



W E L C O M E



U.S. Department of Transportation
Office of the Assistant Secretary for
Research and Technology

Mac Lister

A screenshot of the website for the ITS Professional Capacity Building Program. The header includes the United States Department of Transportation logo and navigation links. The main content area features a navigation menu, a 'WHAT'S NEW' section with several news items, and a 'FREE TRAINING' section with a list of courses. A blue banner at the top of the main content area reads 'Welcome to ITS Professional Capacity Building' and provides a brief description of the program.

United States Department of Transportation
OFFICE OF THE ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY
Intelligent Transportation Systems
Joint Program Office

ITS Professional Capacity Building Program / Advancing ITS Education

About | ITS Training | Knowledge Exchange | Technology Transfer | ITS in Academics | Media Library

WHAT'S NEW

New Web-Based Training from ITS Joint Program Office

- Connected Vehicle Reference Implementation Architecture Training now available

New NHI Course

- Systems Engineering for Signal Systems Including Adaptive Control (NHI-133123)

New ITS Case Study Available

- National ITS Architecture

Added to T3 Archive

- Learn from the Experts: Open Data Policy Guidelines for Transit - Maximizing Real Time and Schedule Data-Legalities, Evolutions, Customer Perspectives, Challenges, and Economic Opportunities - Part II Presented on August 7, 2014
- Saving Lives and Keeping Traffic Moving: Quantifying the Outcomes of Traffic Incident Management (TIM) Programs Presented on July 31, 2014

FREE TRAINING

The ITS PCB Program and partners offer many free ITS training courses.

- Web and Blended Courses from CITE
- ITS Standards Training
- Upcoming T3 Webinars

Welcome to ITS Professional Capacity Building
The ITS PCB Program is the U.S. Department of Transportation's leading program for delivering ITS training and learning resources to the nation's ITS workforce.

Program Manager Knowledge and Technology Transfer
ITS Joint Program Office
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www.pcb.its.dot.gov



U.S. Department of Transportation
Office of the Assistant Secretary for
Research and Technology

Jeffrey Spencer



The screenshot shows the website for the ITS Professional Capacity Building Program. At the top, it identifies the United States Department of Transportation, Office of the Assistant Secretary for Research and Technology, and the Intelligent Transportation Systems Joint Program Office. A navigation menu includes 'About', 'ITS Training', 'Knowledge Exchange', 'Technology Transfer', 'ITS in Academics', and 'Media Library'. A central banner reads 'Welcome to ITS Professional Capacity Building' and states that the program is the U.S. Department of Transportation's leading program for delivering ITS training and learning resources. Below this, a 'FREE TRAINING' section lists 'Web and Blended Courses from CITE', 'ITS Standards Training', and 'Upcoming T3 Webinars'. On the right, a 'WHAT'S NEW' section lists recent updates, including 'New Web-Based Training from ITS Joint Program Office' (Connected Vehicle Reference Implementation Architecture Training), 'New NHI Course' (Systems Engineering for Signal Systems), and 'New ITS Case Study Available' (National ITS Architecture).

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ITS Transit Standards Professional Capacity Building Program

Module 4:

Transit Communications Interface Profiles (TCIP), Part 2 of 2: Structure and Elements of TCIP—Accessing TCIP via TIRCE and TCIP Tools

Acknowledgments

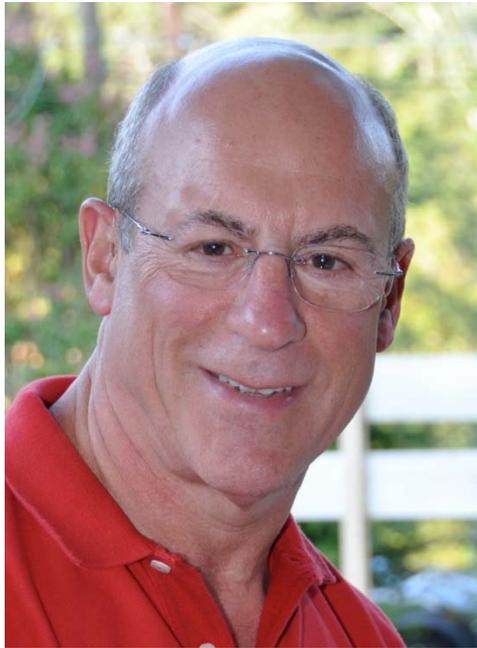
- **Ayers Electronic Systems, LLC**
- **Critical Link, LLC**
- **National Transit Institute**

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Instructor



Jerome M. Lutin, Ph.D., P.E., AICP
Senior Director (Retired)
New Jersey Transit
South Brunswick, NJ, USA

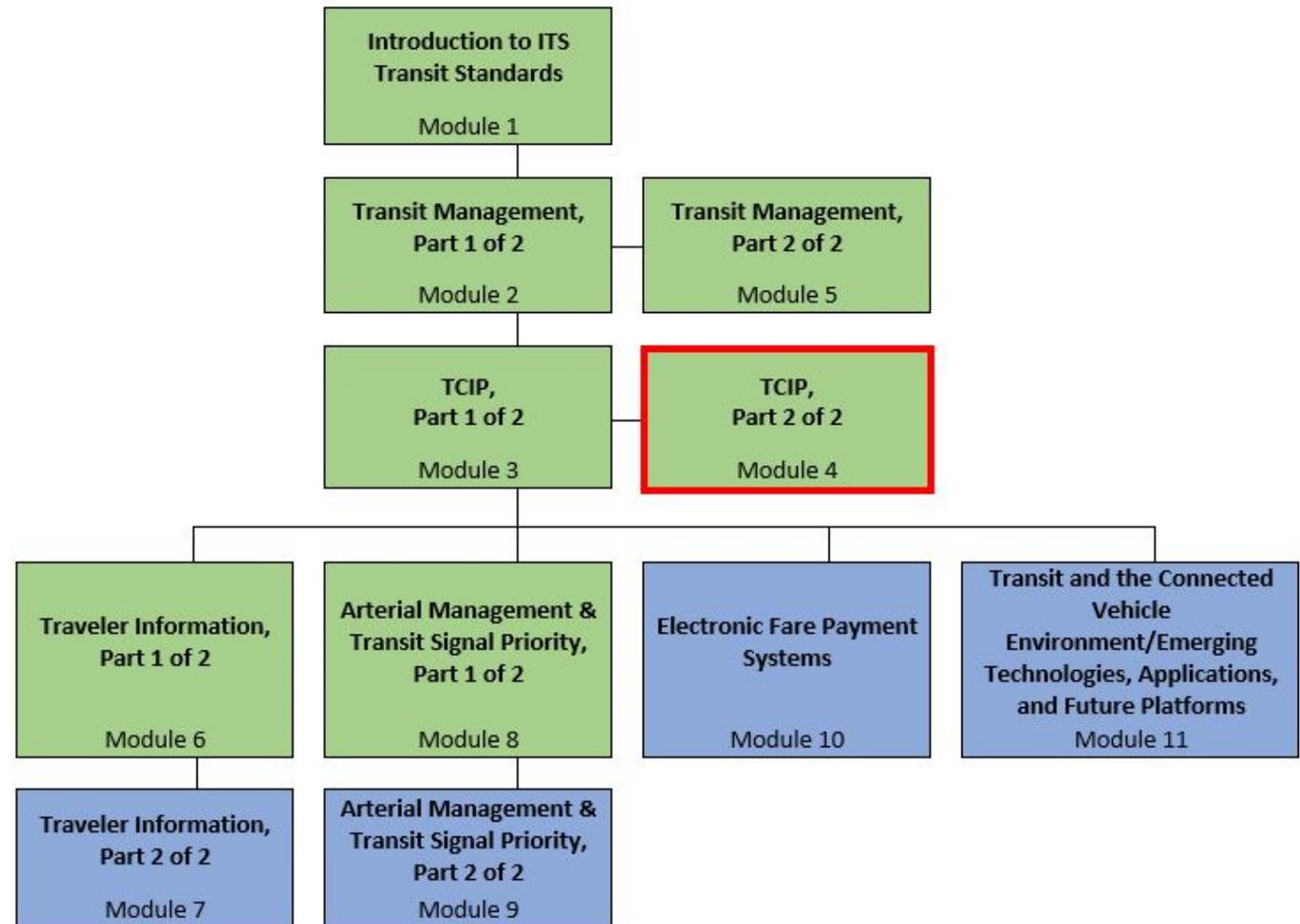
Target Audience

- Transit procurements staff;
- Transit IT staff;
- Metropolitan Planning Organizations (MPO) staff;
- Department of Transportation (DOT)/ITS staff;
- Transit ITS contractors and consultants;
- Transit technology vendors;
- Transit Traveler Information System managers; and
- Traffic Management Center (TMC) / Traffic Operation Center (TOC) managers.

Recommended Prerequisite(s)

	Decision-Maker	Project Manager	Project Engineer
Module 1: Introduction to ITS Transit Standards	N/A	✓	✓
Module 2: Transit Management, Part 1 of 2	N/A	✓	✓
Module 3: Transit Communications Interface Profiles (TCIP), Part 1 of 2	N/A	✓	✓
Module 5: Transit Management, Part 2 of 2	N/A	✓	✓

Curriculum Path (Project Manager)

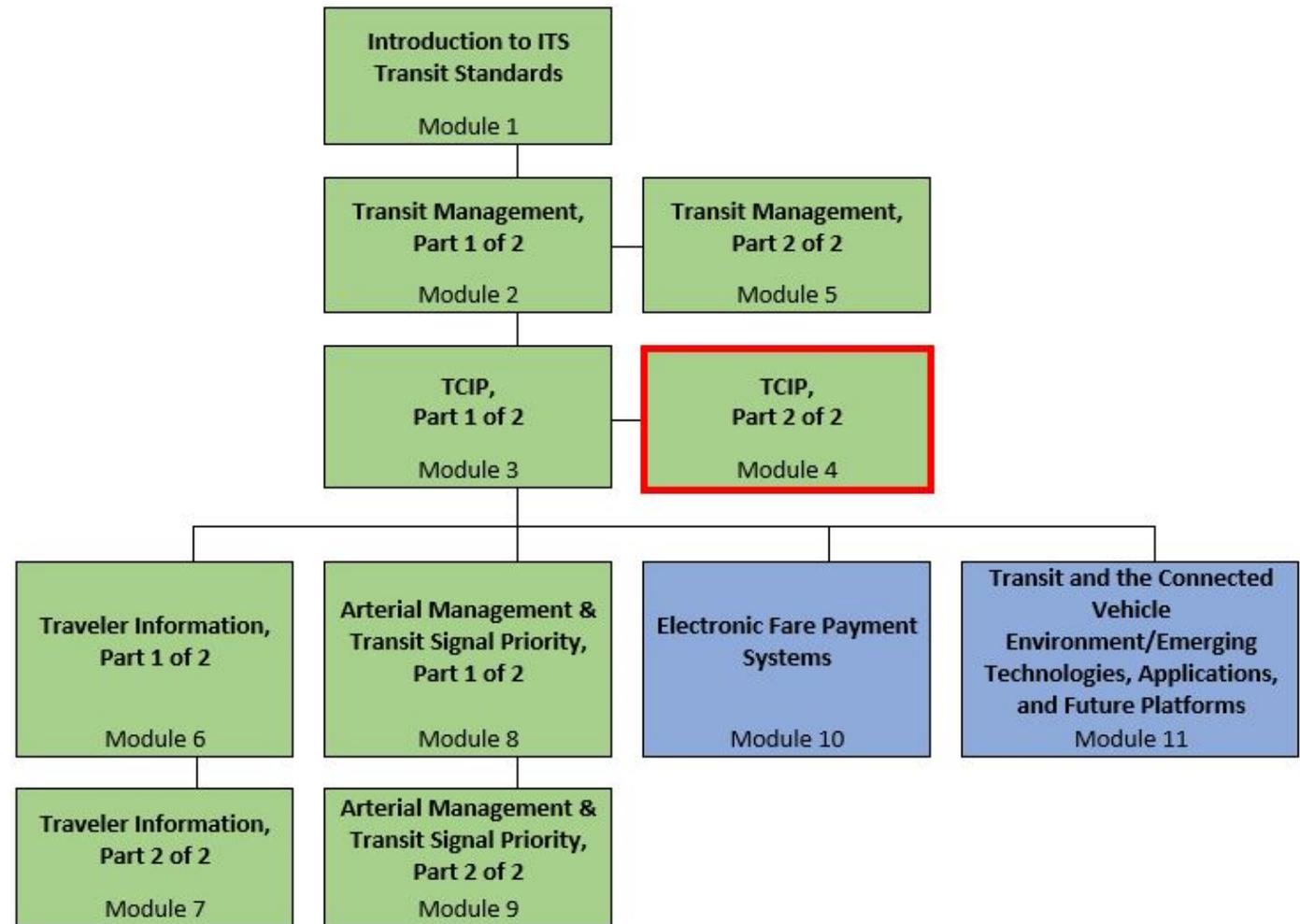


 Recommended Prerequisite Modules

 Optional Modules



Curriculum Path (Project Engineer)



 Recommended Prerequisite Modules

 Optional Modules



Learning Objectives

1. Illustrate the “communications stack” and show how it relates to TCIP.
2. Describe the TCIP Implementation, Requirements and Capabilities Editor (TIRCE) and how it is used as the key to TCIP.
3. Identify and provide examples of data elements, data frames, messages, and dialogs.
4. Describe how data are organized in TCIP data exchanges
5. Define a Profile Requirements List (PRL) and explain how it is used to specify TCIP requirements in a transit ITS project.
6. Articulate and describe the uses of each tool in the TCIP suite of tools.
7. Summarize the range of TCIP applications, implementation tools, and additional training.

