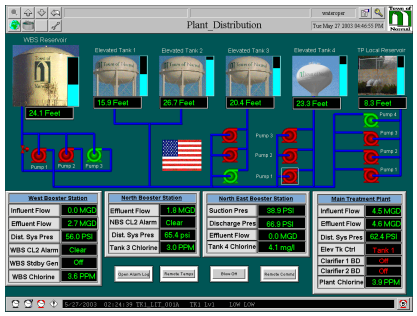
Industrial Wireless 101 Seminar

Ken Majerus
ProSoft Technology

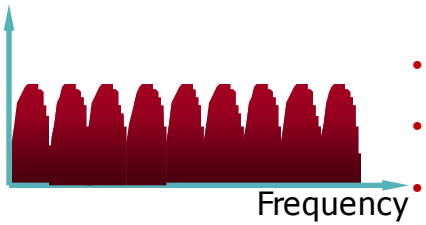
ProSoft® TECHNOLOGY
Where Automation Connects.™

Why Go Wireless??



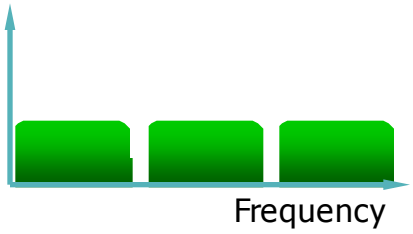
Basic Radio and Wireless Technology

Frequency Hopping



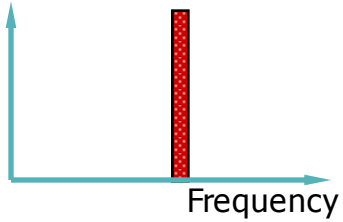
- 900MHz & 2.4GHz
- Slow
- SCADA

802.11

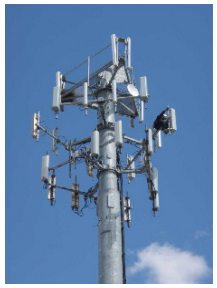


- 802.11a/b/g/n
- High Speed
- Very High Speed
- I/O
- Video

Licensed



- 450MHz – 470MHz
- Very Slow
- Long Range
- SCADA



Cellular

- 3G GSM & CDMA
- Remote SCADA
- Remote Machine Access

Telemetry I/O

- Analog In -> Analog Out
- Digital In -> Digital Out

Blue Tooth/Zigbee

- Remote HIM
- NOT for any control/reliable comms

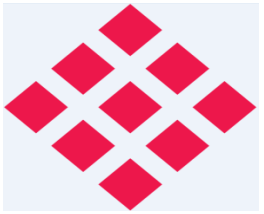
Wireless Sensors

- WirelessHART
- Pressure, Level, Temperature

Designing a Radio Network

Part Selection:

Radio Technology

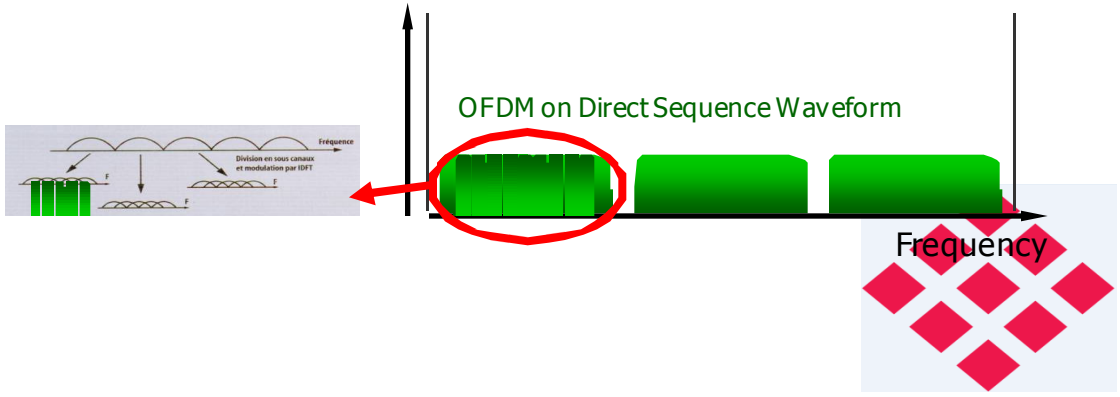


Technology on 900 MHz & 2.4 GHz

- Frequency Hopping Spread Spectrum (FHSS)
  - 900 MHz
  - 2.4GHz

- Direct Sequence Spread Spectrum (DSSS)
  - 802.11b (2.4GHz)

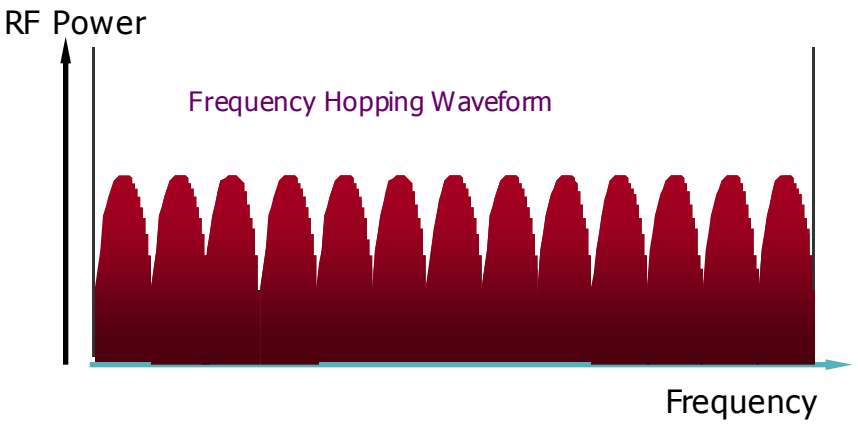
- Orthogonal Frequency Division Multiplexing (OFDM)
  - 802.11a/g (5 GHz/2.4GHz)



