

Remote Monitoring & Communication Technologies

Ohio Gas Association
2009 Technical Seminar

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Remote Monitoring & Communication Technologies

What are we going to cover?

- Remote Monitoring System Requirements
- Various Communication Technologies
- Simplify, demystify and clarify components and technologies

Remote Monitoring System Requirements

- **Supported System Requirements**
- **System Components**

Remote Monitoring System Requirements

Supported System Requirements

- **Solicited and unsolicited communications**
- **Multiple communication technologies**
 - **Land-Line**
 - **Cellular**
 - **Radio**
 - **Satellite**

Remote Monitoring System Requirements

Supported System Requirements (cont.)

- Scheduled polling for instantaneous values and archive (historical) data**
- Unsolicited scheduled inbound communications**
 - Schedule the next communication time in the field device**
- Alarm handling & notification**

Remote Monitoring System Requirements

Supported System Requirements (cont.)

- Unmanned operation (automated)
- Non-Proprietary, open database
 - Oracle
 - SQL
- Common connectivity standards
 - OPC
 - TCP/IP

Remote Monitoring System Requirements

Supported System Requirements (cont.)

- Integrate with legacy systems
 - SCADA
 - Billing
 - System Planning/Modeling
- Support for legacy devices
- Non-Proprietary – Multi-Vendor hardware support

Remote Monitoring System Requirements

Supported System Requirements (cont.)

- GUI's (Graphical User Interface)
- Reporting Tools
 - Data
 - Alarms
 - System monitoring and performance
- Data Validation

Remote Monitoring System Requirements

Supported System Requirements (cont.)

- User-friendly

Remote Monitoring System Requirements

Components

- **Host Software Application(s)**
 - **Communication Server**
 - **Configuration Utilities**
 - Device
 - System
 - **Alarm Handling & Notification**
 - **Reporting**
 - **Data validation (billing data)**
 - **GUI**

Remote Monitoring System Requirements

Components (cont.)

– Infrastructure/systems

- Server / PC Workstation(s)
- Database
- Network (LAN, WAN)
- Firewall / security
- Modem connectivity
 - Dialup telephone lines
 - Modem Pool

Remote Monitoring System Requirements

Components (cont.)

– Infrastructure/systems (cont.)

- **Internet Connectivity**
 - IP Based communications
 - Digital Cell, Frame Relay, etc.
 - Dedicated Public IP Address
- **Radio Connectivity**
 - Master Radio
 - Antenna(s)

Remote Monitoring System Requirements

Components (cont.)

– Infrastructure/systems (cont.)

- **Failure Recovery**
 - Database Backups
 - System Redundancy
 - Fail-over
 - Off-Site Data Storage
- **Cellular Data Services**
- **Satellite Data Services**

Remote Monitoring System Requirements

Components (cont.)

– Remote Site

- **Intelligent Electronic Devices**
 - **Electronic Volume Correctors / Flow Computers**
 - **Electronic Pressure Monitors / Recorders**
 - **Cathodic Protection Monitors / Recorders**
- **Communications**
 - **Telephone**
 - **Cellular**
 - **Radio**
 - **Etc.**

Remote Monitoring System Requirements

Components (cont.)

– Remote Site (cont.)

- **Power Supply**
 - Battery
 - AC
 - Solar
 - Thermo-electric
- **Mast / Antenna Assembly**
 - Cellular Communications
 - Radio

Remote Monitoring System Requirements

Components (cont.)

– Remote Site (cont.)

