STANDARDS ITS TRAINING
TRANSIT

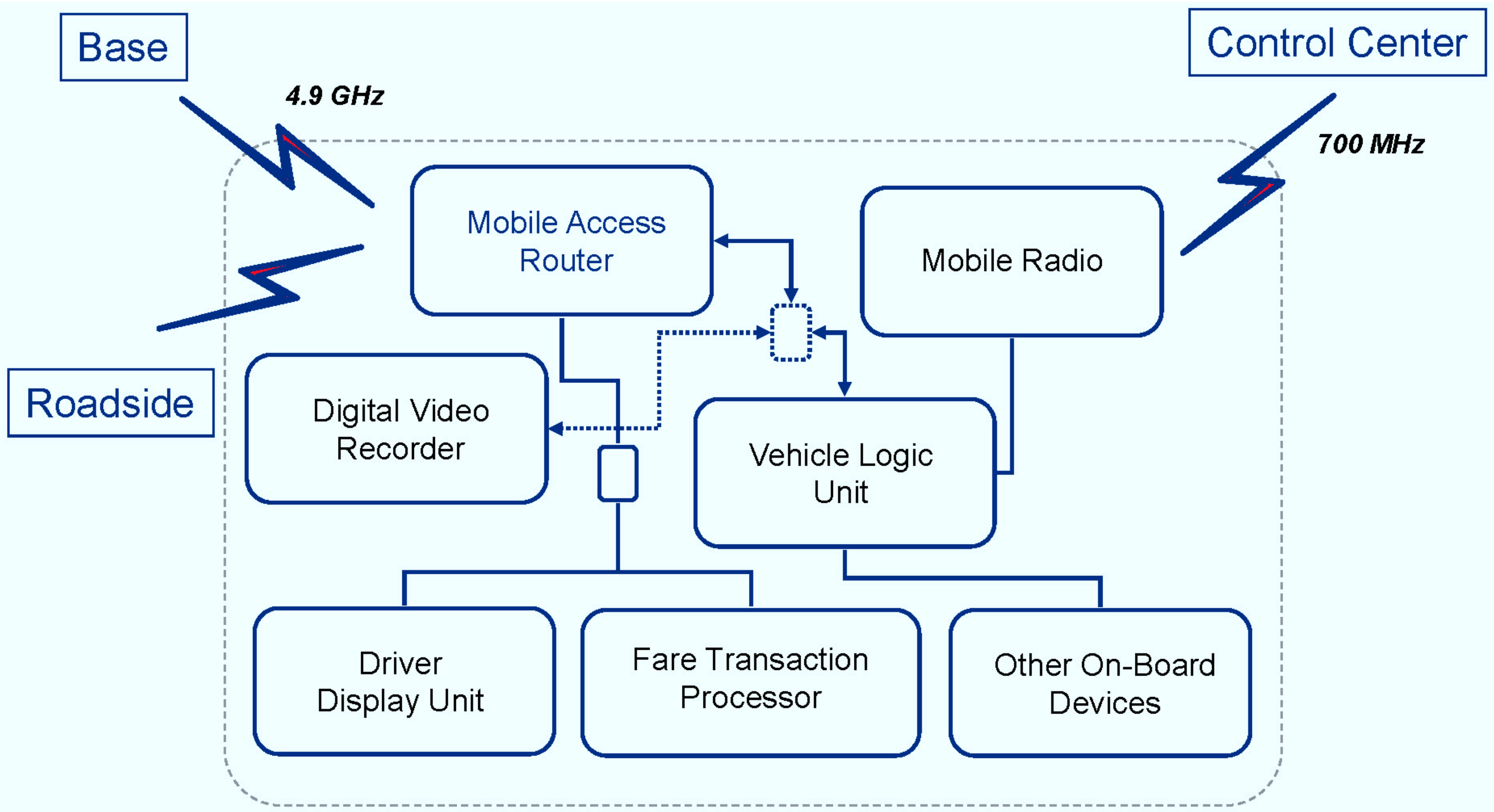
WELCOME

U.S. Department of Transportation

Office of the Assistant Secretary for Research and Technology

Module 19:

On-Board Transit Management Systems



Instructor

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President

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Learning Objectives

Review key concepts from Module 5 **Transit Management Standards, Part 2 of 2**

Describe how to **use the most prevalent standards** for On-board Transit Management systems for buses

Illustrate **how to procure** systems using the most prevalent transit on-board management standards

Learning Objective 1

Review Key Concepts from Module 5 **Transit Management Standards, Part 2 of 2**

Standards Facilitate Meeting User Needs

- User need:
  - Requirement for system to solve user problem
  - Part of systems engineering process (SEP)
  - FTA National ITS Architecture Policy includes identification of applicable ITS standards
  - May be satisfied by using standards
- Standards being used to meet user needs:
  - Users may not need customized solutions
  - Data exchanges facilitated among applications and entities
  - Can choose most suitable and cost-effective applications, knowing they use common standards

Structure and Use of Data Exchange Standards

Standards Facilitate Meeting User Needs (continued)

- **Benefits from using standards:**
  - **Reduce complexity and cost** in design, procurement, development and management
  - Ensure **wider choice of suppliers**
  - Certain types of standards **strategic to economic performance**

Standards Facilitate Meeting User Needs: Value

- **Protection of investment:**
  - Modularization and incremental deployment
  - Choice of suppliers
  - Reuse
- **Interoperability:**
  - Roadmap for evolution
  - Data management
- **Improved quality and value:**
  - Risk reduction
  - Better abstraction
  - Better testing
  - Process and tool support
  - Modularization
  - Reuse

Structure and Use of Data Exchange Standards

Open System Interconnection (OSI)

- International Organization for Standardization (a.k.a. ISO) standard for worldwide communications that defines networking framework for implementing standards/protocols in seven layers

- 7 Layers:
  - Application
  - Presentation
  - Session
  - Transport
  - Network
  - Data Link
  - Physical

SUPPLEMENT

OSI 7 Layer Model: Layers 7, 6 and 5

Layer	Application/Example
7. Application. Serves as the window for users and application processes to access the network services	End user layer (Program that opens what was sent or creates what is to be sent)
6. Presentation. Formats the data to be presented to the Application layer. It can be viewed as the "Translator" for the network	Syntax layer (encrypt and decrypt if needed)
5. Session. Allows session establishment between processes running on different stations	Sync and send to ports (logical ports)

Structure and Use of Data Exchange Standards

OSI 7 Layer Model: Layers 4, 3, 2 and 1

Layer	Application/Example
4. Transport. Ensures that messages are delivered error-free, in sequence and with no losses and duplication	Transmission Control Protocol - TCP (host to host, flow control)
3. Network. Controls the operations of the subnet, deciding the physical path the data takes	Packets ("letter," contains IP address)
2. Data Link. Provides error-free transfer of data frames from one node to another over the Physical layer	Frames ("envelopes," contains MAC address)
1. Physical. Concerned with transmission and reception of raw bit stream over physical medium	Physical structure (cables, hubs, etc.)

Structure and Use of Data Exchange Standards

SAE J1708/J1587

- Facilitates **vehicle area network** (VAN)
- Only describes **two lowest layers**
  - Physical
  - Data Link
- Used in conjunction with **SAE J1587**, which:
  - Is an application layer
  - Defines format of J1708 messages sent between microprocessors devices in transit vehicles
  - Supports communication with external devices connected to VAN
- **J1708 message** consists of Message Identification (MID) character, data bytes and checksum

Structure and Use of Data Exchange Standards

SAE J1939

- **High speed** ISO 11898-1 Controller Area Network (CAN) based communications network:
  - Simple information exchanges and diagnostic data exchanges between components physically distributed throughout vehicle
  - Allows components associated with different manufacturers to communicate with each other
- **Successor to SAE J1708/J1587** low speed networks - earlier standards provided simple information exchange between on-board components
- Every J1939 message uses **identifier** that defines:
  - Message priority
  - From whom it was sent
  - Data that is contained within it

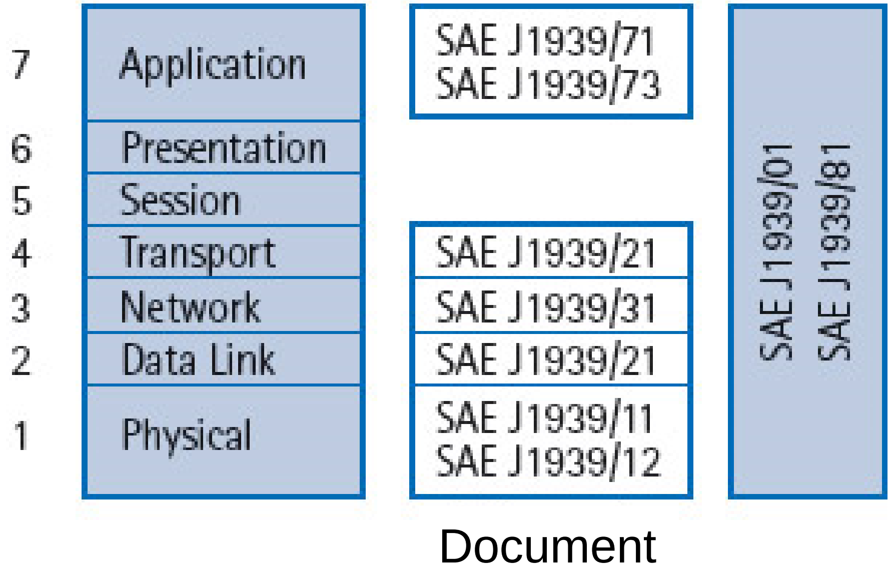
Structure and Use of Data Exchange Standards