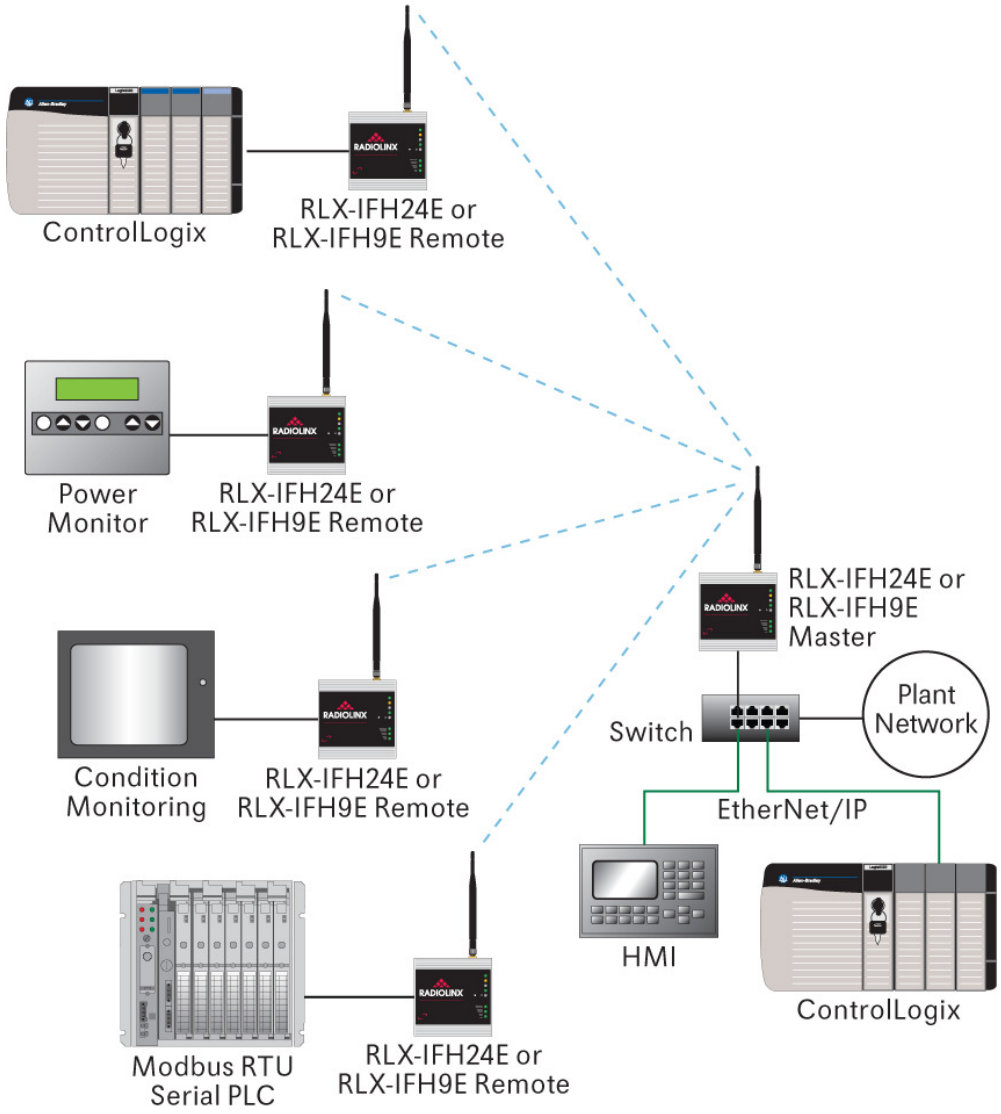
Technology on 900 MHz & 2.4 GHz

Frequency Hopping

- Range – 20+ miles
- Latency - ~200ms
- 900 MHz and 2.4 GHz

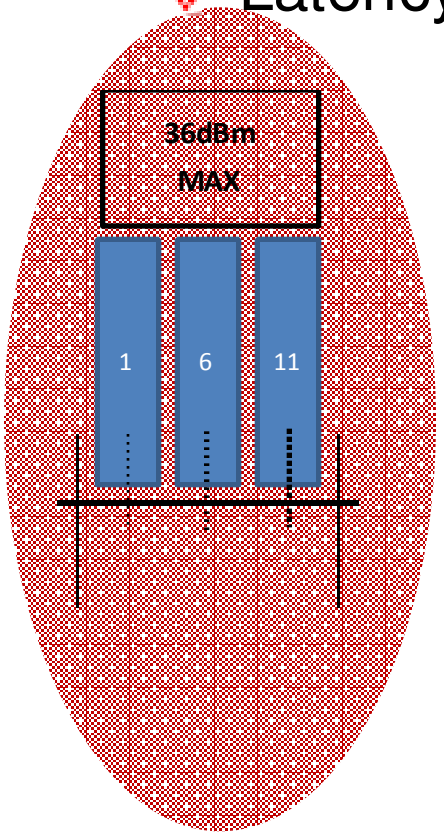


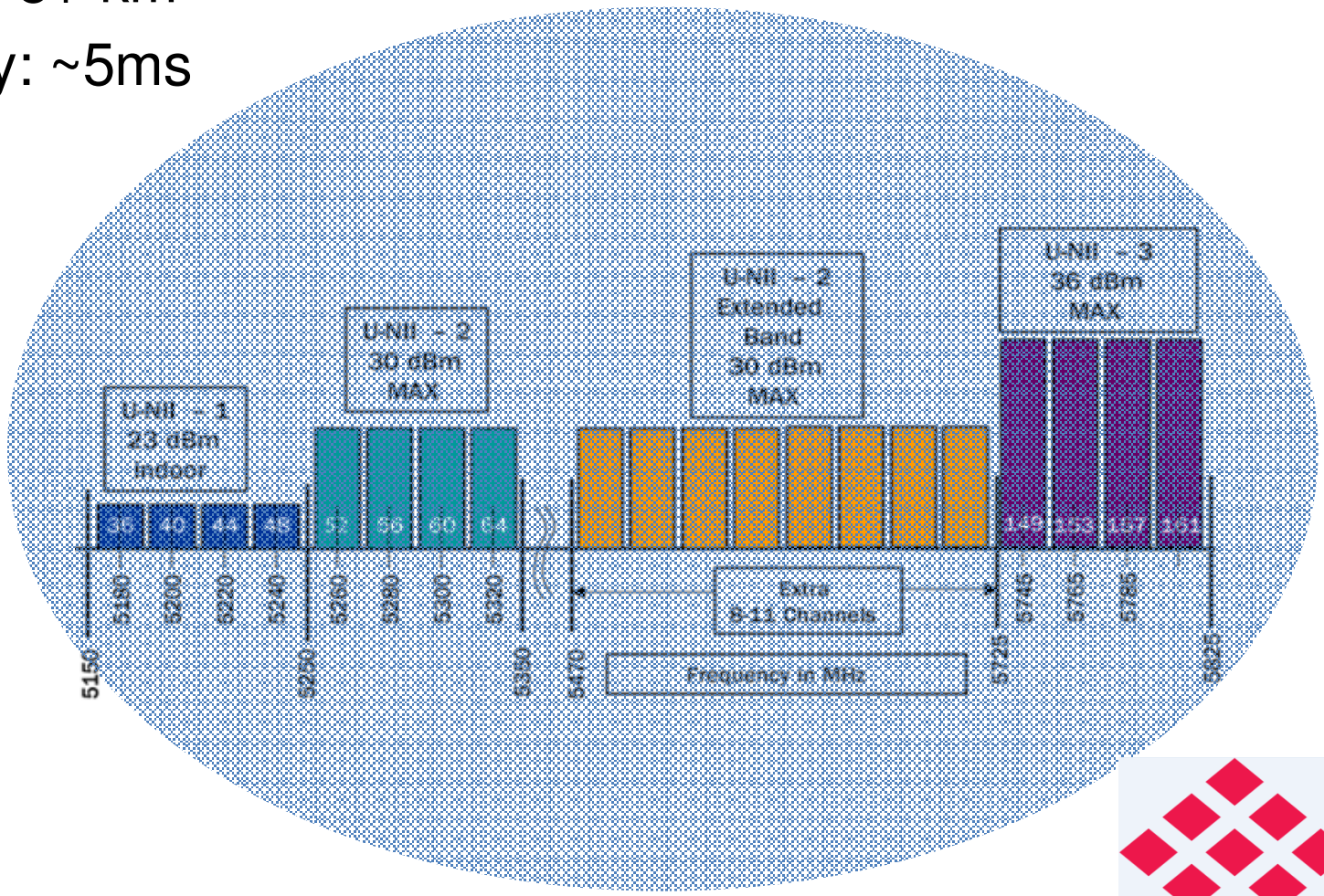
900 MHz and 2.4 GHz
Industrial Frequency Hopping Ethernet



Technology on 2.4GHz & 5 GHz

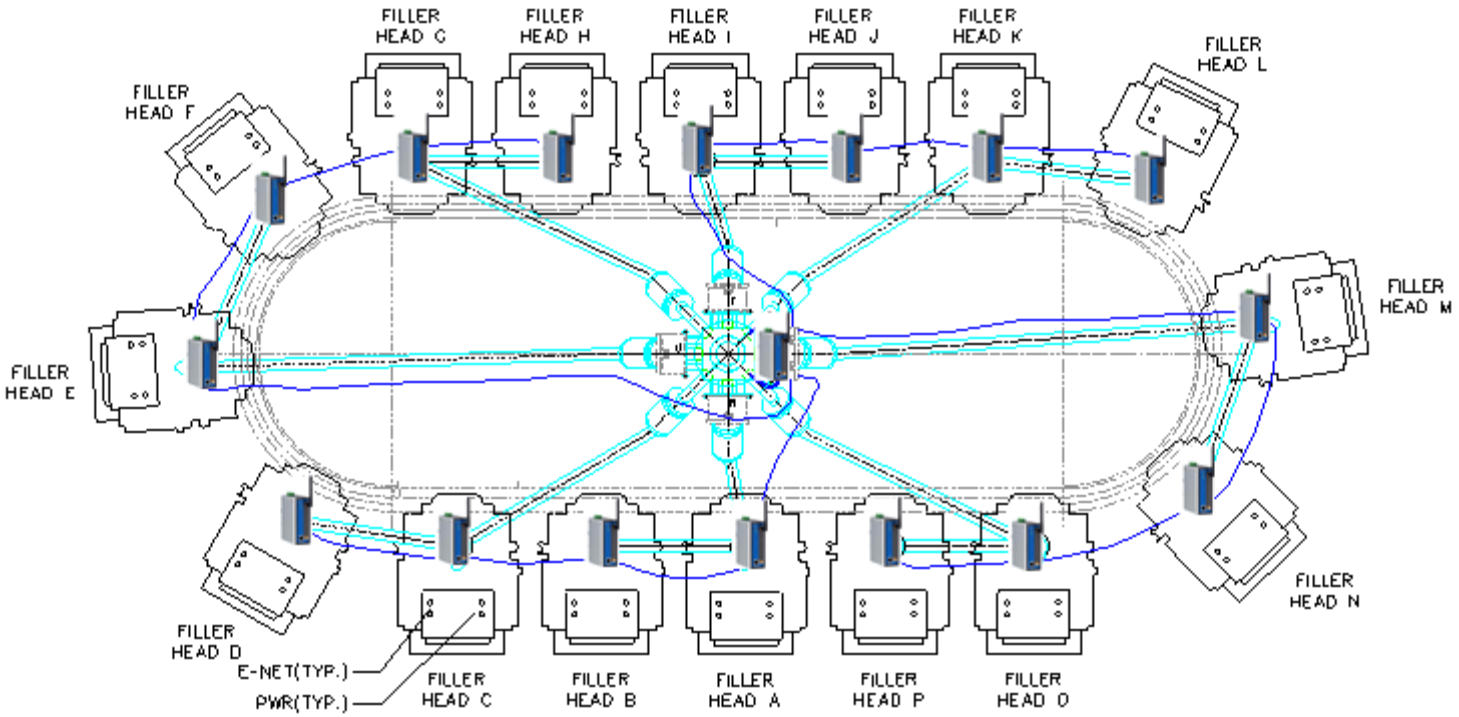
- 2.4GHz (3 channels) & 5GHz Band (23 channels)
- Range: 8+ km
- Latency: ~5ms