- Grounding / Isolation System**
- Surge & Lightning Protection**

Communication Technologies

– Telephone

- Dialup
- Leased Line
- Frame Relay

– TCP/IP

– Digital Cellular

- CSD
- Packet Switched - EDGE / EVDO / iDEN

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

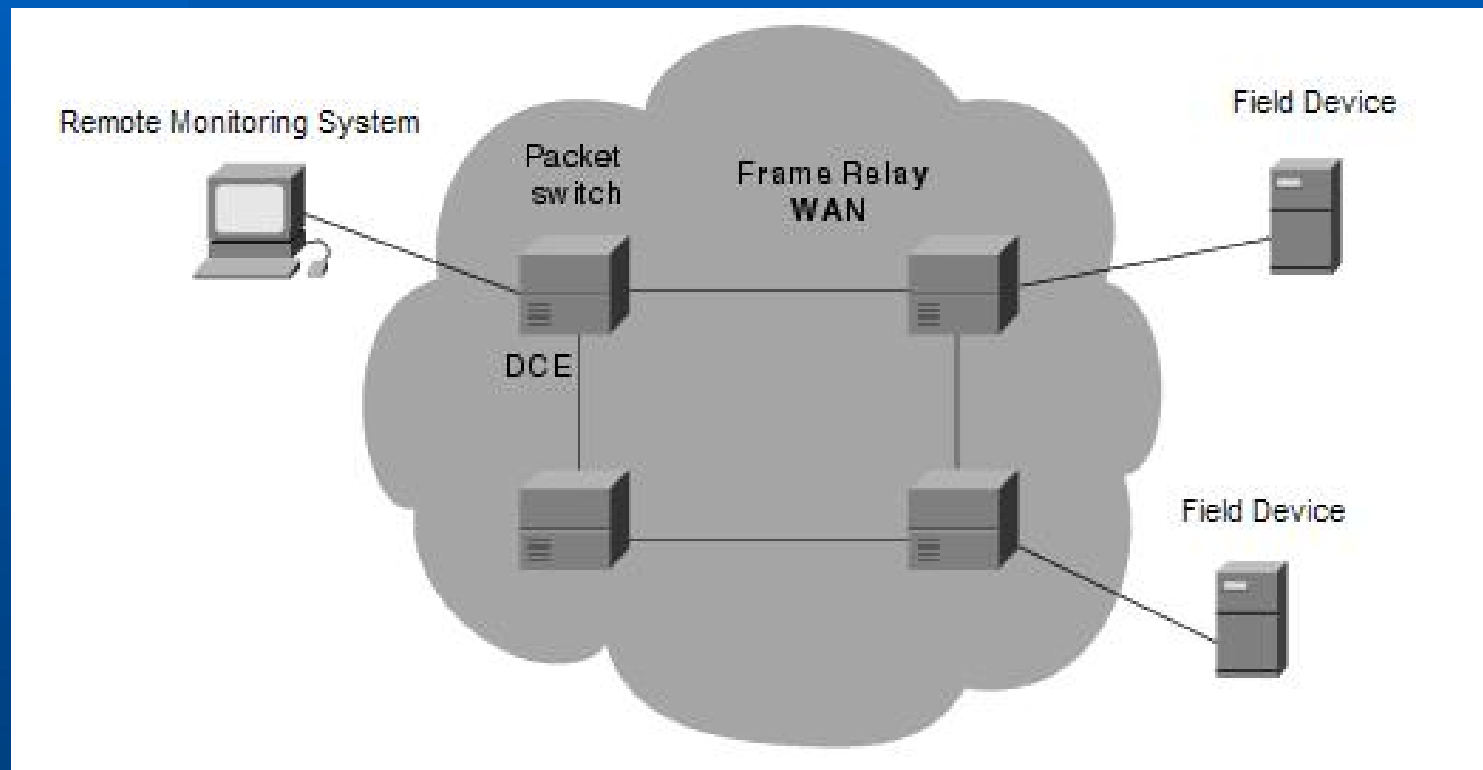
Communication Technologies

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 – EDGE / EVDO / iDEN

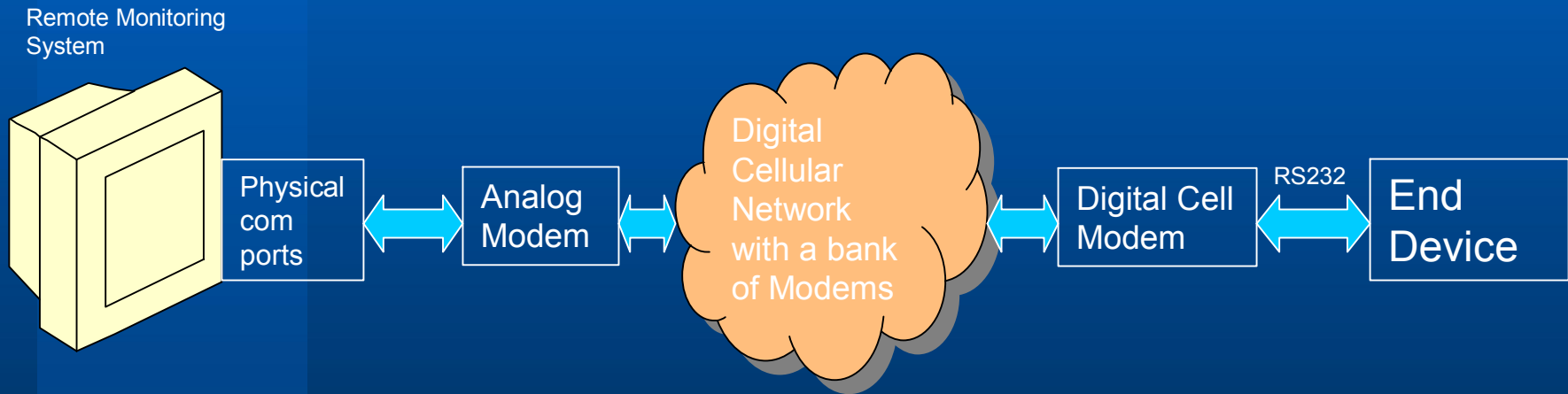
Communication Technologies

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 By AT&T, T-Mobile, Verizon & Alltel
