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T312:
Applying Your Test Plan to a Transportation Sensor System (TSS) Based on the NTCIP 1209 Standard v02

Instructor

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President

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San Diego, CA, USA

Target Audience

- Traffic management and engineering staff
- Operations and maintenance staff
- System integrators
- Device manufacturers
- Test personnel

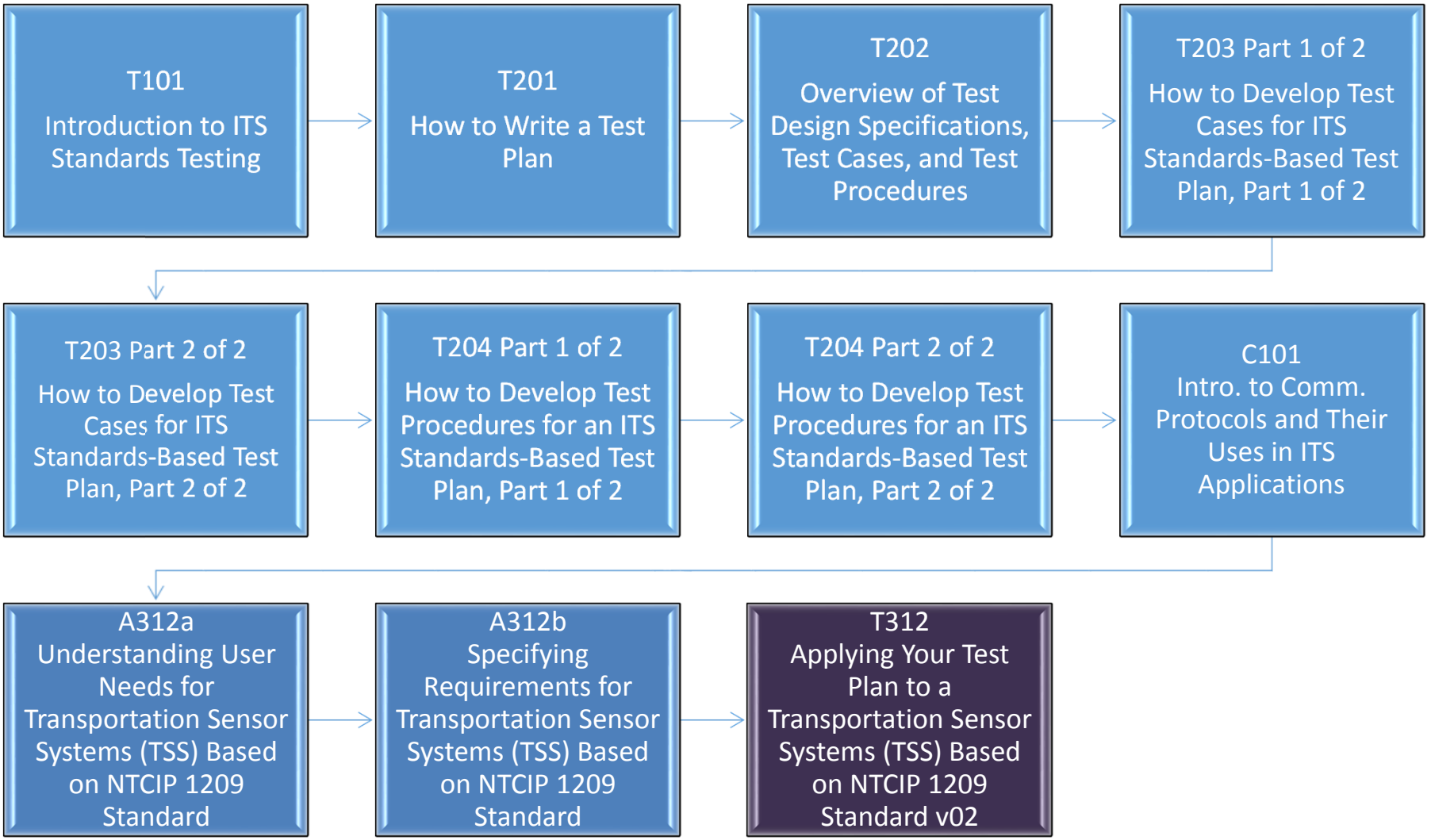
Recommended Prerequisites

- T101: Introduction to ITS Standards Testing
- T201: How to Write a Test Plan
- T202: Overview of Test Design Specifications, Test Cases, and Test Procedures
- T203 Part 1 of 2: How to Develop Test Cases for ITS Standards-Based Test Plan, Part 1 of 2
- T203 Part 2 of 2: How to Develop Test Cases for ITS Standards-Based Test Plan, Part 2 of 2

Recommended Prerequisites (cont.)

- T204 Part 1 of 2: How to Develop Test Procedures for an ITS Standards-Based Test Plan, Part 1 of 2
- T204 Part 2 of 2: How to Develop Test Procedures for an ITS Standards-Based Test Plan, Part 2 of 2
- C101: Introduction to the Communications Protocols and Their Uses in ITS Applications
- A312a: Understanding User Needs for Transportation Sensor Systems (TSS) Based on NTCIP 1209 Standard
- A312b: Specifying Requirements for Transportation Sensor Systems (TSS) Based on NTCIP 1209 Standard

Curriculum Path



Learning Objectives

1. Recognize the purpose, structure, and content of well-written test documentation based on Institute of Electrical and Electronics Engineers (IEEE) Std 829-2008

2. Describe TSS testing and the role of test documentation within the context of the systems life cycle

3. Identify a process to develop test documentation for a TSS specification based on National Transportation Communications for Intelligent Transportation Systems Protocol (NTCIP) 1209 Standard v02

4. Describe the testing of a TSS using sample test documentation

Learning Objective #1: Recognize the Purpose, Structure, and Content of Well-Written Test Documentation Based on IEEE Std 829-2008

- Describe the documents used to specify testing
- Describe the documents used for test reporting