Rotary Commutater Replacement

- This plant has a filler that fills 16 bottles at a time with laundry detergent, liquid soap or other products.
- PLC Processor talking with 16 Remote I/O Blocks



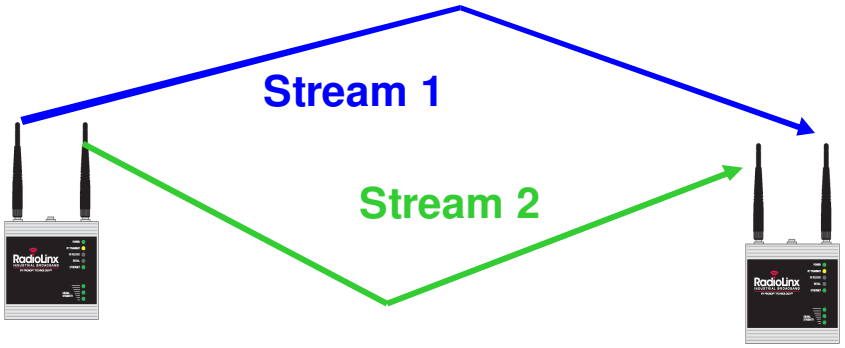
Technology on 2.4GHz & 5 GHz

802.11n Enhancements

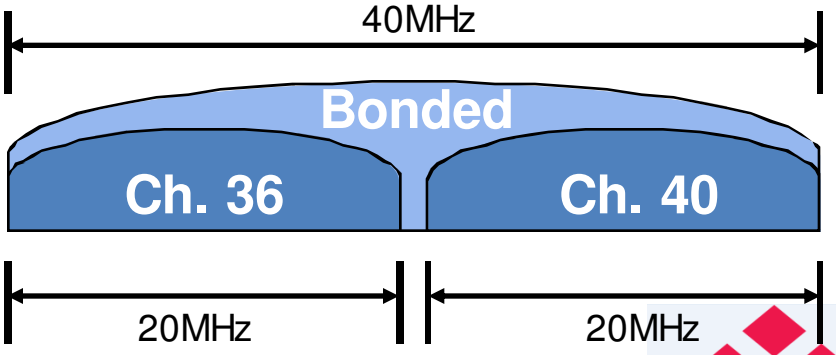
Greater Speeds

1 Channel	2 Channels	Streams
7 Mbps	15 Mbps	1 Stream
72 Mbps	150 Mbps	
14 Mbps	30 Mbps	2 Streams
