

ATC/2070 Visão Geral Adjunto

Presented by Robert De Roche

Some slides based up a presentation prepared by
Ralph W. Boaz
Chair of ATC - API Project Manager

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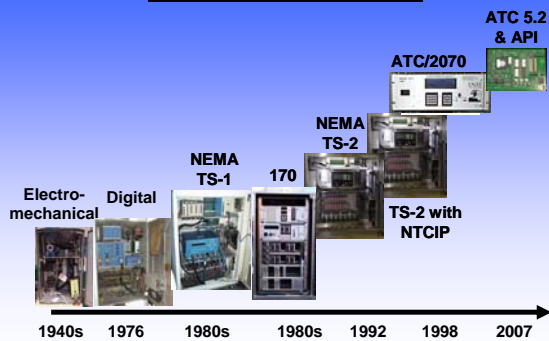
Lecture Overview

- Evolution of Traffic Signal Controller Standards
- Design Goals and Application
- ATC Controller
- ATC Cabinet
- ATC Application Programming Interface

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Cabinets and Controllers

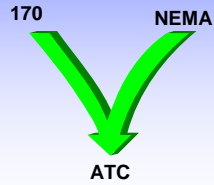


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NEMA TS-1 picture © Signalfan
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ATC/2070 Controller Overview

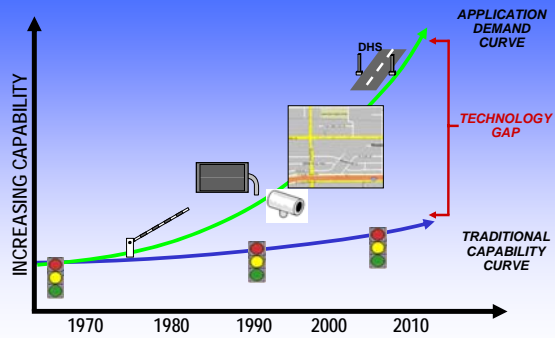
- The ATC is attempting to bring the Model 170 and the TS-2 standards as a national standards while preserving the best of both.



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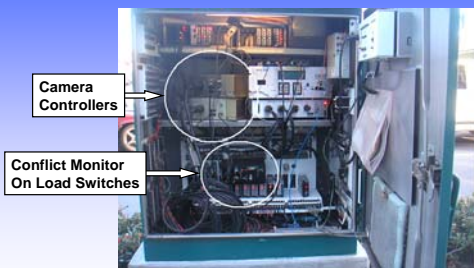
ATC/2070 Controller Overview



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Box-Level Improvement Not The Answer



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ATC/2070 Controller Evolution

- Mid 1990's, **California** began development of a specification for the Type 2070 controller as a Type 170 controller replacement
- Late 1990's, the **FHWA** set forth an initiative to develop an Advanced Transportation Controller (ATC) standard. Three standards organizations form consortium to national standard
- Mid 2002, California releases initial 2070 Specification
- 2006-2007, AASHTO/ITE/NEMA approve and publish ATC/2070 standards

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ATC/2070 Goals

- Open Architecture
- Modular
- Multi-process / Multi-application
- Grow with technology (**ATC only**)
- General purpose computing platform for the transportation community ("PC-like" concepts)

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ATC/2070 Applications

- | | |
|---------------------------------|-------------------------------|
| • Traffic Signal | • General ITS Beacons |
| • Traffic Surveillance | • CCTV Cameras |
| • Transit | • Roadway Weather Information |
| • Communications | • Weigh in Motion |
| • Field Master | • Irrigation Control |
| • Ramp Meter | • Lane Use Signals |
| • Variable/Dynamic Message Sign | |

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ATC/2700 Standards Family

ATC Standards

Controller

Cabinet


Application Programming Interface-API

- **No ATC Application Software or Communications Standard**
 - NEMA TS Standards describe functionality of traffic signal controller
 - NTCIP Standards describe information and communications protocols
 - There are references to Scoot having support for NTCIP


