

Future of Wide Area Networking


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- The background of the slide is a photograph of a train station platform. A woman with shoulder-length brown hair, wearing a dark coat and a scarf, is smiling and looking towards the camera. In the background, a yellow and red train is stopped at the platform, and other people are blurred, suggesting movement. The station has a large, arched glass and steel roof structure.
- How did we get here?
 - Key Drivers?
 - Sample Technologies
 - Next Generation Technology

- 80's – early 90's
 - PMR*
 - Sign Post Location
 - Distance traveled
 - Voice Radio (separate?)

*PMR – Private Mobile Radio

- Mid – late 90's
 - PMR, Cellular, WiFi
 - GPS Location (Differential Correction)
 - Voice/Data Radio (integrated)
 - ADA
 - APCs
 - RTT/PRTT
 - Covert Mics
 - CAD
 - Vehicle Health Monitoring

■ 2000's

- PMR, Cellular, WiFi, WiMAX, Mesh Networks
 - GPS Location (WAAS)
 - Voice/Data Radio
 - ADA
 - APCs
 - RTT/PRTT
 - Covert Mics
 - CAD
 - Vehicle Health Monitoring
 - Traffic Signal Priority
 - CCTV
 - Real-time Passenger Information (RTPI)
 - Passenger WiFi
 - Info-tainment

- 80's – Early 90's
CPU boards and rugged embedded processors
- Mid – Late 90's
WiFi, J1708 & ADA
- 2000's
Customers, Internet & IP Technologies, CPU power
- 2010's
Mobile Routers, Fare Systems, and LTE

Example – UTA Salt Lake City, UT

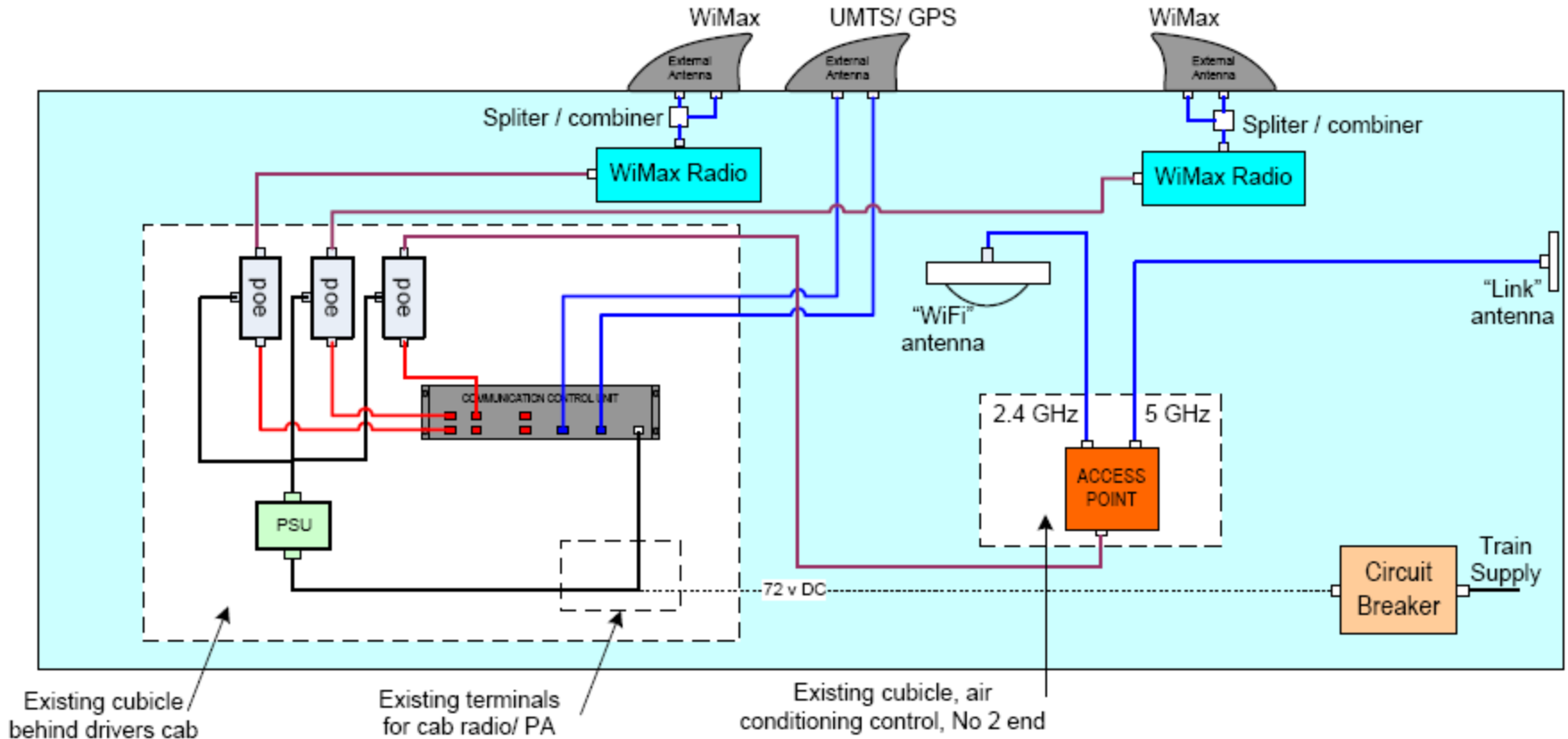
- Broadband Wireless from Central to Trains
- WiFi throughout the consist
- CAD uses IP to all devices as if on a corporate LAN