144 Mbps	300 Mbps	

Multiple Streams

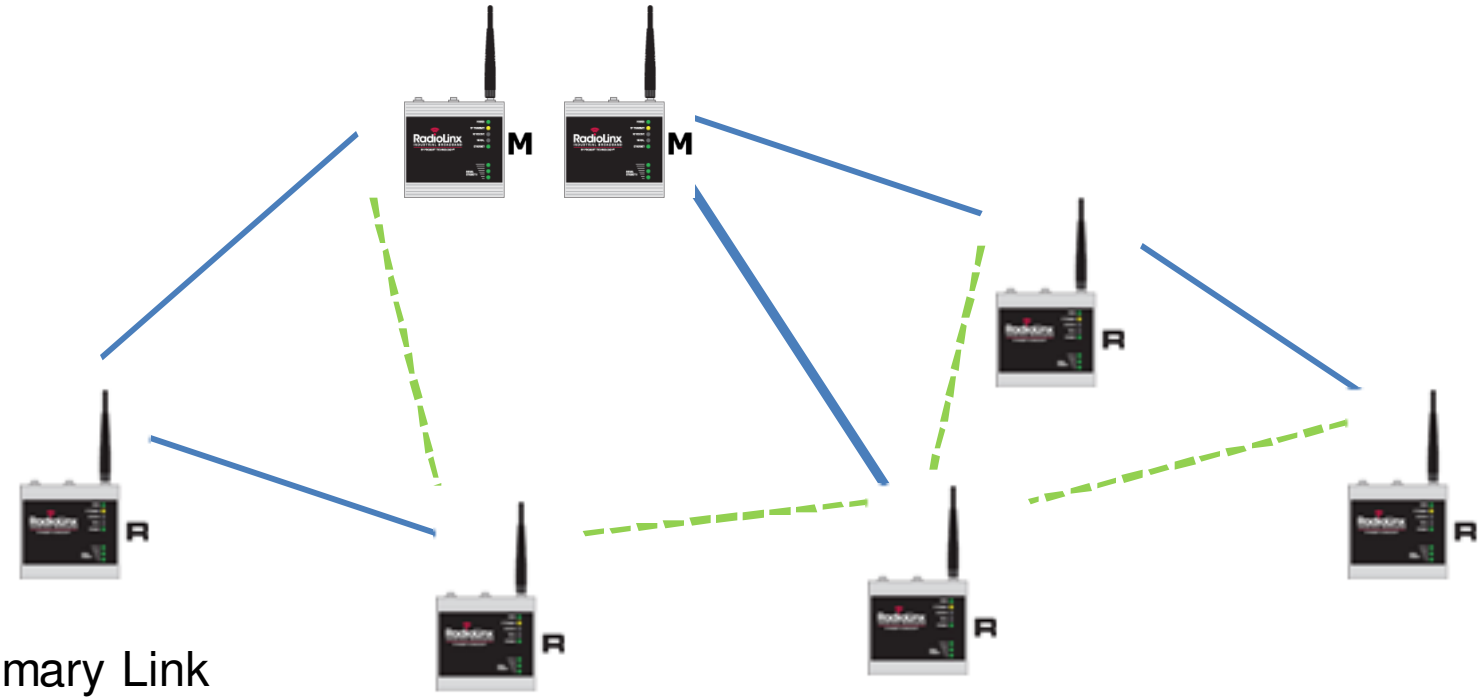


Multiple Channels



Simple Self-organizing Network

- Evaluate every second
- Cost based weights
  - RSSI
  - Hops

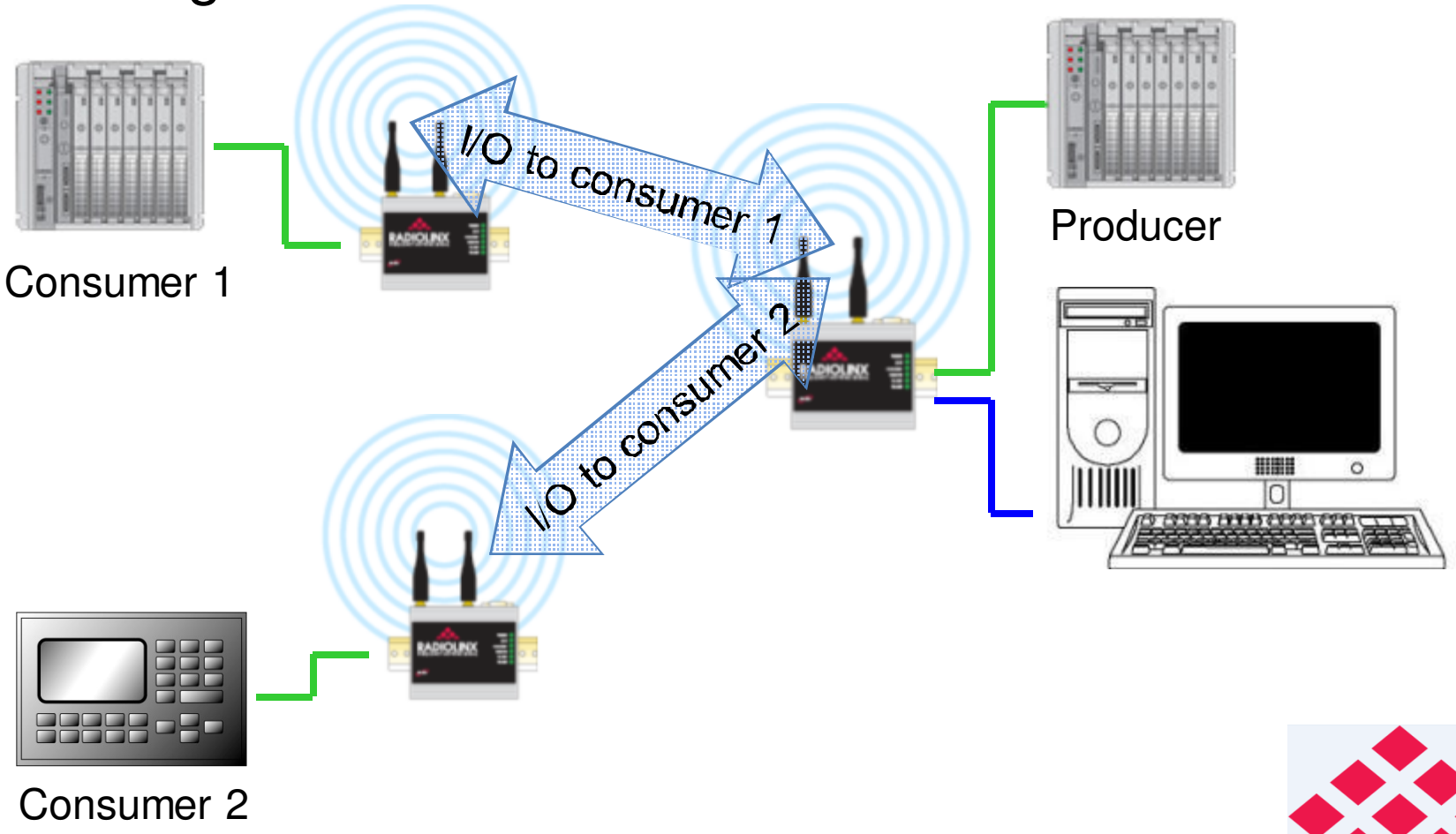


Primary Link

Redundant Links

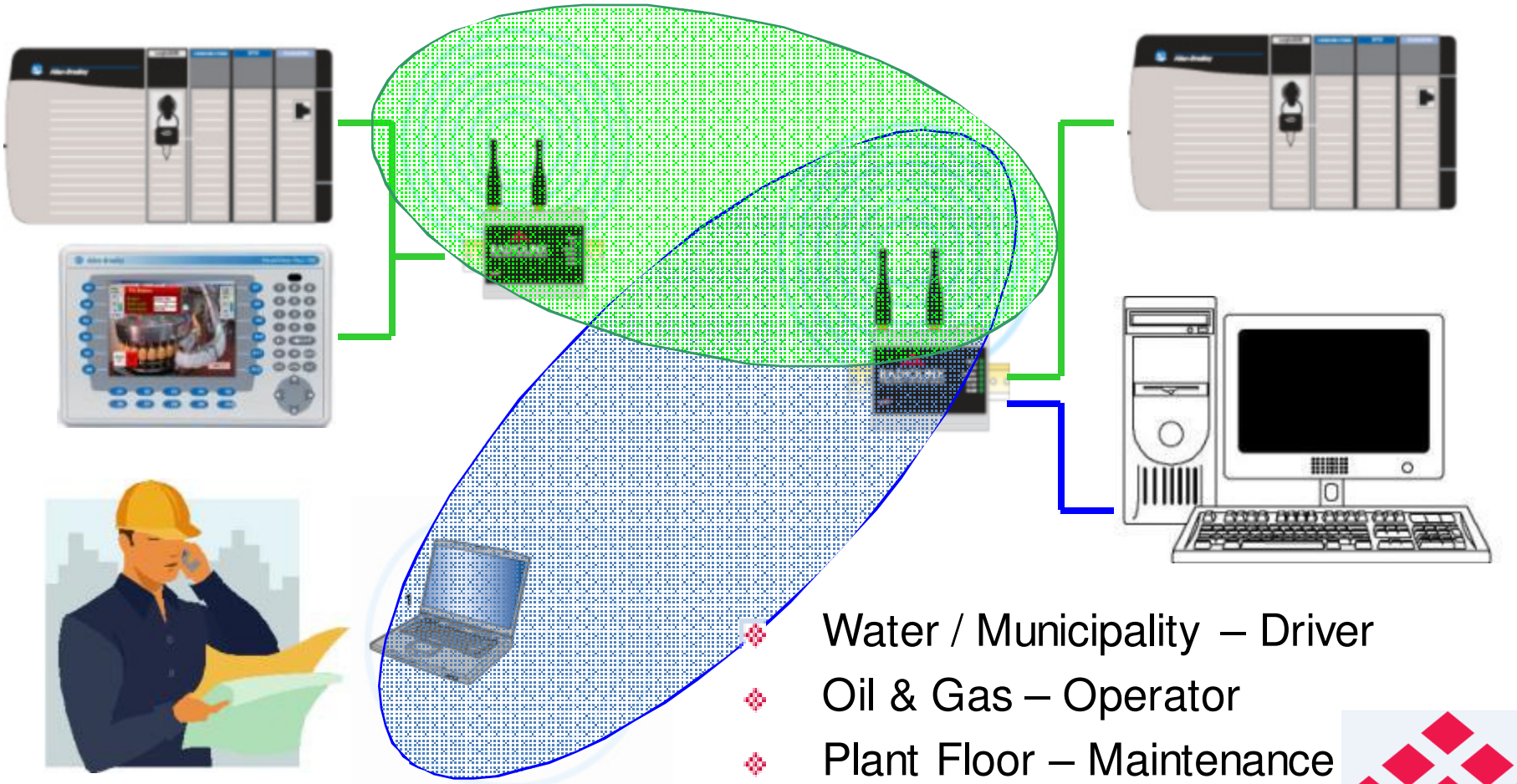
Reliable I/O Message Delivery

- IGMP Snooping allows discovery of multicast groups
- Messages delivered to each consumer