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2070 Controller



- **Typical 2070L Configuration**




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2070 Controller

- **Typical 2070LN Configuration**

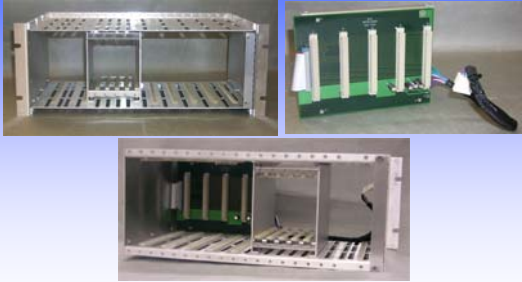


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Unit Chassis and Serial Backplane



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2070-5A VME Cage Assembly and VME Backplane



[VME Backplane allows multiple CPUs but not
deployed due to expense]

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CPU Modules

- 2070-1A MC 68360 with OS 9
with VME Backplane
- 2070-1E -1A but w/o VME
- 2070-1C ATC Engine Board concept
w/Linux



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Field I/O Modules

- 2070-2A "C" Connector for Type 170 Cabinets
- 2070-2B Serial SDLC for ITS Cabinet



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Front Panel Assemblies

- 2070-3A Large Character 4x40 LCD Display
- 2070-3B 8x40 LCD Display
- 2070-3C No LCD Display or Keypad
- 2070-3D 16x40 LCD Display



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Power Supply 2070-4 Module



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Communication Modules

- Async Serial Comm Modules
 - 2070-7A Async Only
 - 2070-7B Async/Sync Capable
- Async/Modem Serial Comm Modules
 - 2070-6A 300/1200 BPS
 - 2070-6B 0-9600 BPS



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Communication Modules (cont.)

- 2070-6D Fiber Optic Modem
- 2070-6E Serial 2 Network
 - Terminal Server
- 2070-6W Wireless Modem
 - Coax port
- 2070-9A/B FSK/Dial-Up Modem
- 2070-Fx Universal Network Card

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2070-8 NEMA Interface Module



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Summary of Modules

Item	Description	2070 Unit	2070 C	2070 N	2070 L	2070 LC	2070 LCN
Unit Chassis		X	X	X	X	X	X
Model 2070 1A CPU Module (Multiple Board VME)		X	X	X	X	X	X
Model 2070 1B CPU Module (68060 CPU and OS-9)							
Model 2070 1C CPU Module (Engine Bird and Linux)							
Model 2070 2A Field I/O Module (170 Style Cabinets)		X			X		
Model 2070 2B Field I/O Module (ITS (C) & NEMA Style Cabinets)			X	X		X	X
Model 2070 3A Front Panel Module (4x40)		O	O	O	O	O	O
Model 2070 3B Front Panel Module (8x40)		O	O	O	O	O	O
Model 2070 3C Front Panel Module (Blank)		O	O	O	O	O	O
Model 2070 4A Power Supply (10 AMP)		X	X	X		X	X
Model 2070 4B Power Supply (3.5 AMP)						X	X
Model 2070 5A VME Cage Assembly		X	X	X			
Model 2070 5B MCB 1A Mounting Assembly					X	X	X
Model 2070 6A AsyncModem Serial Com Module (300-1200 bps)		O	O	O	O	O	O
Model 2070 6B AsyncModem Serial Com Module (9-9600 bps)		O	O	O	O	O	O
Model 2070 6C Not yet defined							
Model 2070 6D AsyncFiber Modem Module (Not yet defined)		O	O	O	O	O	O
Model 2070 7A Async Serial Com Module (EIA - 232, 9pin)		O	O	O	O	O	O
Model 2070 7B Async Serial Com Module (EIA - 485, 15 pin)		O	O	O	O	O	O
Model 2070 8 NEMA Interface Module					X		X
Model 2070 9 Model 2070N Back Cover				X			X

