Leveraging ITS Infrastructures Using the ATC Application Programming Interface

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Emerging ATC Standards

- Advanced Transportation Controller (ATC) Standard v06 (ATC 5201 v06)
- ITS Cabinet Standard v02 (ATC 5301 v02)
- Application Programming Interface (API) Standard v02 (ATC 5401 v02)

Basic TFCS Operation

Architectures for Signal Control

Evolution of Transportation Controller Equipment

Basic Transportation Field Cabinet System (TFCS) Components

Evolution of Transportation Controller Equipment


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Traditional Controller Models

- Equipment runs one application program which uses all of the resources of the TFCS
- Model 170 and most Model 2070 controllers require particular processors
  - Limits opportunity to use new technology
- Traditional NEMA TS 1 and TS 2 standards not open architecture
  - Purchase software from the original manufacturer only
- Doing anything other than originally intended is "outside the box"

Problem with Traditional Transportation Controller Architectures

- Providing a general purpose field computing platform for transportation applications that is:
  - Open architecture
  - Modular
  - Multi-process / Multi-application
  - Can grow with technology
  - Upgrade legacy TFCSs

Purpose of the ATC Family of Standards

- Traffic Signal Control / Traffic Management
  - Center-to-Field, Field Management Stations (FMS)
- Adaptive Control
- Transit/Light Rail Priority
- Emergency Management
  - Emergency Vehicle Priority/Preemption
  - Evacuation Routing
- Data Collection and Distribution
- Lane Use
- Connected Vehicle (CV) Applications
  - Eco Driving, Platoon Management

Applications Identified (cont.)

- Advanced Traveler Information Systems
- Ramp Metering
- Access Control / Parking
- Others

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Key Elements of the ATC 5201 Architecture

- Based on an "Engine Board" concept
- Engine boards have identical pinout – future boards may plug into existing host boards
- Computational capability can grow with technology
- Uses Linux operating system
  - Open source, multi-process, multi-application
- Mechanical requirements only for physical interfaces
- Works with all major transportation field cabinet system standards and specifications
ATC Engine Board Concept

Transportation Controller Comparative Performance

Controllers Conform to Other Standards Using the Engine Board

Examples of ATC Controller Units

Example ATC Controller Units in a TFCS Architecture

ATC 5401 Application Programming Interface

- ATC 5401 Standard (aka API Standard) specifies software (aka API Software or "the API")
- API Software operates on ATC controller units allowing concurrently running application programs to share the resources of the controller and TFCS
- Provides for source code portability, compatibility and interchangeability of application software to any ATC controller unit
API Software Provides Capability to Share Controller and TFCS Resources

Features of API Software

- Front Panel Management
- Field Input/Output (I/O) Management
- Real-Time Clock
- API Utilities

Two Types of Interfaces

- User Interfaces
  - Windowing system for users and application programs to share controller’s front panel
  - Configuration window to view/set system-wide parameters
- C language interface for software developers to create programs that use the API software
  - Front Panel
  - Field I/O
  - Time-of-Day

Front Panel Management

- Front Panel Manager Window
- C function interface
- Application programs able to use dedicated window(s)
- Operational Users interact with window/application program in “focus”
- “Default Window” is the window that has focus when the controller unit is powered up
- Works with screen sizes up to 24 lines x 80 characters
- Minimum screen and keypad defined by the ATC 5201 Standard

Example Application Programs
Field Input/Output Management

- C function interface
- Facilitates application programs to be written so they operate in the various TFCS architectures
  - Caltrans 332-Type Cabinets
  - NEMA TS 1, TS 2 Type 1, TS 2 Type 2 Cabinets
  - ITS Cabinets
- Application programs able to query the API to determine what types of devices are used in the TFCS

Field Input/Output Management (cont.)

- Application programs "register" to access a Field I/O device
- Application programs have "read access" to all input and output field devices
- Application programs "reserve" exclusive "write access" to output points of a Field I/O Device

API Utilities

- ATC Configuration Window
- C function interface
- Standard Utilities
  - Setting System Time
  - Setting Ethernet Ports
  - Selecting System Services
  - Getting Linux and API information
  - Viewing Host EEPROM Information
- Extensible so additional utilities may be added
- Utilities differ from application programs
Things to Consider

- 170 generally not powerful enough for NTCIP communications or connected vehicle applications
- ATCs can be deployed incrementally into your existing TFCS infrastructure
- ATC controller units may be used for multiple center-to-field (C2F) systems and for generations of C2F systems
- Cost of not going to ATC equipment
- ATC approach is not just a purchase but also a part of a strategy

Things to Consider (cont.)

- Get commitments on procurements to provide API software when APIRI is available
  - Projected 3rd Quarter 2015 or earlier
  - API software for Engine Boards
  - Application software compatible with API software
- Reference User Comment Draft ATC 5201 v06.10 or later in specifications
  - Approved ATC 5201 Standard v06 projected for 1st Quarter 2015

Summing It Up

- ATC Standards provide for a general purpose field computing platform for transportation applications that is:
  - Open architecture
  - Modular
  - Multi-process / Multi-application
  - Can grow with technology
  - Upgrade legacy TFCSs
- API Software
  - Operates on ATC controller units
  - Shares the resources of the controller and TFCS
  - Enables concurrent application programs
  - Think Apps!

Resources

- USDOT ITS Professional Capacity Building (PCB) Program
  www.pcb.its.dot.gov
- Institute of Transportation Engineers
  www.ite.org/standards/index.asp
- National Transportation Communications for ITS Protocol
  www.ntcip.org/library/documents

QUESTIONS?

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