Traffic Segmentation – VLAN

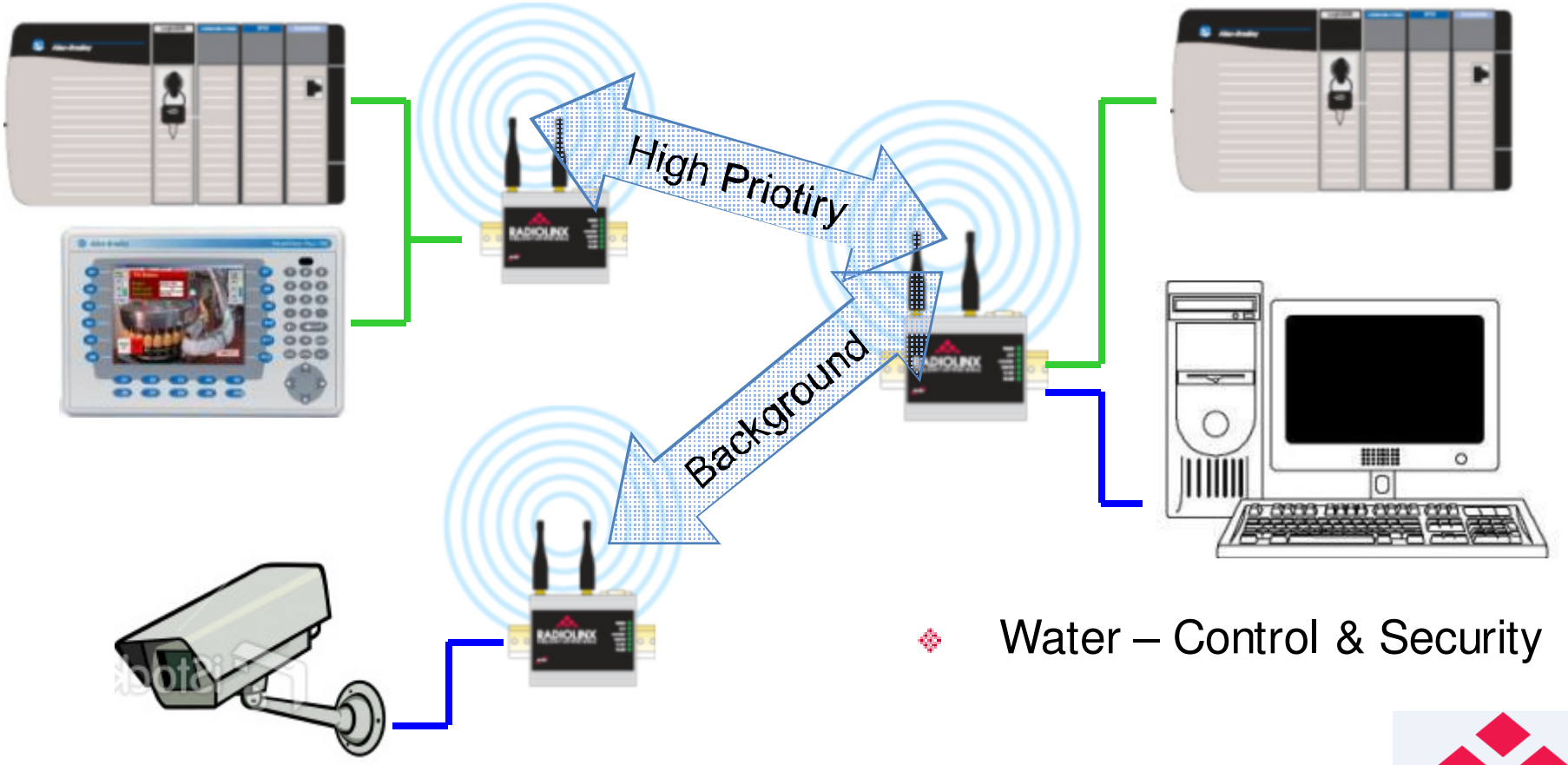
- Isolation between mobile worker & control data



- Water / Municipality – Driver
- Oil & Gas – Operator
- Plant Floor – Maintenance

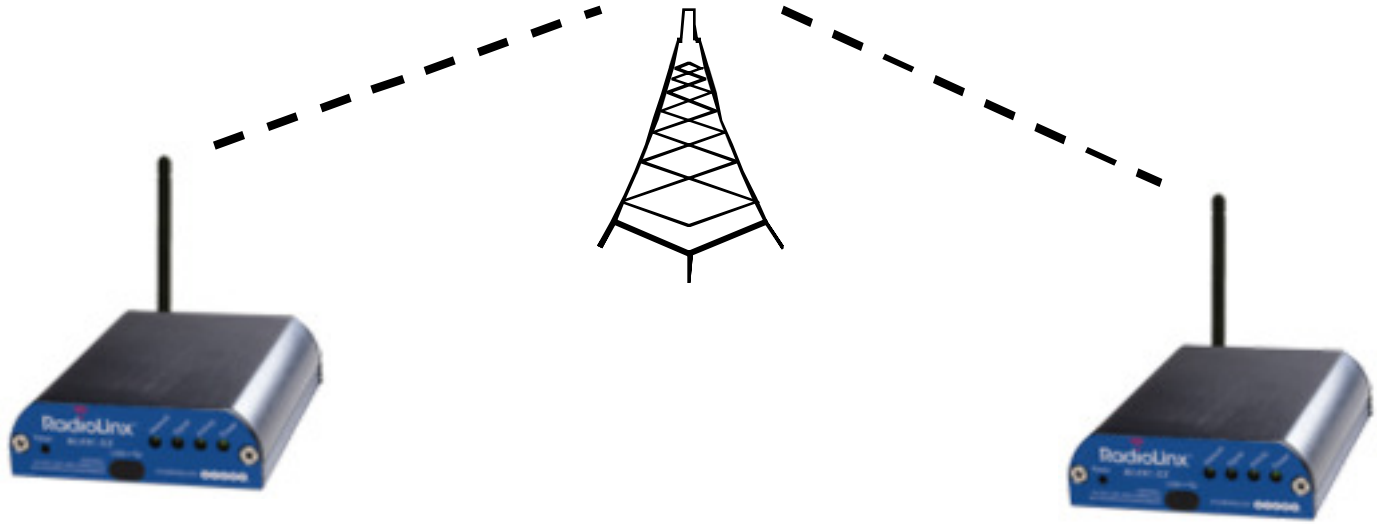
Prioritization – Quality of Service

- Prioritization of Data – QoS, WMM



- Water – Control & Security

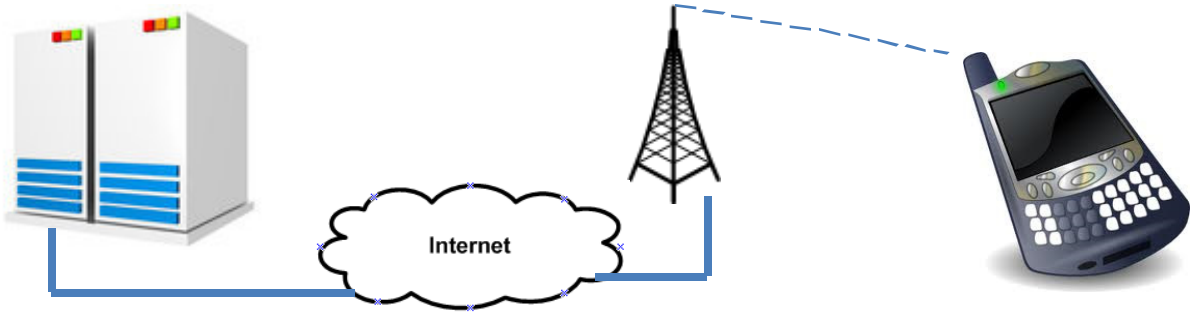
Cellular Technology



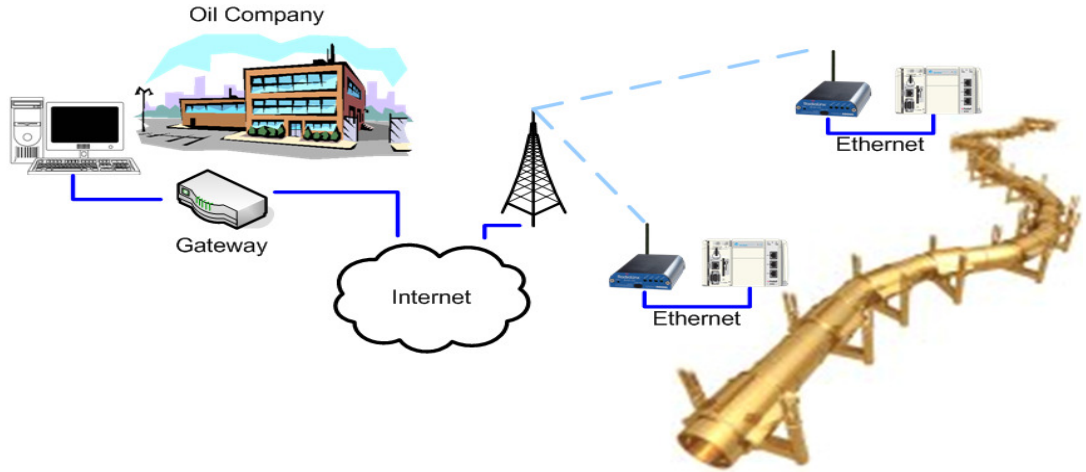
Cellular Radio / Specs.

