WiMAX for Remote Oil Production Sites
WiMAX Forum Oil & Gas Event
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Houston Texas
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Project Background

• GE Customer: Wireless Data Communications out of Liberal, Kansas is a full service partner to GE MDS.

• End customer is an oil firm drilling in North Dakota.

• Data requirements were low, however video used at one site drove higher throughput requirement.

• Customer needed 24/7 SCADA data provided.

• Timeline was critical as weather turns in November inhibiting tower construction and radio field deployment.

• Outdoors CPEs chosen for several sites.
Typical Customer Requirements

• Communications 24/7 from remote locations
• Environmental or work conditions cannot interrupt communications
• Video data capacity required
• Mature technology
• No public infrastructure available at sites
• Severe environmental conditions
• Remote FW upgrade capability
• Plug n play – technicians need simplicity for trouble shooting and maintenance of communications infrastructure
System Design
System Design

Access Point at plant office consists of 3 base stations for 360 degree MIMO receive & transmission.

Mercury subscribers monitor RTU data.

Mercury subscribers gather video & SCADA data.

Access Point at plant office consists of 3 base stations for 360 degree MIMO receive & transmission.
System Deployment

Side views of Plant Office Access Point Deployment
Plant Office Front View
Plant Office Side View

• 3 Mercury 3650 indoor subscribers running MIMO
System Deployment

Mercury subscriber installed at oil well site
Towers also have PtP high capacity licensed radio
Lessons Learned

• Need onsite system design and services for successful WiMAX implementation

• All accessories should be included in shipment

• Customer support is critical in initial WiMAX deployments

• WiMAX systems are bigger than just a product sale

• SW is never done done

• Higher throughput is required

• Weather constraints drive project timelines
Satellite-Enabled WiMAX Solutions
For ‘The Patch’

David Hartshorn
Secretary General
Global VSAT Forum
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The Global VSAT Forum: Facilitating Sustainable Connectivity

- Global Non-Profit Association
- 200+ Companies Headquartered in 100+ Countries
- Reaching Every Nation in the World
- Facilitating Satellite Systems/Service Provision Thru...
  - Enabling Effective Regulation, Spectrum Management
  - Providing Training, Product Testing, Network Validation
  - Facilitating Sustainable Networks
Wi-MAX-VSAT Integration and Interoperability

Certified for the backhaul of all major wireless access standards GSM, CDMA, and Wimax; Femto

Hughes
Wireless Backhaul Options

Wireless Coverage Area – GSM, CDMA – 2&3G, Wimax, LTE etc
Satellite Backhaul: Hard-to-Reach Areas

Rural Areas

Islands

High Speed Trains

Airplanes

Cruise Ships

Oil Rigs

Hughes
Communications Are Reducing Operational Costs in the Energy Sector

Existing Networks Are Enabling…

- Automation = Cost Reduction
- Wide-Area SCADA Applications = Improved Logistics
- Remote Real-Time Decision Making = Higher Efficiency
- Real-time Supply Orders = Reduced Operating Costs
Operator of Liquefied Natural Gas Carriers

Need: Effective Crew Morale and Retention Solution

- **Situation**
  - Provides maritime LNG transportation and regasification services
  - Faces strong competition for qualified and trained crew

- **Problem**
  - Vessels often out to sea for days and even weeks
  - Onboard crew require entertainment during down time
  - Current pay-per-minute solution too expensive to provide crew morale services

- **Solution**
  - VSAT solution with unlimited voice, Internet and data connectivity for a fixed price
  - Prepaid phone services, crew calling solutions and email services

- **Result**
  - Crew is able to stay in touch with friends and family back home
  - Competitive advantage in attracting and retaining crew
Provider of Seismic Services to the Energy Industry

Need: Exchange critical data with onshore experts

• Situation
  – Provides shallow water and ocean bottom seismic data to oil companies and contractors
  – Management of vessels, work plans and schedules driven by seismic analysis
  – Vessels dispersed in Gulf of Mexico and North Sea
• Problem
  – Clients needed real-time reporting capabilities
  – Onshore specialists required instant access to seismic data
• Solution
  – Always-on VSAT solution with secure access to the corporate network and the Internet
• Result
  – Instant access to remote operations, seismic projects and accompanying detailed studies
  – Better management of vessels
  – Enhanced data and services to clients
Provider of Diving & Pipelaying Services