X = Required, O = Optional

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2070 Newest Controller Configurations

2070V UNIT	VME version which mates to 170 & ITS cabinets. Consists of: Unit Chassis, 2070-1A TB, 2070-1A MCB, 2070-2A F/O, 2070-3A Front Panel, 2070-4 Power Supply, and 2070-5 VME Cage Assembly.
2070LX UNIT	LX Unit mates to 170 & ITS cabinets. Consists of: Unit Chassis, 2070-1C CPU, 2070-2A F/O (-2B if ITS Cabinet), 2070-3B Front Panel and 2070-4 Power Supply

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Partial List of Manufactures



Econolite/Safetran, Eagle/Siemens, US Traffic/Quixote, McCain, and Naztec.

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ITS Cabinet Standard



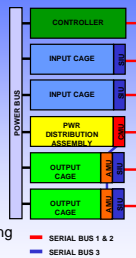
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ITS Cabinet Components

• Buses

- Serial Bus 1
 - Time critical information between Controller to Input & Output Cages and to Power Supply
- Serial Bus 2
 - Non-time critical information between Controller and Input & Output Cages and to Power Supply
- Serial Bus 3
 - CMU to AMU special bus for monitoring output states.



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ITS Cabinet Components

• Pre-existing Detectors

- Model 222 – Two Channel
 - Loop Amplifier (Existing Design)
- Model 224 – Four Channel
 - Loop Amplifier (Existing Design)

• ATC Cabinet defined

- Model 231 One Channel
 - Magnetometer
- Model 232 Two Channel
 - Magnetometer
- Model 242 Two Channel Input
 - DC Isolator
- Model 252 Two channel Input
 - AC Isolator




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ITS Cabinet Components

- Inductive Loop Detectors**
 - 50-700 micro Henries
 - Q minimum = 5
 - Four operating frequencies
 - Pulse and presence mode
 - Sensitivity
 - Sensitivity change
 - Cross coupling
 - Response time
- Magnetic Detectors**
 - Input resistance
 - Max size of sensor
- Isolator Inputs**
 - General purpose
 - 20 or 80 Volt inputs



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ITS Cabinet Components


- Inductive Loop Detectors Manufacturers**
 - Detector Systems
 - Diablo Engineering
 - Eberle Designs
 - Northstar Controls
 - Reno A&E
 - 3M
- Magnetic Detectors**
 - M-Systems
 - TEECO Safety
- Isolator Inputs**
 - Detector Systems
 - Perfect Distribution Control
 - Traffic Sensor Corporation
 - Eberle Designs
 - GDI

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ITS Cabinet Components

- After Market Product Examples**
 - Naztec/Traficon Dual Video Detector
 - Econolite/Autoscope 8 Channel Video Detector
 - 3M 2070 Optical Signal Processor (Visible/Infrared Preemption Module)



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ITS Cabinet Components

- Inductive Loop Detectors Evaluation**
 - See California, North Carolina (et al) Qualified Products List
 - www.dot.ca.gov/hq/traffops/electsys/QPL
 - Research papers on evaluation of different detector technologies
 - tti.tamu.edu/documents/2119-1.psf
 - tti.tamu.edu/documents/1715-1.psf

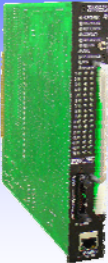
See Handout of 2119 - Project Summary Report

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ITS Cabinet Components

- CMU Controller Monitor Unit**
 - Basic fault coverage includes Conflict, 24Vdc, and CU Watchdog monitoring.
 - Red monitoring senses the absence of signals on a channel.
 - Dual indication monitoring detects simultaneous active signals on a channel.
 - Sequence monitoring ensures sequencing of signals with a proper minimum yellow clearance interval.
 - AC Line Monitoring detects and responds to low AC Line voltages as well as interruptions with a minimum flash interval
- Typical Extras**
 - Event Logging
 - Real Time Clock
 - PC Interface