 - Not Supported By Sprint & Nextel
- **Some Carriers are talking of Eliminating CSD**

Communication Technologies

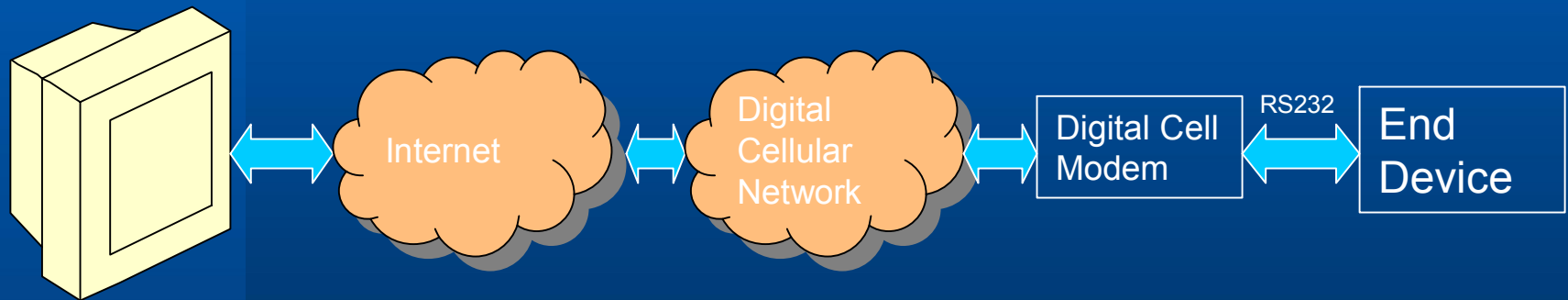
Digital Cellular – Packet Switched

- **Technology Different Based on Carrier**
 - EDGE supported by T-Mobile & Cingular
 - EVDO supported by Alltel, Sprint & Verizon
 - iDEN supported by Nextel
- **May utilizes different modems based on the Provider**
- **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 - \$10 to \$15 per month
 - Unlimited - \$50 to \$60 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**