Need: Visual link into the remote sites

- **Situation**
  - Divers investigate subsea structures and their potential damage
  - Clients’ decisions are based on divers’ discoveries

- **Problem**
  - Difficult to explain verbally to clients the specific damage
  - Hard to grasp the degree of destruction or problems

- **Solution**
  - Remote video streaming service deployed over VSAT
  - Divers video subsea infrastructure that is subsequently shown to clients

- **Result**
  - Real-time monitoring and inspection is now possible
  - Remote video streaming brings clarity and perspective to infrastructure damage
  - Clients are able to see exactly what the divers experience

Harris CapRock
A Big Network Picture

- Terrestrial Backbone, Satellite Overlay
- Fixed, Mobile, Offshore sites
- Dedicated or Shared (VPN’s)

- Single Satellite, Multiple Satellite
- Multiple Beams/Cross Strapped
- Fixed sites: Hospitals, Mission Control, Logistics Center
The Satellite & Wireless EcoSystem

Comms Fm Rig:
- 50% Material Supply
- 40% HQ(s)
- 10% Pers. + Inter-Rig
WIMAX Backhaul via VSAT

- IP support with priority handling of voice & data
  - Use of modulation (8PSK, etc.)
  - Up to 10 Mbit/s per cell ++
  - Low Latency and Jitter
  - BTS Synchronization
  - Power Consumption
  - Ease of Installation
VSAT Deployments, 2000-16

VSAT Terminals in Millions

• Deregulation and improved products drive market acceleration
• New markets such as communications on the move offer new growth opportunities
• Spotbeam satellites are an attractive proposal for a part of corporate needs

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Bandwidth

– Increasing Efficiencies Thru…
  – TCP/IP accelerators
  – VSAT accelerators
  – Carrier In Carrier
  – TDMA shared bandwidth networks
  – Spotbeam Birds
Hardware

- Smaller Antennas: 60cm C-band and 75cm Ku-band
- Lighter Antennas (less then 25Kg)
- Automated Pointing Antennas
- Simple to Commission/de-Commission
Recent Developments

PRESS RELEASE

O3b Networks, With Support from Google, Liberty Global, HSBC, To Deploy World’s First High-Speed, Low-Cost System to Transform Communications Access for Billions Worldwide

--New communications system to enable low-latency trunking for emergency use

Last update: 2:00 a.m. EDT Sept. 9, 2008

ST. JOHN, Jersey, Channel Islands, Sep 09, 2008 (BUSINESS WIRE) -- O3b Networks Ltd. today announced it will begin deployment of a new global communications infrastructure to provide high-speed, low-cost Internet connectivity to emerging markets in Asia, Africa, Latin America and the Middle East.

Backed with financial and operating support from Google, Liberty Global, HSBC Principal Investors and other shareholders, O3b will seek to transform communications access for billions worldwide through its high-capacity, global system, currently being built in the South Atlantic Ocean.

Hughes Brings Broadband Internet to Amazonas

FOR IMMEDIATE RELEASE

Germantown, Maryland, November 24, 2008 — Hughes Network Systems, LLC (HUGHES), the global leader in satellite broadband networks and services, today announced that its Brazilian operating entity, Hughes do Brasil, has won a public tender and signed a 5-year contract with PRODAM – Data Processing Company of the State of Amazonas, to deploy a unique broadband network solution that combines WiMAX and WiFi access technologies with satellite backhaul.

Using this novel solution, PRODAM will provide high-speed wireless Internet access service to customers throughout all 61 municipalities of Amazonas, including government agencies, small businesses, and the public at large.

Covered by its huge rainforest and with the world’s most voluminous river, the State of Amazonas is divided nearly equally between river and land. For such a large and geographically diverse area, PRODAM decided to seek a solution that enabled both landlines and wireless service, which would extend to the state’s remote areas, which are not yet connected to the national grid.

