Mobile Routers

A Path to Flexible Expandability

APTA Fare Collection Workshop

March 30, 2011

Miami, FL

LTK

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Vehicle Systems

- Many vehicle systems require data communications with central computer
  - CAD/AVL
  - Fare Collection
  - Automatic Passenger Counter
  - Security Cameras
  - Vehicle Status Monitor
  - Destination Sign
  - Radio

Vehicle Systems

- Most such systems require
  - Operator interfaces
  - Wi-Fi communications
- Many systems now require
  - GPS location data
  - Stop ID
  - Real-time communications

Challenges

- Space on the dashboard is limited

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Challenges

- Fare Collection Operator Controls
  - Must be ergonomic
  - Must not obstruct view
  - Must allow driver to face boarding passengers
- Antennas – Should be limited in quantity to:
  - Reduce interference
  - Minimize number of network nodes

Challenges

- Systems Procurement
  - Rarely are all systems purchased at one time
  - Support for new technologies desirable
  - Systems often used beyond obsolescence
- Data
  - Volume expanding exponentially
  - Demand for real-time communications growing

Ideal Solutions

- Common Operator Interface
  - Master / slave – which is which?
  - Complications increase as more systems share the interface
- Vehicle Networks Communications Interface
  - SAE J-1708 / J-1586
  - Ethernet
- Shared Wi-Fi Antenna
- Shared GPS Antenna
- Shared Cellular Data Modem

Two Case Studies

- Minneapolis Metro Transit
- Denver RTD

Minneapolis Metro Transit

- Procured in 1999 (Cubic)
- 13-Agency, Multi-modal Integrated System with Contactless Smart Card and Magnetic Fare Media
- Ticket Vending Machines: 90
- Platform Smart Card Validators: 90
- **Onboard (Bus) Smart Card Processors: 1,000+**
- Point of Sale Terminals: 60
- Handheld Smart Card Readers: 12
- Central Data Collection System
- e-Commerce, Autoloaded, and Employer-Sponsored Fare Media Distribution

Minneapolis Metro Transit

- Existing farebox (GFI Cents-a-Bill)
- Existing CAD/AVL system (Siemens)
- Stand-alone smart card system (Cubic)
- Integrated CAD/AVL and Smart Card
  - RS-232 serial data connection
  - Single point login
  - Common operator interface

Minneapolis Metro Transit

- Retained separate Wi-Fi antennas
  - CAD/AVL system required “store and forward” approach for fare collection data
  - Difficult to ensure data integrity
  - Complexity = Cost

Minneapolis Metro Transit

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Minneapolis Metro Transit

- Integration a complete success
- Limited expandability
  - All future systems integration at CAD/AVL
  - Separate Wi-Fi antennas inhibit future growth

Denver RTD

- Two independent, coordinated procurements
  - Farebox system
  - Smart Media Technology (SMT) system
- Smart Media Technology system to be deployed in phases
  1. Annual Passes Only (Eco Pass, Neighborhood, University)
  2. General Public Use
     - Stored Value with Embedded Transfers
     - Floating Period Passes
  3. Support for future open payments required via standards and open architecture