SAE J1939 (continued)

- **Layer 1 (physical layer)** - electric interface with physical medium

- **Layer 2 (data link layer)** - data communication via Controller Area Network (CAN) (ISO standard-ISO 11898 for serial data communication) based on CAN 2.0B

- **Layer 3 (network layer)** - functionality of bridge for transmission of messages between two network segments



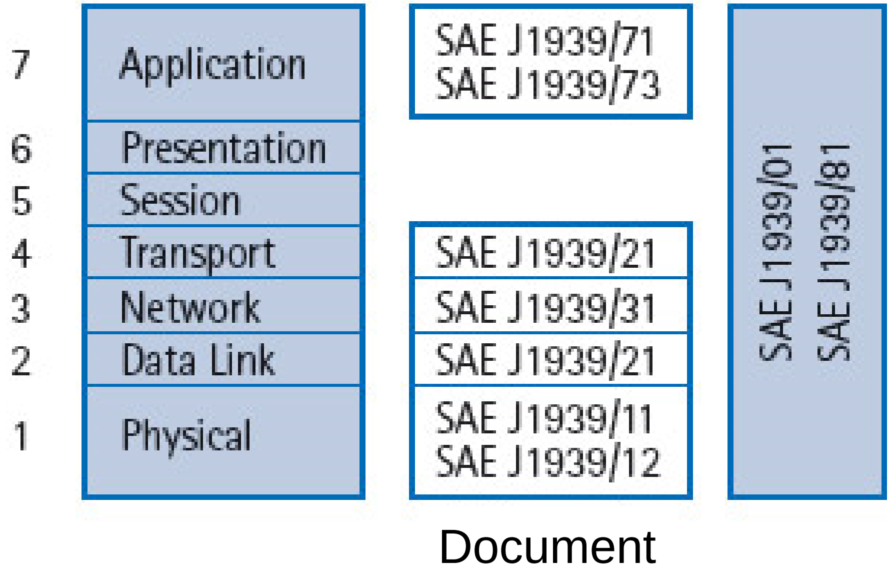
Structure and Use of Data Exchange Standards

SAE J1939 (continued)

- **Layer 4 (transport layer)** - various network services for message request mode, acknowledged transmission, and fragmented transmission of large data blocks

- **Layer 7 (application layer):**
  - Actual data (parameters or network variables with value range, resolution, physical unit and the type of transmission)
  - Each message unambiguously referenced by parameter group number

- **Network management** - automatic allocation or determination of node addresses (plug and play principle)



ITS Standards for Data Exchange Among Transit Management Systems

Center-to-Field (C2F) Application Area Capabilities Related to Transit

- **Interface between transit management center and specific type of infrastructure**: dynamic message signs (DMS) and transit signal priority (TSP)
- **DMS**:
  - **Information to travelers**
  - May use various technologies to display messages using any **combination of characters**
- **TSP**:
  - **Intersection control** through local traffic signal controller
  - **Interface** between traffic management center and on-street master controller
  - Based on **analysis of transit vehicle’s conditions** and **traffic characteristics** for a given time and type of day
  - Center **invokes appropriate pre-configured** traffic signal control system **timing plan**

ITS Standards for Data Exchange Among Transit Management Systems

Center-to-Vehicle/Traveler (C2V) Application Area Capabilities Related to Transit: Vehicle

Interface between transit management center and transit or paratransit vehicles

- Collecting **automated vehicle location information**
- Collecting **operational and maintenance data**
- Providing transit vehicle driver with **electronic dispatch and routing instructions**
- Providing **traveler information** to vehicle
- Providing **schedule information** used to develop corrective actions on-board
- Providing **fare management information**, including invalid traveler credit identities, to transit vehicles
- Supporting **transit vehicle operator authentication** and ability to **remotely disable vehicle** in emergency situations

ITS Standards for Data Exchange Among Transit Management Systems

Center-to-Vehicle/Traveler (C2V) Application Area Capabilities Related to Transit: Traveler

Interfaces between traveler information providers and devices used by traveling public

- **General traveler information**, including traffic information, transit information (fares, real-time schedules, and transactions), incident information, event information, and parking information
- **Emergency traveler information**, including alerts and advisories, and evacuation information
- **Traveler services information** (e.g., dining, lodging, etc.)
- **Trip planning**, using various modes of surface transportation and route options
- **Route guidance**

ITS Standards for Data Exchange Among Transit Management Systems

Center-to-Center (C2C) Application Area Capabilities Related to Transit

- **Multimodal coordination** between transit agencies and other public transportation modes
- **Transit incident information,** schedules, fare and pricing information
- **Transit information** suitable for media use
- **Emergency transit schedule information** to other operations centers
- **Transit system information** to traffic management centers
- **Personalized transit routes** requested by travelers
- **Financial institution approval** and status of electronic fare payments
- **Law enforcement** regarding the notification of violations

CASE STUDY

STANDARDS ITS TRAINING TRANSIT

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ITS Joint Program Office
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ITS Standards for Data Exchange Among Transit Management Systems

Case Study for C2V Flows: Chattanooga Area Regional Transportation Authority (CARTA)

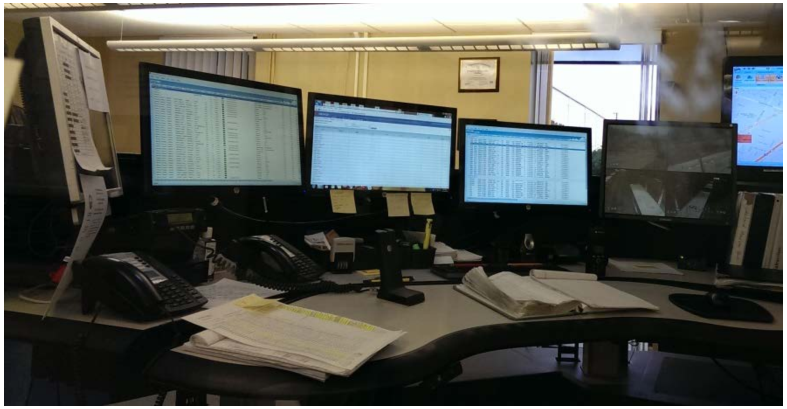
- **66 vehicles** operating in max. service and **10,040,856 annual passenger miles**
- **Required multiplex system** on all buses purchased:
  - System connected to **SAE J1939** data bus
  - **Monitor common engine, transmission, and braking faults** transmitted on data bus (e.g., high engine oil temperature, low oil pressure, high transmission oil temperature)
  - **Log data** for later retrieval
- Main purpose was for **integration with other planned in-vehicle equipment**
- Implemented **daily upload of bus diagnostic information** collected onboard to Automatic Vehicle Monitoring server, making data available to maintenance staff

EXAMPLE

ITS Standards for Data Exchange Among Transit Management Systems

Case Study for C2V Flows: CARTA AVM

- Selection of standard(s) to incorporate in functional specifications for AVM system based on:
  - Availability
  - Applicability
  - Maturity
  - Vendors' use/acceptance



- Incorporated into specifications in appropriate location:
  - On-board Device Alarms Reporting
  - Automatic Vehicle Monitoring: On-board System
  - Student Supplement contains specification language

EXAMPLE

Apply Standards to Development of Procurement Specifications

Read a Standard

- Transit Management standards not structured the same way:
  - SAE J1939 based on OSI layers
  - GTFS is a series of comma-delimited text files
  - GTFS-realtime format based on Protocol Buffers
  - TransXChange (UK standard) is XML format
- Need to understand enough to:
  - Identify appropriate standard(s) based on aforementioned criteria
  - Define use of standard(s) in functional requirements/specifications
  - Define how compliance with standard(s) can be tested

Apply Standards to Development of Procurement Specifications

Read a Standard: SAE J1939

Core J1939 Standards	
J1939	Recommended Practice for a Serial Control and Communications Vehicle Network
J1939-01	Recommended Practice for Control And Communications Network for On-Highway Equipment
J1939-02	Agricultural and Forestry Off-Road Machinery Control and Communication Network
J1939-03	On Board Diagnostics Implementation Guide
J1939-05	Marine Stern Drive and Inboard Spark-Ignition Engine On-Board Diagnostics Implementation Guide
J1939-11	Physical Layer - 250k bits/s, Twisted Shielded Pair
J1939-13	Off-Board Diagnostic Connector
J1939-15	Reduced Physical Layer, 250K bits/sec, Un-Shielded Twisted Pair (UTP)
J1939-21	Data Link Layer
J1939-31	Network Layer
J1939-71	Vehicle Application Layer
J1939-73	Application Layer - Diagnostics
J1939-74	Application - Configurable Messaging
J1939-75	Application Layer - Generator Sets and Industrial
J1939-81	Network Management
J1939-82	Compliance - Truck and Bus
J1939-84	OBD Communications Compliance Test Cases for Heavy Duty Components and Vehicles

Apply Standards to Development of Procurement Specifications

Read a Standard: SAE J1939 (continued)