Hughes do Brasil will design and deliver a system that will allow PRODAM to offer high-speed Internet access over a large area, with coverage of over 900 customer premises across the state. The WiMAX and WiFi technologies will be deployed in a combination of landlines and wireless infrastructure, providing the necessary reliability and cost competitiveness that PRODAM required.

Wireless Internet Links Highland Community to the World

Case Study: Highland Community to the World

Intel, USAID and VDC use WiMAX to bring broadband Internet access to the mountains

Need to access the Internet is a common challenge for many mountainous regions around the world. In this case study, Intel, USAID and VDC (Victor Davis Consulting) worked together to bring broadband Internet access to the Highland Community in northern Vietnam, using WiMAX technology.

The Highland Community is a small, picturesque village located in the Ha Giang Province of northern Vietnam. The community is known for its rich agricultural produce and beautiful landscapes. However, the village had limited access to modern technology, including the Internet.

To address this issue, Intel, USAID and VDC provided technical assistance and funding to install a WiMAX network in the Highland Community. The network was designed to provide high-speed Internet access to the village, enabling residents to access the global digital economy.

The project involved several key components: site selection, network planning, equipment installation, and training for local residents on how to use the Internet.

The WiMAX network was successfully deployed in the Highland Community, providing residents with access to a wide range of online services, such as e-commerce, education, and entertainment. The project also helped to create job opportunities in the area, as residents were trained to operate and maintain the network.

The Highland Community project demonstrated the potential of WiMAX technology to bridge the digital divide and bring broadband Internet access to remote and rural areas around the world.
Applications

- **Community**
  - News, Chat, on-line music

- **Tourism**
  - B&Bs
  - eMail, Blogs, Photo-sites

- **School**
  - Geography, Math, et. Al.

- **Farmers**
  - Crop and disease information

- **Health Clinic**
  - Health and pharmaceutical information
The Prodam Project

THE AMAZONAS STATE

- Biggest state in Brazil
  - 1.6 million km²
  - 6x United Kingdom
- State covered by the Amazon forest
- 3.2m POP total
- Capital is Manaus (1.6m POP)
- 62 counties
Project Overview

• VSAT Backhaul for Local Wireless Distribution
  – HX VSATs
  – ALVARION wireless equipment in the remote cities
  – SCPC link to Sao Paulo for Internet
  – 36 month project

• Two Phases
  – First Phase – 15 cities / 15 wireless clients per city
  – Second Phase – 41 cities / 15 wireless clients per city
Project Diagram

Hughes

INTERNET

CITY OF SÃO PAULO

CITY OF MANAUS

PRODAM

CITY OF SÃO PAULO
Remote Site Details

- **HX 200**
- **UPS No Break**
- **FIREWALL SONICWALL**
- **SWITCH CISCO**
- **WIMAX IDU**
- **Rack 20U**
- **AU WIMAX ODU**
- **SU WIMAX ODU**
- **Existing LAN**
- **PC - PONTO CLIENTE**
- **SU WIMAX ODU E WIFI**
- **Wi-Fi Zone**
- **Public Internet**
- **Hughes HOTSPOT**
WiMAX, Satellite, and… CSR in ‘The Patch’

The Win Win Win…

• **Governments:** Achieve ‘Millenium Development Goals’, Higher Standards of Education, Health, Connectivity, New Jobs, Increased GDP, New Taxpayers

• **Communities:** Access to the world, including education, trade, communication with relatives/ friends and entertainment

• **Oil Company:** Lower-Cost, High-Impact CSR Solution

• **Infrastructure Providers:** New Business Opportunities
Systems Profile Requirements
O&G Applications
-The Digital Oilfield Transport Network-

Marathon Oil Corporation
David Barker – Sr. IT Business Specialist
Agenda

- Before we define the System Profile
  - Where do we come from?
  - Where are we today?
  - Where is it all going?

