

Communication Technologies for the Natural Gas Industry

Ohio Gas Association
2011 Technical Seminar

March 31 & April 1, 2011

Communication Technologies

What are we going to cover?

- Various Communication Technologies**
- Strengths and Weakness**
- Power Requirements**
- Simplify, demystify and clarify components and technologies**

Communication Technologies

– Telephone

- Dialup
- Leased Line
- Frame Relay

– TCP/IP

– Digital Cellular

- CSD
- Packet Switched – TCP/IP

Communication Technologies

– Radio

- Licensed
- Unlicensed – Spread Spectrum

– Satellite

- LEO
- GEO

Communication Technologies

Telephone - Dialup

- Referred to as POTS or PSTN
- Utilizes a temporary or switched connection between 2 points
 - Subsequent phone calls can take different routes
- Designed to exchange voice information
 - Telephone converts an acoustic signal to an electrical equivalent
- One of the most widely deployed communication networks

Communication Technologies

Telephone - Dialup (cont)

- **Utilizes a MODEM for Data Communications**
 - Modulate – convert digital 1's & 0's to analog signals
 - Demodulate – convert analog signals to digital 1's & 0's
- **Low Power**
 - Battery Powered Equipment can be easily utilized
- **Low Startup Costs**
 - Modems are relatively cheap
 - No other equipment is generally necessary

Communication Technologies

Telephone - Dialup (cont)

- **Information Bottleneck**
 - 9600 Baud or less for most field applications
- **Continuous Monthly Costs**
 - \$30 to \$50 per month
 - Long Distance charges apply
- **No guarantee to the level of service / performance**

Communication Technologies

Telephone – Leased Line

- **Utilizes a dedicated connection between 2 points**
 - Connection is always on
- **User Leases / Rents this dedicated connection**
 - Costs are based on the distance between the 2 points
- **High Power**
 - Requires external power
 - AC, Solar, etc.

Communication Technologies

Telephone – Leased Line (cont)

- **Low Startup Costs**
 - Modems are relatively cheap
 - No other equipment is generally necessary
- **Information Bottleneck**
 - 9600 Baud or less for most field applications
- **Continuous Monthly Costs**
 - High compared to other technologies
- **Being phased out in favor of Frame-Relay**

Communication Technologies

Telephone – Frame Relay

- **Extends your corporate network to the end device**
 - Thru the telephone providers network
- **Utilizes TCP/IP to move data between points**
- **Low Startup Costs**
 - Network card required and are relatively cheap
- **Fixed Monthly Costs**
 - Costs are approx \$100 to \$150 per month
 - Not based on the connection time or the amount of data transmitted