Learning Objective #1: Illustrate the “Communications Stack” and Show How It Relates to TCIP

- Communications layers
- TCIP model for data exchange
- File transfer and real time

Open Systems Interconnection (OSI) Model

Open Systems Interconnection (OSI) Model

7. Application Layer – Message Format – TCIP is used in this layer

6. Presentation Layer – Encryption/decryption – XML is used in this layer

5. Session Layer – Manages connection between computers

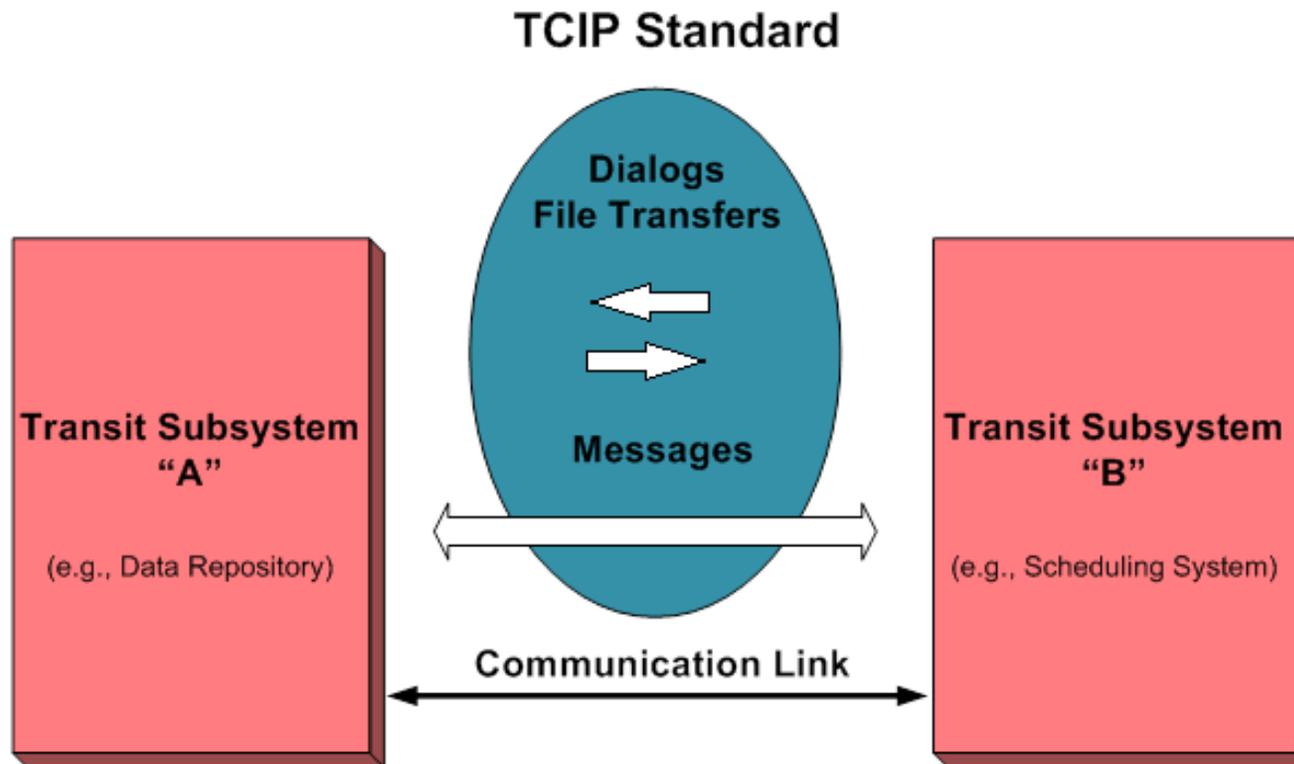
4. Transport Layer – Creates segments or “packets” of data

3. Network Layer – Addressing and routing

2. Data Link Layer – Access to physical layer, error detection

1. Physical Layer – Electrical properties of connection

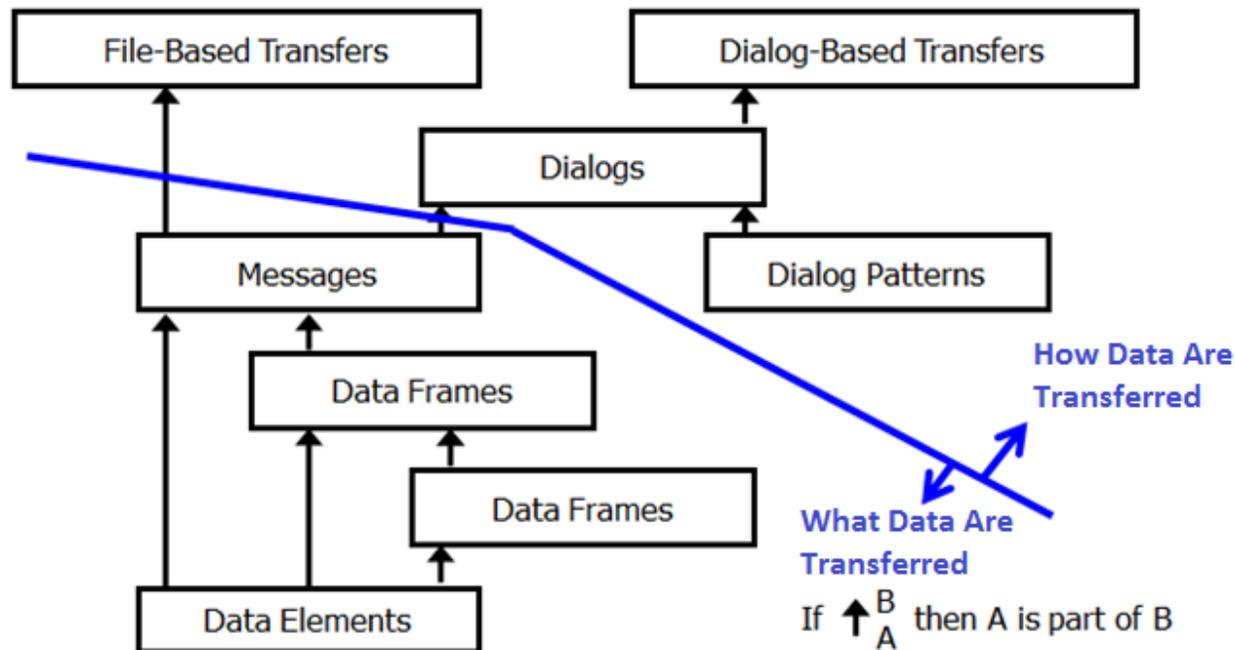
TCIP Model for Data Exchange



TCIP Building Blocks

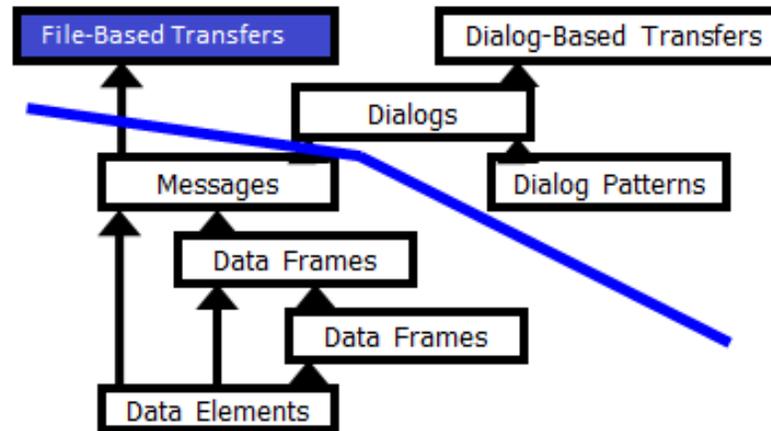
This graphic illustrates the distinction between what data are transferred, which is shown below the blue line; and how the data are transferred, which is shown above the blue line.

TCIP Building Blocks



How Data Are Transferred – File-Based Exchange

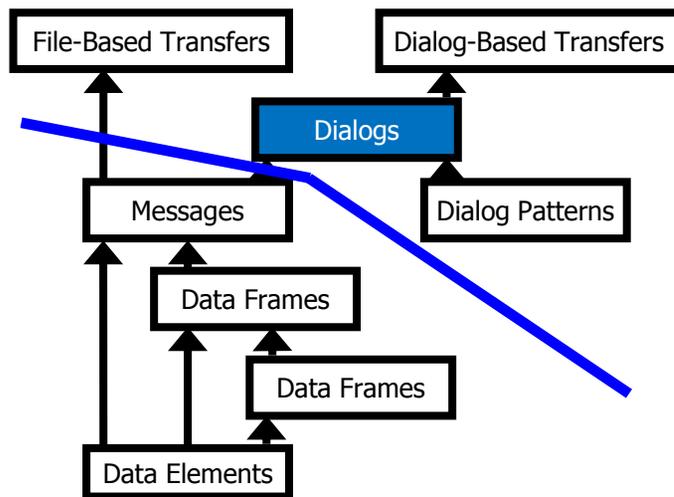
Transfer Data Without the Use of Dialogs in a Non-Real-Time Manner



- Computer application saves data in a file
- File is transferred to another system
- File is loaded and read by another computer application
 - Sometimes involves human interaction
- This interaction requires an agreed-upon description for the files
 - TCIP messages provide this description

Dialogs

Specify the Operational Purpose, Dialog Pattern, Messages, and Other Special Conditions/Constraints



Publication Dialog Definition – Refer to Section 7.1

Dialog Name: Publish Fleet Locations	Business Area: CC
---	----------------------

Dialog Purpose:
Allows a subscriber to obtain PTV locations by subscribing through a single business system (e.g. CAD/AVL) rather than subscribing to each PTV individually.

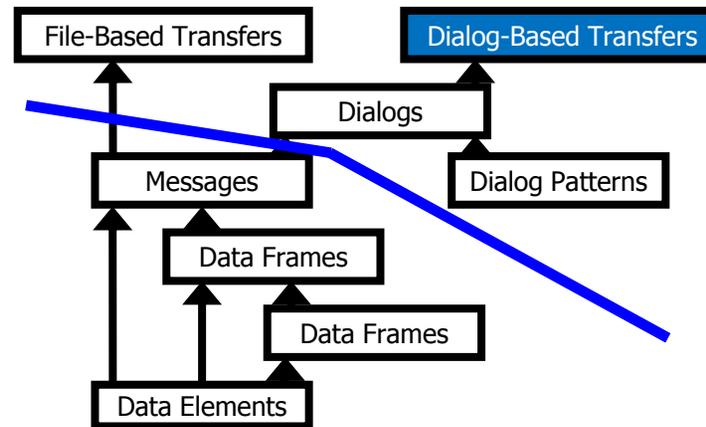
Publication Type: Event

Row Updates Supported: None

Publication Request and Response	Name	Identifier
Messages:	[CcFleetLocationSub]	Cc 2063
Request:	[CcFleetLocation]	Cc 2064
Response:	[CptSubErrorNotice]	Cpt 2000
Error response:		

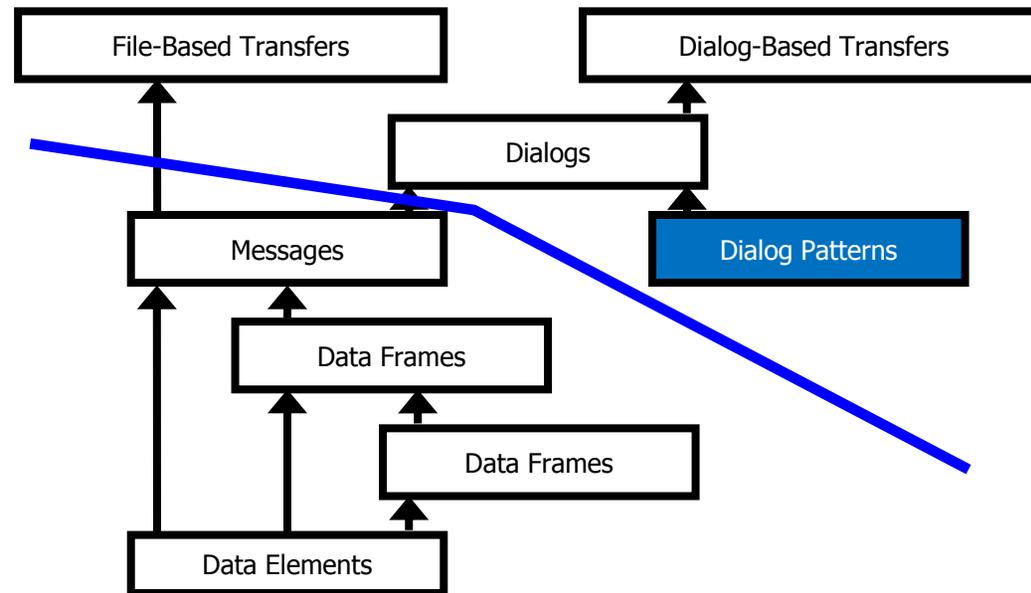
Dialog-Based Transfer

Real-Time Transfer (Machine-to-Machine) Using Dialogs



- Does not define:
 - How data are stored, translated, and manipulated
 - How data are formatted and presented to human users
 - How systems/components trigger or initiate dialogs
 - Details of the interactions with human users

Dialog Patterns



- Defines the sequence of actions for a dialog
- Can be reused for multiple purposes

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Which of the following is defined in a TCIP dialog?

Answer Choices

- a) How data are stored and translated
- b) How data are formatted
- c) How systems present data to human users
- d) How messages are sequenced

Review of Answers



a) How data are stored and translated

Incorrect. Dialogs do not determine how data are stored and translated.



b) How data are formatted

Incorrect. Dialogs do not determine how data are formatted.



c) How systems present data to human users

Incorrect. Dialogs do not determine how data are presented to human users.



d) How messages are sequenced

Correct! Dialogs specify the sequential order of messages.

Summary of Learning Objective #1

Illustrate the “Communications Stack” and Show How It Relates to TCIP

- There are seven layers in the OSI model “communications stack”
- TCIP model for data exchange includes the “what,” which are data elements, data frames, and messages, and the “how,” which are file transfers, dialogs, and dialog patterns
- TCIP can exchange data in both file transfer and real time

Learning Objective #2: Describe the TCIP Implementation, Requirements and Capabilities Editor (TIRCE) and How It Is Used as the Key to TCIP

- Interface specification
- Agency perspective – defining business applications by creating a Profile Requirements List (PRL)
- Vendor perspective – testing product compliance using a Profile Implementation Conformance Statement (PICS)

Interface Specification

Detailed Interface Specifications Are Critical for Success

- Ability to understand (and specify) exactly what information is to be exchanged across the interface (both the “how” and the “what”)
- Minimizes opportunities for agency/vendor technical disconnects
- Provides verification test criteria
- Maintenance and future upgrades

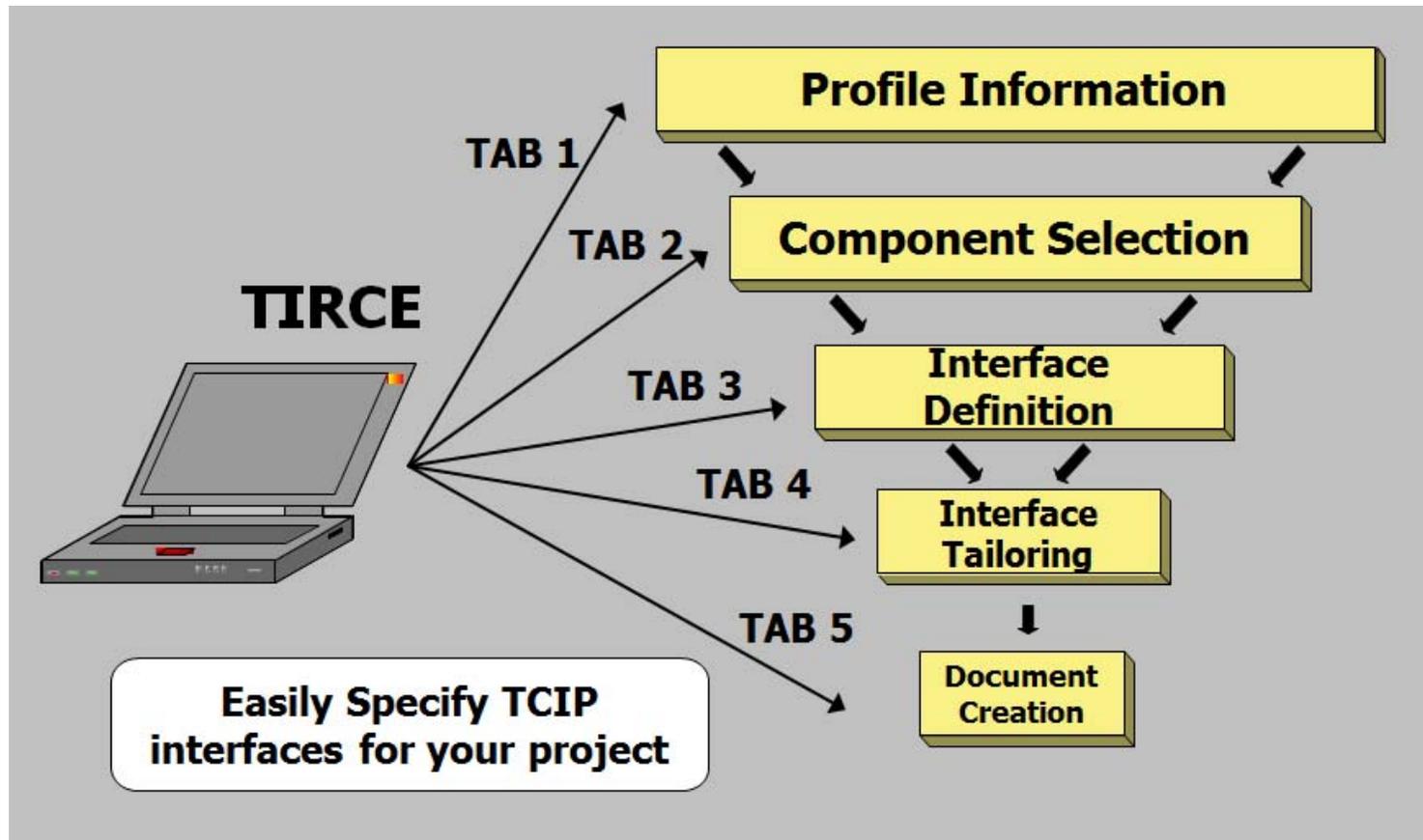
Interface Specification (cont.)