- System Profile for Digital Oilfield
  - Ethernet
  - RF
  - Mechanicals
  - OPS & Management

- WiMAX
  - Not a bad foundation
  - WIMAX Challenges

- Marathon Today
Before we define the System Profile

■ Where do we come from
  ▪ Collection of multiple, individual, old networks and protocols
  ▪ No efficiencies, Performances or QoS
  ▪ Little or no remote management... and forced to do in-field programing
  ▪ Little or no real-time applications

■ What we need today
  ▪ Single IP transport covering all sites (fixed/nomadic)
  ▪ Better Efficiencies, Performances, QoS, Connectivity
  ▪ Remote management and programming
  ▪ Support for new applications being designed for real-time performance

■ Where it is all going
  ▪ IP all the way to the end-device
  ▪ Real-time, office-like performance and applications... ANYWHERE!
System Profile for Digital Oilfield

**Ethernet perspective**
- The system has to be a simple L2: ...it is the transport
- By-directional QoS per VLAN, to fit the applications
- > 50 MBPS/sectors
- < 10ms Latency in the PMP Transport
- > 150,000 PPS/Sectors

**RF perspective**
- Predictable with associated Coverage Planning Tools
- 8 Mbps at 8 miles
- Self-Aligning, zero-touch Remote Antenna System
- MIMO a/b, so we can deliver capacity & distance in the same sector
- Cover the entire 5.2, 5.4, 5.8 GHz in a single unit, remotely controlled
System Profile for Digital Oilfield

- **Mechanicals**
  - Need Class 1/div 2 remote radio (CPE)
  - Powder-coated with rust/H2S proof accessories
  - Need -40F to +140F... and all the way to 160F in some instances

- **OPS & Management**
  - Remote capabilities on the IP side and the RF side
    - Setup/configuration/management
    - troubleshooting/factory reset command
  - Two release of codes present for smoother upgrades
  - Pay-as-you-grow capacity with S/W options
  - STD-based PoE (connect to Switch or Router)
  - AES 128/256 security
WiMAX not a bad foundation

- **WiMAX: Conceptually is a great idea**
  - It was needed: QoS, solid scheduler, IP-based
  - It was going to be changing Broadband Wireless
  - It was the promise of Broadband for all
  - It promised 70Mbps with low latency

- **Reality: Was not developed for Industrial needs**
  - Yes it has good QoS, Scheduler and it is IP-based
  - But... we needed more capacity and lower-latency
  - But... we needed more remote devices that are rated for our environment
  - And ...the 3.65 Spectrum has many restrictions, doesn’t offer enough spectrum

- **To meet our needs, WiMAX would need to deliver:**
  - More capacity, lower latency, industrial remotes, zero-touch remotes
WiMAX Challenges

- **WiMAX Business targets**
  - Current vendors don’t target the industrial O&G deployment
  - Manufacturers are targeting the low-cost dongle or CPE
  - Service Provider deployments bank on over-subscription and target consumer revenues

- **WiMAX Technology designed for consumer access**
  - Designed for premium consumer access... not industrial transport
  - We have an access technology... it is WIFI. We needed transport

- **WiMAX Performance not quite enough**
  - We need much more capacity with much lower latency ...Up/Down Streams
The WIMAX Challenges

- **Mechanical Standards not suited for oil and gas**
  - No Class 1/Div 2
  - No enough temperature range (we need -40F to +140F)
  - Not H2S resistant
  - Not durable enough

- **What has to change with WiMAX for the O&G Market**
  - We need powerful remotes with full diagnostics... not dongles
  - Do not allow phone/typing while driving... Mobility is OK as long as we have CAPACITY
  - We can’t be over-subscribed, we are broadcasting real-time all the time
  - We are big on security and want to control our own Transport Network
  - It may take 5 hours to drive to a site, we need reliable and remotely manageable remotes
Advice to the WiMAX community

End-User message to manufacturers & SP’s in the room

- **Product manufacturers**
  - Develop industrial-grade and fully remotely managed devices
  - Develop product with higher capacity and lower latency
  - Develop support for more frequency bands
  - Don’t focus on mobility, but connectivity
  - Don’t focus on access, we have WI-FI for that

- **Service Providers**
  - Don’t deliver networks with over-subscriptions
  - Let us manage our Own QoS within your network
  - Deliver 100% coverage
  - Deliver 8-20 Mbps “CBR” in both directions ... anytime and anywhere
  - Don’t make us pay for alignment ... ever
Marathon Today