IEEE Std 829-2008 – IEEE Standard for Software and System Test Documentation

Comparison of IEEE Testing Standards

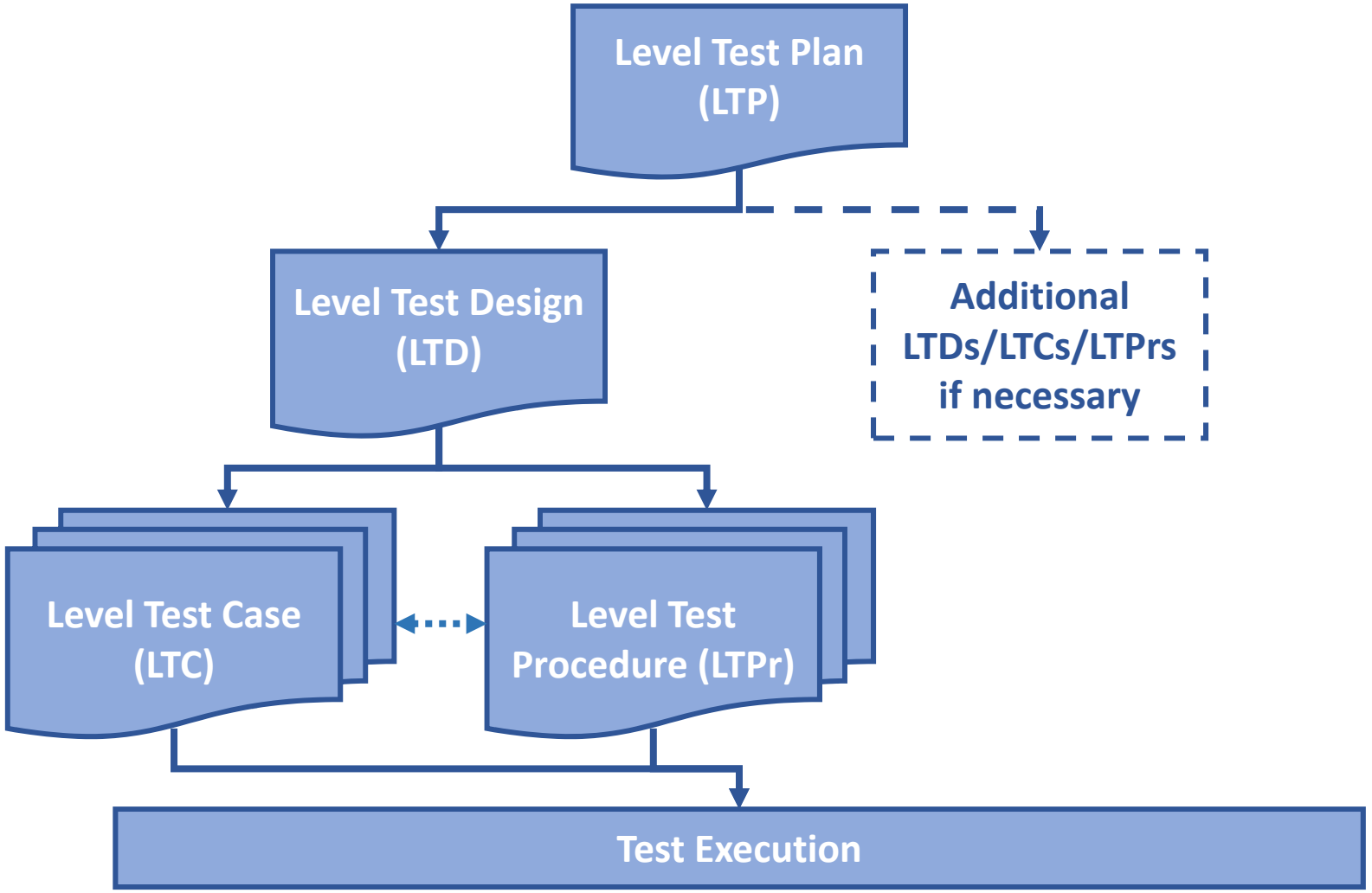
IEEE Std 829-2008	IEEE Std 829-1998
Level Test Plan (LTP)	Test Plan
Level Test Design (LTD)	Test Design Specification
Level Test Case (LTC)	Test Case Specification
Level Test Procedure (LTPr)	Test Procedure Specification
Level Test Log (LTL)	Test Log
Anomaly Report (AR)	Test Incident Report
Level Interim Test Status Report (LITSR)	*No corresponding document*
Level Test Report	Test Summary Report

Using the term "test documentation" to refer to a collection of test documents.

Documents Used to Specify Testing

Test Document	Purpose
Level Test Plan (LTP)	Specifies scope, approach, resources, and schedule for a specified level of testing. “Level” can be replaced by name of the particular level of testing being covered by the plan.
Level Test Design (LTD)	Specifies refinements of the test approach in the LTP and identifies the features to be tested by this design and associated tests.
Level Test Case (LTC)	Defines the information needed as it pertains to inputs and outputs from the software or software-based system being tested. May represent a single test case or a group of test cases for a segment of an LTD.
Level Test Procedure (LTPr)	Specifies the steps for executing a set of test cases or, more generally, the steps used to exercise a software product or software-based system item in order to evaluate a set of features.

Documents Used to Specify Testing (cont.)