Mobile Terminate vs. Originate

Mobile Originate – Device goes out to the Internet



Mobile Terminate – Something tries to reach the device via the Internet



Data Plan

No Contract

verizon

2GB/s

at&t

2 Year

5GB/s

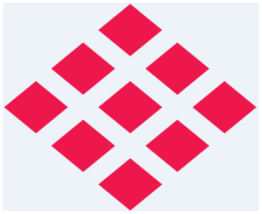
250KB/s

Sprint

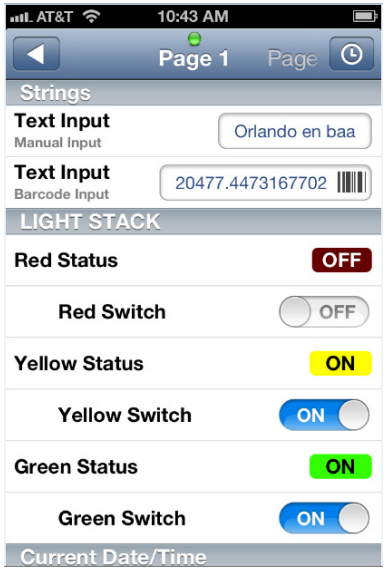
T··Mobile·

50KB/s

1 Year



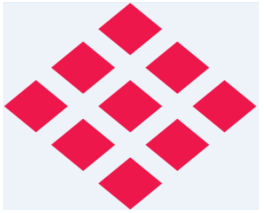
Remote Control System Monitoring



Designing a Radio Network

Part Selection:

Antenna, Cable, Accessories



Designing a Radio Network

- Antennas Focus Energy
- Types

Yagi

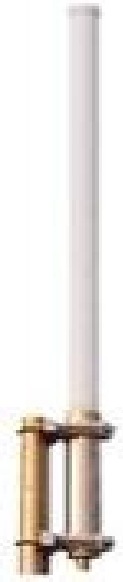
Parabolic

Panel

Omni

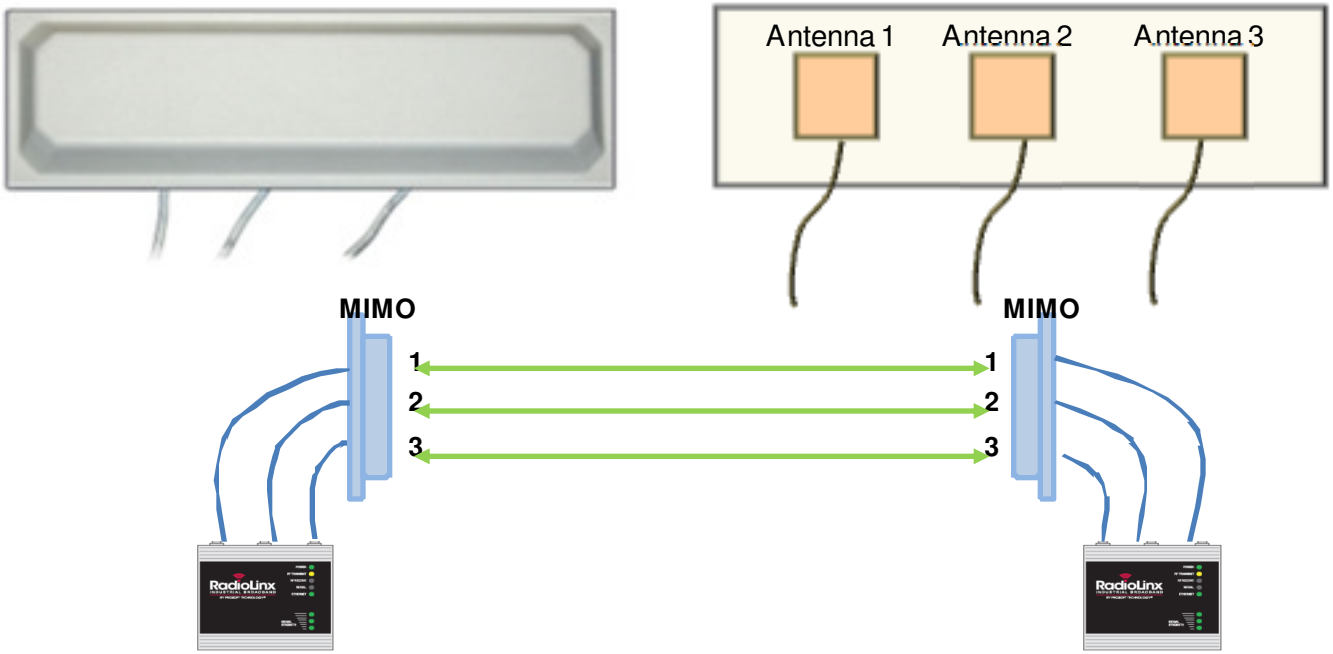
Designing a Radio Network

- Polarization
- Frequency bandwidth
- Effective Power Gain – dBi

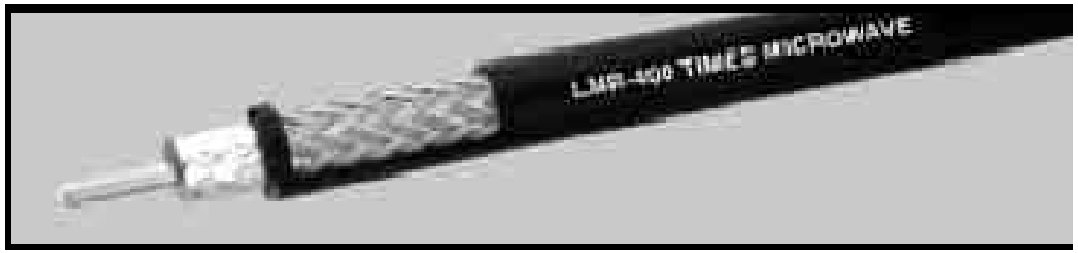


802.11n – MIMO Antennas

- MIMO: Multiple-Input, Multiple Output
- 3 Antennas in one: Each antenna contains 3 elements that act as 3 separate antennas.
- Streams: Multiple antenna elements allow for multiple streams.



Designing a Radio Network



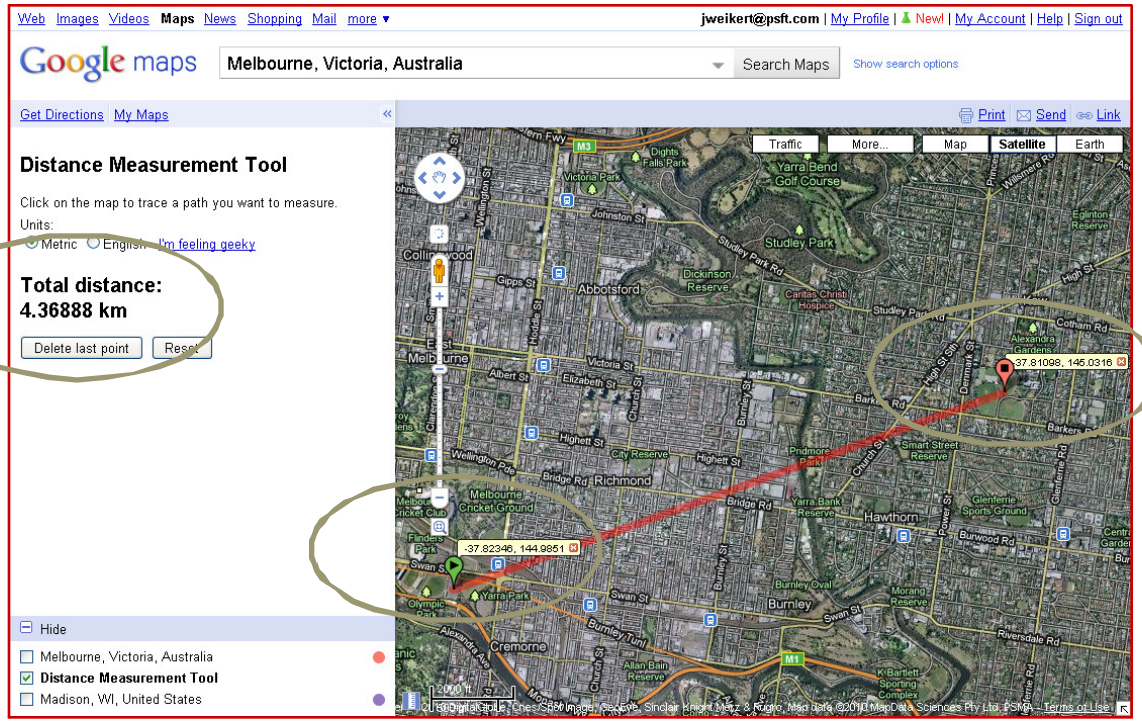
Cable Type	dB loss per 100' @2400 MHz
RG-316	42
LMR 195	19
LMR 400	6.8
LMR 600	4.4
LMR 1200	2.3
Heliax LDF 4	3.5
Heliax LDF 5	2.0
Heliax LDF 7	1.3