- Our History with WiMAX
  - Invested a lot in WiMAX - time, energy, trials, equipment
  - Assessed many solutions
  - Tried several WiMAX products at 3.65Ghz

- What we deployed in the end
  - Redline/Cisco O&G industrial Solution

- What we got as a result
  - a Digital Oilfield Solution that met all our needs
  - A future proof network, not just for today
  - Supporting any data, any time, anywhere.... with real-time performances
  - Delivering 8 Mbps at 8 miles with 5ms latency and no alignment needed

- Like having Wireless Fiber, on demand
Present day activities – Eagle Ford WWDC

- **16 Towers deployed and in use in the Eagle Ford Asset**
  - High-capacity backhaul with super low-latency
  - Multi-point sector antennas provide connectivity for entire field
  - Sectors antennas on towers provide >8 mile coverage radius

- **Redline RAS System deployed in Eagle Ford for drilling rigs**
  - Provides business network, GuestNet and VOIP to rigs
  - WI-FI hotspots at key locations cover the entire drilling rig area
  - WI-FI and MESH WI-FI technology as the access (Edge)
  - “Zero Touch” multipoint transport
  - Network for company man, safety trailer and doghouse comes on automatically after rig move - just raise the mast and apply power
Present day activities – Eagle Ford WWDC

- **Redline’s RAS**
  - allows us to leverage the communications network in new ways
  - Enables true nomadic connectivity ANYWHERE for WWDC
  - Much greater bandwidth for multiple applications
  - Commercial and In-House applications
  - BYOD – mobile devices supported ANYWHERE
What's next?

The Vision/Goal for the future is to change the way Marathon Oil conducts its business in the field through seamless connectivity and workforce automation

- Multiple Concurrent networks: Redline, 3G, 4G services
- Vehicular “mobility” - maintain connectivity anywhere in the asset
- Greater HES focus through constant connectivity
- Ability to work smarter, faster, safer – Video, RFID and Lenell in remote field locations
- Avoid useless nuisance trips to locations – work remotely

Greater return on investment

- Productivity increases have been proven
- Eliminated recurring charges for slower satellite communications
QUESTIONS

Marathon Oil Corporation
David Barker – Sr. IT Business Specialist
Redline Communications
A CASE STUDY
Challenges and Opportunities for the WIMAX in the Digital Oilfield
Louis Lambert, Managing Director – Strategic Accounts
AGENDA

- Introduction
- Client challenges
- The solution
- Next steps
- Questions
Client Needs

- **BUSINESS NEEDS**
  - High-performance communication infrastructure for oilfield life-cycle
    - First priority was real-time Drilling/Completion: Highest ROI
    - Operational monitoring/adjustments also required real-time data
  - All users/machines to connect from anywhere, anytime
  - Zero-touch configuration and self-healing systems
  - Round the clock availability for collaboration
  - WI-FI everywhere
Client Challenges

- **GEO COVERAGE**
  - The transport network was the biggest challenge
    - Limited existing infrastructure
    - Varied terrain
    - Great distances
    - Harsh winters
Client Challenges

- SECURELY ENABLING MULTIPLE APPLICATIONS
  - High-capacity, Low Latency, real-time applications
    - Drilling
    - Surveillance
  - Real-time automation & control
  - Ubiquitous field communications
  - Segmenting connectivity for & enabling BYOD Support
    - the various business units
    - guest users (contractors)
Client Challenges

- TRANSPORT TECHNOLOGY CHALLENGES
  - High Capacity - MBPS and PPS
  - Sub 10ms latency - a “must”
  - ZERO touch alignment for non-fixed assets, i.e.: drilling rigs and pickups
  - Class1 Div2/ATEX Zone 2 certified equipment
  - Leveraging WI-FI as the ubiquitous access technology for users
  - A scalable long term solution
Client Challenges

- **IT & LOGISTICS** - building industrial infrastructure is not the core business
  + Replicating the same architecture/methods/procedures... Globally
  + Getting the right infrastructure up... quickly
  + Finding the right partner with Global experience & reach
Needed a Solution that was proven!