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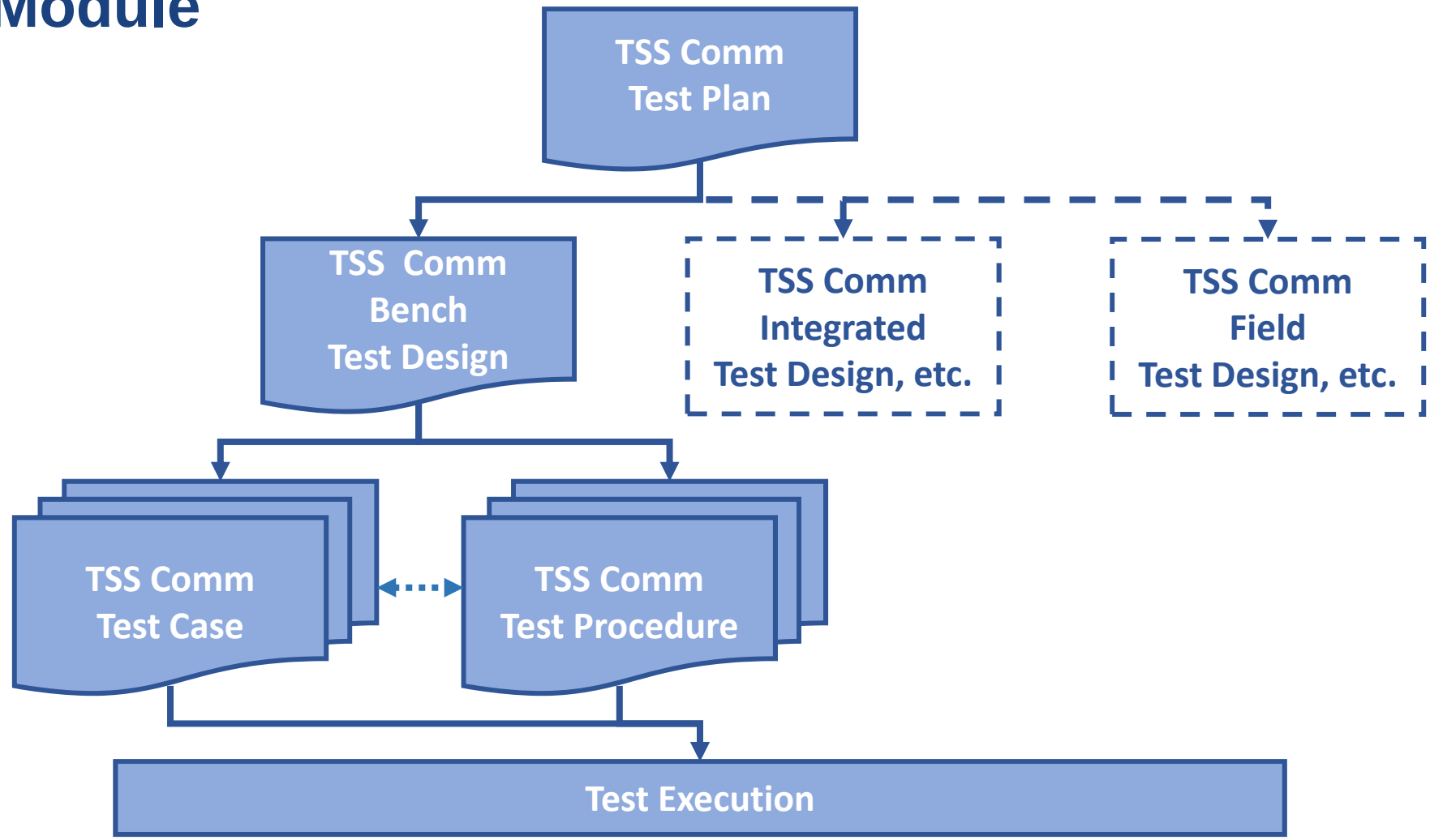
Test Specification Documents Used in This Module