TIRCE – for Interface Specification

- Guides user through a step-by-step process of converting an agency's functional requirements into a TCIP-compliant specification
- A top-down systems engineering approach to defining the data exchange interfaces between transit components
 - Information that will be exchanged
 - Manner in which information is exchanged

Interface Specification (cont.)

The Five Tabs of TIRCE



PRL and PICS

Profile Requirements List (PRL)

Profile Implementation Conformance Statement (PICS)

- PRL and PICS are very similar in structure
 - PRL defines the interface from the agency's perspective
 - PICS defines the interface from the vendor's perspective
- Both define the TCIP dialogs and messages for each interface in the system

TIRCE – Agency Perspective

Profile Requirements List (PRL)

- Generates detailed interface requirements
 - Top-down systems engineering approach
 - Interface requirements embodied in the PRL
- Allows an agency to define a project incrementally over time
- Quickly compare vendor responses to RFP requirements as stated in the PICS

TIRCE – Vendor Perspective

Profile Implementation Conformance Statement (PICS)

- Provides TCIP-compliance “spec-sheet” for vendors’ products (PICS)
- Provides a structured, precise response to interface requirements in a PRL
- Quickly evaluate RFPs against existing product capabilities (Diff)
- Software development support
 - Tailored XML Schema

TIRCE – Agency and Vendor Perspective

- TIRCE includes a Diff function to compare the PRL and PICS

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Which statement best characterizes a Profile Requirements List (PRL)?

Answer Choices

- a) A PRL includes a Diff function
- b) A PRL is developed by the vendor
- c) A PRL specifies the size of the files in the data exchange
- d) A PRL is developed by the agency

Review of Answers



- a) A PRL includes a Diff function

Incorrect. The Diff function is used to compare the PRL and PICS.



- b) A PRL is developed by the vendor

Incorrect. The PRL is developed by the procuring agency.



- c) A PRL specifies the size of the files in the data exchange

Incorrect. The PRL does not specify the size of the files.



- d) A PRL is developed by the agency

Correct! The PRL is developed by the procuring agency.

Summary of Learning Objective #2: Describe the TCIP Implementation, Requirements and Capabilities Editor (TIRCE), and How It Is Used as the Key to TCIP

- **Interface specification:** TIRCE provides detailed specifications and XML schema for interfaces between machines that are exchanging data
- **Agency perspective:** Create a PRL that defines the components to be connected, the interfaces needed, and the dialogs to be implemented to facilitate the data exchange
- **Vendor perspective:** Create a PICS document that allows a vendor's product to be compared with an agency's requirements

Learning Objective #3: Identify and Provide Examples of Data Elements, Data Frames, Messages, and Dialogs

- Data elements
- Data frames
- Messages
- Dialogs
- Dialog patterns

Data Element

- An atomic piece of information related to a person, place, thing, or concept
 - Examples:
 - SCH-TimepointID – a timepoint alphanumeric identifier
 - SCH-TimepointName – a timepoint name
 - LRMS.Latitude – latitude in microdegrees

Data Elements (cont.)

- TCIP Data Types are based on Abstract Syntax Notation (ASN.1)
 - BOOLEAN
 - ENUMERATED
 - INTEGER
 - UTF8String
 - Numeric String
 - OCTET String

- TCIP has extended ASN.1 – created subtypes
 - Integer subtypes
 - Date and Time subtypes
 - String, Name, and Identifier subtypes

Data Frames

- Groupings of data elements and other data frames to describe more complex concepts
- The groupings help organize information to describe or identify objects or concepts in the real world
- Examples:
 - SCHTimepointIden identifies a timepoint
 - Contains the data element with its unique alphanumeric identifier (SCH-TimepointID) and can also contain optional data elements including agency number and name
 - SCHTimepointInfo describes a timepoint
 - Contains its identifier and location

TCIP Messages

- Aggregations of data elements and data frames into a larger, more complex structure
- A complete, understandable, one-way communication that consists of data elements and data frames conveying metadata and information
- For example, CptStoppointList is a message transmitting a list of all stop points

TCIP Message Example “SchTimepointList”

C.319 Message **SchTimepointList** {Sch 2007}

Use:

Provide a specified version of timepoint information

Remarks:

A timepoint may be used in more than one pattern.

An agency may decide to include all timepoints for the agency within a timepoint version, or to limit a version to the timepoints included on a route or group of routes, however all timepoints referenced in a pattern list (SchPatternList message) must be included in the version of the timepoints referenced by that pattern list. The update-thru field that the information provided reflects all updates thru the indicated datetime. This message can be used to convey changes to a timepoint list version since a specified time. In such a case, the update-since field indicates the date/time from which updates are provided. The deleted-timepoints field indicate timepoints deleted from the list since update-begin.

ASN1:

```
SchTimepointList ::= SEQUENCE {
  subscriptionInfo      CPTSubscriptionHeader,
  languages              CPTLanguageList OPTIONAL,
  update-since          CPT-DateTime OPTIONAL,
  timepointVersion      SCH-TimetableVersionID OPTIONAL,
  effective              CPT-DateTime,
  expires                CPT-DateTime OPTIONAL,
  timepoints             SEQUENCE (SIZE(1..10000)) OF SCHTimepointInfo OPTIONAL,
  deleted-timepoints     SEQUENCE (SIZE(1..25000)) OF SCHTimepointIden OPTIONAL
}
```

The following dialogs use this message:

[Publish Timepoint List](#)

TCIP Dialogs

- Dialogs specify:
 - The operational purpose of the exchange of information
 - Dialog pattern
 - Messages included in the dialog
 - Special conditions/constraints
 - Relationships with other dialogs

TCIP Dialog Example: “Publish Timepoint List”

D.147 Dialog Publish Timepoint List

Use:

Allows a subscriber to obtain timepoint information by effective datetime or version number. The subscriber can determine the required timepoint effective date/ version number using the Publish Master Schedule Version dialog.

Remarks:

The dialog may be used to request updates to a timepoint list since a specified date/time if the subscriber has previously obtained the complete timepoint list with the specified effective date or version number.

Dialog Contents

Message	Role	File Transfer
SchTimepointListSub	Request	No
SchTimepointList	Response	Yes
CptSubErrorNotice	ErrorResponse	No

Dialog Row Updates

Message	Field	Data Frame
SchTimepointList	timepoints	SCHTimepointInfo

TCIP Has 11 Types of Dialog Patterns

1. Publication
(query, periodic, and event)
2. Command-Response
3. Report
4. Silent alarm
5. Load
6. Unload
7. Voice radio call
 - Operator-initiated
 - Dispatch-initiated
8. Signal control and prioritization
9. Blind notification
10. Push
11. Traveler service request

TCIP Dialog Patterns 1 - 4

1. Publication (query, periodic, and event)
2. Command-Response
3. Report
4. Silent alarm

TCIP Dialog Patterns 5 - 8

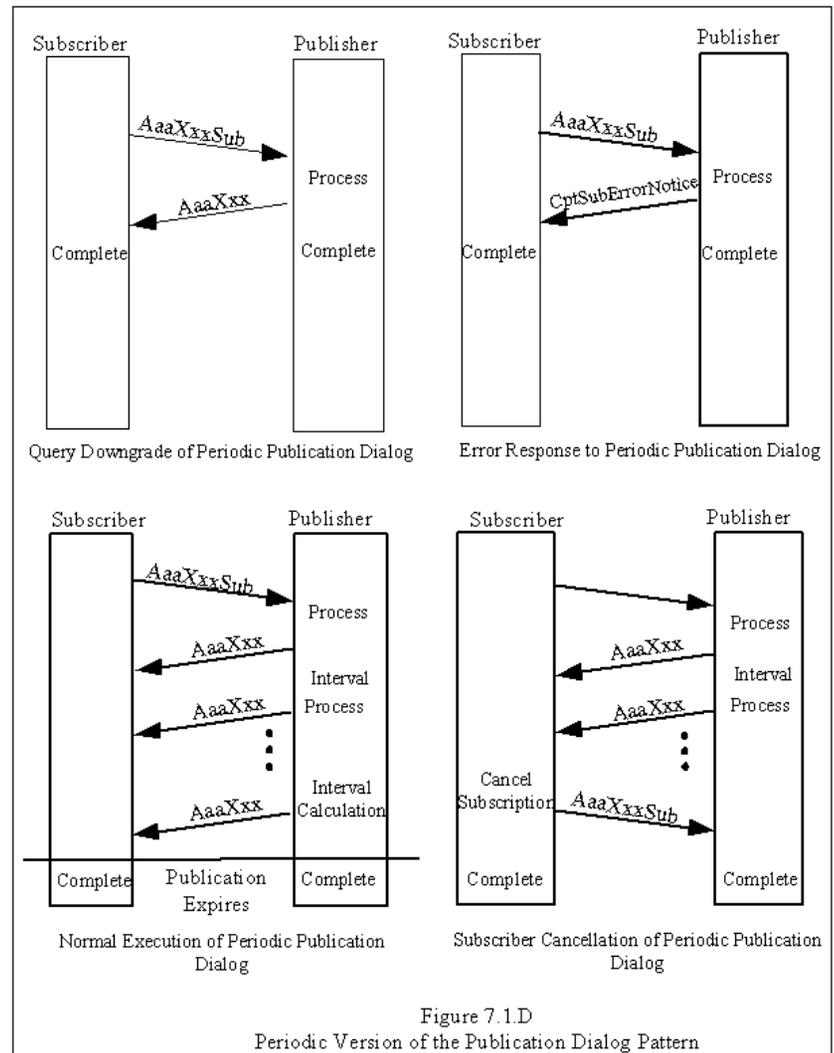
5. Load
6. Unload
7. Voice radio call
 - Operator-initiated
 - Dispatch-initiated
8. Signal control and prioritization

TCIP Dialog Patterns 9 - 11

- 9. Blind notification
- 10. Push
- 11. Traveler service request

TCIP Dialog Pattern Example

Periodic Variations of Publication Dialog



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Which of the following statements about data elements is correct?

Answer Choices

- a) A data element can include a data frame
- b) A data element can only include integers
- c) A data element cannot be used to identify a person
- d) A data element can be used to represent a concept

Review of Answers



- a) A data element can include a data frame

Incorrect. A data frame can include a data element, but a data element cannot include a data frame.



- b) A data element can only include integers

Incorrect. A data element can include several types of ASN.1 representations.



- c) A data element cannot be used to identify a person

Incorrect. A data element can be a person's name or other identifier.



- d) A data element can be used to represent a concept

Correct! A data element can represent a person, place, thing, or concept.

Summary of Learning Objective #3: Identify and Provide Examples of Data Elements, Data Frames, Messages, and Dialogs

- **Data Element:** An atomic piece of information related to a person, place, thing, or concept
- **Data Frame:** Groupings of data elements and other data frames to describe more complex concepts
- **Message:** Aggregations of data elements and data frames into a complete, understandable, one-way communication conveying metadata and information
- **Dialog:** Specified sequence of messages for an operational purpose including any special conditions
- **Dialog Pattern:** Common forms of dialogs that can be used repeatedly for multiple purposes

Learning Objective #4: Describe How Data Are Organized in TCIP Data Exchanges

- TCIP identifiers
- Optional items (fields)
- Versioning
- Row updates
- Applicability
- Local extensions
- Multilanguage support

TCIP Identifiers

- Allow an agency to provide information about items (e.g., bus stop inventory, timepoint inventory) to an application once, and then refer to the item in subsequent messages
 - For example, if we want to associate passenger count information with a bus stop, we can associate it with the identifier, and not send a complete description of the bus stop with each set of passenger counts

TCIP Identifiers (cont.)

TCIP Identifiers

- Allow items to be uniquely identified across all transit agencies in the US
 - Employees
 - Intersections
 - Operator bases
 - Operators
 - Organizational units
 - Shelters
 - Stop points
 - Transfer clusters
 - Transit facilities
 - Vehicles
 - Fare policies
 - Fare zones
 - Trips
 - Incidents
 - Amenities
 - Announcements
 - Geographic zones
 - Service bulletins
 - Travelers
 - Blocks
 - Notes
 - Patterns
 - Pattern segments
 - Routes
 - Runs
 - Timepoints
 - Trains

TCIP Identifiers (cont.)

- TCIP Iden Frames ALWAYS contain:
 - Alphanumeric identifier (e.g., vehicle_id)

- TCIP Iden Frames MAY contain:
 - Optional agency number
 - Optional string designator that uniquely represents the item within the agency (e.g., route_designator)
 - Zero or more optional string name fields for the identified item (e.g., first-name, last-name, VIN)

Optional Items (Fields)

- Support a functional requirement that is not common to all agencies (e.g., an announcement can be text, audio, or both)
- Support a capability that is only required in certain contexts (e.g., a warning in a message)
- Convey information that may or may not be available (e.g., photographs of a stoppoint)

Annex B.79 Data Frame: CPTStoppointIden {CPT 1016}

Use: Uniquely identify a stoppoint whether in a single, or multi agency environment.