Trackside WiMAX Base Stations

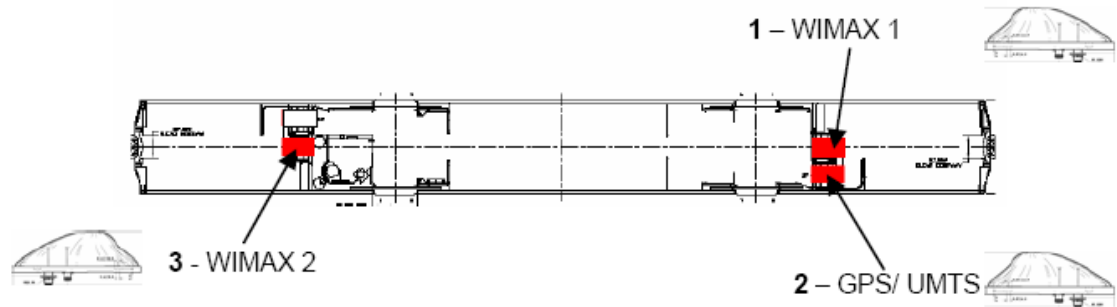
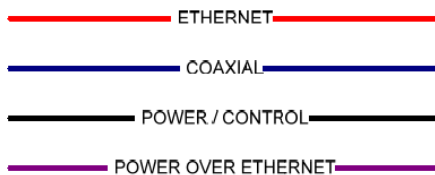
- Redline WiMAX Radios are located along track with line of sight
- Spacing is determined by permissible power, frequency used and topography – usually 3 miles between sites (UTA installed 27 tower)
- Spectrum
 - License Exempt – widely available esp. 5GHz
- Backhaul – Fiber (alternative backhaul options: wireless, point-to-point, leased circuits, DSL, microwave)