Designing a Radio Network

- Process to follow
  - Get GPS Coordinates
  - Perform Path Study
  - Create initial Bill of Materials
  - Obtain test units and antennas
  - Site Visit – visually inspect and test links
  - Permanent Installation
  - Performance Testing
  - Commission with equipment

Designing a Radio Network

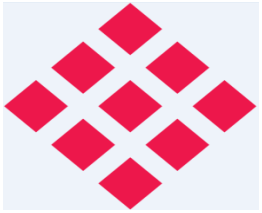
- Determine GPS Coordinates
  - Use tool like Google maps or GPS



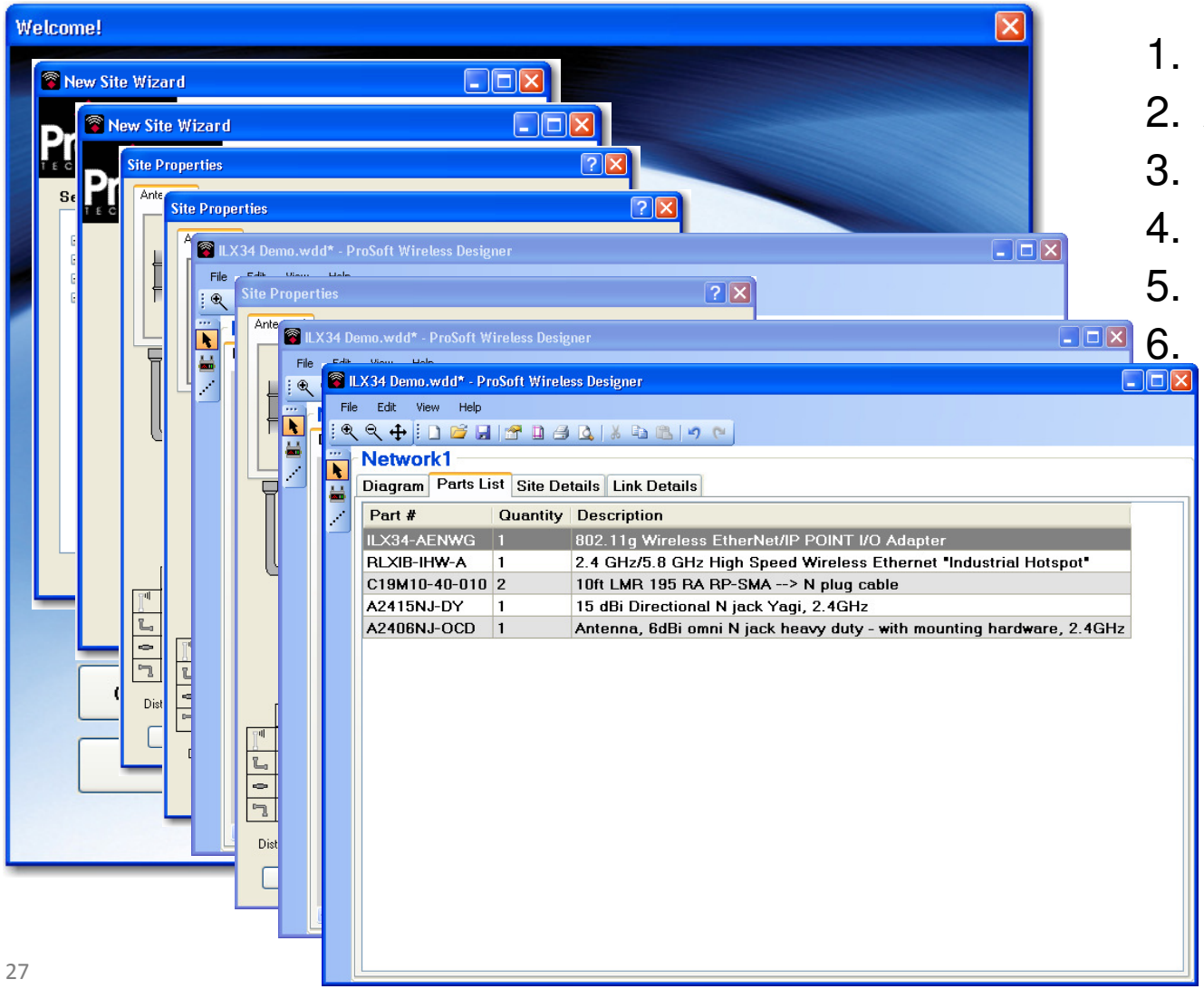
OR

Designing a Radio Network

Wireless Designer Tool



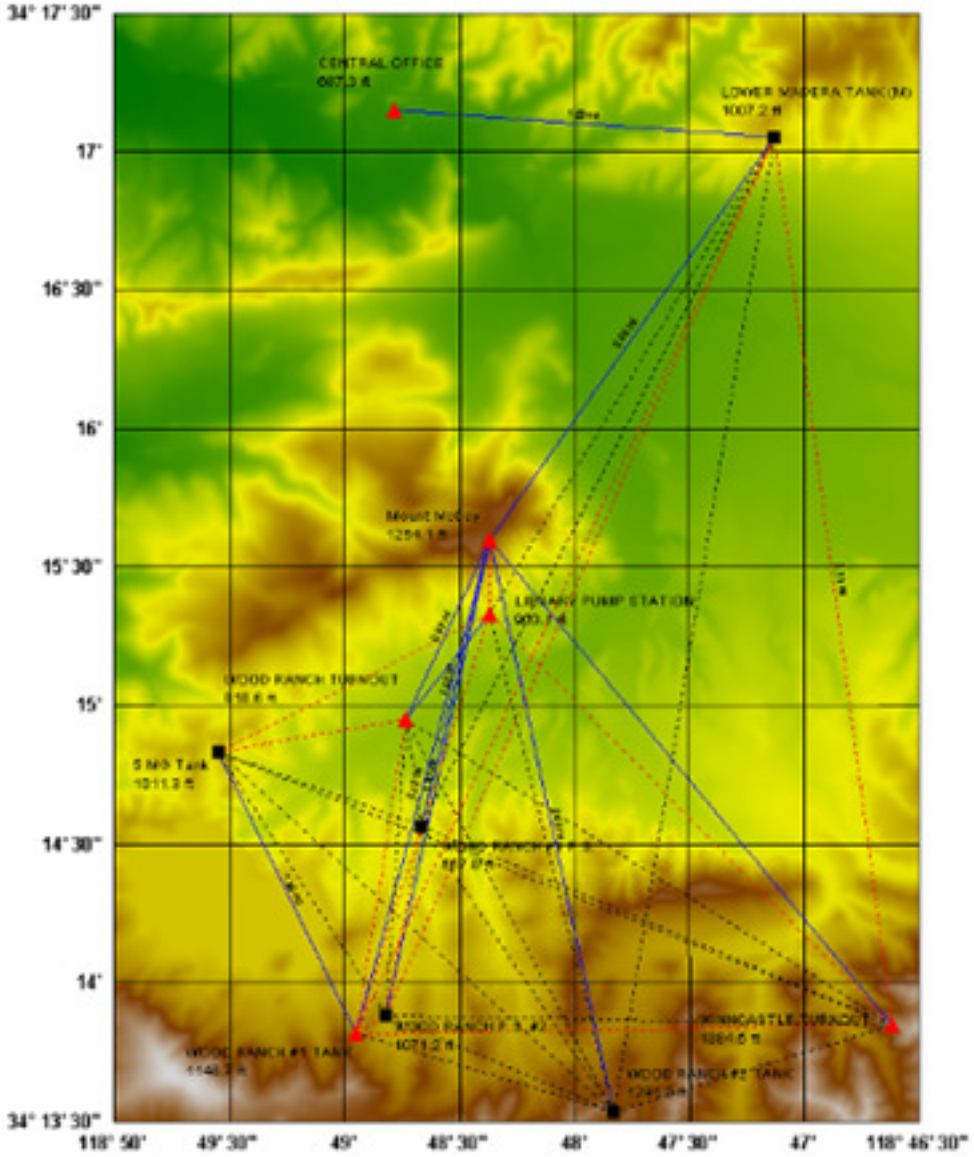
Designing a Radio Network



1. Wizard guided defaults
2. Add Sites with defaults
3. Evaluate Link
4. Modify if desired
5. Review Choices
6. Create Materials List

