

Overview of PTC

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DEDICATION BEYOND EXPECTATION



Topics

- ▶ PTC History and Mandate
- ▶ PTC Functions
- ▶ ITC versus ACSES
- ▶ ITC PTC Architecture
- ▶ ACSES Architecture
- ▶ Interoperability
- ▶ Players
- ▶ Challenges
- ▶ Need for Your Own Integrator
- ▶ Key Decisions and Activities

PTC History and Mandate

- ▶ Accident in LA in 2008
- ▶ Rail Safety Improvement Act
- ▶ Safety Functions Prescribed
- ▶ Deployment Schedule Prescribed
- ▶ Specific requirements for passenger and hazmat corridors
- ▶ Recent proposed change to deployment baseline
- ▶ Congressional proposals for change to final deployment date
- ▶ RSAC meeting October 21 in DC to discuss NPRM on regulatory change proposals

PTC Functions

- ▶ Prevent train to train collisions
- ▶ Prevent over-speed derailments
- ▶ Prevent incursions into work zone limits
- ▶ Prevent movements through a switch left in the wrong position
- ▶ Provide interoperability between PTC systems of different railroads

I-ETMS versus ACSES

▶ I-ETMS

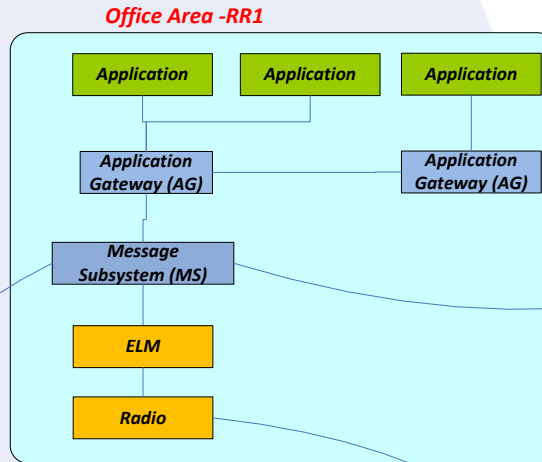
- Industry standards developed through Interoperable Train Control (ITC)
 - ▶ ITC technical committees develop technical content, then published by AAR
- GPS-based location system
 - ▶ Wheel tacho dead reckoning
 - ▶ Integration with route and switch information
- Standard communications from office to onboard
- Back Office Server acts as communications gateway
- Track database (subdiv file) describes permanent wayside infrastructure
- New GIS track surveys required
- New 220 MHz radio as interoperable train-wayside communications
 - ▶ Cell, WiFi, other IP paths also used
- Temporary speed restrictions sent as bulletin messages

I-ETMS versus ACSES

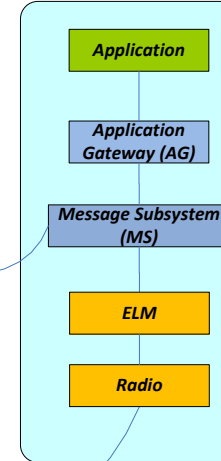
- ▶ Advanced Civil Speed Enforcement System (ACSES)
 - PTC requirements met by combination of ACSES and ATC, with common onboard display unit
 - PTC Steering Committee coordinating interoperability in Northeast
 - Uses transponders for location and temporary speed restrictions
 - Use TSR Server as bridge between dispatch and onboard systems
 - Interoperability Issues
 - ▶ Data radio (new 220 MHz system)
 - ▶ Communications Management Unit (CMU)
 - ▶ Temporary Speed Restriction (TSR coordination)
 - ▶ Other railroad-specific applications
- ▶ Amtrak is member of ITC Committee and working with freight railroads on interoperability issues
 - Dual radio systems where necessary
 - Dual wayside installations where necessary
 - Amtrak Back Office Server

ITC PTC Architecture

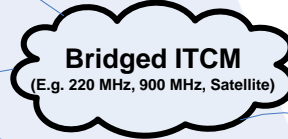
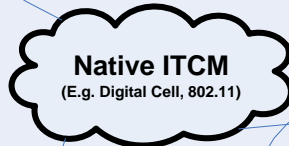
Office RR1