- Most messages intended to be broadcast
- Data transmitted on the network without specific destination:
  - Permits any device to use data without requiring additional request messages
  - Allows future software revisions to easily accommodate new devices
- When message must be directed to particular device, specific destination address included within message identifier

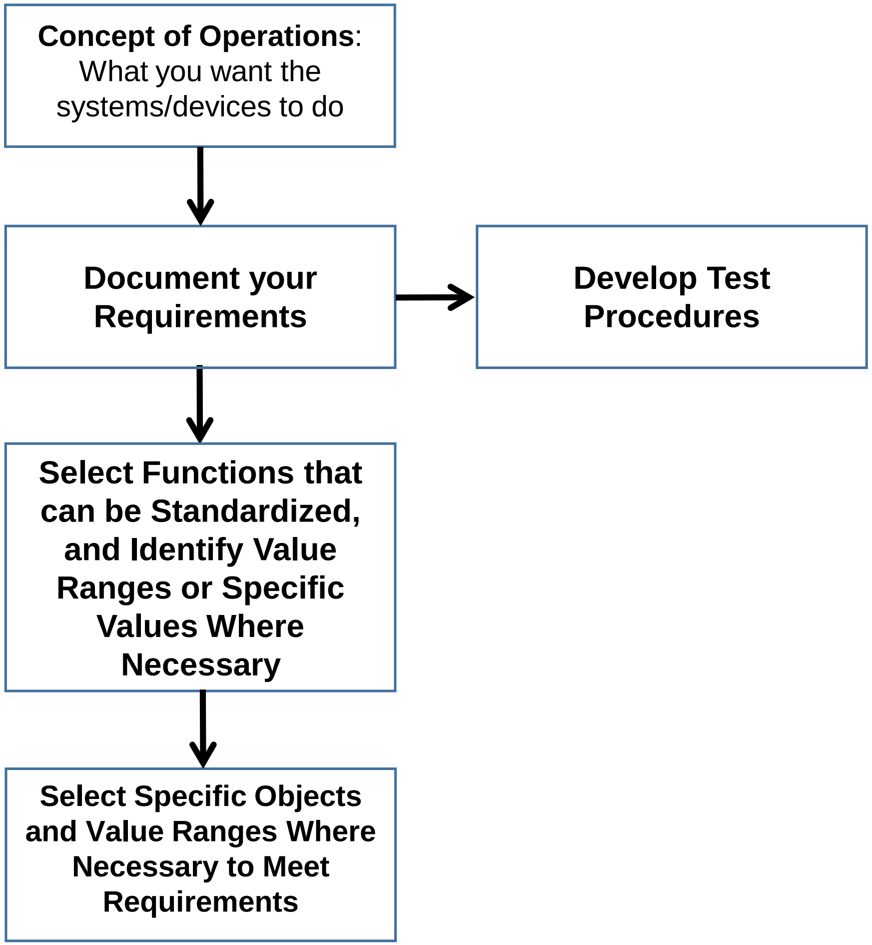
Apply Standards to Development of Procurement Specifications

Incorporate a Standard into a Specification for Procuring a Transit Management System

- Discussion of Concept of Operations (ConOps)
- Components/devices you expect to be supplied in system
- Functions to be supported, value ranges and optional capabilities required
- Detailed listing of requirements
- Language requiring use of standardized dialogs
- Testing program

Apply Standards to Development of Procurement Specifications

Incorporate a Standard into a Specification



ACTIVITY

Question

Which one of these is not a layer within Open System Interconnection (OSI) model?

Answer Choices

a) Application

b) Data

c) Service

d) Physical

Review of Answers

a) Application

Incorrect. This is Layer 7 within the OSI model.

b) Data

Incorrect. This is a Layer 2 within the OSI model.

c) Service

Correct! This is not a layer within the Open System Interconnection (OSI) model.

d) Physical

Incorrect. This is a Layer 1 within the OSI model.

Learning Objective 2

Describe the details and how to **use the most prevalent standards** for On-board Transit Management systems for buses

Contents and Use of SAE J1587

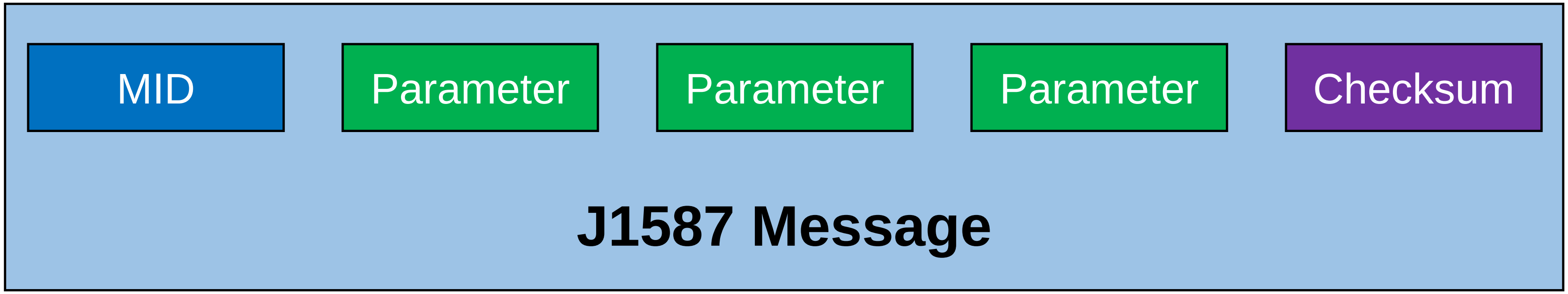
Define and Describe the Purpose of J1587

- Defines messages transmitted on SAE J1708 network
- Specifies transport, network and application layers
- Outdated and being replaced by J1939
- Defines format of messages and data being communicated between on-board microprocessors
- Promotes software compatibility among microcomputer based modules
- Used with SAE J1708, which:
  - Defines requirements for hardware and basic protocol needed to implement J1587
  - Specifies data link and physical layers

Contents and Use of SAE J1587

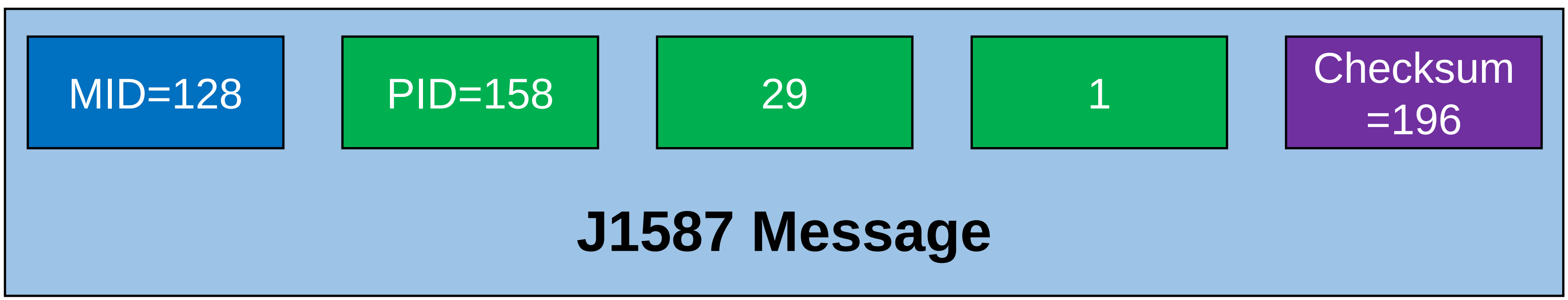
Describe the J1587 Message Format

- Format:
  - Message identifier (MID) – source address of transmitting node
  - One or More Parameters
  - Checksum
- Messages start with MID indicating source address of transmitting node



J1587 Example

- J1587 specifies a parameter for Battery Voltage
- MID is 128, which means Engine #1
- Battery Voltage is PID 158



Contents and Use of SAE J1587

Use of SAE J1587

- J1587 is outdated, but is often **found in legacy systems**
  - **Vehicle and component information**
  - **Routing and scheduling information**
  - **Driver information** relating to driver activity
- **SAE J1708, defining basic hardware and conditions** required for on-board data exchange
- With J1708 backbone in place, **J1587** added for **general on-board information sharing and diagnostic functions**
- Whenever **J1587** mentioned, assume that **J1708** is included
- Thus, use of **J1587 and J1708 described together**

Contents and Use of SAE J1708

Define and Describe the Purpose of J1708

- Addresses transmission of electronic signals and information among bus components
- Identifies minimum hardware and procedural requirements for routing messages over network
- Establishes method for determining:
  - Which device is communicating (i.e., engine, farebox, etc.)
  - Length of time that each device is allowed to communicate
  - Which device has priority in accessing network when two try to gain access simultaneously
  - That message was received correctly should there be problems in transmission
- Describes physical and data link layer