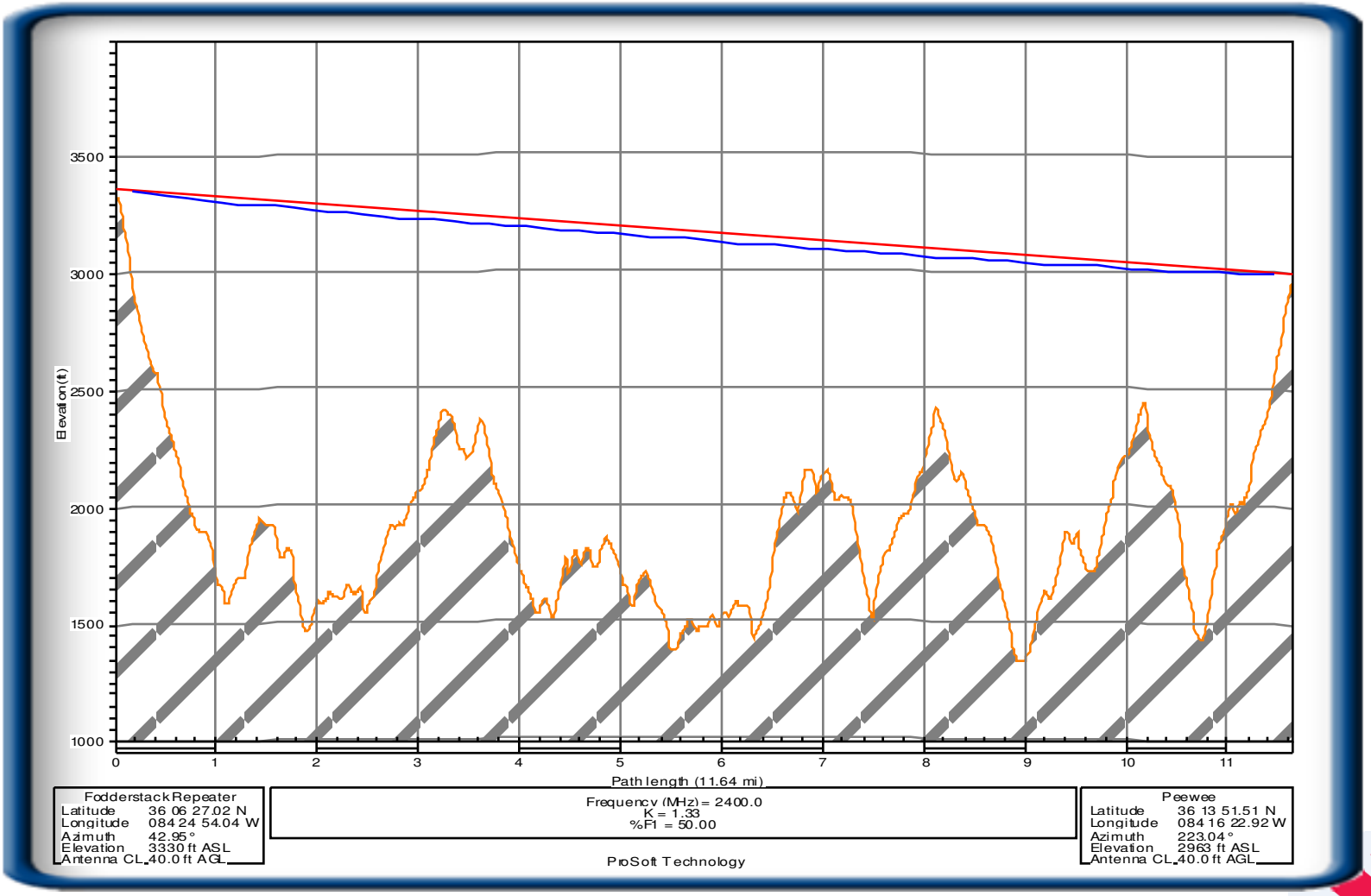
Designing a Radio Network

Radio Path Design – PathLoss Software Topology

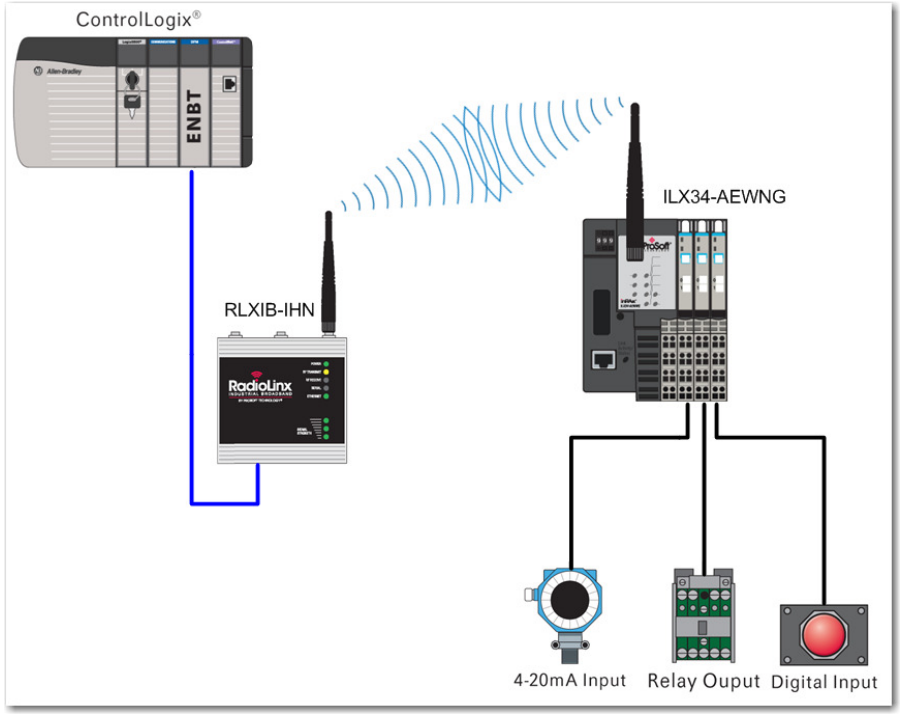


Designing a Radio Network

Radio Path Design – PathLoss Software Path Profile



Wireless I/O


ControlLogix®
ENBT
RLXIB-IHN
RadioLinx
ILX34-AEWNG
4-20mA Input
Relay Ouput
Digital Input

Success Stories

Process Automation

- Liberty Airport Systems – Airport Lighting
  - Canadian Forces Base in Trenton, Ontario
  - Winnipeg International Airport
  - Phoenix Mesa Gateway Airport
- Challenge
  - Runway & taxiway lighting, flood lights for fueling, loading
  - Redundant Network to Fiber, broken during construction
  - Mobile areas (de-icing)
- Solution Details
  - HMI in Main control tower
  - 802.11abg Radio
- Benefit
  - Reliability & Flexibility
  - IGMP for Multicast

Success Stories

- Large Resort & KiddieLand Park
  - Large Resort – Indy (24), Monorails (5), Innoventions (3), Parade routes (70)
  - KiddieLand Park– Parades (10), Large Ride(25)
  - KiddieLand Hong Kong – Parades (30)
- Challenge
  - Mobile parade cars & ride cars communicate to central controllers along the route.
- Solution Details
  - Frequency hopping

  radios with device networks
- Benefit
  - Roaming along the route
  - Support many different protocols

Success Stories

Process Automation

- Green Planet Farms – Soy Protein Isolation
- Challenge
  - Integrate process measurements and motor control in one system
  - Plant wide wireless worker access
- Solution Details
  - 802.11a/g
- Benefit
  - Wireless access during construction
  - Wireless control during operation

Rockwell Technology:

- Plant PAx
- ControlLogix

Success Stories Aluminum Manufacturing

- Kaiser Aluminum Plant
- Challenge
  - Overhead crane that moves through an area with a large furnace
  - Position of the crane hook &load could “interfere” with the furnace
  - Warning light and horn in the cab
- Solution Details
  - 802.11a/g Radio
  - Wireless Point I/O Adapter

Success Stories Printing

- Printer for Phone books
- Challenge
  - Motors were overheating
  - Monitor motor temperature
- Solution Details
  - 802.11a/g Radio
  - Wireless Point I/O

Landfills

MotoZip

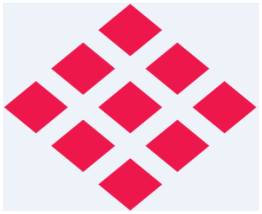
Why Go Wireless??

PLACE YOUR APPLICATION HERE

QUIZ

What does MIMO stand for?

How would you best describe Energy pattern for an Omni Antenna?



Thank you

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