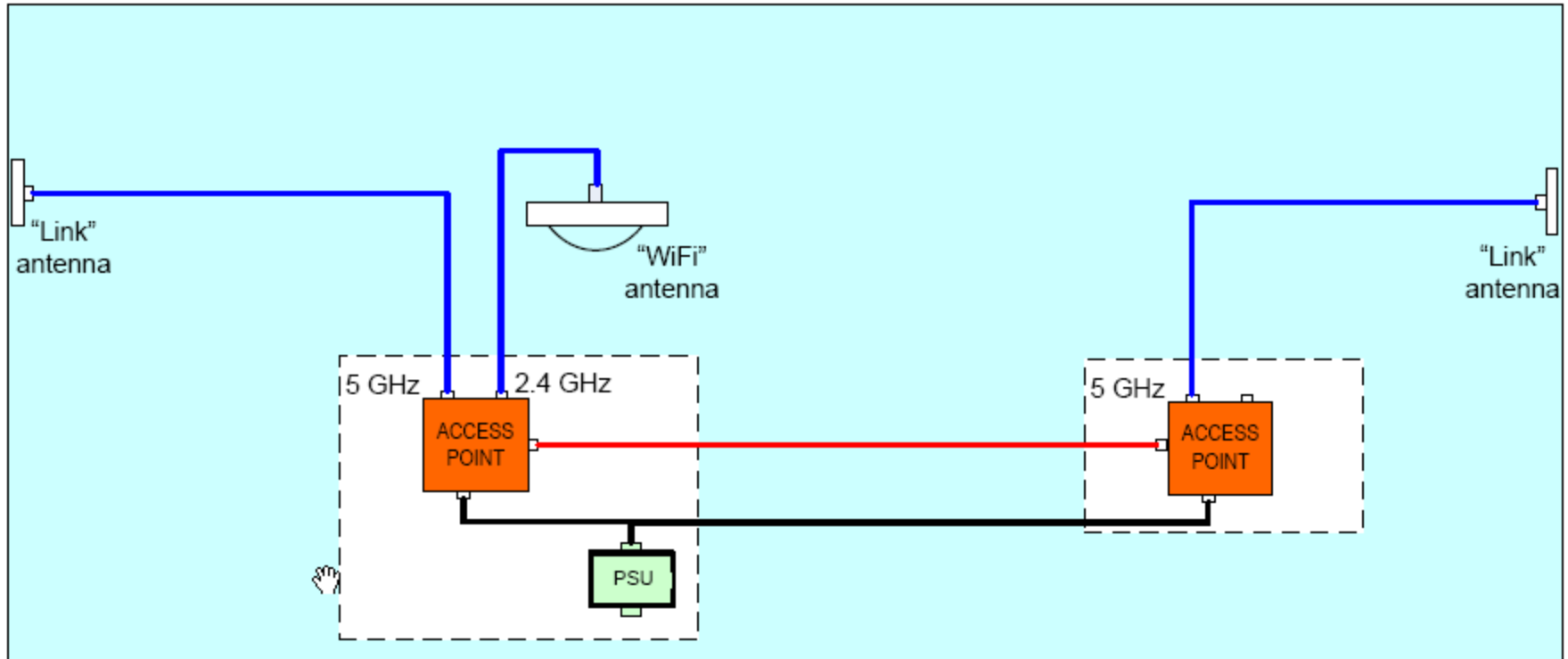
Cab Car Install



KEY

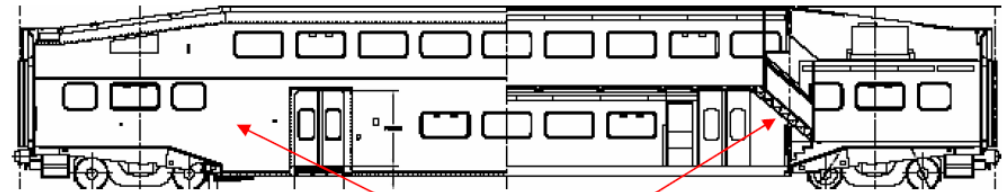


Coach Car Install



KEY

- ETHERNET
- COAXIAL
- POWER / CONTROL
- POWER OVER ETHERNET



Air Conditioning Cupboards

- **Flexible Wireless Utilization**

 - Share IP devices with Vehicle Devices

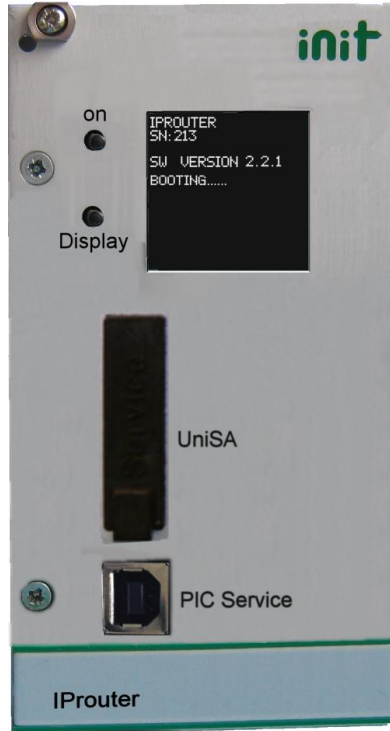
 - Prioritized IP device selection

 - Adaptable – Add/exchange cards

 - Common Router capabilities

 - Address Translation - NAT

 - Virtual LANs

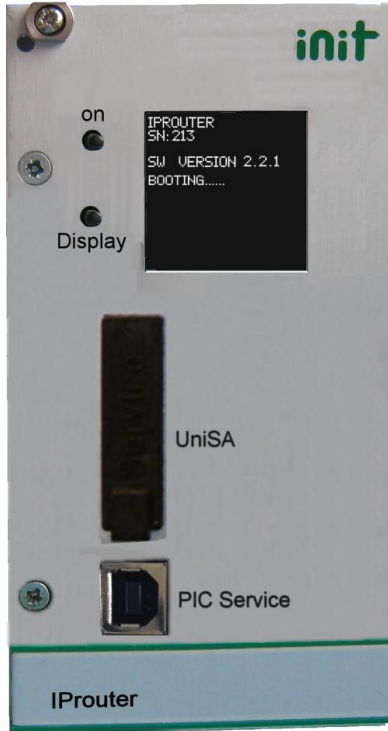


Provides access to wireless IP devices
Allows Sharing by multiple devices

- COPILOTpc VLU
- CCTV
- Fareboxes
- TSP
- Other Ethernet peripherals

Supports multiple IP devices:

- UMTS/GSM/CDMA/UMTSvoice
- 802.11 a/b/g/n
- WiMAX
- 4.9GHz Wi-Fi and MESH
- 5 Internal slots for various devices

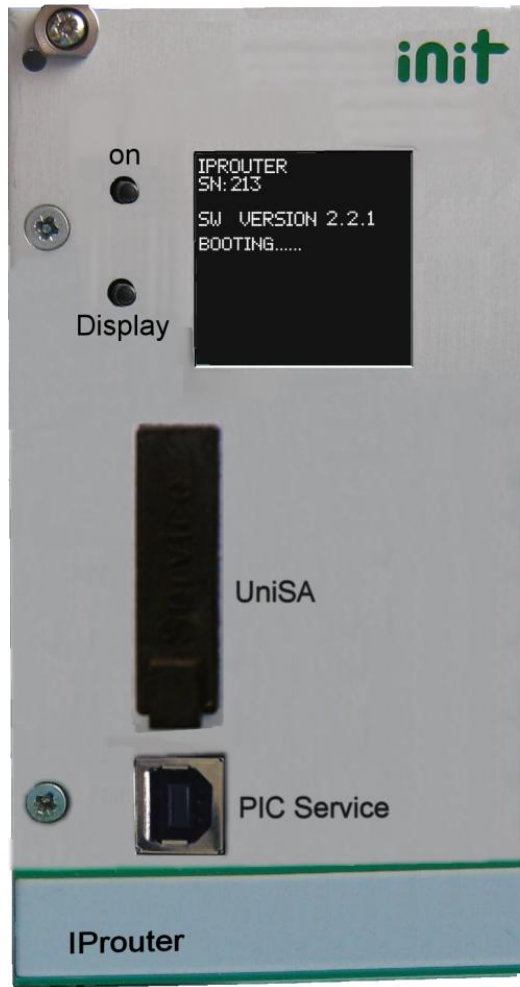


General

- Intel ATOM Processor
- 512 MB storage
- Additional slots accessible from back panel
- Ruggedized for Transit – IP54
- 20 Channel GPS

Interfaces:

- Ignition signal for the device
- 4x 10/100 Mbit Ethernet connection
- One USB port for external devices
- One Audio Input and one audio output
- EEPROM memory on the backplane.



Interfaces:

- Status Display module
- 2 USB ports for keyboard & Mouse
- VGA
- Ethernet
- Service and PIC ports.
- SIM card access

- Open Fare Card Systems



- Accept Bank Cards
- Process instantly
 - 600ms or less
- Accept anywhere
 - Kiosk
 - Bus
 - Train



- MANY transactions
- Secure – Encryption
- All revenue vehicles
- Secure backhaul

**NOT POSSIBLE With
CURRENT PMR
DATA TECHNOLOGY**

■ Possible Candidates

3G + Cellular

- UMTS
- EV-DO
- HSPA+
- LTE

- **LTE – Long Term Evolution**

Claims 15ms round trip

10 Mbps - 2.5 to 4 x 3.5G speeds

GSM, CDMA, US & European Spectrum

US Deployment under way

Coast to coast by end of 2013 – Verizon

Private build outs possible

Bridging with P25

Thank you
for your attention.

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