Contents and Use of SAE J1708

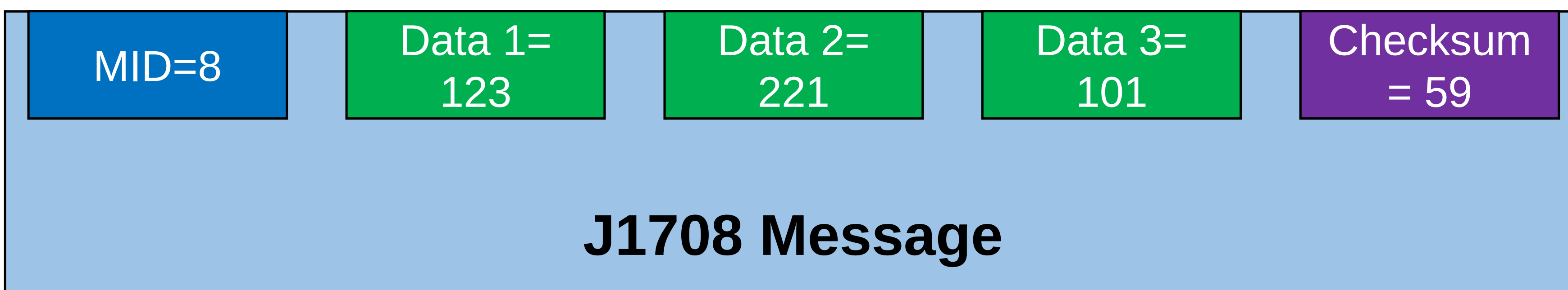
Define and Describe the Purpose of J1708 (cont'd)

- SAE J1587 or J1922, defines actual data or functions to be transmitted. SAE J1708 only defines hardware and basic software
- Data can be transferred between devices in more cost-effective way:
  - Minimizes hardware cost
  - Offers flexibility and further expansion of existing system
  - Uses standard industry electronics
- Transmission rate 9600 bps
- Message up to 21 bytes long

Contents and Use of SAE J1708

Describe the J1708 Message Format

- Message consists of MID, data bytes and checksum
- Data content not described in J1708 specification but in overlaying protocol, such as J1587
- MID is 0-255
  - MIDs 0-68 belong to predefined devices to ensure consistency.
  - MIDs 69-86 are set aside for J1922 protocol.
  - MIDs 87-110 are reserved for future applications.
  - MID 111 is designated for factory tests of electronic control units and shall not be used by any on-board unit.
  - MIDs 112-127 are not reserved and can be used as wanted.
  - MIDs 128-255 are reserved for SAE J1587 protocol.



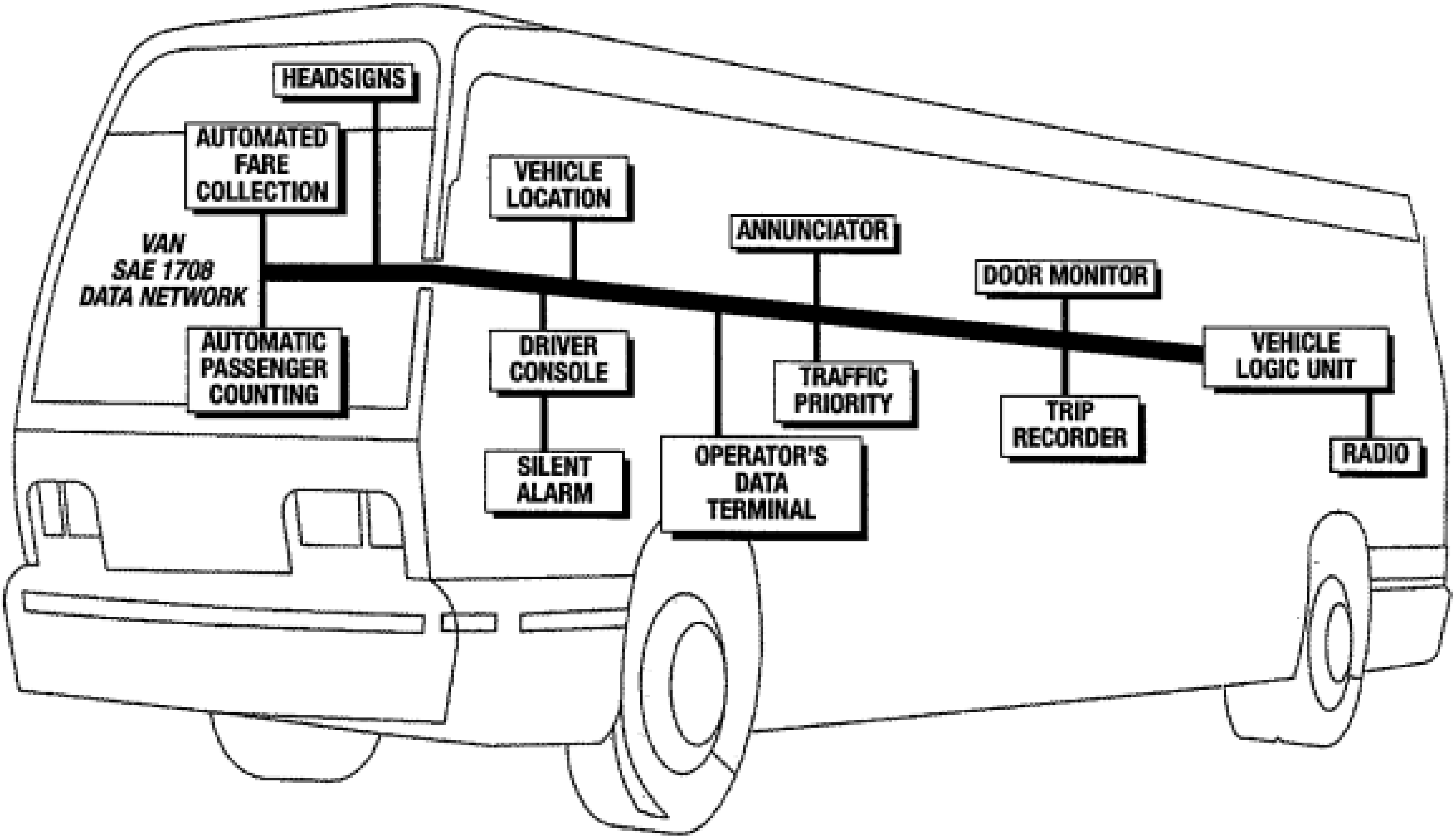
Contents and Use of SAE J1708

Use of SAE J1708

- Exchange information between AVL, VLU, fare collection, radio, passenger information, and other systems
- Integration examples:
  - Passenger information systems with AVL provides **automatic next-stop audio and visual announcements**
  - Fare collection with passenger counters, passenger information systems and AVL **identifies passenger trends**
  - On-board cameras and AVL to store **video images** on-board **for review** or send **emergency-related images** in real time
- Combine health-monitoring capabilities of vital on-board components with AVL to send fault alarms in real time

Contents and Use of SAE J1708

Use of SAE J1708



Contents and Use of SAE J1939

Define and Describe the Purpose of J1939

- Defines how information transferred across network to allow Electronic Control Units to communicate information (e.g. vehicle speed)
- 17 J1939 documents – see earlier slide on how to read a standard
- Capable of handling requirements currently satisfied by J1708/J1587/J1922
- Spans all seven OSI layers
- Data rate of 250,000 bits per second, making it much faster than J1708

Contents and Use of SAE J1939

Define and Describe the Purpose of J1939 (cont'd)

- Permits connection of up to 30 units compared to maximum of 20 for J1708
- Ensures data transmission time fully utilized
- Most messages defined by J1939 intended to be broadcast
  - Data transmitted on network without specific destination
  - Permits any device to use data without requiring additional request messages
  - Allows future software revisions to easily accommodate new devices
- Uses the 29-bit identifier defined within CAN 2.0B protocol

Contents and Use of SAE J1939

Define and Describe the Purpose of J1939 (cont'd)

- Defines message timeouts, how large messages are fragmented and reassembled, the network speed, the physical layer, and how applications acquire network addresses
- Defined using collection of individual SAE J1939 documents based on layers of OSI model
- Uses Controller Area Network (CAN) protocol permitting any Electronic Control Units (ECU) to transmit message on network
- Every message uses an identifier that defines:
  - Message priority
  - From whom it was sent
  - Data that is contained within it
- Collisions are resolved non-destructively as result of arbitration process that occurs while identifier transmitted

Contents and Use of SAE J1939

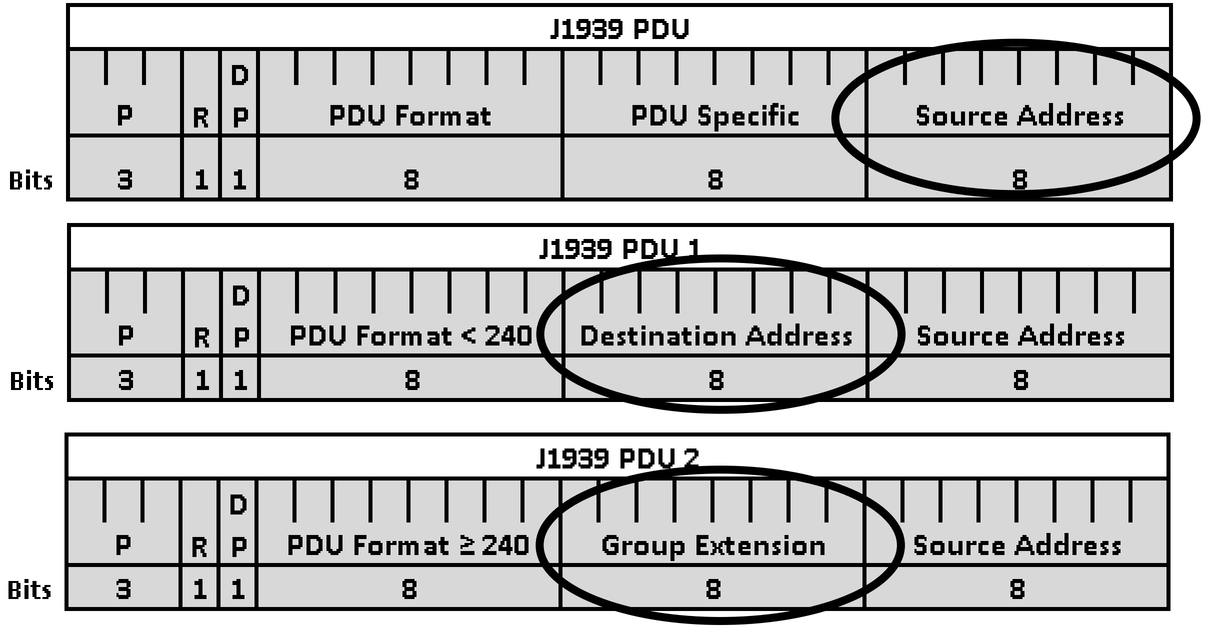
Define and Describe the Purpose of J1939 (cont’d)