ASN.1 Representation:

```
CPTStoppointIden ::= SEQUENCE{
  stoppoint-id      CPT-StoppointID,
  agency-id         CPT-AgencyID          OPTIONAL,
  name              CPT-StoppointName     OPTIONAL,
  nameLangs        CPTAdditionalLanguageContents  OPTIONAL,
  designator        CPT-StoppointDesignator  OPTIONAL,
  designatorLangs  CPTAdditionalLanguageContents  OPTIONAL,
  agencydesignator  CPT-AgencyDesignator  OPTIONAL,
  agencydesignatorLangs CPTAdditionalLanguageContents  OPTIONAL
}
```

Versioning

- Data items in TCIP need to be updated from time to time
- TCIP's primary means of tracking versions of these items is by updating the effective date-time
- Some TCIP data items also have optional integer-based version numbers to provide backward compatibility with legacy business systems

ASN.1 Representation:

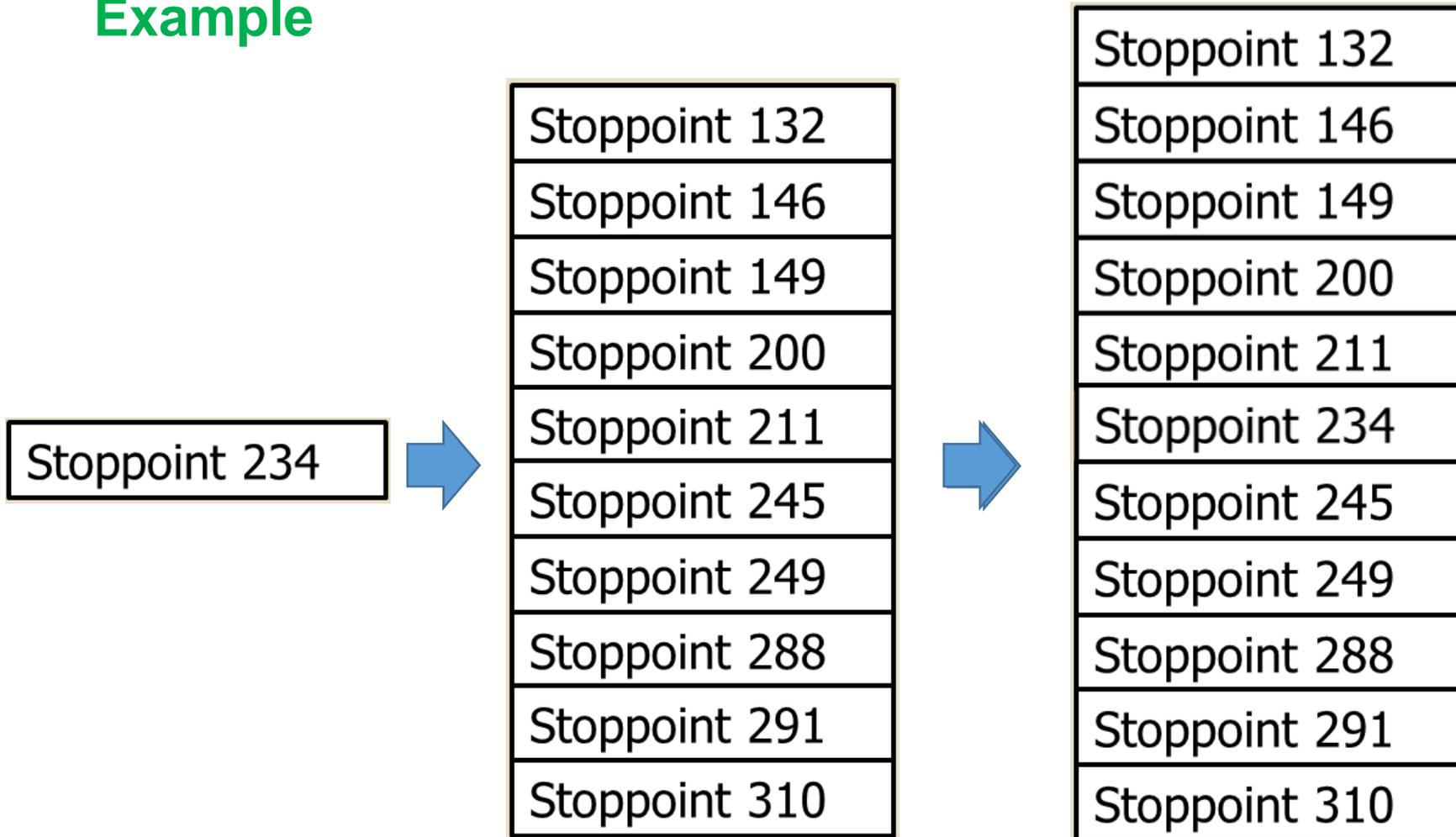
```
SchPatternList ::= SEQUENCE {
    subscriptionInfo      CPTSubscriptionHeader,
    languages             CPTLanguageList          OPTIONAL,
    patternVersion       SCH-TimetableVersionID      OPTIONAL,
    effective            CPT-DateTime,
    update-since        CPT-DateTime          OPTIONAL,
    update-thru         CPT-DateTime,
    stoppointVersion    CPT-StoppointVersion         OPTIONAL,
    stoppointEffective  CPT-DateTime,
    timepointVersion    SCH-TimetableVersionID      OPTIONAL,
    timepointEffective  CPT-DateTime,
```

Row Updates

- Many TCIP messages provide lists of items that can be lengthy
 - Bus stops
 - Timepoints
 - Employees
 - Vehicles
- Row updates allow changes to be sent to previously provided lists

Row Updates

Example

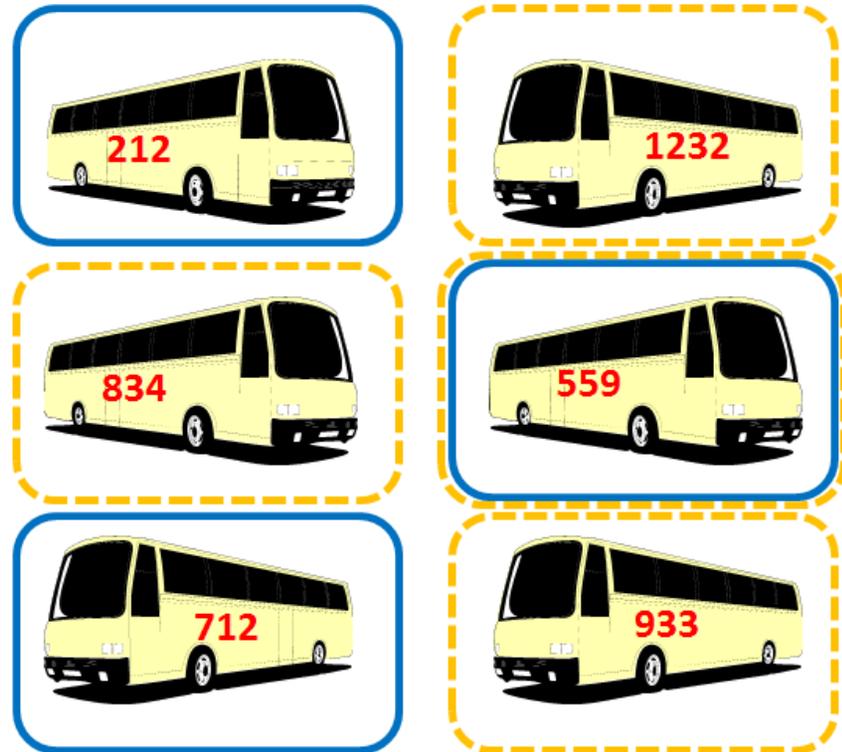


Row Updates (cont.)

- A message requesting row updates includes a field indicating the date-time when changes are requested
- A message providing row updates contains a field indicating the date-time that changes are provided
- A row update message may contain rows to be added, rows that replace old rows, or rows to be deleted

Applicability

- A TCIP message may contain an Applicability Field indicating the scope of the information requested or provided by that message
- Applicability Field (if present) usually occurs in the message application header



Affected by
brake recall

Wirelessly
load maps

Local Extensions – Two Types

Type 1 – Code Extension

- Adds a value to a specified enumerated list of values
 - Data Element: SCH-ServiceType {SCH-41}
 - Describes the type of transit service provided
 - Local use example:
 - BayFerryConnector (128) – ongoing service
 - SuperBowl (129) – one time event

Local Extensions (cont.)

Type 1 – Code Extension

Local Extensions – Type 1

```

SCH-ServiceType ::= ENUMERATED {
regular      (1), -- Regular,
express     (2), -- Express,
circular    (3), -- Circular,
radial      (4), -- Radial,
feeder      (5), -- Feeder,
jitney      (6), -- Jitney,
limited      (7), -- Limited,
nonRevenue  (8), -- Non-revenue,
unknown     (9), -- Unknown,
charter     (10), -- Charter Service,
school      (11), -- School Service,
special     (12), -- Special Service,
operatorTraining (13), -- Operator Training,
maintenance (14), -- Maintenance Service,
noService   (15), -- No Service,
standBy     (16), -- Stand-by,
extra       (17), -- Extra,
-- 18-127 reserved
-- 128-255 local use
... -- # LOCAL_CONTENT
}

```

Local Extensions (cont.)

Type 2 – Frame/Message Extension

Type 2 - Frame/message extensions – add locally specified data to the sequence Data Frame: CCBlockWorkRecord

- Describe events related to work done by a PTV

```
CCBlockWorkRecord ::= SEQUENCE {
block          SCHBlockIden,
begin-time     CPT-DateTime          OPTIONAL,
end-time       CPT-DateTime          OPTIONAL,
timepoints     SEQUENCE (SIZE(1..15000)) OF CCTimepointHistory  OPTIONAL,
stoppoints     SEQUENCE (SIZE(1..15000)) OF OBStoppointRecord    OPTIONAL,
deviations     SEQUENCE (SIZE(1..1000)) OF CCRouteDeviationRecord  OPTIONAL,
passenger-miles CC-PassengerMiles   OPTIONAL,
... -- # LOCAL_CONTENT
}
```

- Local use example:

```
dailySamples  SEQUENCE(SIZE(1..1000)) OF ABCAirQualitySample  OPTIONAL
```

Multilanguage Support

- TCIP can support multiple languages, beginning with TCIP version 3.0.4
- Languages are specified using ISO 639 codes
- “CPTLanguageList” data frame specifies the default and additional languages
 - Optional item
 - Where string content appears in a message, “CPTAdditionalLanguageContent” data frames provide the information in the additional languages

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Which statement best characterizes a TCIP identifier?

Answer Choices

- a) Uses a shorthand code to represent an item
- b) Identifies a TCIP-generated message
- c) Identifies a unique data frame
- d) Always includes a string designator to identify an item

Review of Answers



- a) Uses a shorthand code to represent an item

Correct! A TCIP identifier can be used to represent an item that may have a longer description.



- b) Identifies a TCIP-generated message

Incorrect. A TCIP identifier represents items in the real world, not TCIP elements.



- c) Identifies a unique data frame

Incorrect. A TCIP identifier would not be used to represent a TCIP data frame. An identifier is a data element.



- d) Always includes a string designator to identify an item

Incorrect. String designators are optional types of identifiers; alpha-numeric identifiers are mandatory.

Summary of Learning Objective #4: Describe How Data Are Organized in TCIP Data Exchanges

TCIP Provides a Way To:

- Create unique identifiers for information across all transit agencies
- Identify version of information provided
- Incrementally update large data sets
- Define and use groups of items/entities
- Include locally defined data in TCIP messages

Learning Objective #5: Define a Profile Requirements List (PRL) and Explain How It Is Used to Specify TCIP Requirements in a Transit ITS Project

- Profile Information
- Component selection
- Interface definition
- Interface tailoring
- Document creation

Profile Information

TIRCE 3.0.8 - Project PRL

0%

Step 1 - Profile Information | Step 2 - Component Selection | Step 3 - Interface Definition | Step 4 - Interface Tailoring | Step 5 - Document Creation

Please enter your project information below.
If you are unsure what to enter, hover your cursor over the field for details.

Project Name:

Agency/Company Name:

Agency/Company ID:

Agency Model:

Will languages other than English be used? Yes No

Will agency-defined applicability groups be used? Yes No (Answer "Yes" if unsure)

TCIP Version: 3.0.6

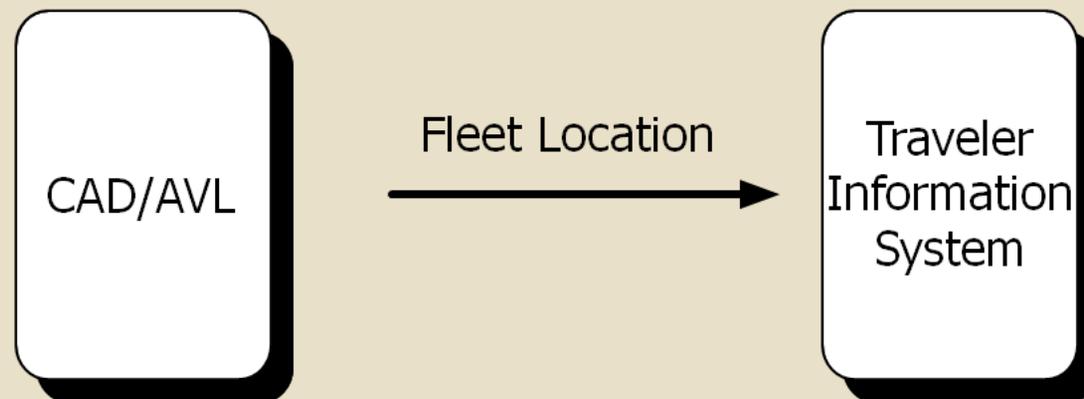
Next >>

Exit | Open | Save | Diagram

TIRCE Example – Component Selection

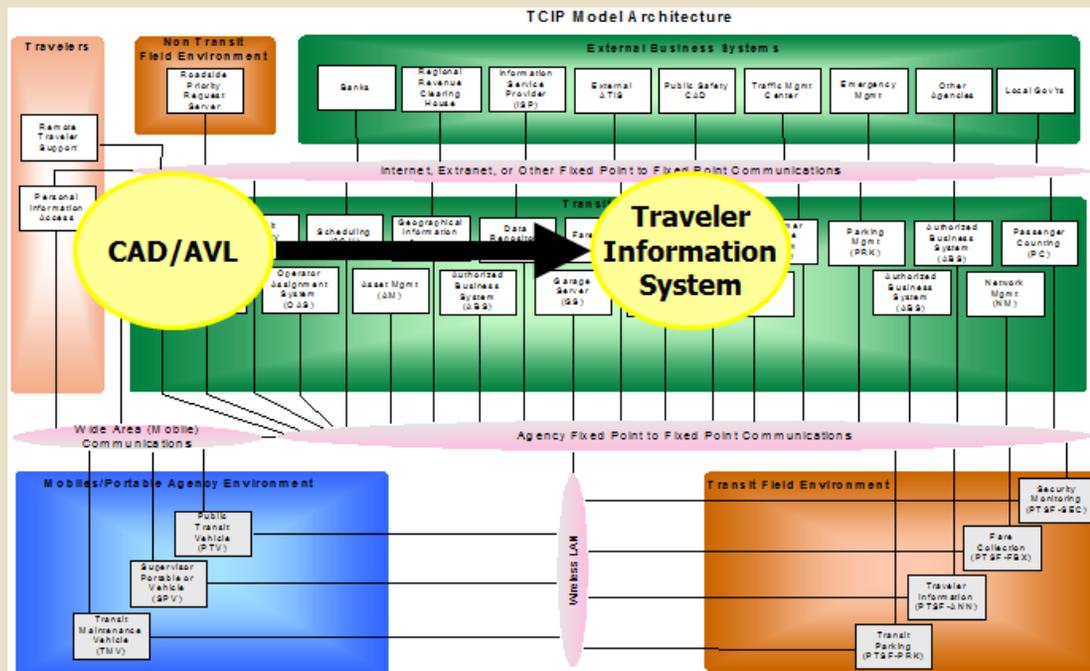
TIRCE Example

- Transferring fleet location information between a CAD/AVL system and a Traveler Information System



