEY

LNG - Liquefied Natural Gas • **FLNGV -** Floating Liquefaction Vessel • **AHT -** Anchor Handling Tug • **SOV -** Service Operating Vessel • **FCS -** Fast Crew Supplier • **PSV -** Platform Supply Vessel