- J1939 messages built on top of CAN 2.0b - make specific use of extended frames
- First three bits are priority field - sets message’s priority on network and helps ensure messages with higher importance sent/received before lower priority messages. Zero is highest priority
- Next bit reserved for future use - should be set to zero
- Next bit Data Page field used to expand maximum number of possible messages
- Next eight bits Protocol Data Unit Format (PDU F) field - used to determine if message intended for specific device on network or for entire network
  - If value of PDU F < 240, message meant for specific device
  - If value is 240 or greater, message intended for all devices
- Next eight bits Protocol Data Unit Specific (PDU S) field - based on value of PDU F field

Contents and Use of SAE J1939

Define and Describe the Purpose of J1939 (concluded)

- If PDU F intended for specific device, PDU S is address of specific device, PDU S field called Destination Address
- If PDU F intended for all devices, PDU S is Group Extension field used to increase number of possible broadcast messages. Format is called PDU 2
- Last eight bits identify address of device that transmitted current message - Source Address Field



Contents and Use of SAE J1939

J1939 Characteristics

- Extended CAN identifier (29 bit)
- Bit rate 250 kbit/s
- Peer-to-peer and broadcast communication
- Transport protocols for up to 1785 data bytes
- Network management
- Definition of parameter groups for commercial vehicles and others
- Manufacturer specific parameter groups are supported
- Diagnostics features

Contents and Use of SAE J1939

J1939 Example

- **Sample of a parameter** group definition:
  - Name: Engine temperature 1 – ET1
  - Transmission rate: 1s
  - Data length: 8 bytes
  - Extended Data Page 0
  - Data page: 0
  - PDU format: 254
  - PDU specific: 238
  - Default priority: 6
  - PG Number: 65,262 (00FEEE16)

- **Description of data**:
  - Byte: 1 Engine Coolant Temperature
  - 2 Engine Fuel Temperature 1
  - 3,4 Engine Oil Temperature 1
  - 5,6 Engine Turbocharger Oil Temperature
  - 7 Engine Intercooler Temperature
  - 8 Engine Intercooler Thermostat Opening

Use of Wireless Access Points and On-board Internet

Use of IEEE 802.11x

- Agencies use wireless access points (WAPs) to upload / download data and perform software updates for vehicles
- Current WAPs use IEEE 802.11ac
- On-board Wi-Fi for passengers uses 802.11x

Examples of Use of On-board Standards to Provide a Single-point Logon

What is Single-point Logon?

- Computer-aided Dispatch (CAD) allows for single point logon for all on-board systems
- Driver can initiate systems connected to CAD (e.g., AVL, farebox)
- Reduces potential for error
- Where more than one GPS unit on board provides one GPS location and time/date stamp for all systems
- Keeps operational information being used and generated by on-board systems synchronized

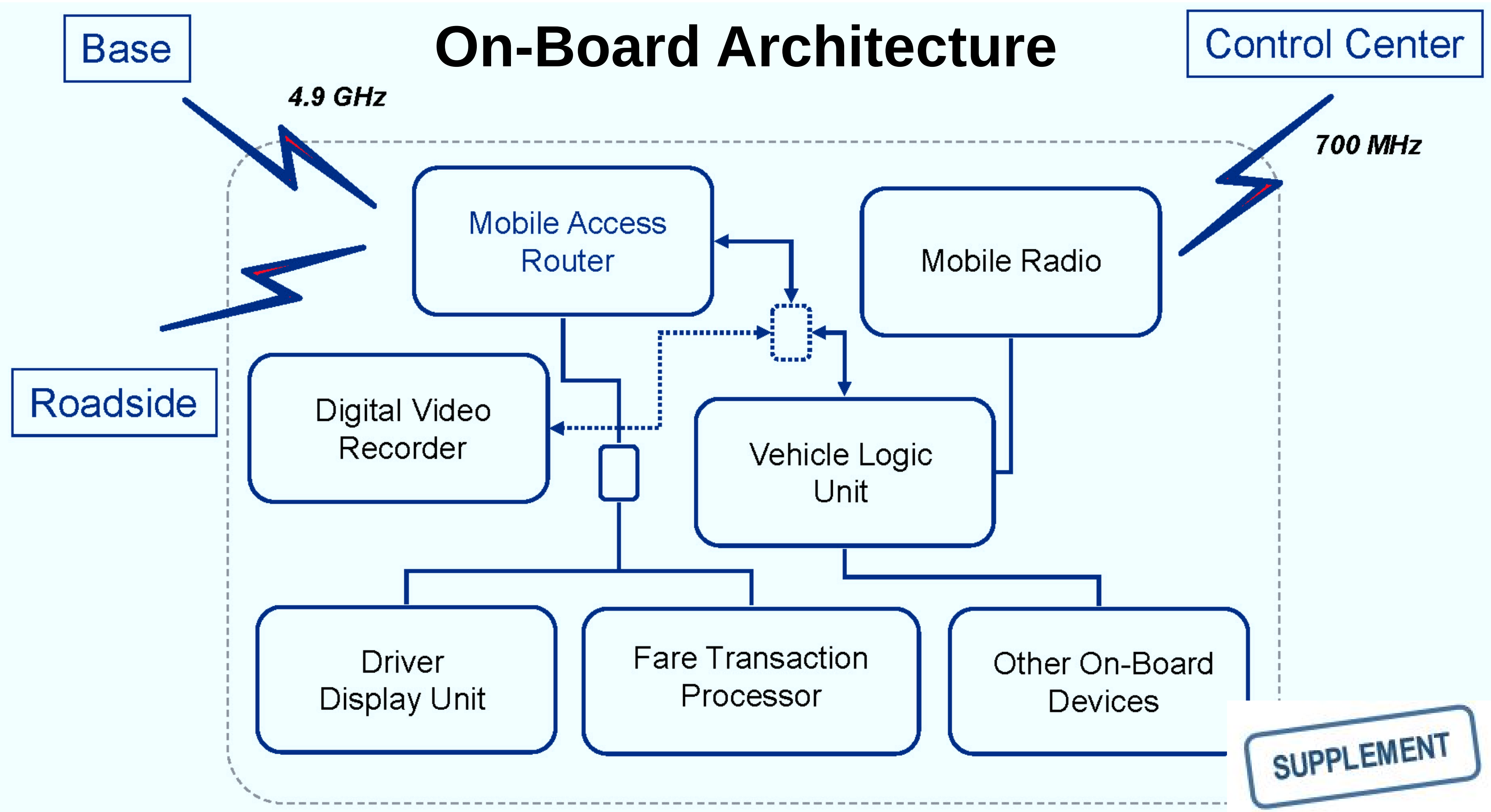
Using Standards to Perform Single-point Logon to On-board Devices

- Capital District Transportation Authority in Albany, NY
- Intelligent Transportation Management System (ITSM) includes **bidirectional interface** between farebox and MDT/VLU with single point logon
  - Over **J1708/1587** network
  - **Single point logon** shall negate need for operators to logon
  - Login includes time, date, driver ID no., route, run, trip and/or pattern, real-time vehicle location, and vehicle number, which shall be transferred to the MDT/VLU through **bidirectional interface**
  - **Changes** made either by driver or remotely by dispatch **through MDT** will **update farebox logon and vice versa**
  - Operator shall continue to be able to use all farebox operator control unit (OCU) features

EXAMPLE

Examples of Use of On-board Standards to Provide a Single-point Logon

Single-point Logon at King County Metro



Examples of Use of On-board Standards to Provide a Single-point Logon

King County Metro (continued)

- On-Board Systems (OBS) Project:
  - Smart bus concept
  - GPS/odometer/gyroscope solution
  - Stop announcements
  - Next stop electronic displays
  - Destination sign integration
  - Automatic passenger counting
  - Vehicle monitoring
  - Installs in progress