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Cabinet Types

- Cabinet Housing 1**
 - Similar to Type 332 cabinet – 24" x 30" x 67"
- Cabinet Housing 2**
 - Similar to Type 336 cabinet – 24" x 20" x 46"
- Cabinet Housing 3**
 - NEMA P cabinet base dimensions with double front and back doors with two racks – 44" x 26" x 66"
- Cabinet Housing 4**
 - Proposed compact version for pole mounting

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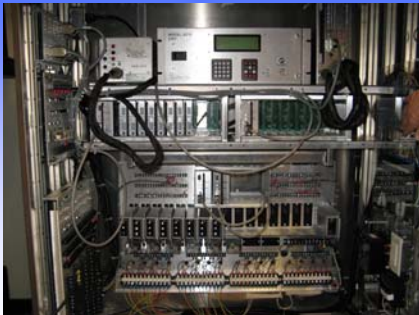
ITS Cabinet Standard



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ATC/TS2 Hybrid Cabinet



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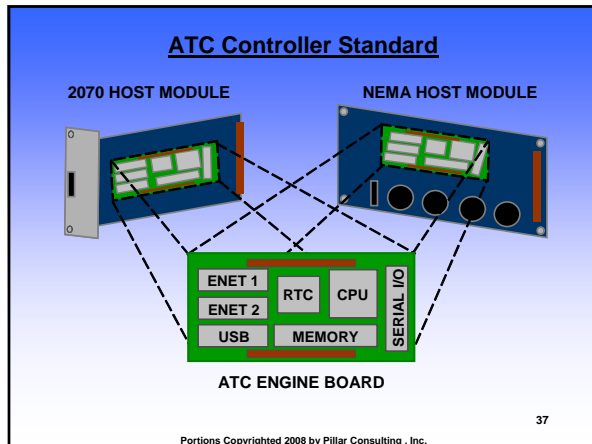
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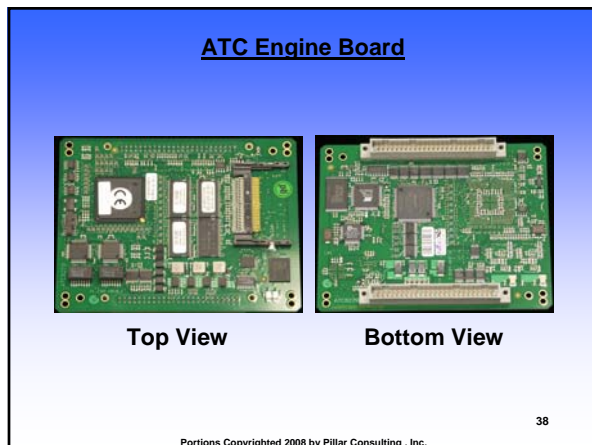
ATC Controller Standard

- ATC Controller Standard 5.2 centers around an “*engine board*” concept
- Engine board is a building block for new ATC architectures
- Must support the ATC API and 2070 Comm modules