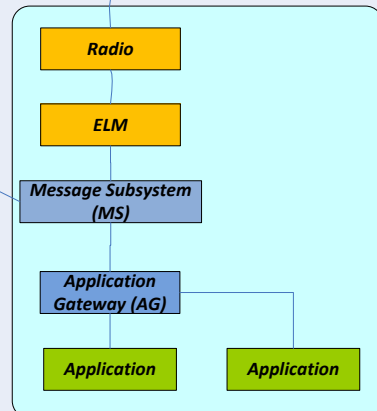
Office Area -RR2



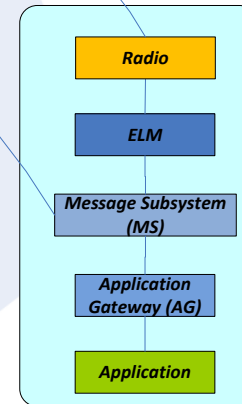
Office RR2



Loco RR1



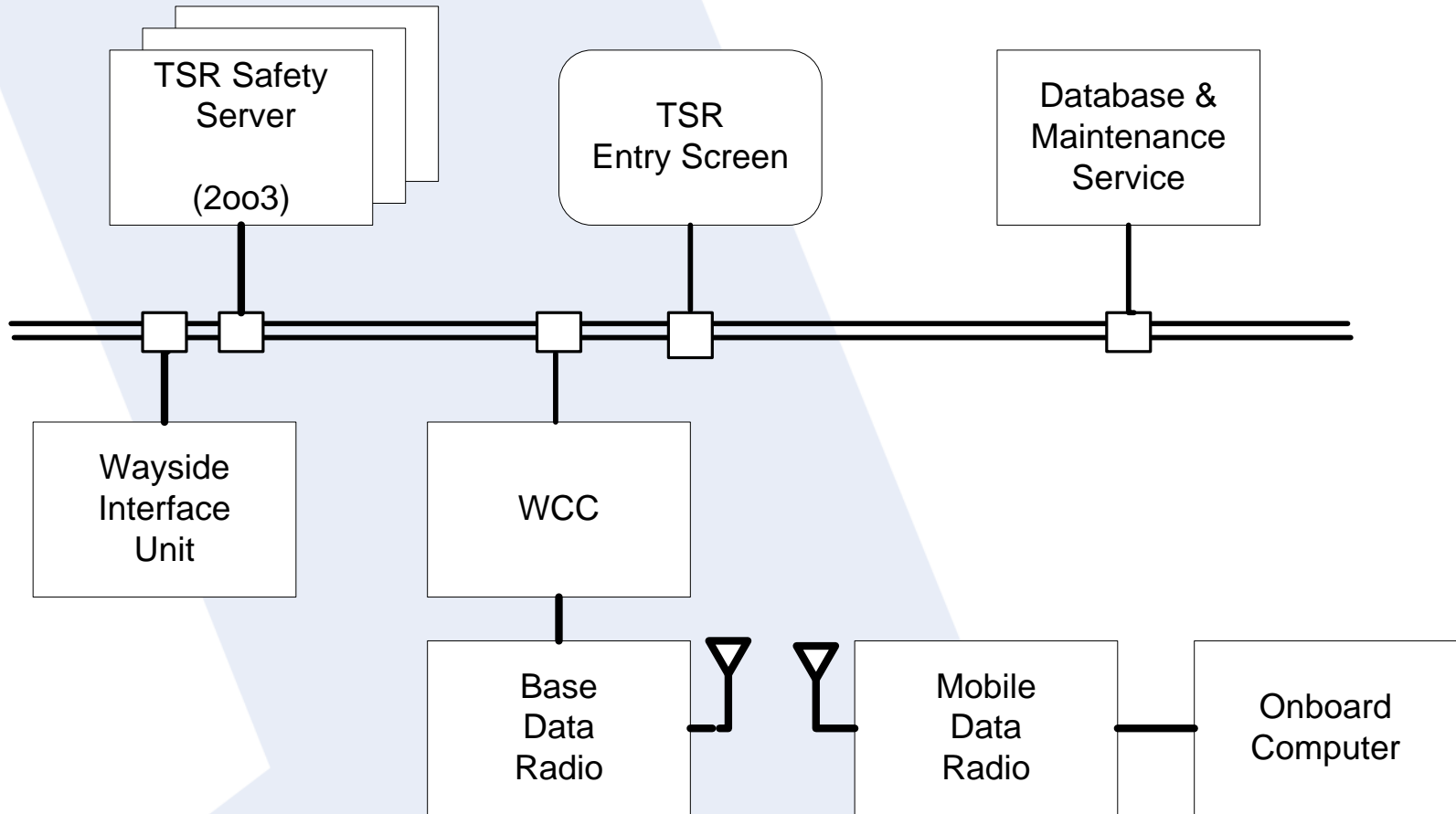
Remote Area (e.g. Locomotive) - RR1



Remote Area (e.g. wayside) - RR2

Wayside RR2

ACSES Architecture



Interoperability with the Carriers using the ITC Platform

- ▶ Amtrak has been working closely with Norfolk Southern on interoperability on the NEC for freight trains using the V-ETMS system
 - Using common elements of the ACSES/V-ETMS systems
 - Coordinating radio spectrum usage
 - Developing system elements specific to V-ETMS for use in a cab signal environment
- ▶ All V-ETMS equipped trains will be able to receive and interpret cab signals
- ▶ WIU's will be only be installed at interlockings
- ▶ The information provided by the WIU will be the same information provided to an ACSES equipped train except in a different message format
- ▶ Amtrak will install an ITC Back Office Server (BOS)
- ▶ Amtrak will install a separate ITC compatible data radio network for handling ITC or V-ETMS equipped trains

Interoperability

- ▶ Interoperability between PTC systems operated by different railroads is a regulatory requirement.
- ▶ Regulation does not dictate a solution, only functional requirements.
- ▶ Class 1 railroads standardizing on I-ETMS (Interoperable Electronic Train Management System), which is defined by industry standards
- ▶ Northeast Corridor commuter roads standardizing on ACSES (Advanced Civil Speed Enforcement System)
- ▶ Communications exchanges required between different systems
 - I-ETMS to I-ETMS on different railroads
 - I-ETMS to ACSES
 - I-ETMS to ???
 - ACSES to ???
- ▶ Dual equipage option
- ▶ Dedicated locomotives option

Players

▶ I-ETMS

- Onboard System – Wabtec Railroad Electronics
- Back Office Server - ARINC as sub to Wabtec
- Dispatch – every railroad has unique system, different suppliers
- Wayside – several, mostly traditional wayside suppliers
- ITCM messaging – Redhat as sub to Meteorcomm
- ITC 220 MHz radios – Meteorcomm as designer, possible multiple manufacturers
- Wayside Status Relay Service – Princeton Consultants for CSX, other railroads may be developing their own internally

I-ETMS Challenges

- ▶ No total PTC system integrator
 - Components being developed independently by different suppliers