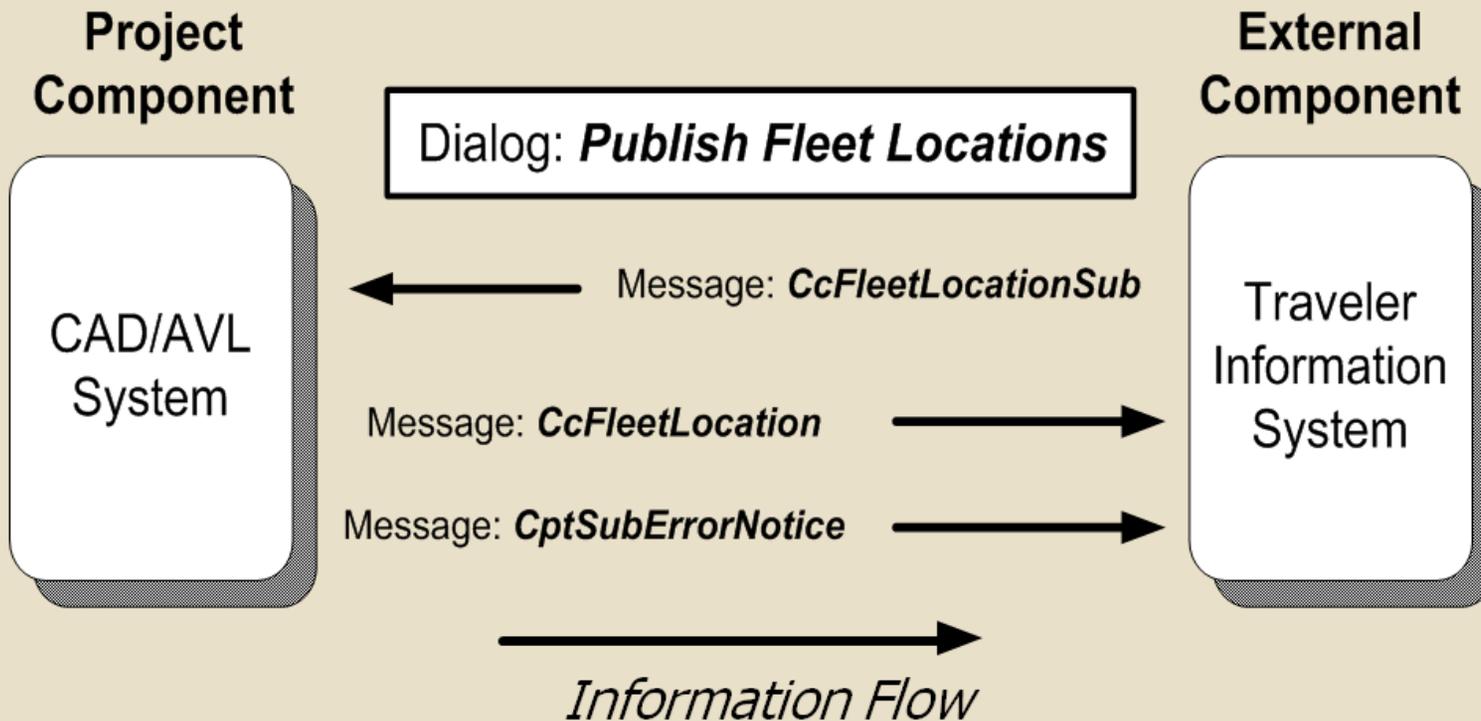
TIRCE Example – Component Selection

Fleet Location Transfer Example



TIRCE Example – Interface Definition and Tailoring

Fleet Location Example



TIRCE Example – Document Creation

Profile Requirements List (PRL) Cover Sheet			
Project Name: abc			
Creation Date: August 17, 2014			
Agency/Company Name: abc			
Agency ID:			
Agency Model: Unknown			
Project Component(s): Computer Aided Dispatch/Automatic Vehicle Location			
External Component(s): Traveler Information System			
Profile Requirements List (PRL)			
Project Name: abc			
Agency/Company Name: abc	Agency ID:	Agency Model: Unknown	
Project Component:	IP/Network Address:	Port/Transport Address:	
Computer Aided Dispatch/Automatic Vehicle Location	CAD_AVL	CAD_AVL_PORT	
External Component:	IP/Network Address:	Port/Transport Address:	
Traveler Information System	TIS	TIS_PORT	
Non TCIP Interfaces Supported:			
Exceptions to TCIP Requirements:			
Conformance Class 1A: Supported Dialogs			
Project Component: Computer Aided Dispatch/Automatic Vehicle Location			
External Component: Traveler Information System			
Dialog Name	Role	TCIP Version	PRL Annex
Publish Fleet Locations	Publisher	3.0.6	1A.1
Conformance Class 2A: TCIP Message Files Accepted			
Project Component: Computer Aided Dispatch/Automatic Vehicle Location			
External Component: Traveler Information System			
File Attributes & Limitations:			

Example of XML-Encoded TCIP Message Produced by TIRCE for a PRL

```
| version="1.0" encoding="UTF-8"?>
ccLocationReport sourceport="62627" sourceip="192.168.0.65" created="2013-04-24T17:17:29.960Z" sourcea
_Final_3_0_4.xsd" xmlns:local="http://www.tcip-3-0-4-local" xmlns:tcip="http://www.TCIP-Final-3-0-4"
:xsi="http://www.w3.org/2001/XMLSchema-instance">
request-id>4001</request-id>
status-info>3</status-info>
time-reported>2016-01-07T13:10:23</time-reported>
latitude>31000000</latitude>
longitude>-89000000</longitude>
- <direction>
  <deg>90</deg>
  <rad>0</rad>
  <cdeg>0</cdeg>
</direction>
  <speed>50</speed>
</tcip:ccLocationReport>
```

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Which of the following is not included in the preparation of a Profile Requirements List (PRL)?

Answer Choices

- a) Profile information
- b) Component selection
- c) Vendor conformance
- d) Interface tailoring

Review of Answers



a) Profile information

Incorrect. Profile information is included in a PRL.



b) Component selection

Incorrect. Component selection is included in a PRL.



c) Vendor conformance

Correct! Vendor conformance is not included in preparing a PRL. The DIFF function would be used.



d) Interface tailoring

Incorrect. Interface tailoring is used in preparation of a PRL.

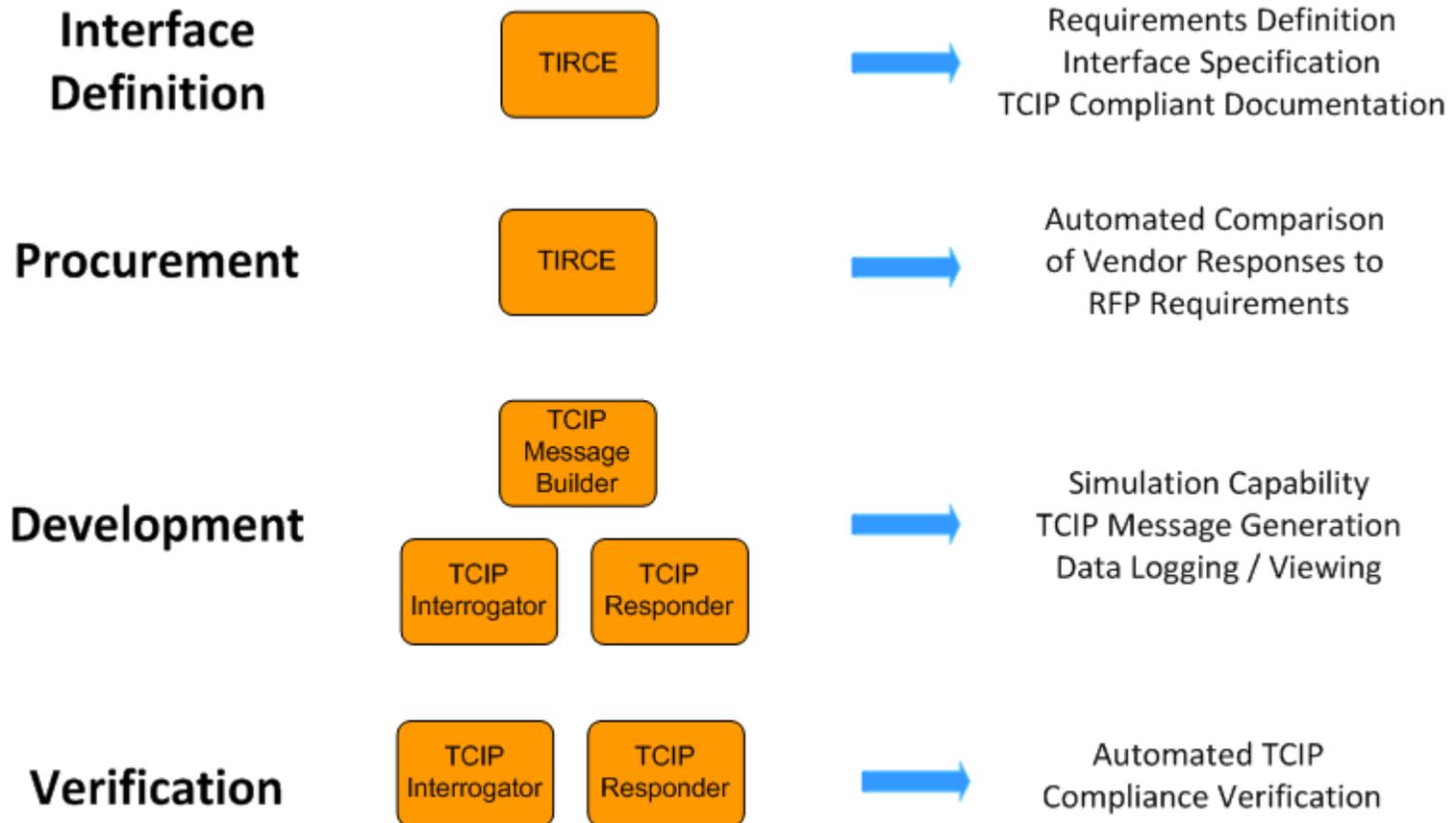
Summary of Learning Objective #5: Define a Profile Requirements List (PRL) and Explain How It Is Used to Specify TCIP Requirements in a Transit ITS Project

- Profile information includes entering data to describe the project and identify the agency developing the profile
- Component selection involves choosing the subsystems that will exchange data
- Interface definition involves selecting the file transfers and dialogs
- Tailoring involves selecting specific messages to be exchanged
- Document creation involves producing the Profile Requirements List (PRL) specifications and XML schema

Learning Objective #6: Articulate and Describe the Uses of Each Tool in the TCIP Suite of Tools

- Interface Definition – TIRCE
- Procurement –TIRCE
- Development – Message Builder, Interrogator, Responder
- Verification – Interrogator, Responder

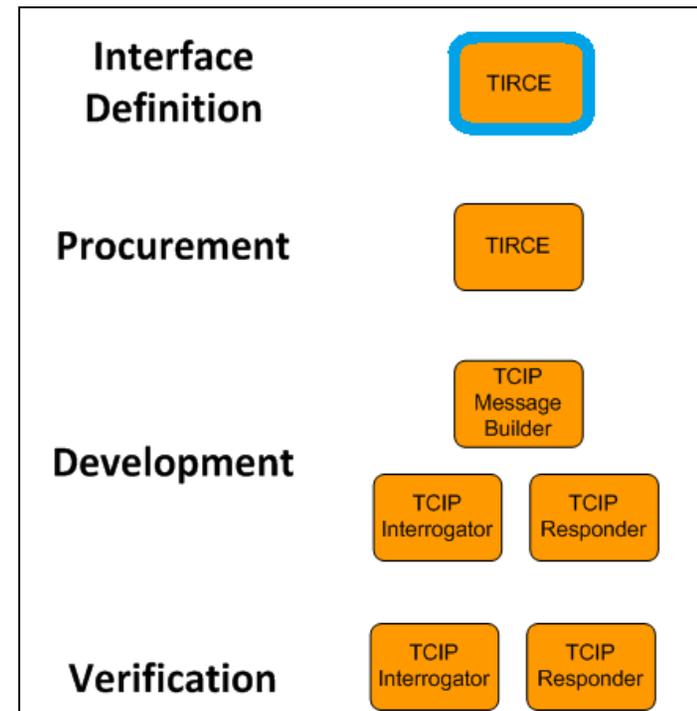
TCIP Tool Suite



Uses of TCIP Tools: Interface Definition – TIRCE

TIRCE Allows a User to Specify an Interface in Five Steps

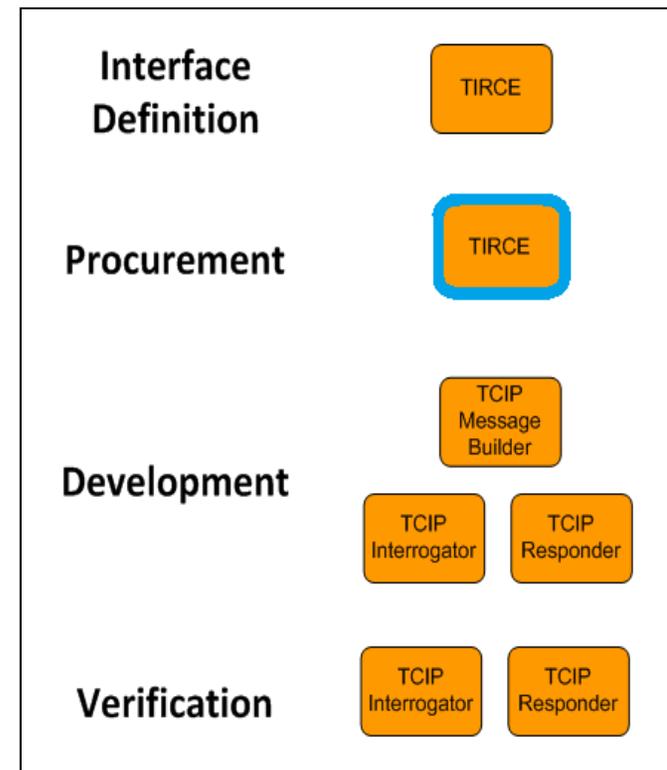
- Specify profile information
- Select components
- Define interfaces
- Tailor interfaces
- Produce documents



Uses of TCIP Tools: Procurement – TIRCE

TIRCE Produces Two Key Documents to Facilitate ITS Procurements

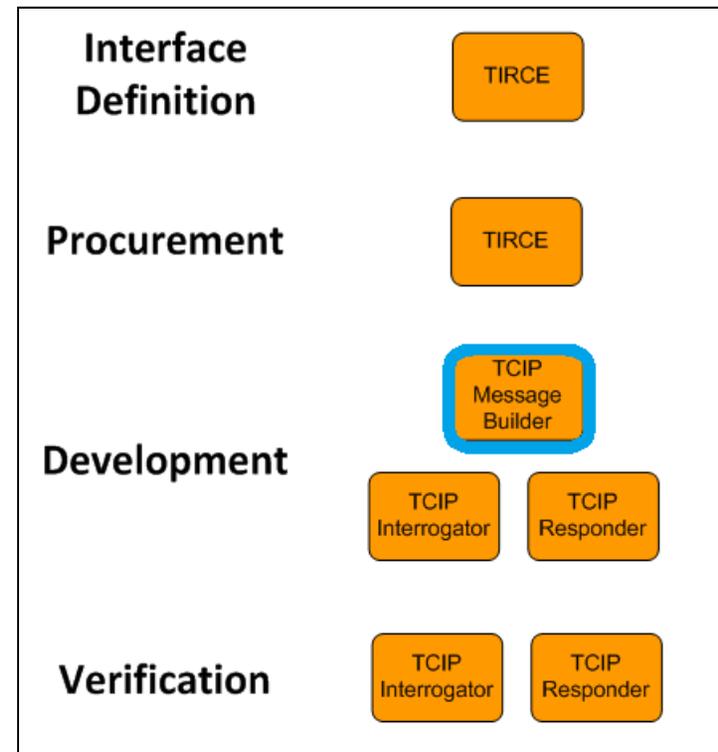
- Profile Requirements List (PRL)
- Profile Implementation Conformance Statement (PICS)
- TIRCE provides a Diff function:
 - To compare agency requirements (PRL)
 - With vendor product specifications (PICS)