**OXY:** Digital Oil field connectivity Texas, North Dakota, Oman.

**Shell/PDO:** 45,000 Km² Smart Field Operation - Oman

**Marathon Oil:** Semi-Mobile drilling rig connectivity Texas & Oklahoma.

**Tatweer:** Digital Oil field - Bahrain

**Chevron:** Wafra digital oil field project in Wafra, Kuwait.

**Total Oil:** Mobile exploratory Drilling units Offshore platforms at 20 Km.

**Pemex:** Enhanced oil recovery in the Bay of Campiche, Mexico.

**Petrobras:** Portable remote offices and mobile drilling rigs in Peru.

**ENI:** 400 Km of backhaul connectivity in Agiba Egypt.
The Solution

- Addressed and exceeded all client challenges
- Provided outstanding ROI based on significant efficiency improvements for both drilling and field operations

- **Redline high-capacity private wireless transport network**
  - High performance IP communications, anywhere in the Oilfield
  - Network transporting all of the client’s applications
Solution Implemented – Some details (phase 1)

- **8 Tower Sites to cover almost 900 square miles**
  - Leveraged 4 leased towers and built 4 new ones

- **A ring-architecture transport backbone**
  - Redline Point-To-Point connecting all the towers
  - Each tower equipped with Redline Multipoint units
    - 4 primary sectors and 4 redundant sectors

- **Connecting**
  - All rigs connected with Redline RAS (Rapid Alignment System)
  - All well, gathering stations, and field offices connected with Redline
  - Now equipping pickups with RAS
**Solution Implemented**

- **BUSINESS PERSPECTIVE**
  - Delivered connectivity to all FIXED/NOMADIC users and machines
  - Enabled real-time operational collaboration between field and HQ
  - Eliminated Stop/Gamble decisions: real-time decisions with all needed data
  - ROI less than 1 year for the entire infrastructure CAPEX
    - Avoided some dry wells
    - Increased everyone’s efficiency
    - Video monitoring and surveillance reduced field commutes
Solution Implemented

- GEO COVERAGE PERSPECTIVE
  - Coverage was delivered for the entire field
  - Critical locations equipped with redundant equipment
  - Prediction maps allow IT/Business to plan, not react
  - Coverage plan was 100% reliable
Solution Implemented

- **APPLICATIONS PERSPECTIVE**
  - All field and enterprise applications operating on a single, highly secure infrastructure
  - Guest users can connect via guest WI-FI
  - No more boundaries/limitations between Field and HQ
Solution Implemented

- TRANSPORT TECHNOLOGY PERSPECTIVE
  - “Wireless Fiber”
  - Payload of 400 MBPS per base station with (ZERO oversubscription)
  - 220,000 PPS on field connections
  - About 5ms latency in the field transport network
  - CLASS 1/div 2 certified equipment
  - ZERO touch alignment for all nomadic devices
Drilling Rig Sites

Backhaul to Tower
100 Mbps
<3 ms Latency
Solution Implemented

- IT & LOGISTICS PERSPECTIVE
  - Dependable, high-performance, industrial infrastructure
  - Remote management and upgrades save time and cost
  - Reliable coverage prediction maps
Client Quote

Redline Enabled the “Carpeted” environment...

-“Instantaneous and uninterrupted access to the all network services, for all users”

- Any data... Anywhere... Anytime
- Redline made The DIGITAL OILFIELD possible
Solution Implemented

- CURRENT PERSPECTIVE
  - High-performance infrastructure, with “plenty” of headroom
  - Infrastructure is designed and built to last
  - A client-specific “Infrastructure Cookbook” has been developed

- IMPACT
  - The infrastructure has enabled the client to change the way they work in the Oilfield
  - They continue to discover additional ROI on the already-paid CAPEX
  - Success has also been replicated in their other fields
  - The infrastructure is now a critical component of every day operations
Next Steps

- Next
- Phase 2 (started)
- The client continues to deploy and enable
  - More fixed/nomadic remote sites getting connected as they are built
  - More video surveillance
  - More corporate IP telephony & services
  - HSE Helmet-Cams... and other applications are now all possible
Questions

Smart Drilling

Field Offices

Operational Video Surveillance

Wellhead Automation
Thank you