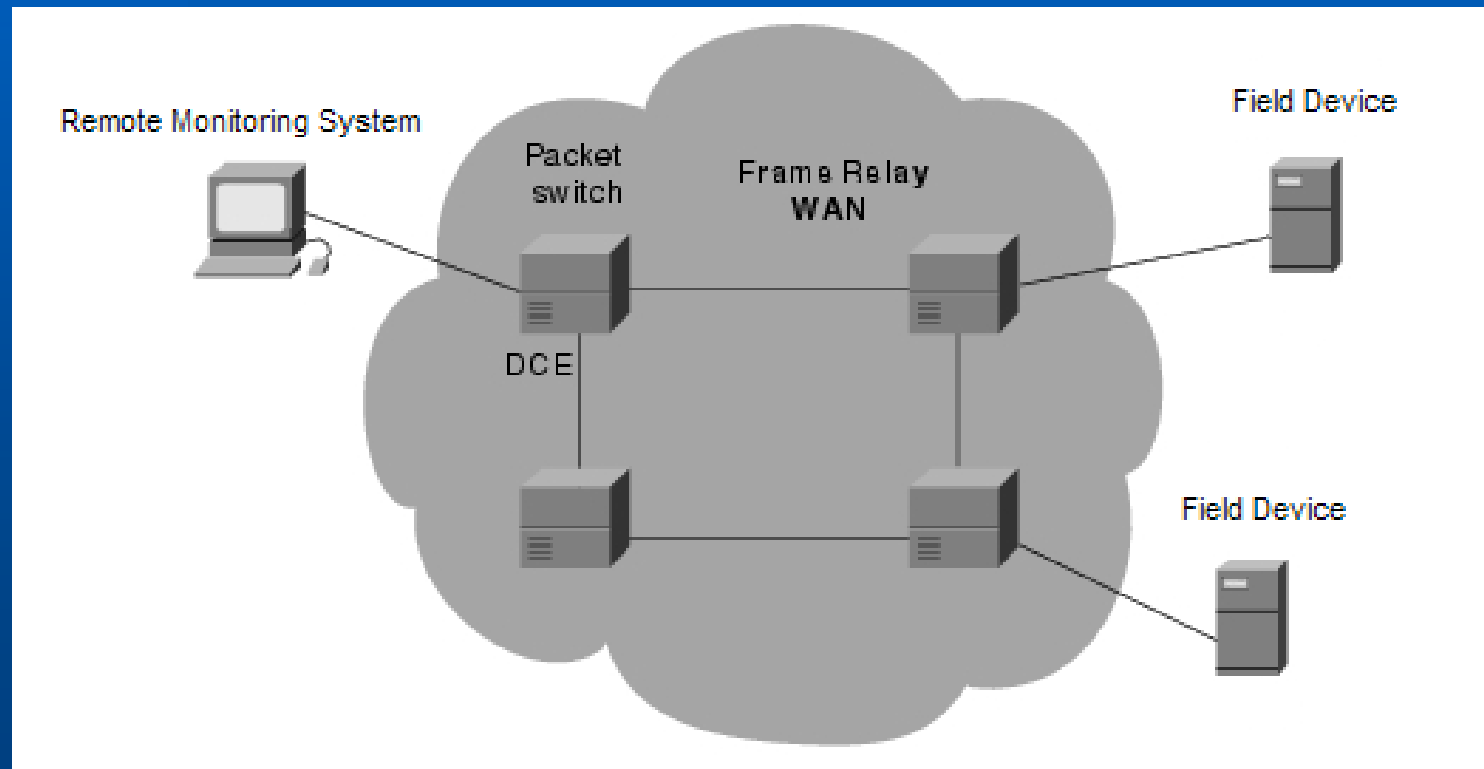
Communication Technologies

Telephone – Frame Relay (cont)

- **Fast Communications**
 - 100K BPS and higher data speeds
- **Can require changes to Remote Monitoring Applications**
 - Legacy applications were designed for dial-up or leased line connections
 - TCP/IP support required

Communication Technologies

Telephone – Frame Relay (cont)



Communication Technologies

TCP/IP

- **Transmission Control Protocol (TCP) is a protocol used along with the Internet Protocol (IP) to send data in the form of individual packets between computers over IP networks (i.e. Internet, LAN's, WAN's)**
- **TCP keeps track of the packets that a message is divided into for efficient routing through the Internet**

Communication Technologies

TCP/IP (cont)

- **IP is the protocol, or method, used in communicating data from one computer to another across the Internet. It is simply a delivery method. Each computer on the network, private and public, is allocated a unique address (IP Address). IP forwards each data packet based on the destination address (IP Address). Individual packets may be routed differently.**

Communication Technologies

TCP/IP (cont)

- Proper IP addressing is essential for establishing communications between any two network devices.
- The fundamental rule is simple: every network device must have a unique IP address.
- IP addresses can be assigned dynamically or statically
 - Static IP addresses in field devices is much easier to keep track of.