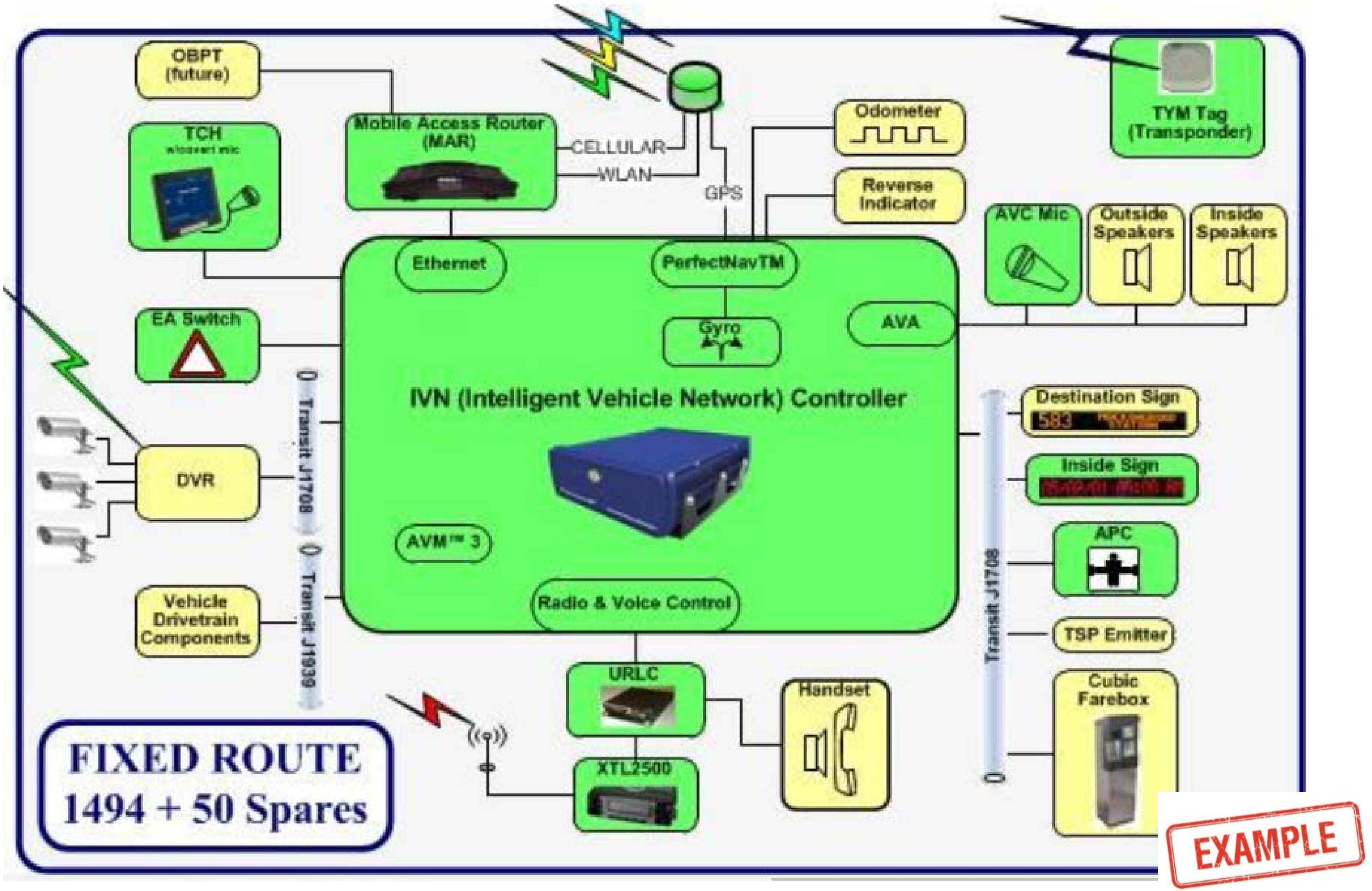
EXAMPLE

Examples of Use of On-board Standards to Provide a Single-point Logon

- Business need for integration:
  - **Single logon for operators**
  - Automatic fare zone changes
  - Space and power constraints
  - Maintenance requirements
  - Network infrastructure support
  - Multiple hardware and software vendors
  - Phased implementation

SUPPLEMENT

Use of On-board Standards to Provide a Single-point Logon



ACTIVITY

Question

Which one of these differences between SAE J1939 and J1708 is NOT true?

Answer Choices

a) J1939 is much faster than J1708

b) J1939 permits a connection of more devices than J1708

c) J1939 is based on the Controller Area Network (CAN)

d) J1939 covers the same number of OSI layers as J1708

Review of Answers

a) J1939 is much faster than J1708

Incorrect. SAE J1939 has a data rate of 250,000 bits per second, making it much faster than J1708

b) J1939 permits a connection of more devices than J1708

Incorrect. SAE J1939 also permits a connection of up to 30 units compared to a maximum of 20 for a J1708 network

c) J1939 is based on the Controller Area Network (CAN)

Incorrect. J1708 is not based on the CAN

d) J1939 covers the same number of OSI layers as J1708

Correct! J1939 covers all 7 layers while J1708 only covers 2

Learning Objective 3

Illustrate **how to procure** systems using the most prevalent transit on-board management standards

CASE STUDY

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ITS Joint Program Office
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Case Study of Procuring System(s) Using SAE J1708/1587

Norwalk Transit District (NTD) CAD/AVL System

Identify system integration needs: Using vehicle area network (VAN) to connect mobile data terminal (MDT) with:

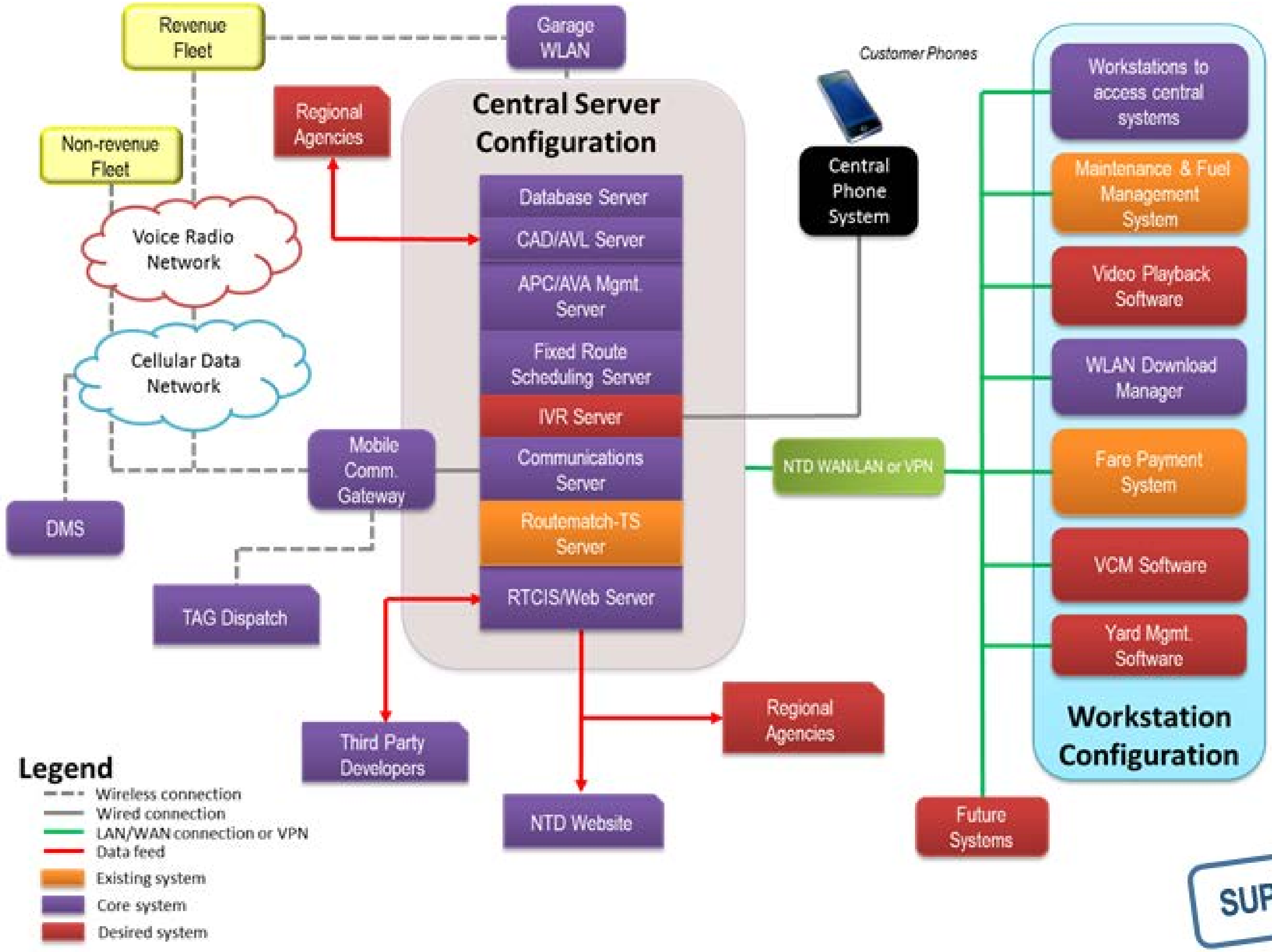
- Farebox
- Headsign
- Automatic passenger counter (APC) controller
- Digital video recorder (DVR)
- Automatic voice annunciation (AVA) controller
- Interior AVA dynamic message signs (DMS)
- Optional on-board equipment:
    - Transit signal priority (TSP) emitters
    - On-board surveillance system
    - Maintenance network gateways for vehicle component monitoring