Uses of TCIP Tools – Development

TCIP Message Builder

- Enables user to generate XML-encoded TCIP messages
- Messages are used by the TCIP Test Console applications
- Load / save / view / edit TCIP messages



TCIP Message Builder – Example

Enter Message Data for File: CcFleetLocation

Message: CcFleetLocation

Enter data for each field in the form below:

Name	Type
subscriptionInfo	CPTSubscriptionHeader
requestedType	CPT-SubscriptionType
expirationDate	CPT-Date
expirationTime	CPT-Time
reportInterval	CPT-Duration
requestIdentifier	CPT-RequestIdentifier
subscriberIdentifier	CPT-ApplicationIdentifier
publisherIdentifier	CPT-ApplicationIdentifier
locations	CCPTVLocation
vehicle	CPTVehicleIdentifier
vehicle-id	CPT-VehicleID
vin	CPT-VIN
name	CPT-VehicleName
designator	CPT-VehicleDesignator
date-time	CPT-DateTime
loc-lat	Irms:Latitude

subscriptionInfo - CPTSubscriptionHeader

requestedType CPT-SubscriptionType

expirationDate CPT-Date

expirationTime CPT-Time

reportInterval CPT-Duration

requestIdentifier CPT-RequestIdentifier

subscriberIdentifier CPT-ApplicationIdentifier

publisherIdentifier CPT-ApplicationIdentifier

locations - CCPTVLocation - 25000

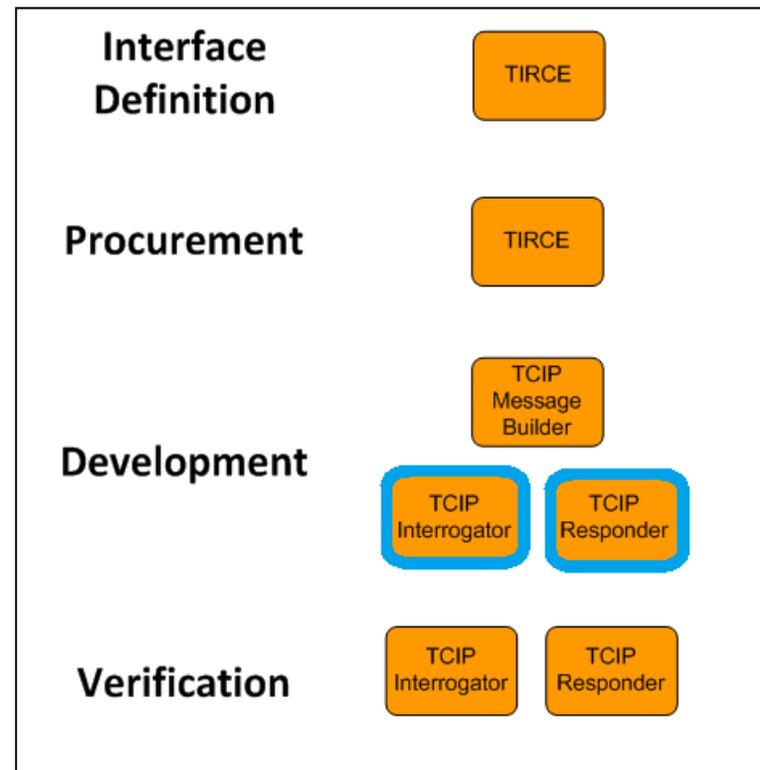
	vehicle (F)	date-time	loc-lat
1			

Buttons: Help, Save, Close

Uses of TCIP Tools – Verification

TCIP Test Console

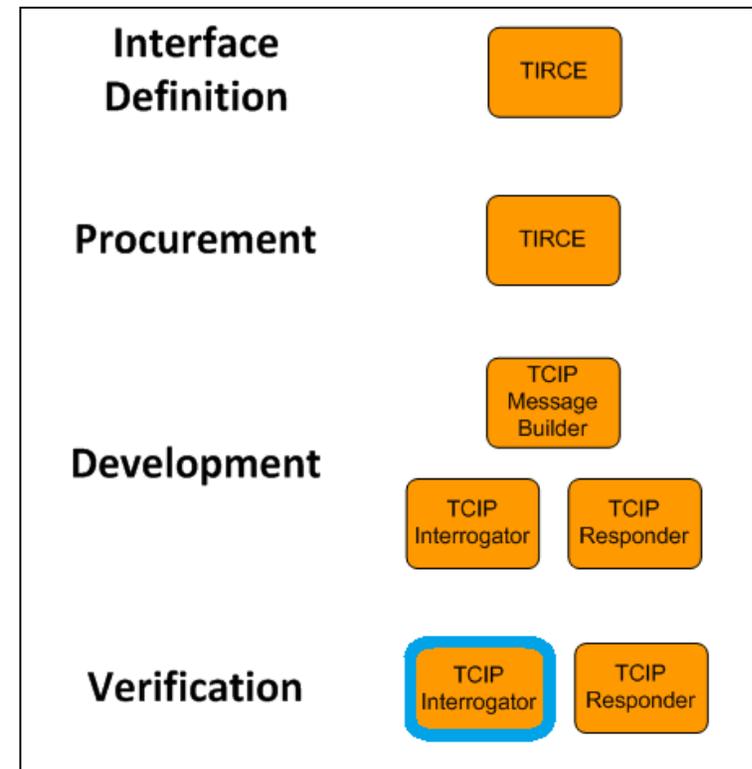
- Provides capability to simulate one, or both, ends of a TCIP interface
- Consists of two functions:
 - TCIP Interrogator → requests TCIP data
 - TCIP Responder → supplies TCIP data



Uses of TCIP Tools – Verification (cont.)

TCIP Interrogator

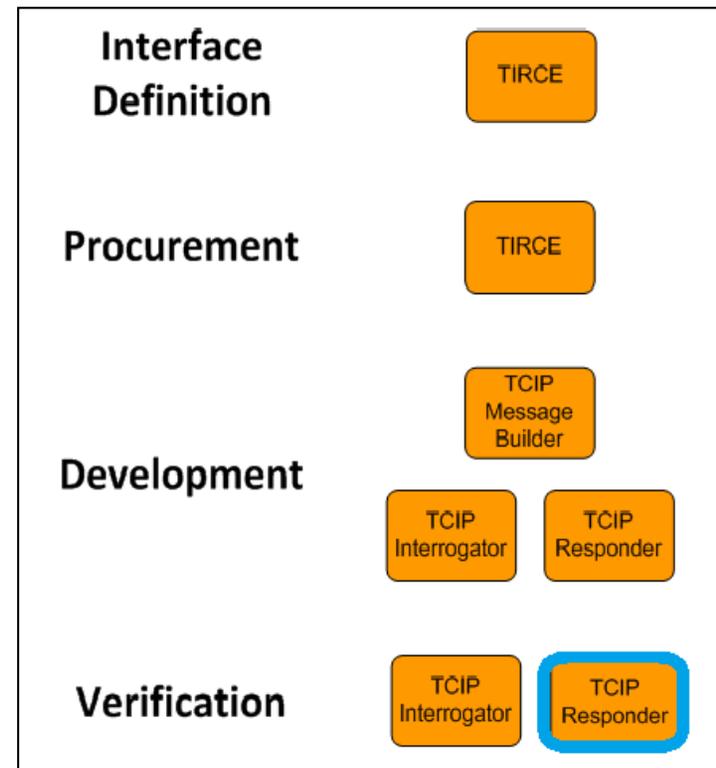
- Simulates a TCIP-compliant device
 - Client side of interface
 - Subscribes to a provider (publisher) of TCIP data
- Establishes a TCIP communications link with a TCIP device under development or test
- Transmits/receives TCIP messages
- View/log TCIP messages
- Automated TCIP message verification



Uses of TCIP Tools – Verification (cont.)

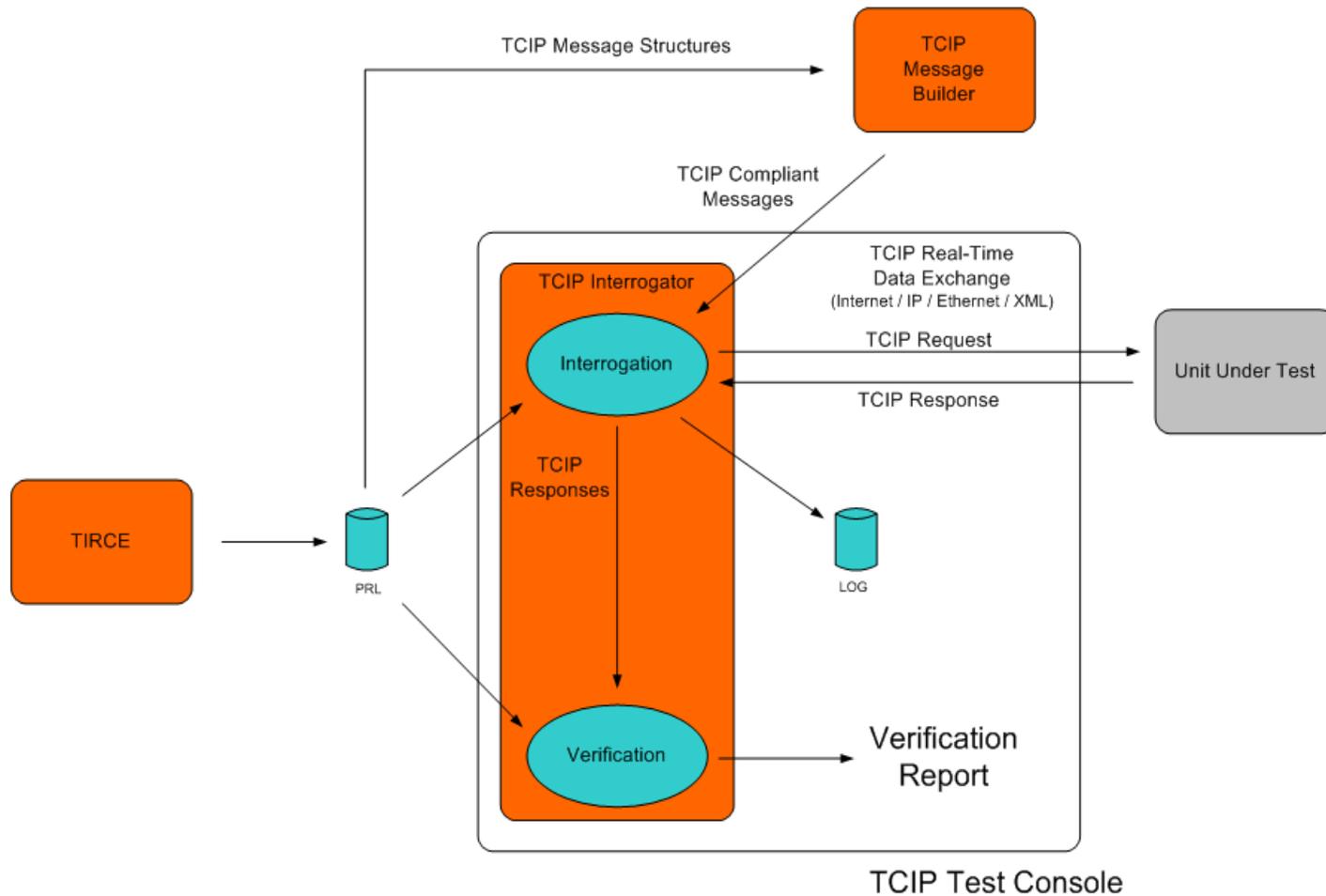
TCIP Responder

- Simulates a TCIP-compliant device
 - Server side of interface
 - Provides TCIP data upon receipt of a subscription request
- Data are preloaded
 - Previously created (via TCIP Message Builder) or recorded TCIP messages



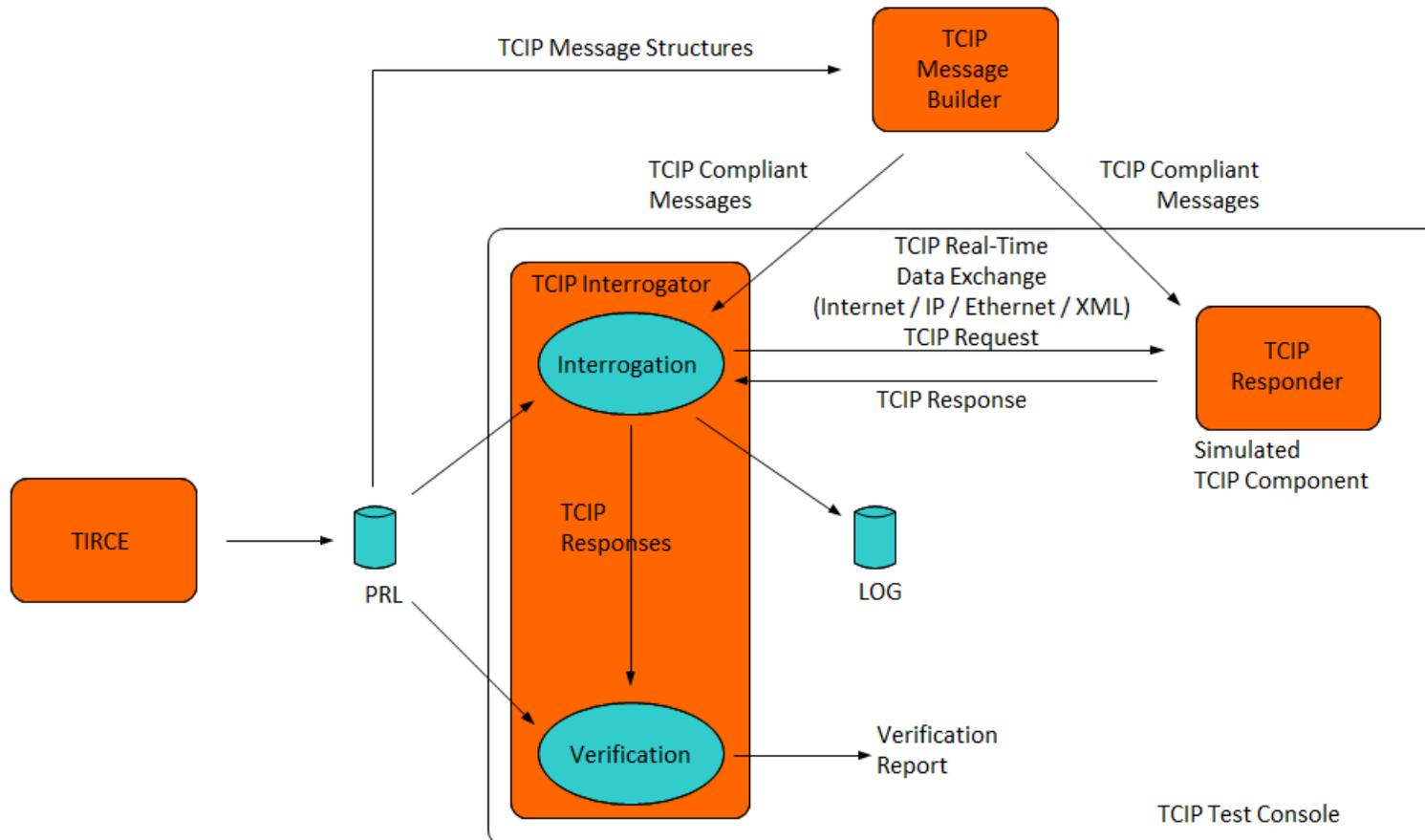
TCIP Tool Suite – Test Console

Testing a Component



TCIP Tool Suite – Test Console

Testing a Simulated Component



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Which of the following statements about the underlined TCIP tool function is FALSE?