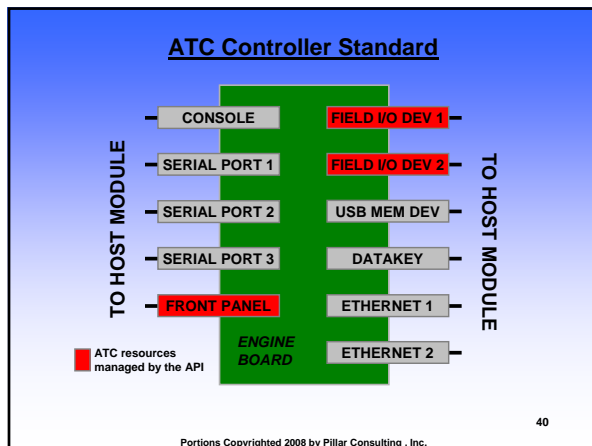
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- ### ATC Engine Board
- **As technology changes, new Engine Boards can be designed to take advantage of it**
 - Make, model, and version of CPU is not defined
 - Type and amount of memory is not defined
 - Interface to Host Module is standardized
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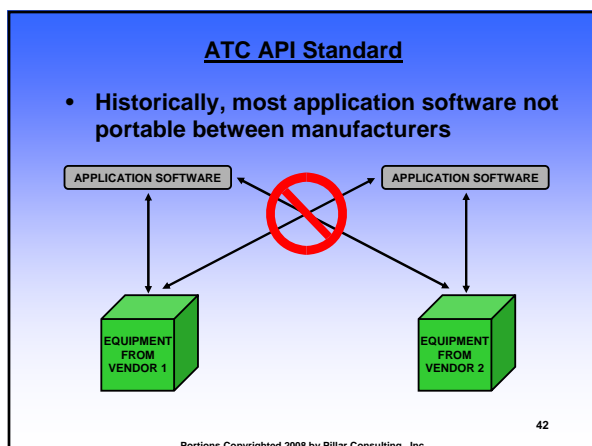


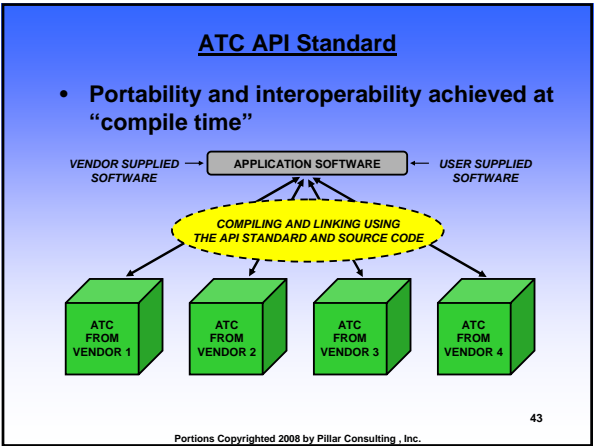
ATC Application Programming Interface

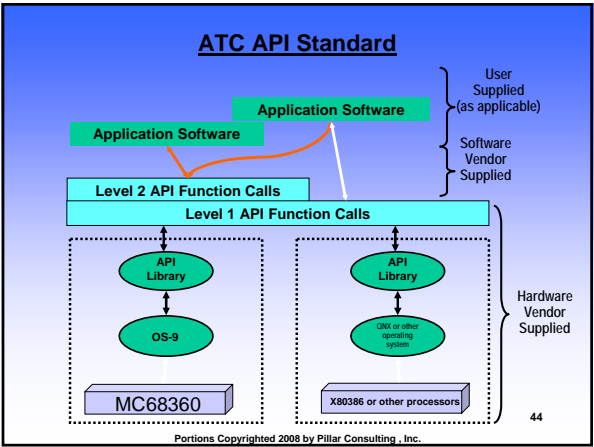
- **What is API?**
 - An API is a set functions that can be called by an application program to access underlying hardware features and establish inter-processing communications
- **GOALS:**
 - Make applications portable between different hardware / operating systems
 - Allow multiple applications to run on the same controller (e.g. CCTV, Ramp Control, Intersection control)
- **Two levels**
 - Layer 1 basic services
 - Layer 2 Multiple applications