Communication Technologies

Digital Cellular

- 2 Methods of moving data using Digital Cellular Network
- Circuit Switched Data (CSD)
- Packet Switched – TCP/IP based

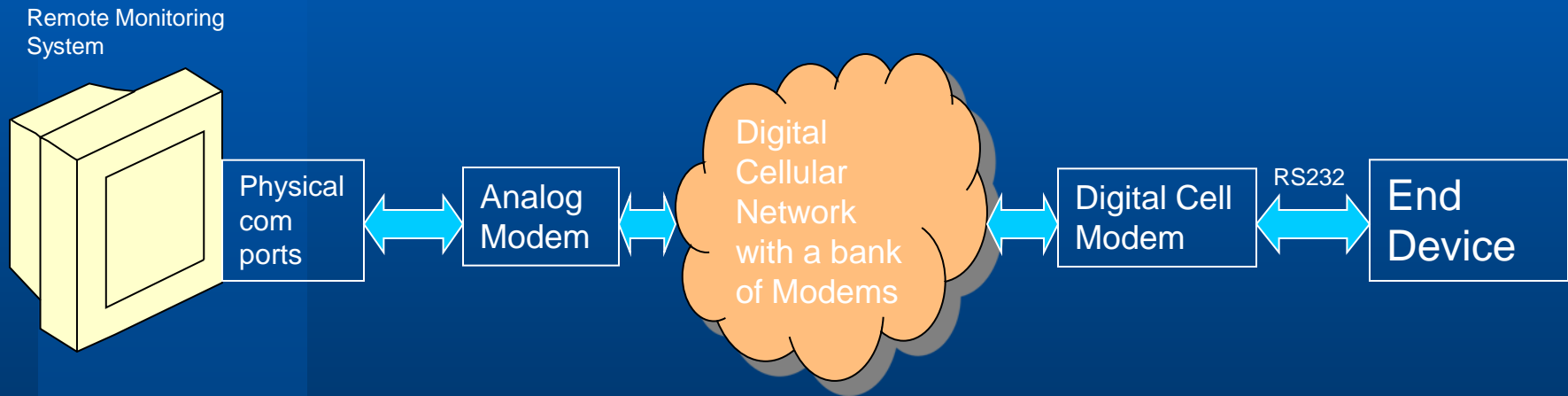
Communication Technologies

Digital Cellular - CSD

- **Simulates a Dialup connection from the Remote Monitoring System and the field device**
 - No changes required to the Remote Monitoring System
 - Modem used at the Host
 - Field Device requires a RS-232 connection to communicate with the Digital Cell Modem

Communication Technologies

Digital Cellular – CSD (cont)



Communication Technologies

Digital Cellular – CSD (cont)

- **Ease of Installations**
 - No need to run phone lines
- **Provide Communications to Remote Locations**
 - Hard to reach locations
 - Remote locations
- **Information Bottleneck**
 - 9600 Baud or less for most field applications

Communication Technologies

Digital Cellular – CSD (cont)

- **Higher Startup Costs**
 - Cell Modems cost more
- **Power Concerns**
 - **Need External Power**
 - AC
 - Solar
 - Thermo-Electric
 - **Power Switching**
 - Turn Cell Modem On & Off

Communication Technologies

Digital Cellular – CSD (cont)

- **Continuous Monthly Costs**
 - Based on the connection time / airtime
 - Long Distance and Roaming charges apply
 - Airtime costs can generally be negotiated
- **Not Supported by All Carriers**
 - Supported Only by Verizon
 - Dropped by the Rest of the Carriers
 - Limited Support at best
- **Verizon not Specific on the Future of CSD**