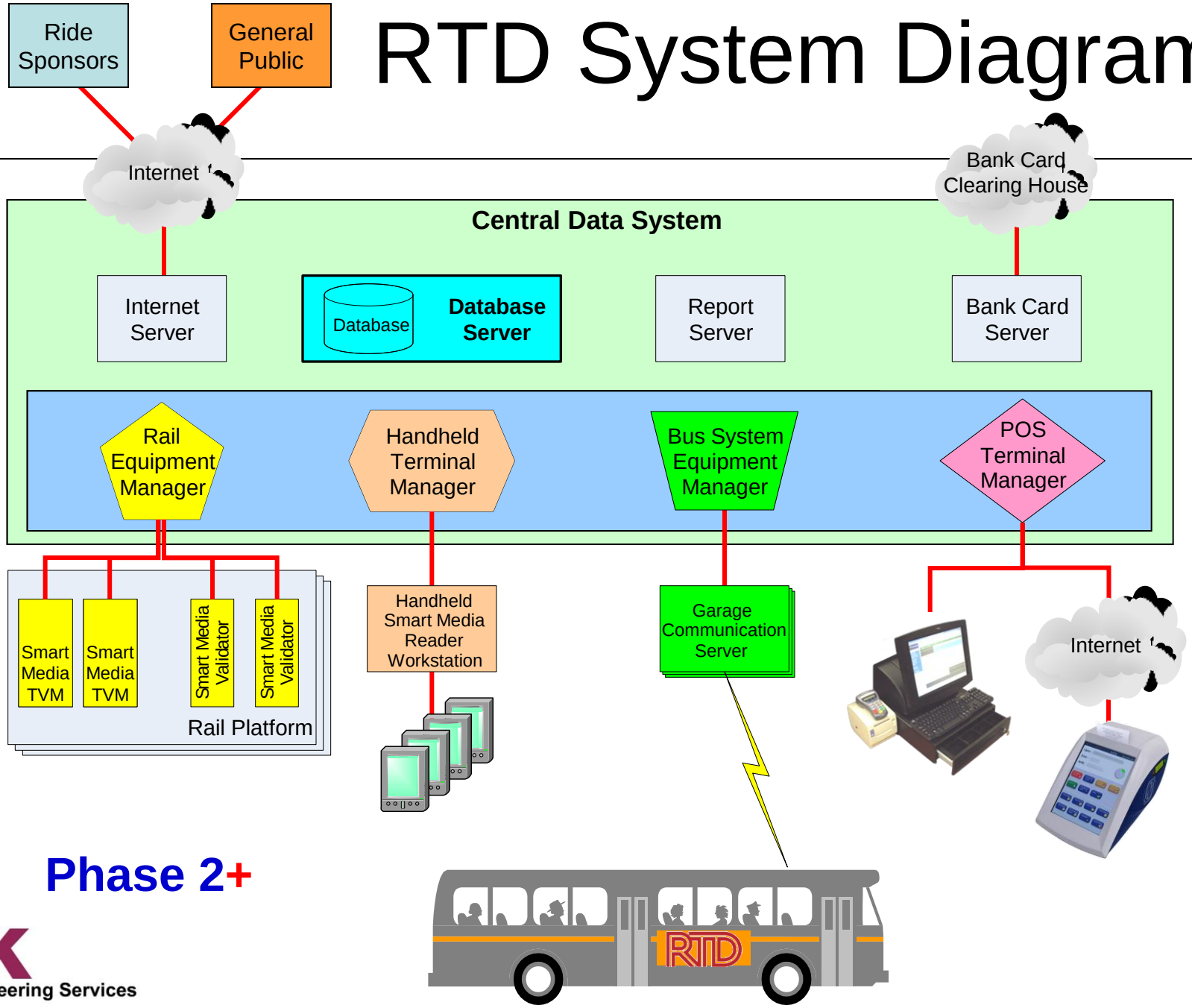
Denver RTD

- Smart Media Technologies contract awarded 2010 (ACS)
- Farebox contract pending (GFI)
- Original goal to integrate SMT and farebox via Mobile Communications Gateway and Router (aka MCGR)
- Provide growth for additional integration, especially CAD/AVL (recently awarded to INIT)

Denver RTD

- Mobile Communications Gateway and Router to provide:
  - Common Ethernet routing for multiple devices
  - Shared Wi-Fi antenna
  - Shared GPS antenna
  - Path for growth to include 3G/4G modem and on-board Wi-Fi

RTD System Diagram



Phase 2+

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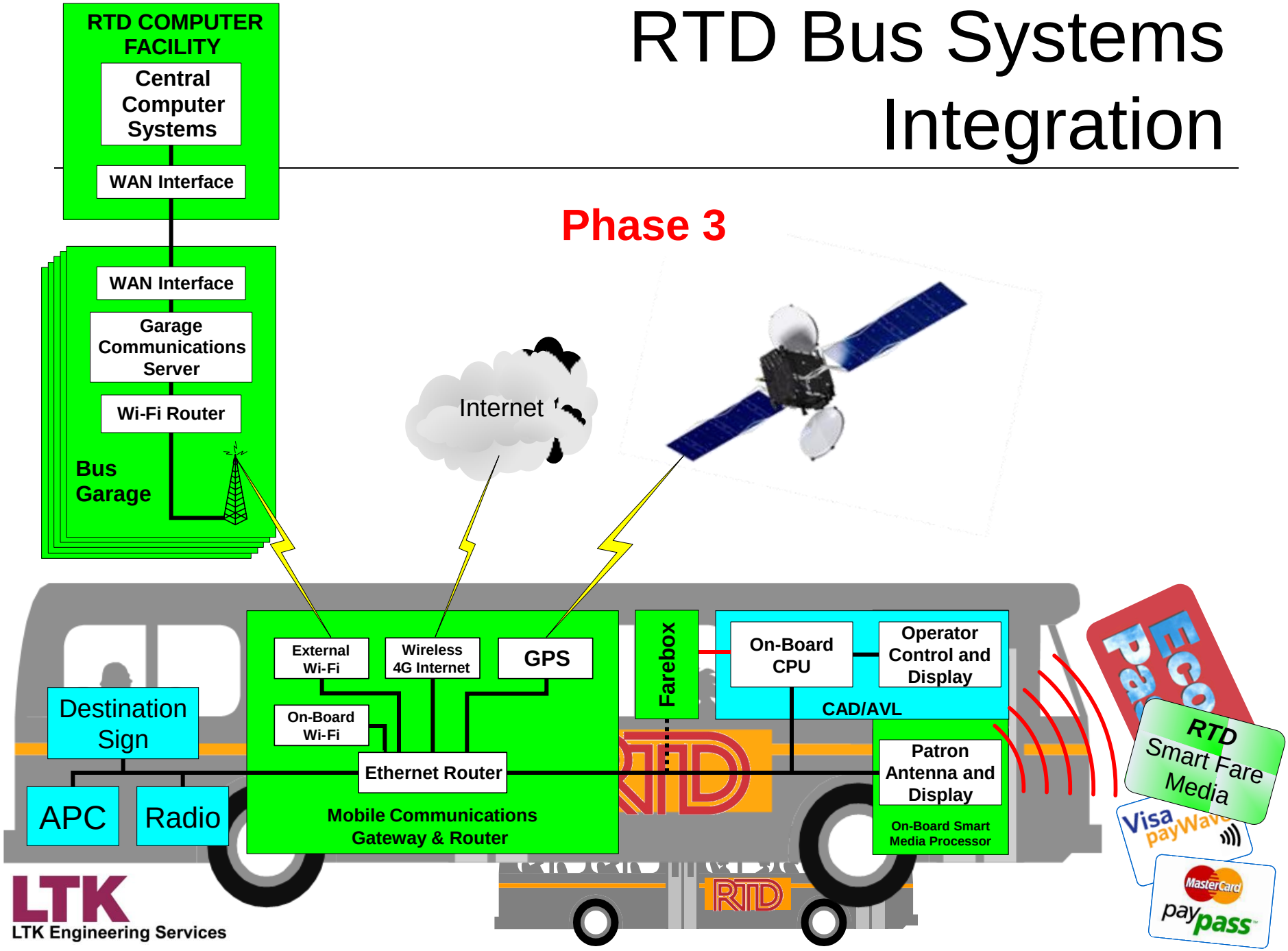
RTD Bus Systems Integration