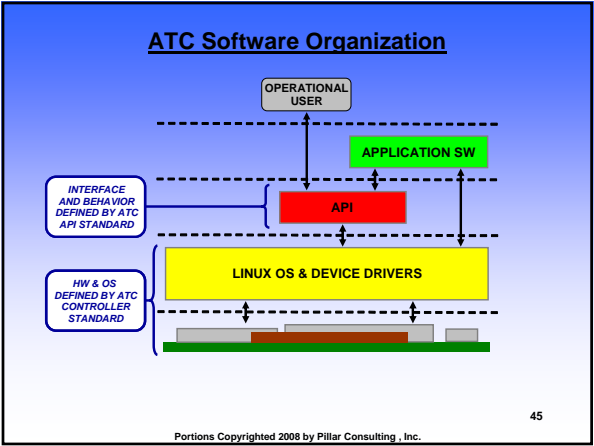
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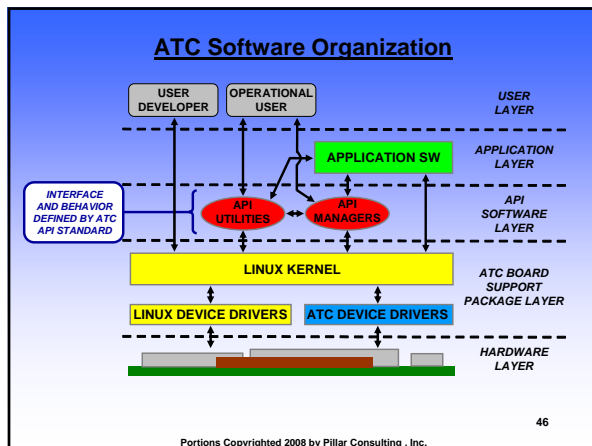
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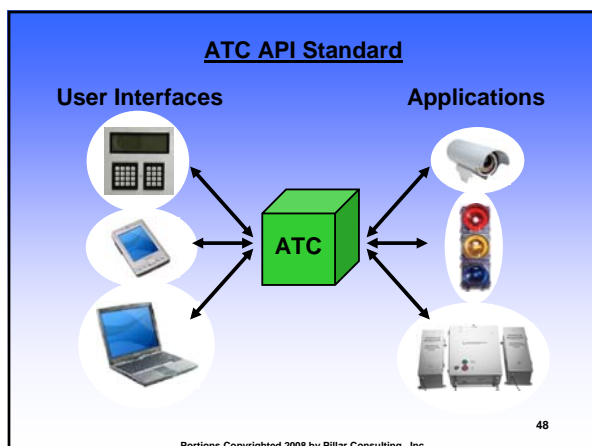


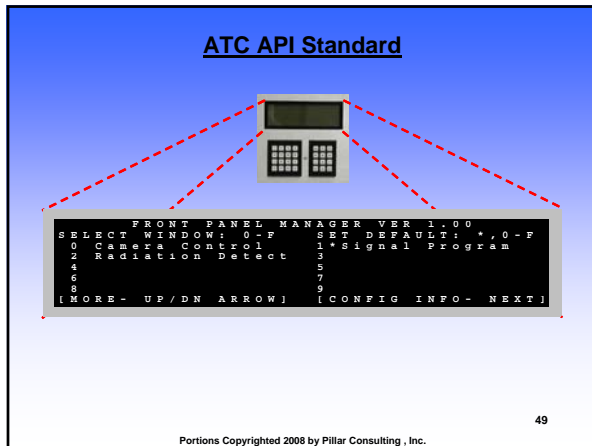
ATC API Standard

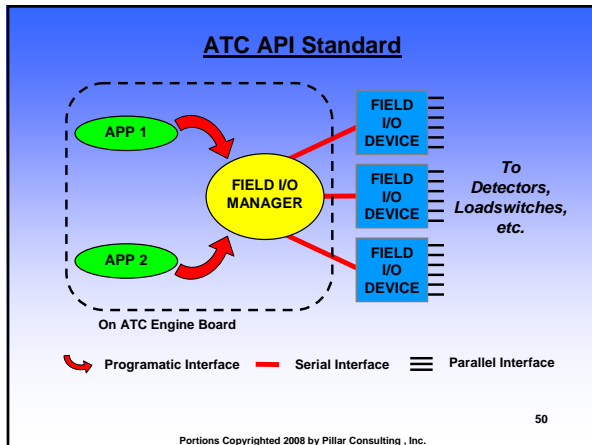
- Allows software to be written that can operate on any ATC regardless of manufacturer
- Provides interoperability of multiple software applications on a single controller unit
- API software runs “on top of” Linux O/S on ATC Engine Board
- Creates a broader software market