Answer Choices

- a) Interrogator simulates a client component requesting data
- b) Responder simulates a server providing data
- c) Test Console corrects errors in XML schema
- d) TIRCE (Diff function) compares a PICS with a PRL

Review of Answers



a) Interrogator simulates a client component requesting data

Incorrect. This statement is true.



b) Responder simulates a server providing data

Incorrect. This statement is true.



c) Test Console corrects errors in XML schema

Correct! This statement is false. The test console does not correct XML errors.



d) TIRCE (Diff function) compares a PICS with a PRL

Incorrect. This statement is true.

Summary of Learning Objective #6: Articulate and Describe the Uses of Each Tool in the TCIP Suite of Tools

- TCIP Implementation, Requirements and Capabilities Editor (TIRCE) can be used to specify interfaces between components
- TIRCE also can be used to prepare procurement documents representing the agency view, Profile Requirements List (PRL), and vendor's view, Profile Implementation Conformance Statement (PICS)
- TCIP Message Builder can be used to construct TCIP-compliant messages using XML. Messages can be saved, viewed, and edited.
- TCIP Test Console can simulate one or both ends of a TCIP interface. It includes an interrogator, which simulates the client side of the data exchange, and a responder to simulate the server side of the data exchange

Learning Objective #7: Summarize the Range of TCIP Applications, Implementation Tools, and Additional Training

- Non-normative TCIP content – model architecture and concept of operations
- Normative TCIP content – building blocks, data elements to dialogs
- Implementation tools
- Examples of TCIP implementation at transit agencies
- Overview of National Transit Institute (NTI) on-site training for TCIP

Non-Normative TCIP Content – Model Architecture and Concept of Operations

- TCIP contains non-normative material that has not been balloted but is useful as context for applying the standard. The following items are non-normative:
 - TCIP Model Architecture
 - TCIP Concept of Operations

Non-Normative TCIP Content – Model Architecture and Concept of Operations (cont.)

Where do I find it?

- American Public Transportation Association (APTA)
 - Transit Communications Interface Profiles (TCIP) Standard Development Program
 - APTA-TCIP-S-01 4.0 Volume I

How do I get it?

- Download FREE from:
 - <http://www.aptatcip.com/APTA-TCIP-S-01%204.0.htm>

Normative TCIP Content – Building Blocks, Data Elements to Dialogs

Where do I find it?

- TCIP 4.0 Volume I - Basis for conformance
- TCIP 4.0 Volume II - Data and Dialog Definitions
 - Annex A - TCIP Data Elements
 - Annex B - TCIP Data Frames
 - Annex C - TCIP Messages
 - Annex D - TCIP Dialogs
- TCIP 4.0 Volume III - TCIP XML Schema
 - Annex E – TCIP XML Schema

TCIP Implementation Tools

- TIRCE
- Message Builder
- Test Console

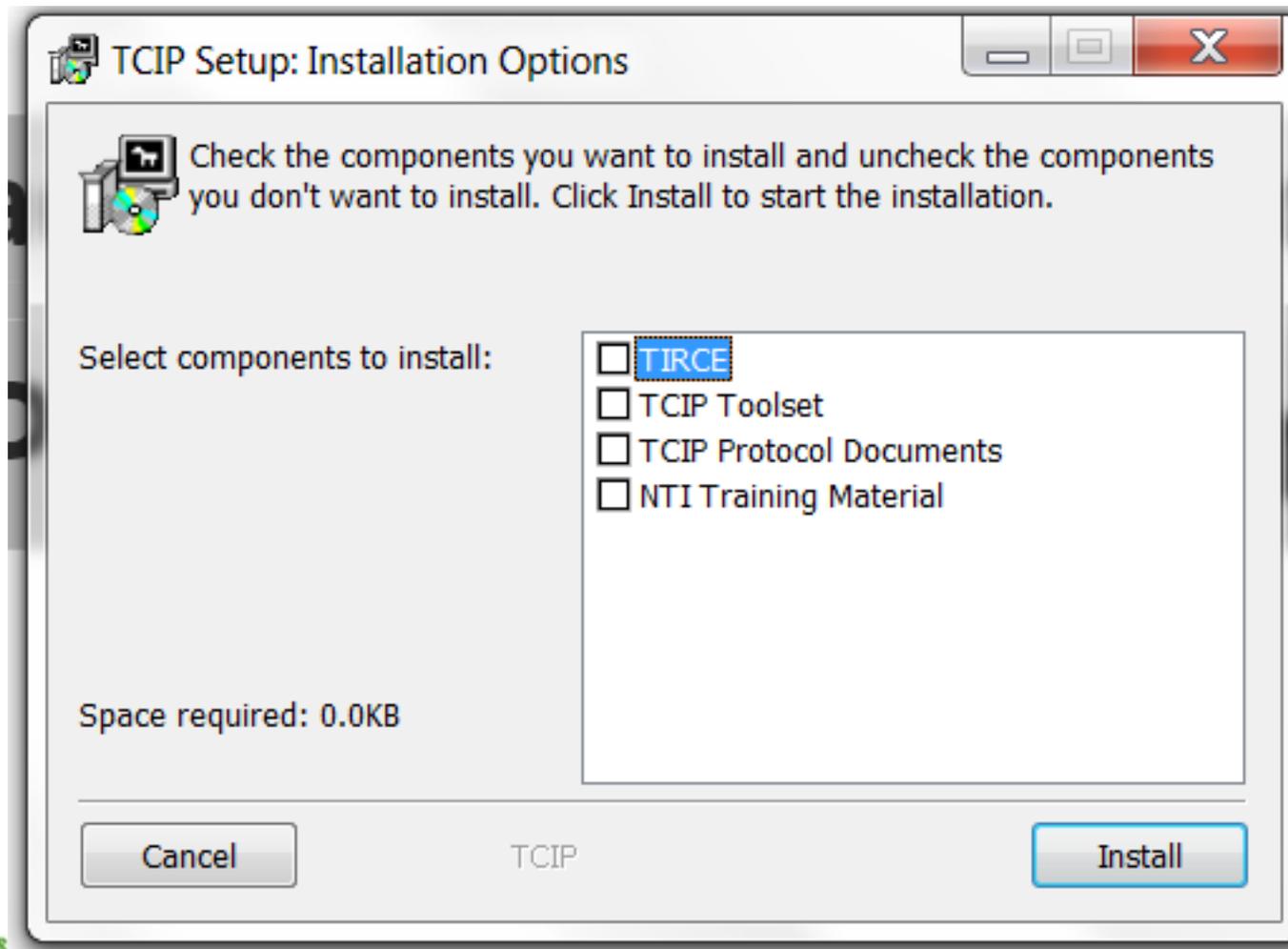
Where do I get them?

- Transit Communications Interface Profiles (TCIP) Standard Development Program APTA-TCIP TIRCE & Support Tools and Support Tool Installation Instructions

Download FREE from:

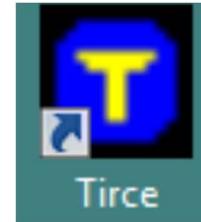
- <http://www.aptatcip.com/APTA%20TCIP%20TIRCE%20&%20Support%20Tools.htm>

TCIP Tools Download - Implementation Tools

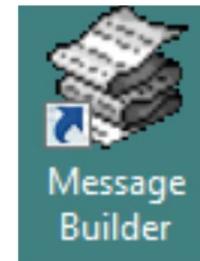


TCIP Tools Download – Implementation Tools

TIRCE Icon



TCIP Message Builder Icon



TCIP Test Console Icon

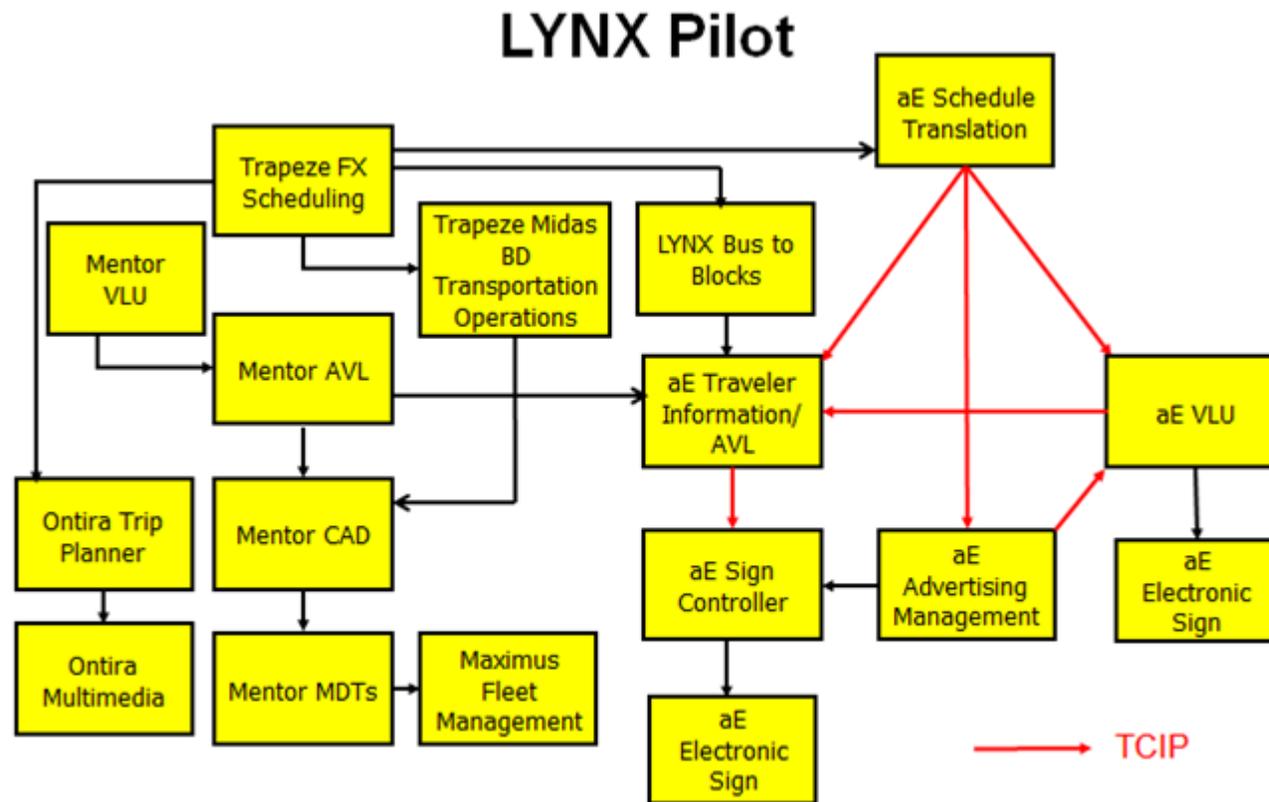


Who Is Using TCIP? Examples and Real World Applications

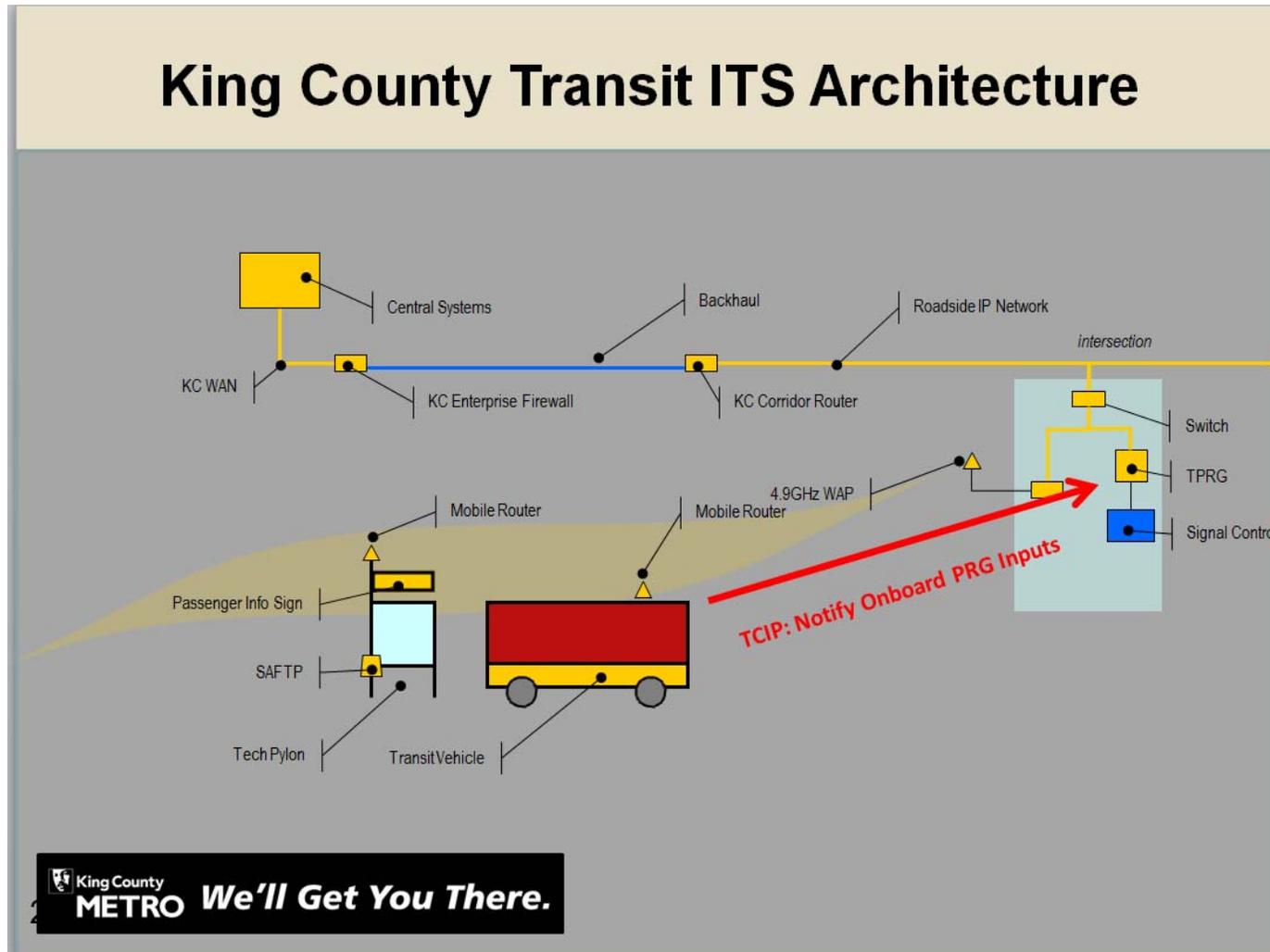
Current TCIP Projects

- LYNX (Orlando)
- King County Metro (Seattle)
- New York MTA (NYC)
- AMT (Montreal)
- WMATA (Washington DC)
- DART (Dallas)

