

# 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

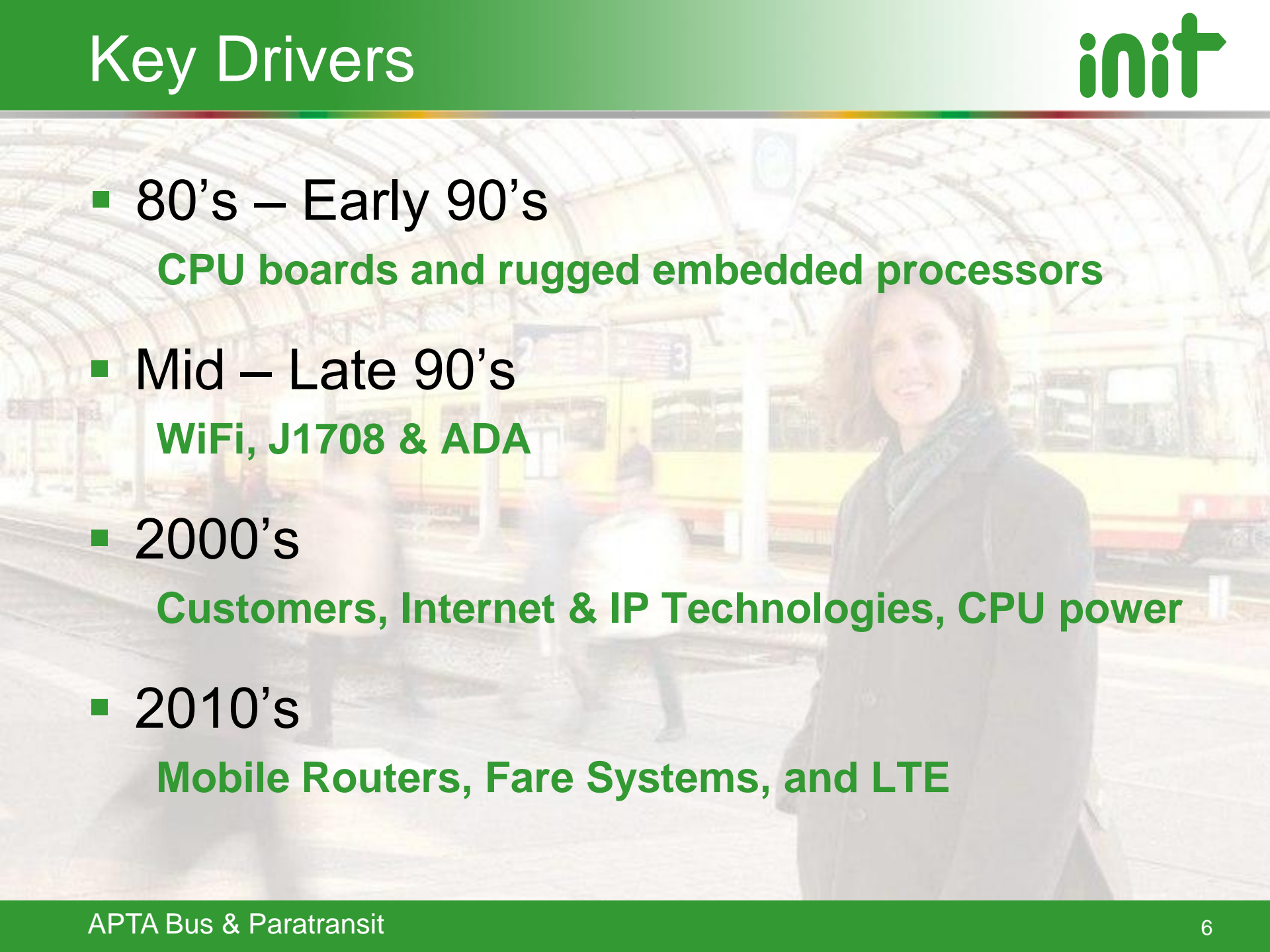
- 80's – early 90's
  - PMR\*
    - Sign Post Location
    - Distance traveled
    - Voice Radio (separate?)