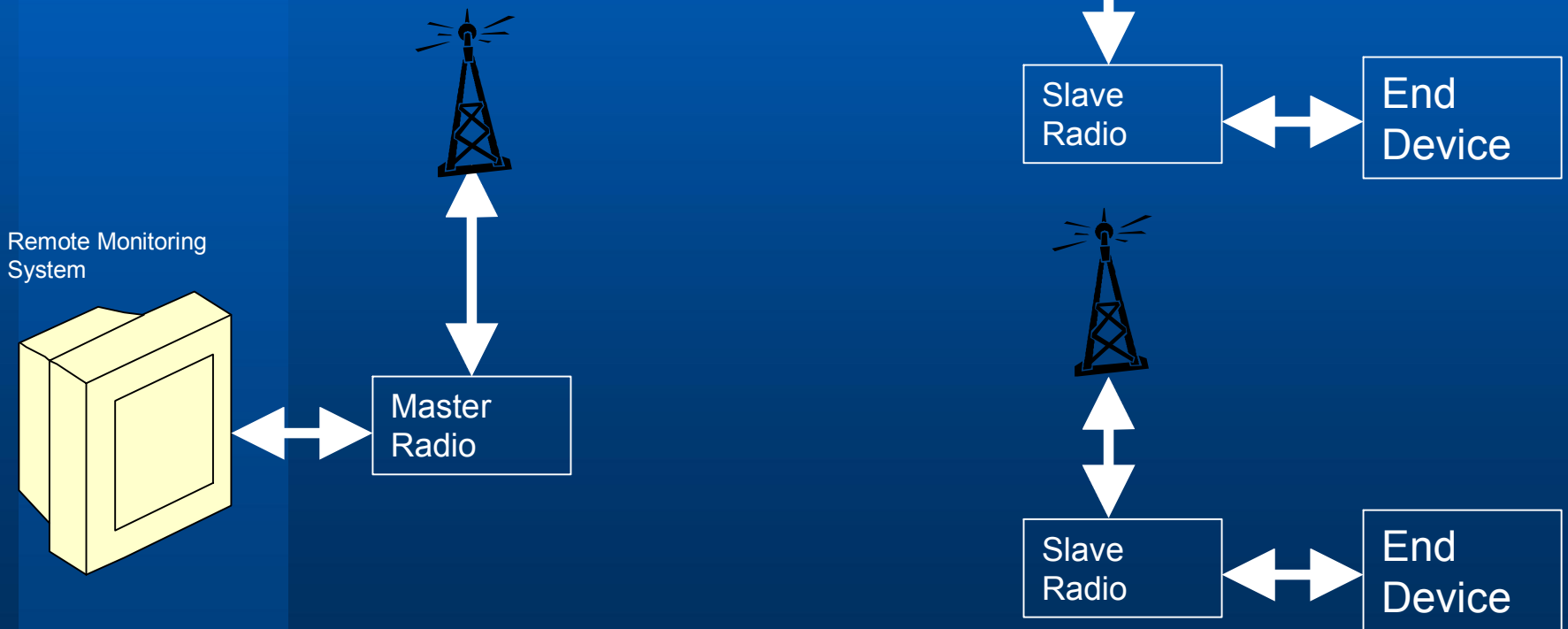
Communication Technologies

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



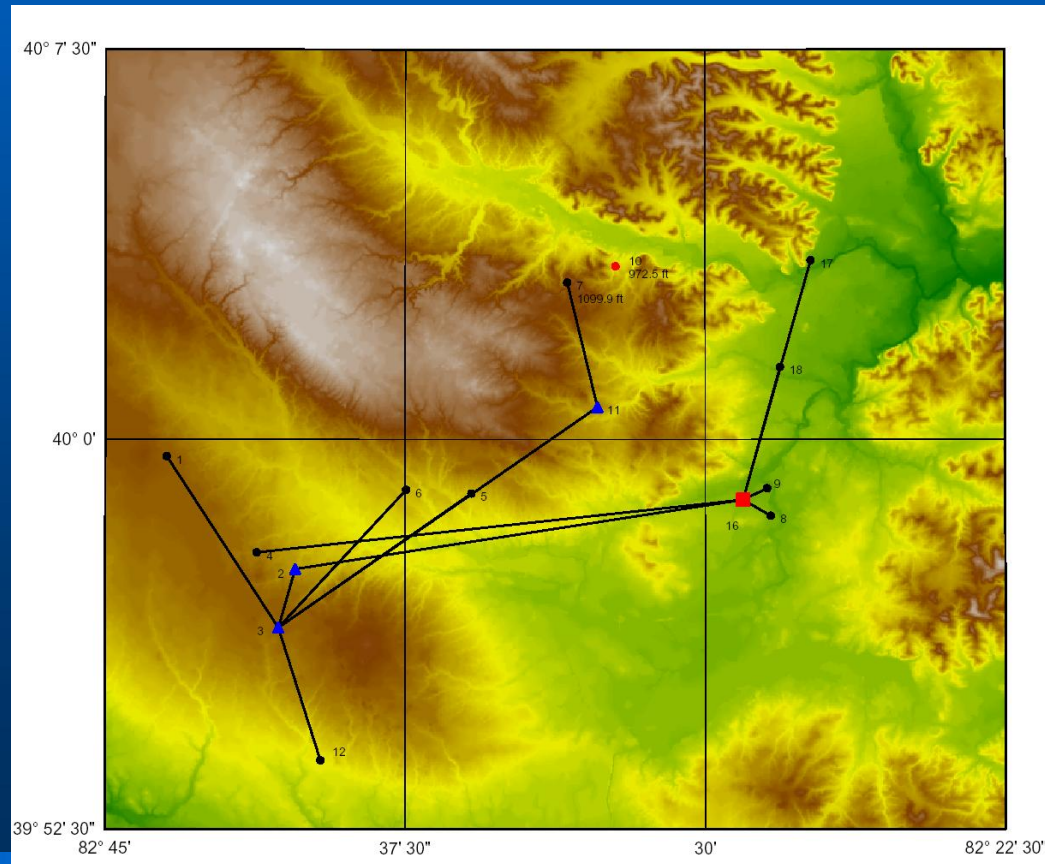
Communication Technologies

Radio (cont)