Communication Technologies

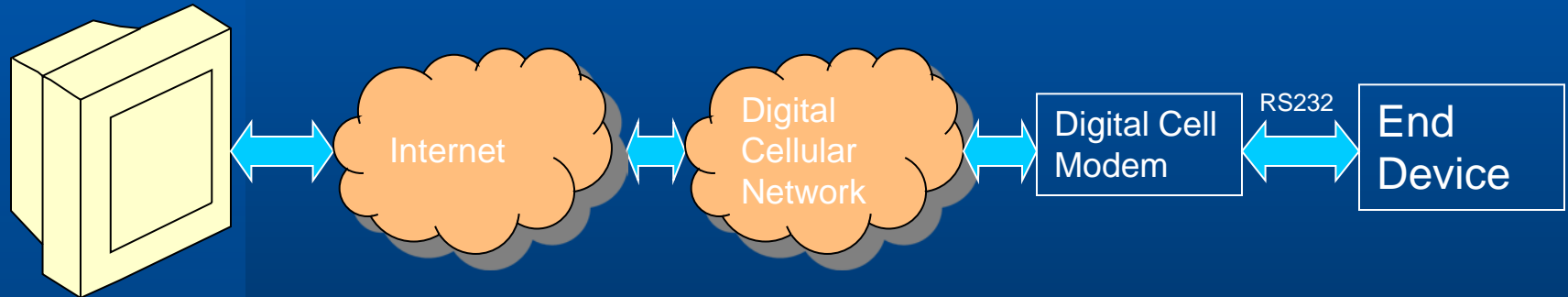
Digital Cellular – Packet Switched

- **Different Modem Technology Based on Carrier**
 - Utilizes Different Modems Based on the Provider
 - Modems are Carrier Specific
- **Utilizes TCP/IP to Transmit Data**
 - Transparent to the user regardless of provider
 - May requires changes to your Remote Monitoring System

Communication Technologies

Digital Cellular – Packet Switched (cont)

Remote Monitoring
System



Communication Technologies

Digital Cellular – Packet Switched (cont)

- **Ease of Installations**
 - No need to run phone lines
- **Provide Communications to Remote Locations**
 - Hard to reach locations
 - Remote locations
- **Fast Communication Speeds**
 - 100K + bps

Communication Technologies

Digital Cellular – Packet Switched (cont)

- **Higher Startup Costs**
 - Cell Modems cost more
- **Power Concerns**
 - **Need External Power**
 - AC
 - Solar
 - Thermo-Electric
 - **Power Switching**
 - Turn Cell Modem On & Off

Communication Technologies

Digital Cellular – Packet Switched (cont)

- **Continuous Monthly Costs**
 - Based on the amount of data transmitted
 - No Long Distance charges
 - Block of 1 to 2 Meg – Under \$10 per month
 - Unlimited - \$40 to \$50 per month
- **Supported by All Carriers**
 - Same technology used to send E-Mail and Pictures via your cell-phone

Communication Technologies

Digital Cellular – Things to Consider

- **Coverage Analysis**
 - Get with carrier to ensure good cell coverage
- **Negotiate Rates**
 - Airtime for CSD
 - Data Rates for Packet Switched
- **Require Pooling of Data / Minutes**
- **Require Static IP Addresses for Packet Switched**