\*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

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- The background of the slide is a photograph of a train station platform. A yellow train is stopped at the platform, and several people are visible, including a woman in the foreground wearing a dark coat and a scarf. The platform has a glass and metal roof structure.
- 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

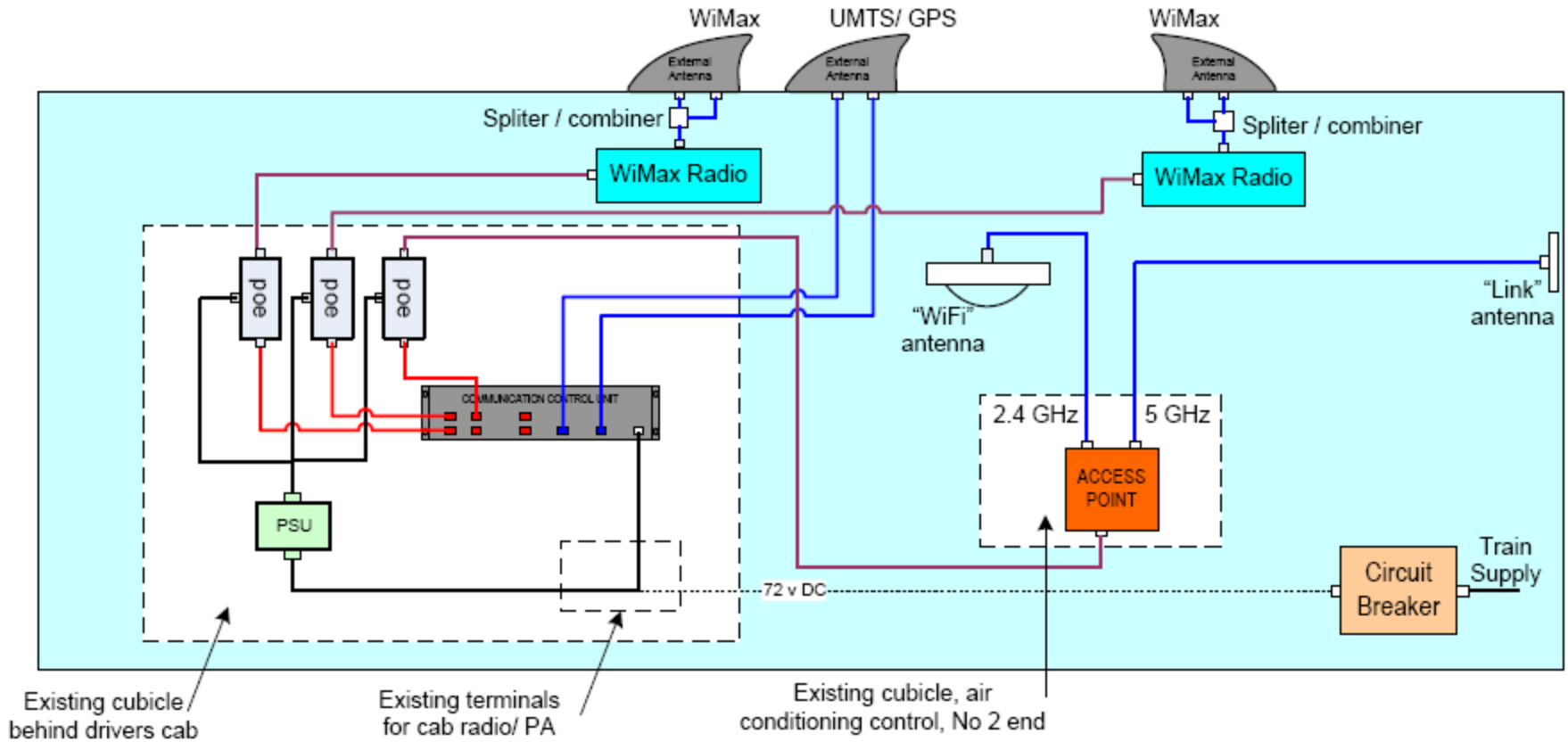
## Trackside WiMAX Base Stations

- 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)