Phase 3



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Denver RTD

- Mobile Communications Gateway and Router

- InMotion Technology “onBoard Mobile Gateway”
- www.inmotiontechnology.com

Denver RTD

- Delay in farebox contract (funding)
  - Eliminated SMT-to-farebox integration
  - Integration with CAD/AVL simplified to J-1708
- SMT-to-CAD/AVL integration
  - Single point login
  - Automatic GPS-based stop ID
  - Route/run updates
  - Status messages
  - Transaction results and operator input

Denver RTD

- Benefits of MCGR approach
  - Standard hardware and software interfaces
  - Supports single operator interface
  - Single Wi-Fi antenna
  - Single GPS antenna
  - Secure data communications
  - Provides flexible path for growth
  - Can support innovative passenger services
  - Cost-effective, long-term investment

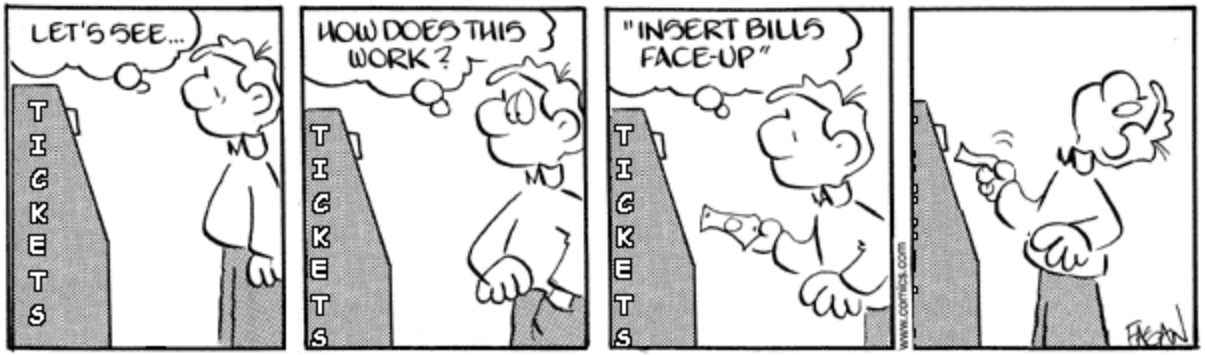
Helpful Hints

- Internet Protocol (IP) addresses
  - Each router/vehicle should have a unique IP address
  - Each device type (e.g., card reader) should have an assigned IP address that is the same throughout the system
- Power Management
  - Provide a “UPS” capability to provide power for a limited time after vehicle is shut down
  - Select devices to use UPS according to need

Helpful Hints

- Data Security
  - Require devices to initiate data communications
  - Use IEEE 802.11i with AES encryption
- Single Point Login
  - Keep it simple
  - Rely on “master” system to validate login parameters
- Common Operator Interface
  - Fare collection screen will likely be most commonly used
  - Make default screen when door open

Questions?



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