 - Component delivery schedules not driven by master schedule / in flux
- ▶ Requirements, components, and communications technology will continue to change
 - ITC 220 MHz Radio delayed; driving some RRs to cellular as interim solution
 - Spectrum is an issue
 - Lack of details on traffic volumes leads to uncertainty in number of channels required
- ▶ Timeframe for deployment
 - Locomotive installations
 - Wayside installations
- ▶ Availability of personnel with necessary background
- ▶ Capacity of key industry players

I-ETMS Challenges

- ▶ Components coming at different times, not in any order
- ▶ Component deliver schedules in constant flux
- ▶ Requirements not completely stable
- ▶ Most software being delivered in multiple releases
- ▶ Components currently match different spec and ICD versions
- ▶ Requirements, components, and communications technology will continue to change
- ▶ Large, complex system
- ▶ Multiple departments involved in PTC testing and deployment

Need for Your Own Integrator

- ▶ Integrate systems from different suppliers
 - Onboard
 - Dispatch
 - MIS systems
 - Wayside systems
 - Wireless communications
 - Network connections
 - Messaging system
- ▶ Integrate supplier systems with existing office systems
- ▶ Update to dispatch system
- ▶ Interoperability solution
- ▶ Complete railroad-specific integration and testing
- ▶ Railroad mapping and creation of GIS files
- ▶ Long-term configuration management
- ▶ Maintenance and support tools

Key Decisions and Activities

- ▶ FRA Submittals
 - PTC Implementation Plan
 - ▶ Deployment schedule
 - PTC Development Plan
 - ▶ Technology to meet safety requirements
 - PTC Safety Plan
 - ▶ Safety analyses
 - ▶ Processes and support plan to maintain safety
- ▶ Railroad Specific Implementation
 - Use Cases
 - Integration
 - Testing
 - ▶ Lab
 - ▶ Field
 - Deployment
- ▶ Interoperability Validation

Summary

- ▶ Need to pick – ITC, ACSES, or other system
- ▶ Limited near-term choices
- ▶ Need to integrate products from multiple suppliers with in-house systems
- ▶ Need complete system integration for your railroad
- ▶ Need to test integrated system
- ▶ Several documents to be filed with FRA
 - ▶ Need to be specific to your deployment
- ▶ Need radio spectrum
- ▶ Need structured approach and flexible contract arrangements