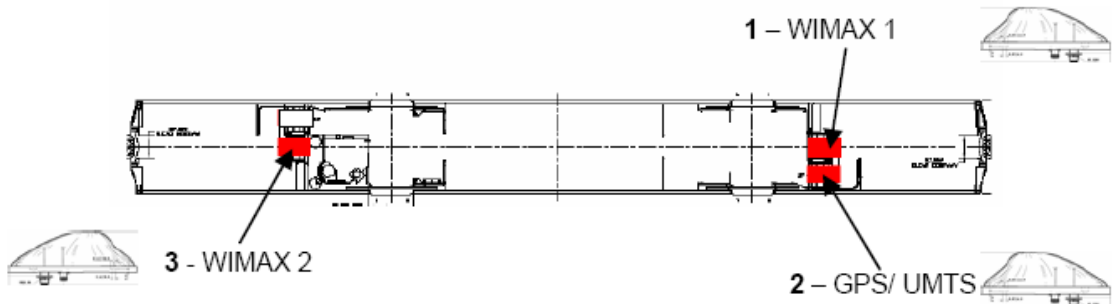


# Cab Car Install

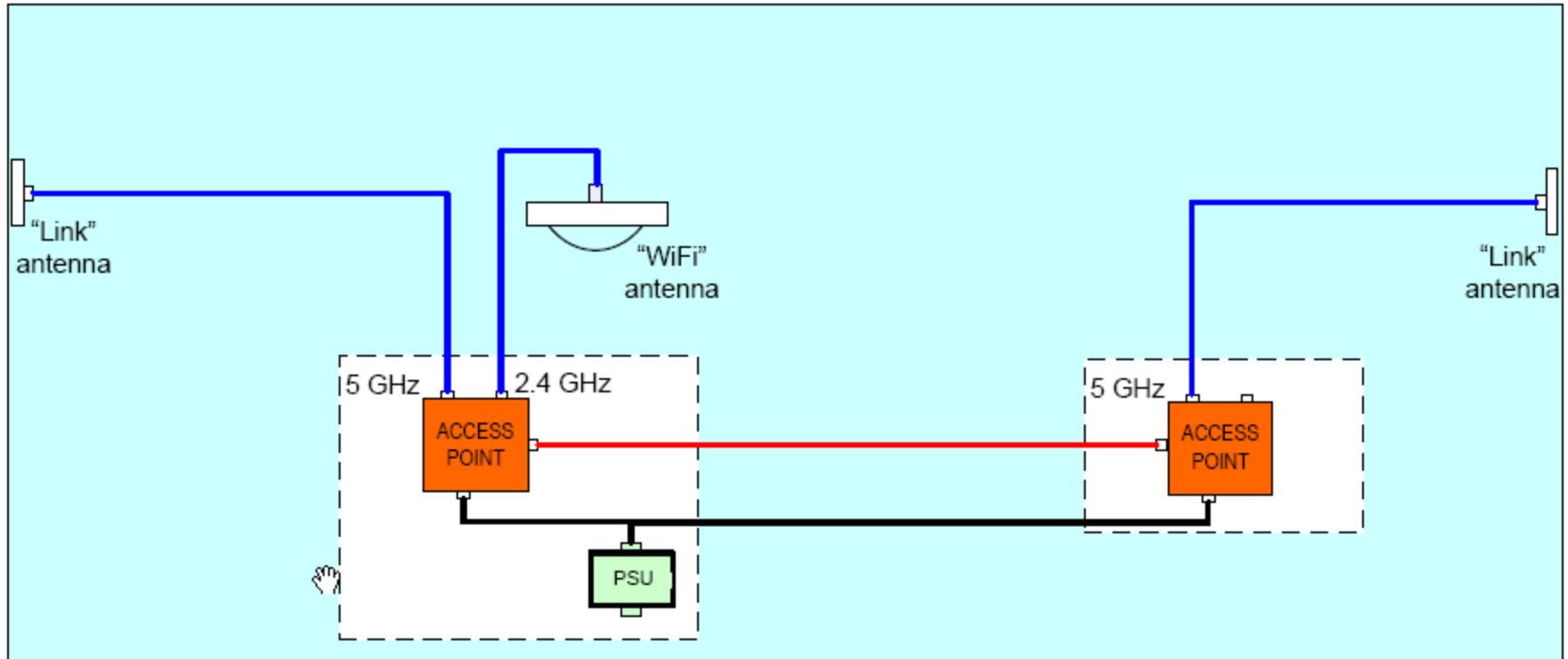


## KEY

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

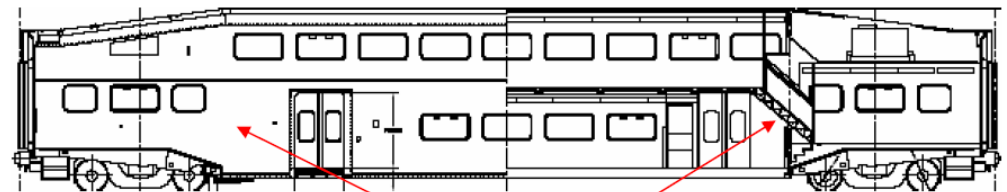


# Coach Car Install



## KEY

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



Air Conditioning Cupboards

- **Flexible Wireless Utilization**

  - Share IP devices with Vehicle Devices

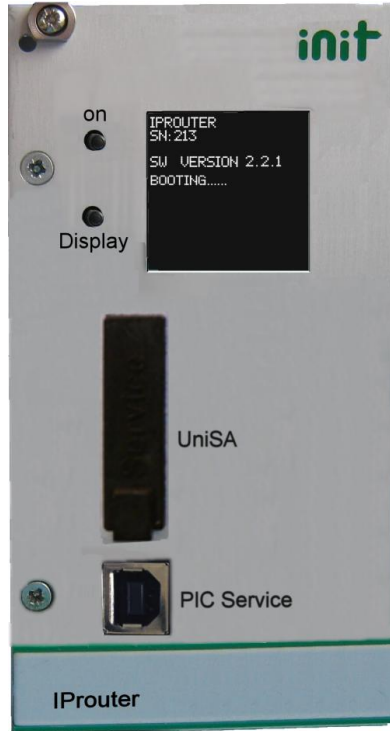
  - Prioritized IP device selection