Single-point login

EXAMPLE

Case Study of Procuring System(s) Using SAE J1708/1587

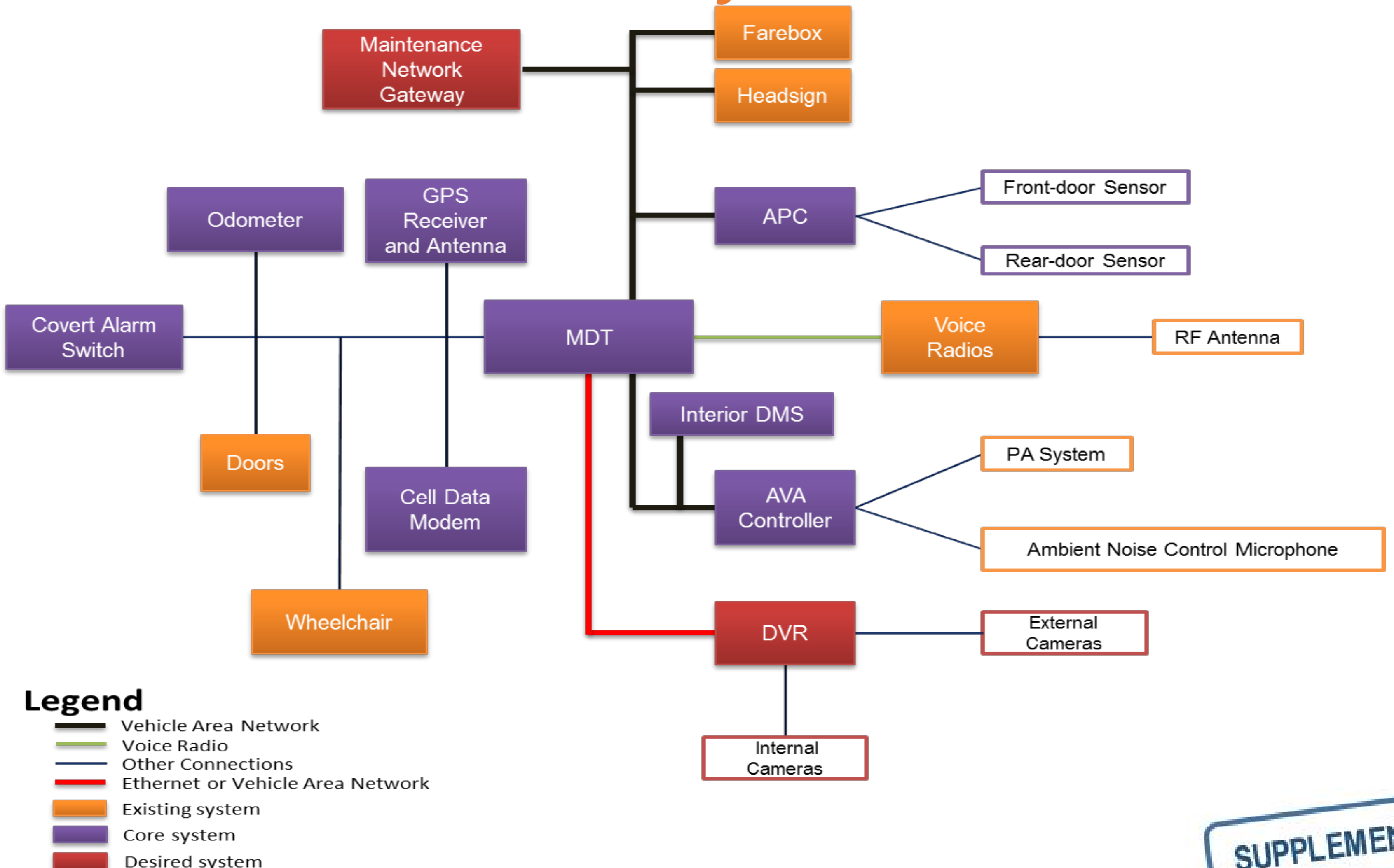
NTD CAD/AVL System



SUPPLEMENT

Case Study of Procuring System(s) Using SAE J1708/1587

NTD CAD/AVL On-board Systems



SUPPLEMENT

Case Study of Procuring System(s) Using SAE J1708/1587

NTD CAD/AVL Procurement

- Vehicle Area Network (VAN)
- Farebox Integration
- Headsign Integration
- APC Installation/ Integration
- Optional Vehicle Component Monitoring
- Integration with Interior DMS
- Optional Interface with Transit Signal Priority (TSP) Emitter (fixed-route only)

Case Study of Procuring System(s) Using SAE J1708/1587

Capital District Transportation Authority (CDTA) Intelligent Transportation Management System (ITMS)

- **Single-point login**
- **SAE J1708/1587 to connect ITMS Vehicle Logic Unit (VLU) with**:
  - Farebox
  - Headsign
  - Automatic Passenger Counters (APC) controller
  - Global Positioning System (GPS) receiver
  - Transit Signal Priority (TSP) emitter
  - Digital Video Recorder (DVR)
  - Automated Vehicle Announcements (AVA) controller
  - Covert alarm
  - Vehicle diagnostics interfaces
  - Support data transfer to/from Central Data System (CDS)
  - P25 radios
  - Interior Dynamic Message Signs (DMS) for AVA

Case Study of Procuring System(s) Using SAE J1708/1587

CDTA ITMS – Interface Control Document (ICD)

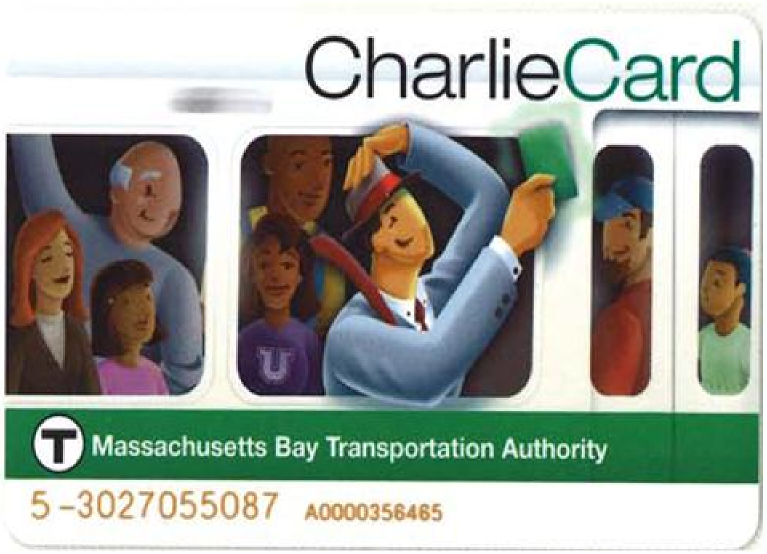
- SPX-Genfare FastFare™ Fareboxes integration with ITMS to provide:
  - GPS data
  - Single login capability across all on-board systems
- ICD:
  - Documents and tracks necessary information to define system's interface
  - Communicates inputs and outputs for all potential actions whether internal to system or transparent
  - Created during Planning and Design Phases
  - Helps ensure compatibility between system segments and components

EXAMPLE

Case Study of Procuring System(s) Using SAE J1708/1587

Potential ICD Contents: Farebox – ITMS Integration

- Scope/Purpose of ICD
- Physical interface
- J1587 Protocol:
  - MID Assignments
  - PID Definitions
  - Application Protocol
- Initialization:
  - Normal Vehicle Power Up
  - MDT/VLU Power Interruption or Reboot
  - Farebox Power Interruption or Reboot