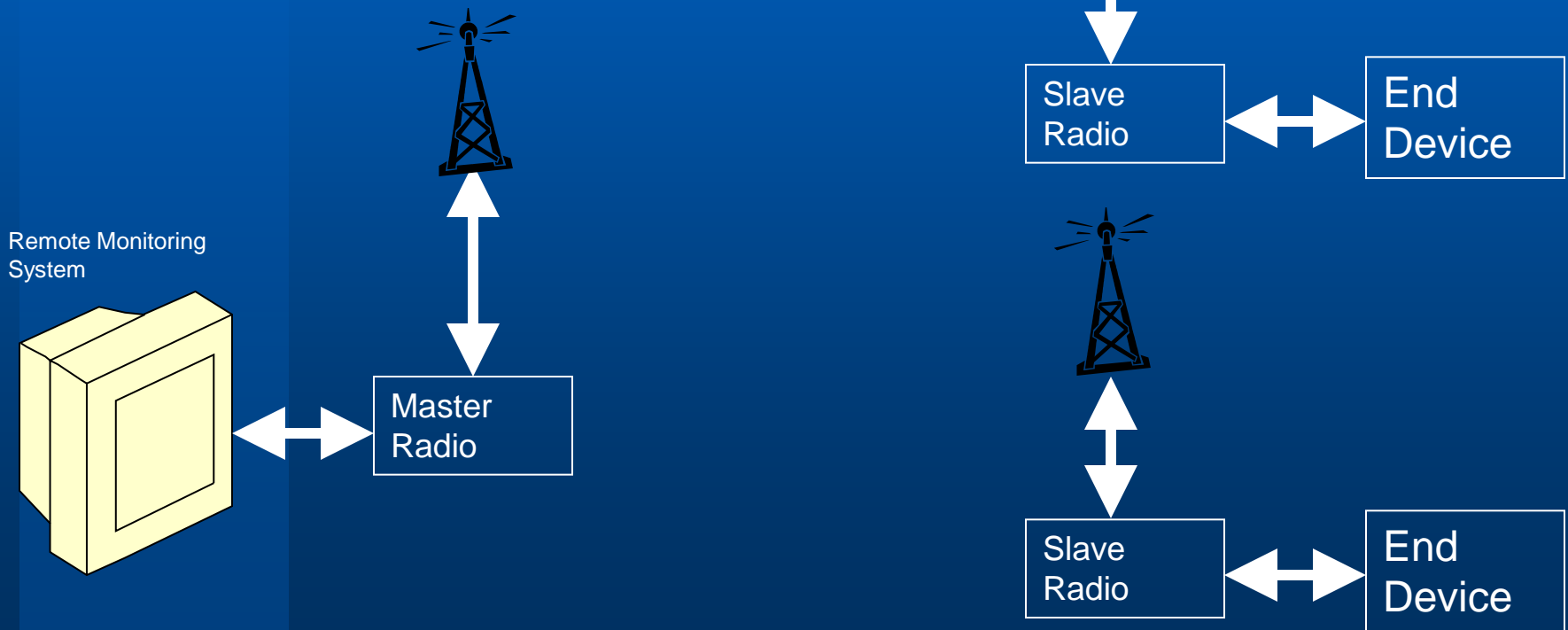
Communication Technologies

Radio

- **Licensed**
 - Frequency allocation controlled by the FCC
 - Higher Power
- **Unlicensed**
 - Spread Spectrum
 - Lower Power
 - 900 MHz Range
- **Line of Site Communications**
- **Simulates a Direct Serial Connection**
 - Really Long Serial Cable