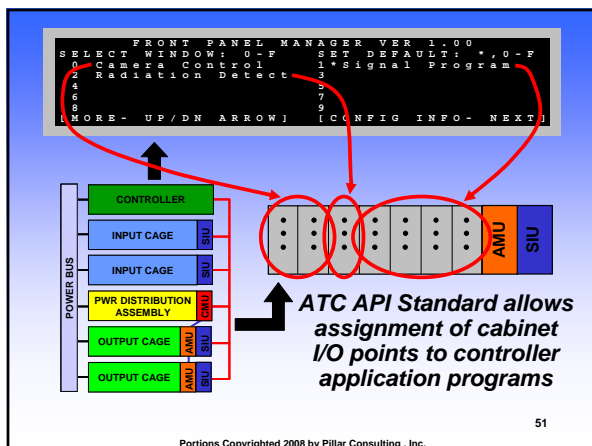
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API Function Calls

Front Panel Manager

- General
- Character Attributes
- Read
- Write
- Cursor
- LED
- Field I/O Manager
- Utilities
- Aux Switches

Field I/O Manager

- General
- Input Configuration
- Output Configuration
- Frame Functions
- Transition Buffer
- Watchdog Monitor
- Fault/Voltage Monitor
- CMU/MMU/Channel Functions

Utility Functions

- Set/Get Time
- Daylight Saving Time
- Time Source and Signaling

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ATC vs Non-ATC Comparisons

	Lower Initial Cost	Multiple Sources for Software	Multiple Application Operation	Advanced Features	NTCIP & High-End Int Comm	Built-in Future Upgrades
170	X	X				
NEMA Controller Non-ATC	X			X	X	
ATC/2070		X	X	X	X	X
ATC		X	X	X	X	X

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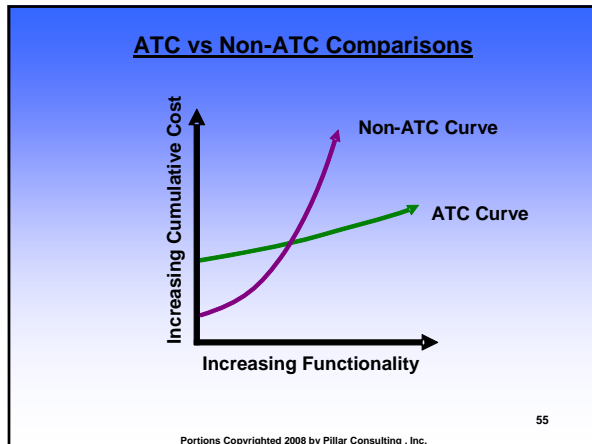
Controller Comparison

Controller	Operating System	MIPS*
170	None	0.2-3.2
2070-1A,1E	OS-9 (proprietary O/S)	4.5
2070-1C	Linux (open O/S) + API	400+

* Millions of Instructions Per Second

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- ### Standards / Specifications
- Caltrans Transportation Electrical Equipment Specifications (TEES) 07/21/08
 - ATC Controller Standard v5.2b 06/26/2006
 - ITS Cabinet Standard v01.02.17b 11/16/2006
 - ATC API Standard v02.06b 09/21/2007
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Contact Information

Robert De Roche
Senior Research Specialist
Texas Transportation Institute
Texas A&M University
College Station, Texas

979-845-6154
b-deroch@tamu.edu
tti.tamu.edu

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Contact Information

Ralph W. Boaz

President
Pillar Consulting, Inc.
4511 Jicarillo Avenue
San Diego, CA 92117

858-352-6281
rboaz@pillarinc.com
www.pillarinc.com



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