SUPPLEMENT

Case Study of Procuring System(s) Using SAE J1708/1587

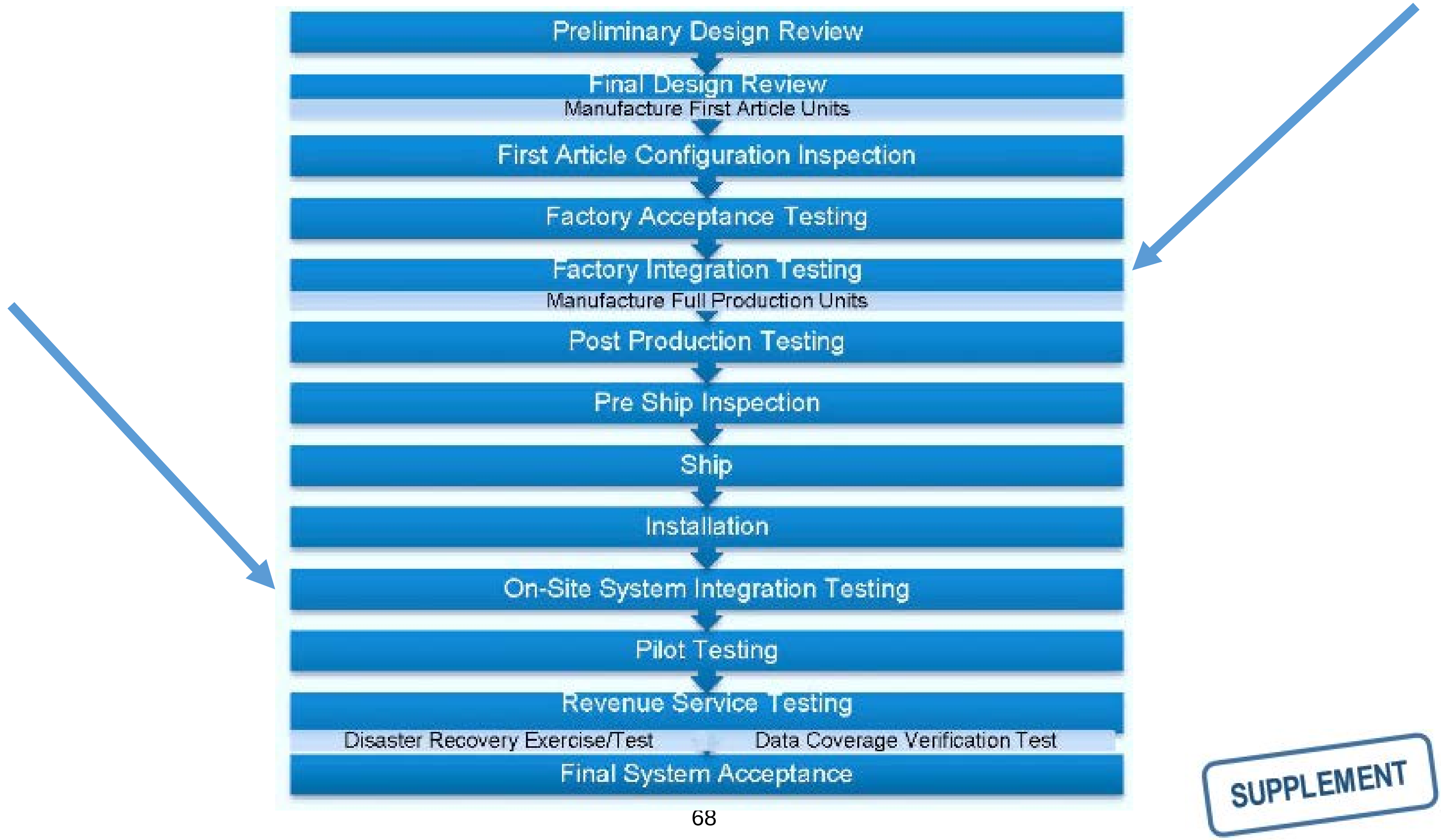
Potential ICD Contents: Farebox – ITMS Integration

- MDT/VLU Initiated Logon
- Farebox Initiated Logon
- Location Reporting
- Starting a Trip
- Servicing a Stop
- Time Synchronization
- MDT/VLU Initiated Driver Logoff
- Farebox Initiated Driver Logoff
- Error Handling

EXAMPLE

Case Study of Procuring System(s) Using SAE J1708/1587

CDTA ITMS – Additional Testing for Integration



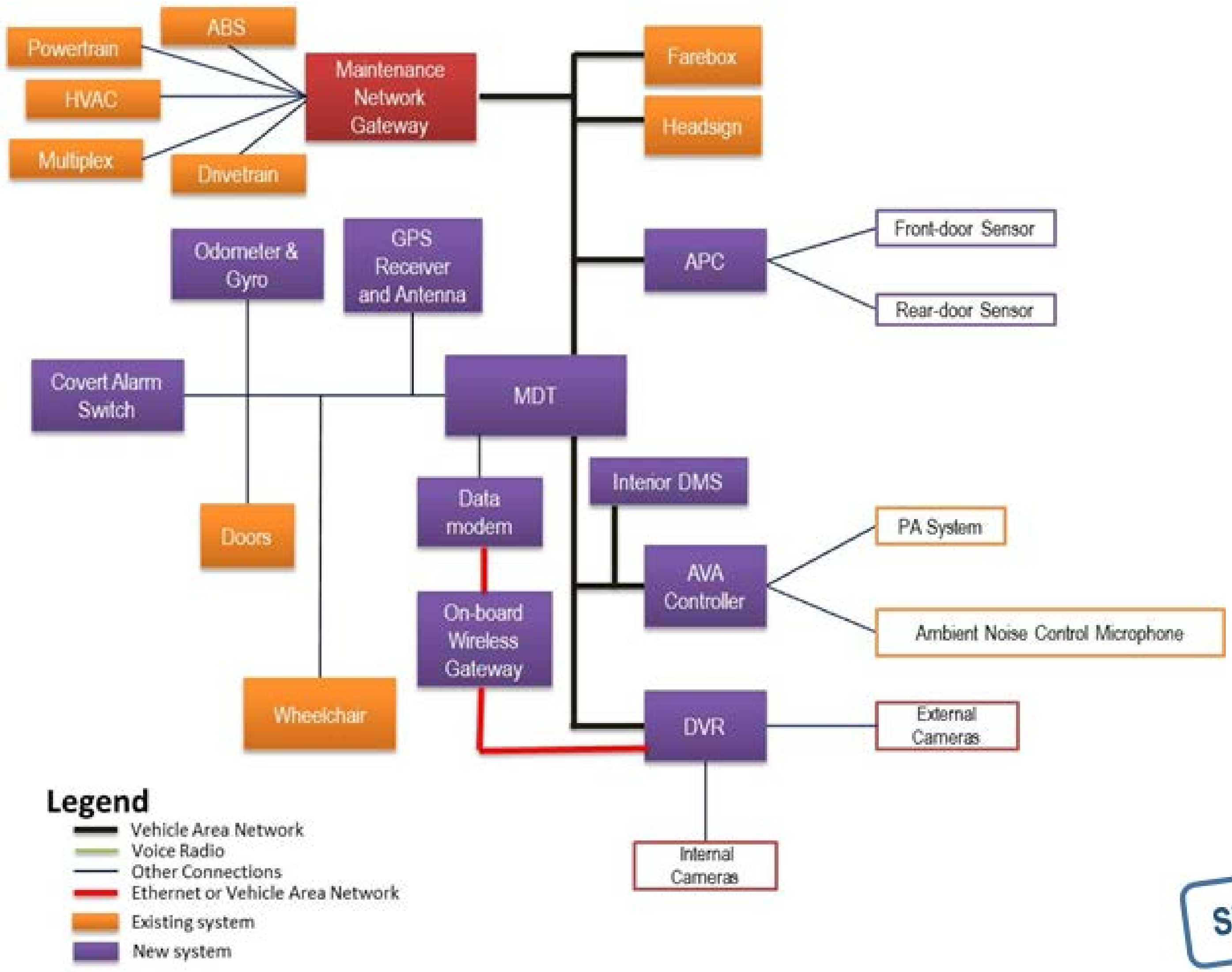
Case Study of Procuring System(s) Using SAE J1939

Ann Arbor Area Transportation Authority (AAATA) CAD/AVL Hardware and Software

- Vehicle area network (VAN):
  - Farebox
  - Headsign
  - New interior DMS that communicate with automatic voice announcement (AVA) controller
  - Automatic passenger counting (APC) controller integrated with the on-board mobile data terminal (MDT)
  - MDT to collect codes from Engine Control Module, Transmission Control Module and Automatic Braking System
  - Optional DVR

Case Study of Procuring System(s) Using SAE J1939

AAATA CAD/AVL On-board Systems



SUPPLEMENT

Case Study of Procuring System(s) Using SAE J1939

AAATA CAD/AVL Procurement

SUPPLEMENT

ACTIVITY

Question

What is an interface control document (ICD)?

Answer Choices

a) Documents and tracks necessary information to define system’s interface

b) Communicates inputs and outputs for all potential actions whether internal to system or transparent

c) Helps ensure compatibility between system segments and components

d) All of the above

Review of Answers

a) Documents and tracks necessary information to define system's interface

Incorrect. This answer is correct along with b and c

b) Communicates inputs and outputs for all potential actions whether internal to system or transparent

Incorrect. This answer is correct along with a and c

c) Helps ensure compatibility between system segments and components

Incorrect. This answer is correct along with a and b

d) All of the above

Correct! All statements are correct

Module Summary

1. Reviewed the structure and use of data exchange standards for Transit Management systems
2. Identified and described contents and use of SAE J1587/J1708 and J1939, and provided examples of single-point logon using standards
3. Provided case studies of procuring systems using SAE J1587/J1708 and J1939
4. Identified what is included in specifications

Module Summary

Lessons Learned

1. The use of data exchange standards for Transit Management systems allow agencies to use components/systems from multiple vendors
2. The use of SAE J1708 must include J1587 as well
3. The selection of standard(s) to incorporate in functional specifications is based on the standard's availability, applicability, maturity and the vendors' use and acceptance of the standard
4. SAE J1708 is outdated, so transit agency may want to consider moving their on-board systems to use J1939

Module Summary

Lessons Learned (continued)

5. Agencies have experienced cost savings through the use of on-board transit standards, as shown in the CARTA case study
6. The use of on-board transit standards facilitates the replacement of on-board components/systems
7. An Interface Control Document (ICD) documents the necessary information required to effectively define a system’s interface as well as any rules for communicating with them
8. Single-point login requires the use of on-board transit standards

Thank you for completing this module.

Feedback

Please use the Feedback link below to provide us with your thoughts and comments about the value of the training.

Thank you!