Communication Technologies

Radio



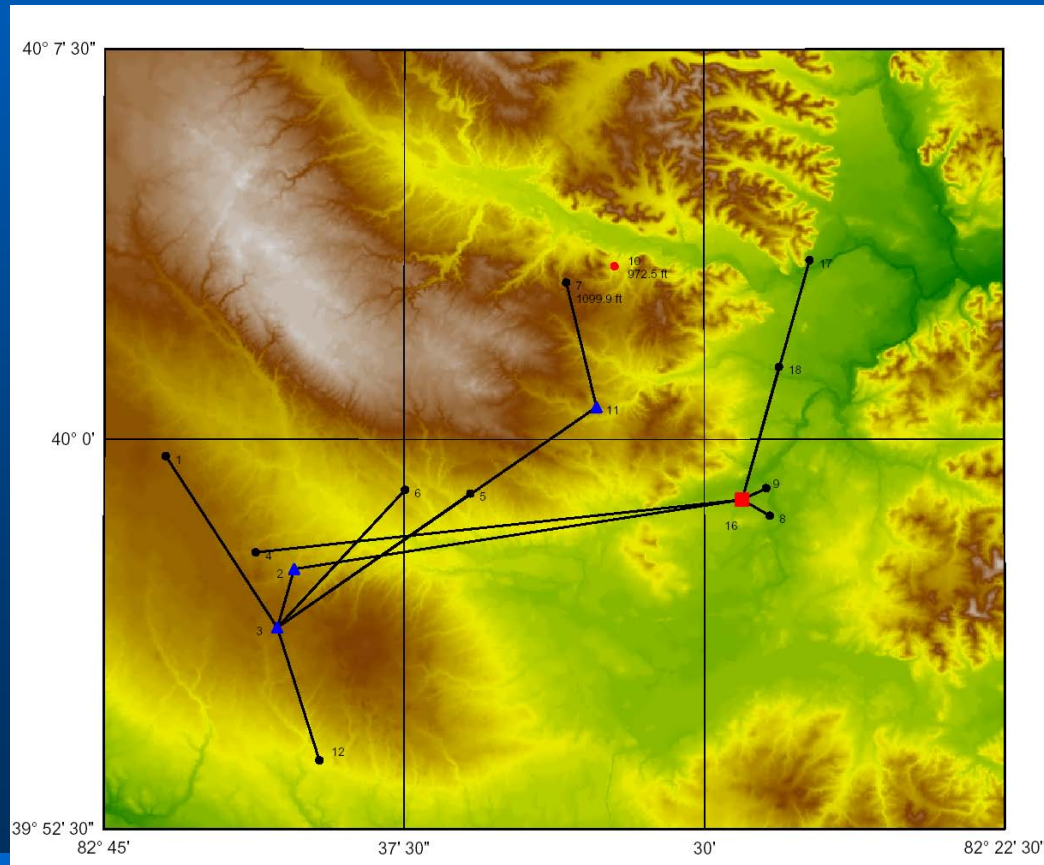
Communication Technologies

Radio (cont)

- **Path Study is Required**
 - Utilizes the Lat's and Long's of Master Site and all End Devices
 - Identifies land obstructions in the Line of Site Communications
 - Determines Antenna Type
 - Di-Pole
 - Directional – Yagi
 - Determines the Mast Height