  - Adaptable – Add/exchange cards

  - Common Router capabilities

    - Address Translation - NAT

    - Virtual LANs

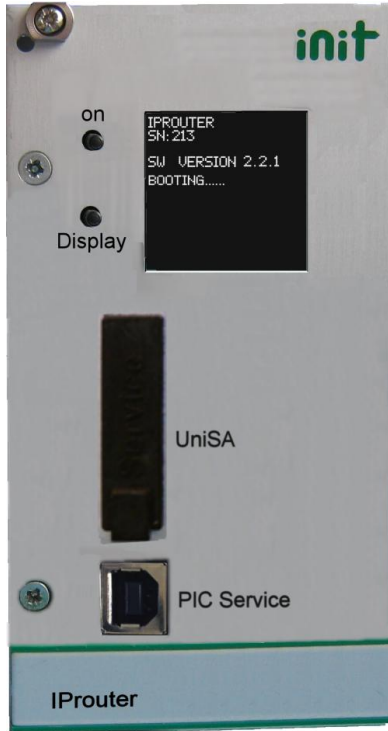


Provides access to wireless IP devices  
Allows Sharing by multiple devices

- 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

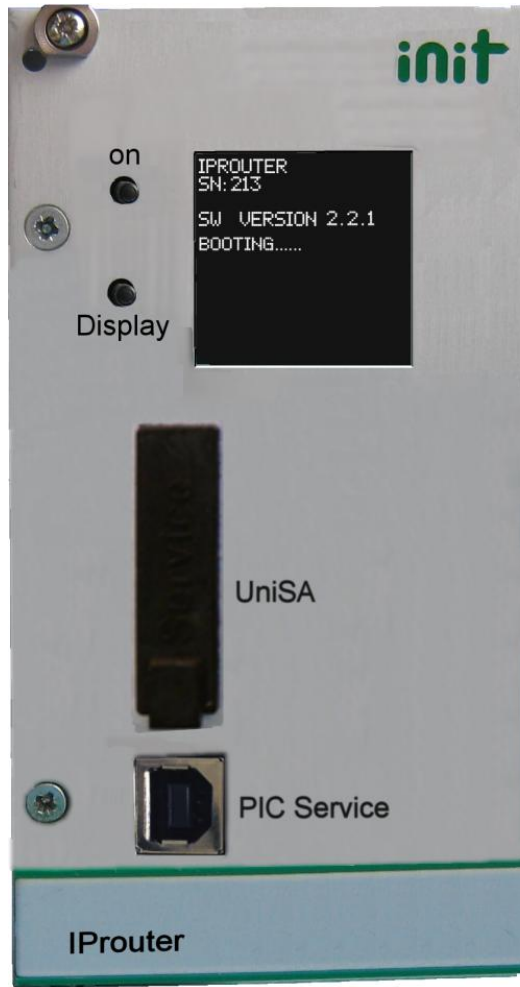


## General

- 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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