Examples of TCIP Implementation at Transit Agencies

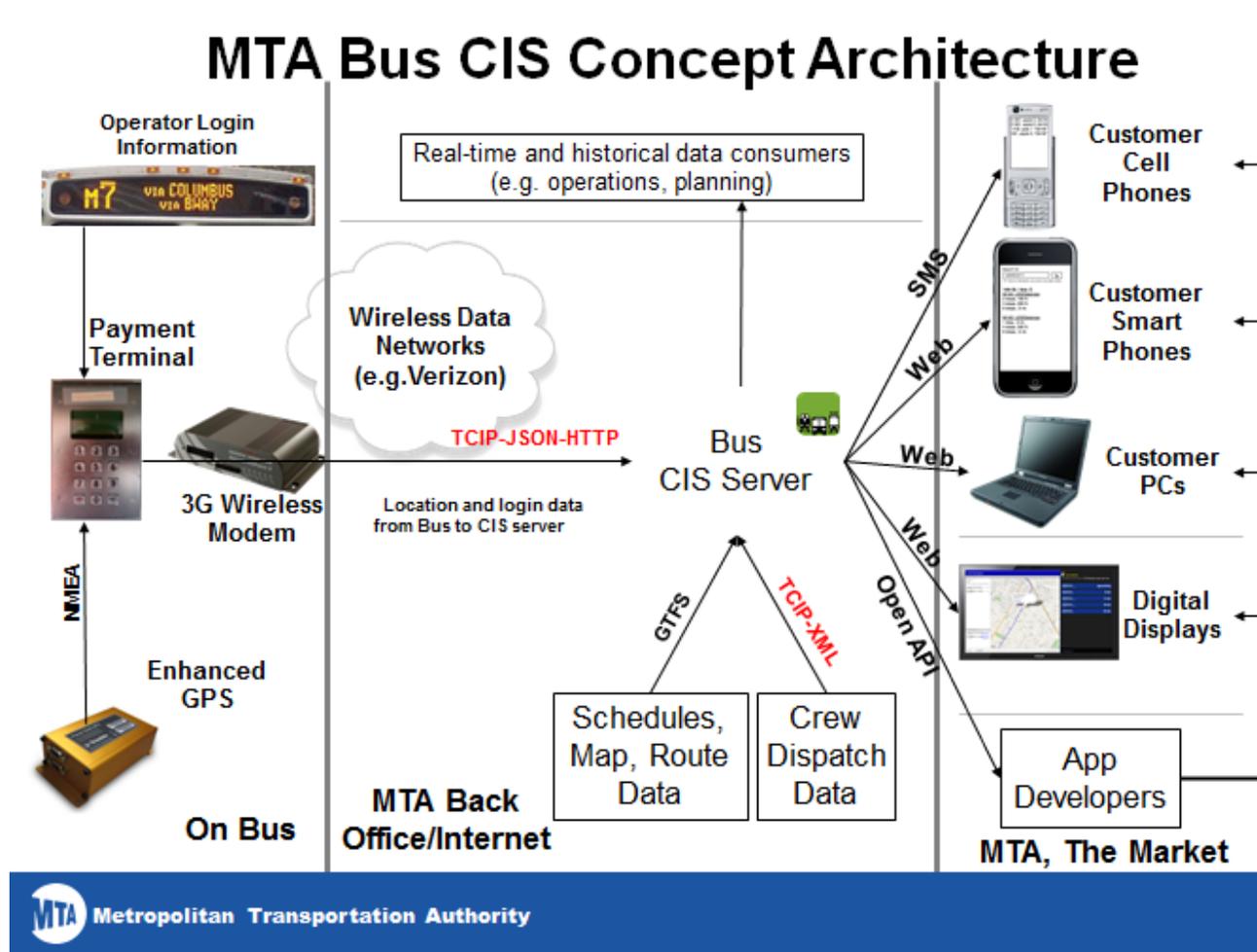


Examples of TCIP Implementation at Transit Agencies (cont.)



 **King County METRO** *We'll Get You There.*

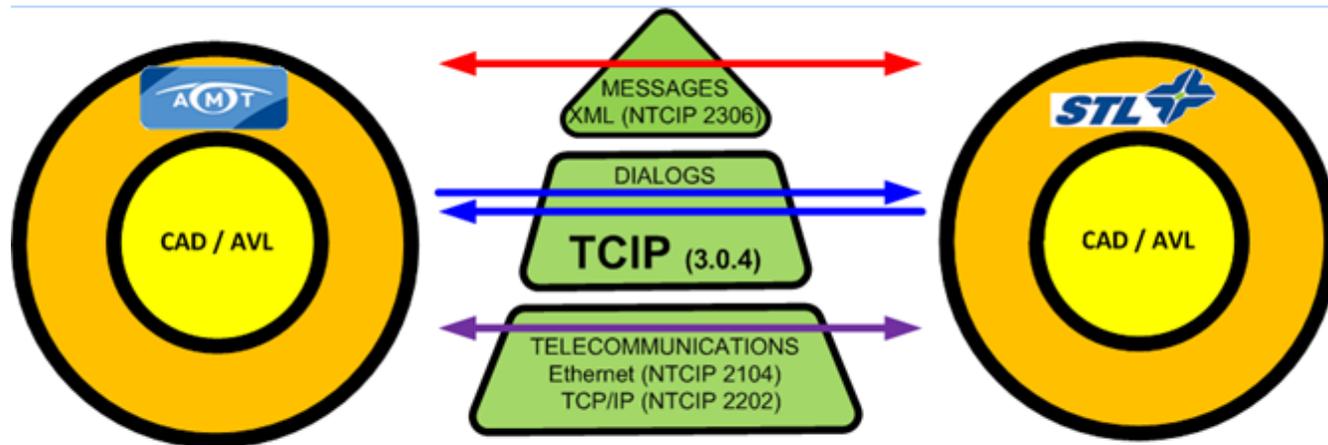
Examples of TCIP Implementation at Transit Agencies (cont.)



Examples of TCIP Implementation at Transit Agencies (cont.)

AMT (Montreal)

Center to center data exchange



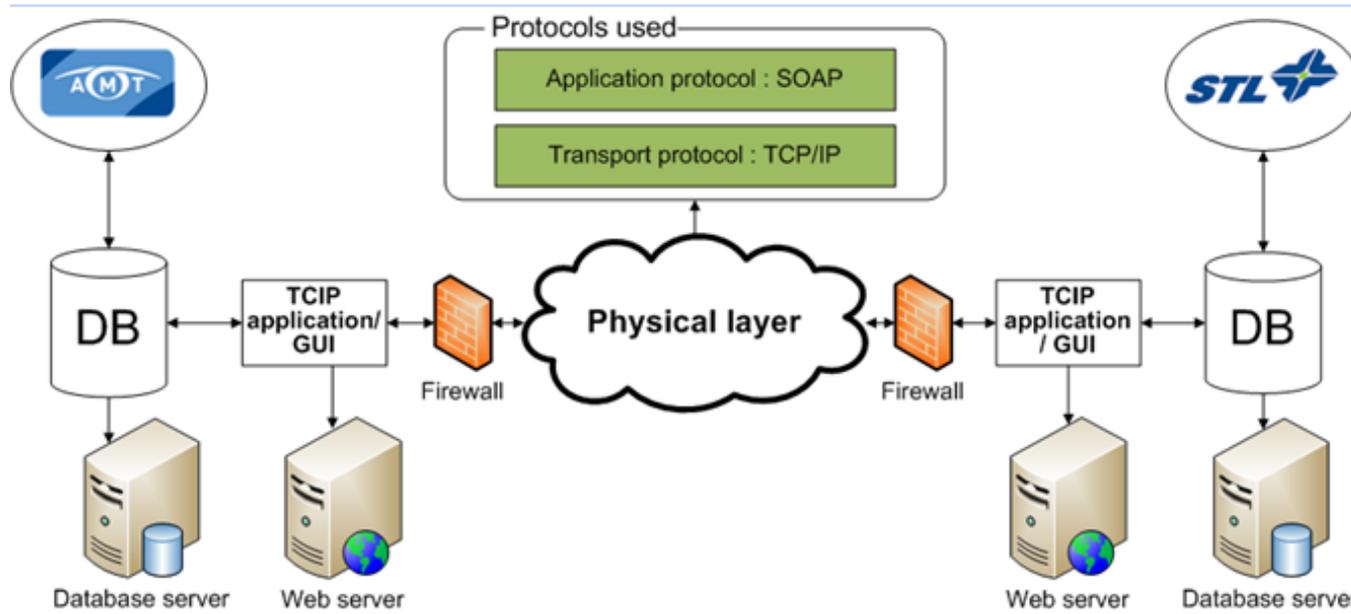
Examples of TCIP Implementation at Transit Agencies (cont.)

AMT (Montreal)

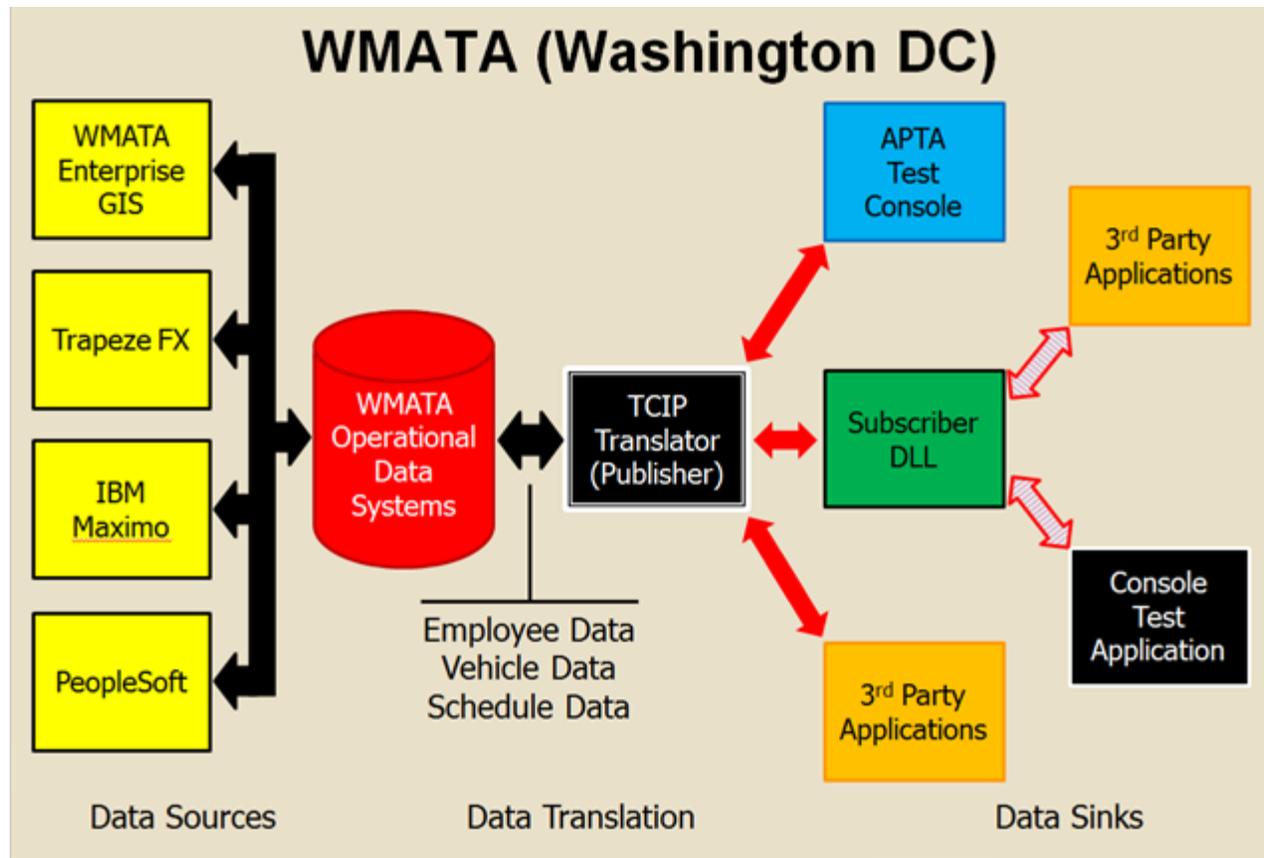
Two TCIP dialogs utilized:

Publish Stop Point ETA

Publish Service Bulletin List



Examples of TCIP Implementation at Transit Agencies (cont.)



National Transit Institute Course

Integrating Transit Applications: Defining Data Interfaces Using TCIP

- The National Transit Institute offers a two-day course
- Covers material presented in both TCIP online modules
- Provides hands-on instruction
- Register at www.ntionline.com

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Which one of the following lists includes only normative elements of TCIP?

Answer Choices

- a) Dialogs, TIRCE, model architecture
- b) TIRCE, dialogs, XML schema
- c) Dialogs, XML schema, data elements
- d) Model architecture, dialogs, XML schema

Review of Answers



a) Dialogs, TIRCE, model architecture

Incorrect. Model architecture is non-normative.



b) TIRCE, dialogs, XML schema

Incorrect. TIRCE is non-normative.



c) Dialogs, XML schema, data elements

Correct! Dialogs, XML schema, and data elements are all normative.



d) Model architecture, dialogs, XML schema

Incorrect. Model architecture is non-normative.

Summary of Learning Objective #7: Summarize the Range of TCIP Applications, Implementation Tools, and Additional Training

- TCIP contains both normative and non-normative information in four volumes
- TCIP includes a set of tools to implement the standard using XML schema
- TCIP documents and tools can be downloaded FREE from APTA's website
- A number of transit agencies are using TCIP in a variety of ways
- National Transit Institute (NTI) offers a two-day on-site TCIP training course

What We Have Learned

1. TCIP is used in the top layer of the “ communications stack .”
2. The TCIP Implementation, Requirements and Capabilities Editor (TIRCE) is a key tool for use in transit ITS procurements.
3. TCIP building blocks include data elements, data frames, messages, and dialogs .
4. Messages are the highest level for TCIP-encoded data in file transfers and dialogs .
5. A Profile Requirements List (PRL) is used to specify an agency’s TCIP requirements in a transit ITS project.
6. The TCIP suite of tools includes: TIRCE , message builder , interrogator , and responder .

Resources

- APTA TCIP-S-001 4.0.0, APTA Draft Standard for Transit Communications Interface Profiles, <http://www.aptatcip.com/Documents.htm>
- [Concept of operations - Wikipedia, the free encyclopedia](http://en.wikipedia.org/wiki/Concept_of_operations)
en.wikipedia.org/wiki/Concept_of_operations
- ITS PCB T3 Webinars on ITS Transit Standards
http://www.pcb.its.dot.gov/t3_archives.asp
- “Integrating Transit Applications: Defining Data Interface Requirements Using TCIP – Participant Workbook”
<https://drive.google.com/file/d/0B15yEPgHsRUAakNLVDMwN3hvN0U/edit?usp=sharing>
- “J. Fayos, draft “NTI Instructor Materials: Integrating Transit Applications: Defining Data Interfaces Using TCIP,” NTI, August, 2013
- NTI Instructor Materials: Integrating Transit Applications: Defining Data Interfaces Using TCIP,” Power Point Presentation, NTI, February, 2012

Next Course Modules

Students who have completed Module 4 may delve into the following PCB modules:

- Module 5: Transit Management Standards, Part 2 of 2
- Module 7: Traveler Information, Part 2 of 2
- Module 9: Arterial Management & Transit Signal Priority, Part 2 of 2
- Module 10: Electronic Fare Payment Systems
- Module 11: Transit and the Connected Vehicle Environment / Emerging Technologies, Applications, and Future Platforms

Thank you for completing this module.

Click [here](#) to open the feedback form

OR

Please provide us your feedback:

http://www.pcb.its.dot.gov/stds_training.aspx

(insert exact location for feedback for each module as well as link to Transit ITS Standards – page to be developed as part of standards training site)



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