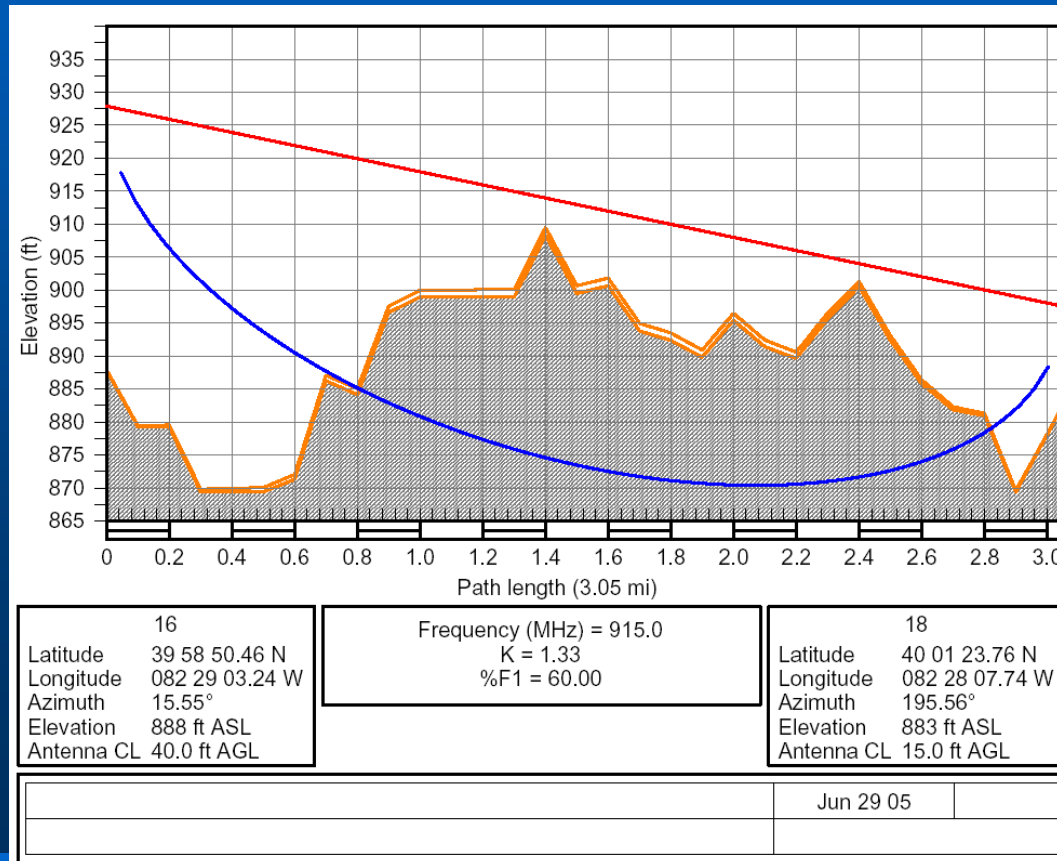
Communication Technologies

Radio (cont)



Communication Technologies

Radio (cont)



Communication Technologies

Radio (cont)

- **Fast Communication Speeds**
 - 100K + bps
- **Much Higher Startup Costs**
 - Radio's
 - Antenna
 - Masts
 - Installation Costs

Communication Technologies

Radio (cont)

- **Power Concerns**
 - **Need External Power**
 - AC
 - Solar
 - Thermo-Electric
 - **Power Switching**
 - Turn Radio On & Off

Communication Technologies

Radio (cont)

- **Continuous Monthly Costs**
 - **Maintenance of the Radio System**
 - **Generally low**

Communication Technologies

Satellite

- **LEO**
 - Low Earth Orbiting
 - Approx. 500 miles above the earth
- **GEO**
 - Geo-Synchronize Earth Orbiting
 - Approx. 22,000 miles above the earth

Communication Technologies

Satellite - LEO

- **30+ Satellites used for Communications**
- **Each Satellite is only available for 20 to 30 minutes at a time**
- **Designed for 100% coverage if you have a 180 degree view in all directions**
 - **Satellites may not always be available**

Communication Technologies

Satellite – LEO (cont)

- **Provides Communication to Remote Locations**
 - Locations not accessible by other technologies
- **Fast Communication Speeds**
 - 100K + bps
- **Higher Startup Costs**
 - Transmitters
 - Receivers
 - Antenna
 - Installation

Communication Technologies

Satellite – LEO (cont)

- **Power Concerns**
 - **Need External Power**
 - AC
 - Solar
 - Thermo-Electric
 - **Power Switching**
- **Continuous Monthly Cost**
 - **Block of 1 to 2 Meg - \$20 to \$30**

Communication Technologies

Satellite – GEO

- **Simulates a Direct Serial Connection**
 - A really, really long serial cable
 - Latency delays may cause problems with some host applications
- **Utilizes a Single Satellite for Communications**
 - Always available communications
- **Provides Communication to Remote Locations**
 - Locations not accessible by other technologies

Communication Technologies

Satellite – GEO (cont)

- **Higher Startup Costs**
 - Transmitters
 - Receivers
 - Antenna
 - Installation
- **Power Concerns**
 - Need External Power
 - AC
 - Solar
 - Thermo-Electric
 - Power Switching

Communication Technologies

Satellite – GEO (cont)

- **Continuous Monthly Cost**
 - Block of 1 to 2 Meg - \$25 to \$35 per month
 - Unlimited - \$90 to \$100 per month
- **Clear View of the Southern Sky**
 - Satellites located in the Southern Sky
 - Antenna must point south
 - Will not work in any other direction

Communication Technologies

Wrapping Up

– Consider Multiple Technologies

- Hybrid System
- No Single Technology Will Meet Your Needs
- Provides for the Most Reliable and Cost Efficient Solution

Communication Technologies

Wrapping Up – cont.

– Preparation and Planning is Critical

- Payload Requirements
- Power Supply Concerns
- Cellular Coverage Analysis
- Radio Path Study
- Site Surveys

Communication Technologies for the Natural Gas Industry

Thank You