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

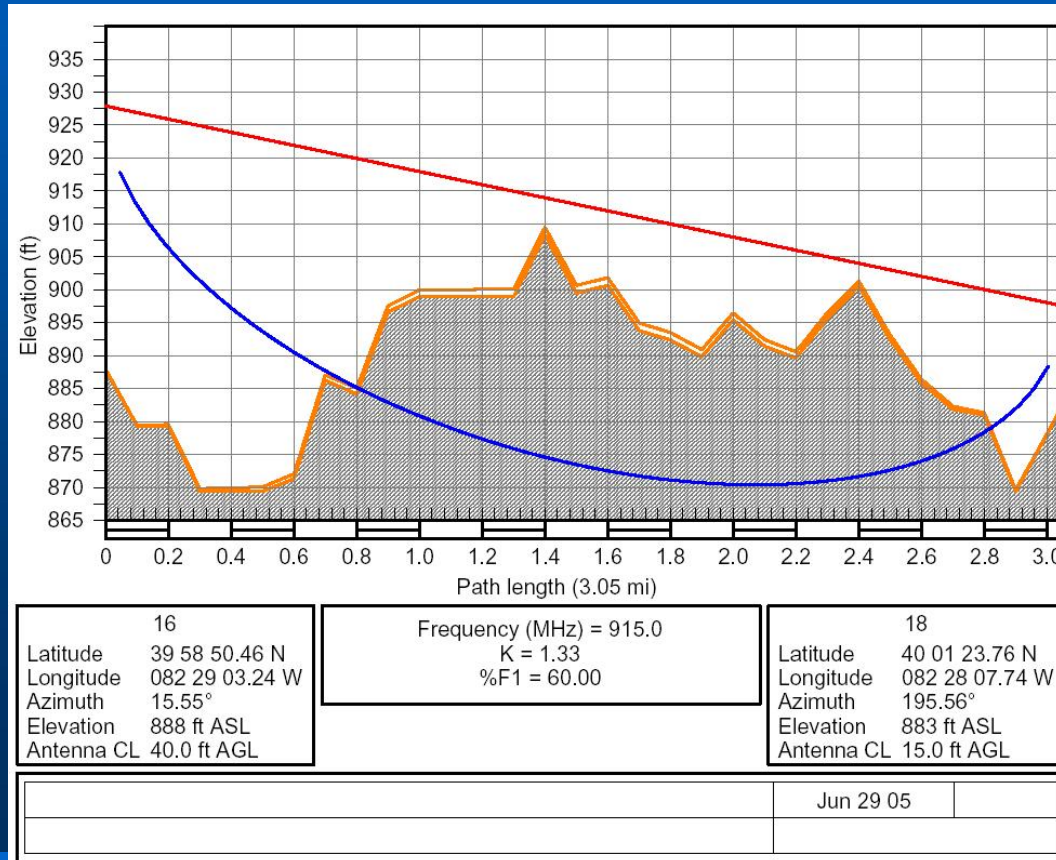
Communication Technologies

Radio (cont)



Communication Technologies

Radio (cont)



Communication Technologies

Radio (cont)

- **Fast Communication Speeds**
 - 100K + bps
- **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

- **Multiple 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

Remote Monitoring & Communication Technologies

Overview

– Remote Monitoring System

- Support Multiple Communication Technologies
- Open System
 - Protocol Support
 - Database
 - Connectivity

Remote Monitoring & Communication Technologies

Overview

- **Communication Technologies**
 - **Hybrid System**
 - **No Single Technology Will Meet Your Needs**
 - **Preparation and Planning**
 - **Power Supply Concerns**
 - **Cellular Coverage Analysis**
 - **Radio Path Study**
 - **Site Surveys**

Remote Monitoring & Communication Technologies

Questions?