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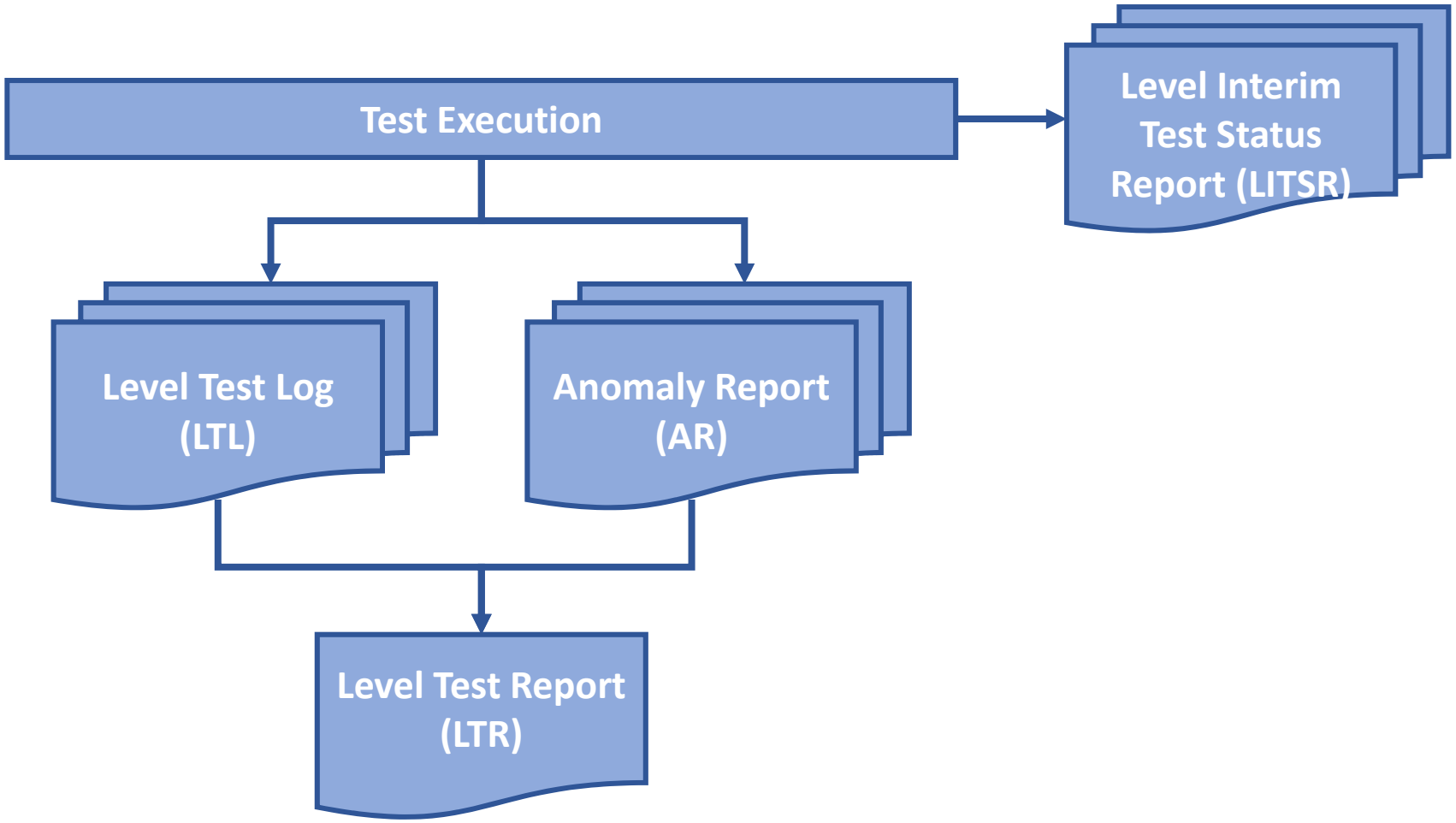
Documents Used in Test Reporting

Test Document	Purpose
Level Test Log (LTL)	Provides a chronological record of relevant details about the execution of tests.
Anomaly Report (AR)	Documents any event that occurs during the testing process that requires investigation. This may be called a problem, test incident, defect, trouble, issue, anomaly, or error report.
Level Interim Test Status Report (LITSR)	Summarizes the results of the designated testing activities and, optionally, provides evaluations and recommendations based on these results.
Level Test Report (LTR)	Summarizes the results of the designated testing activities and provides evaluations and recommendations based on these results.

Documents Used in Test Reporting (cont.)



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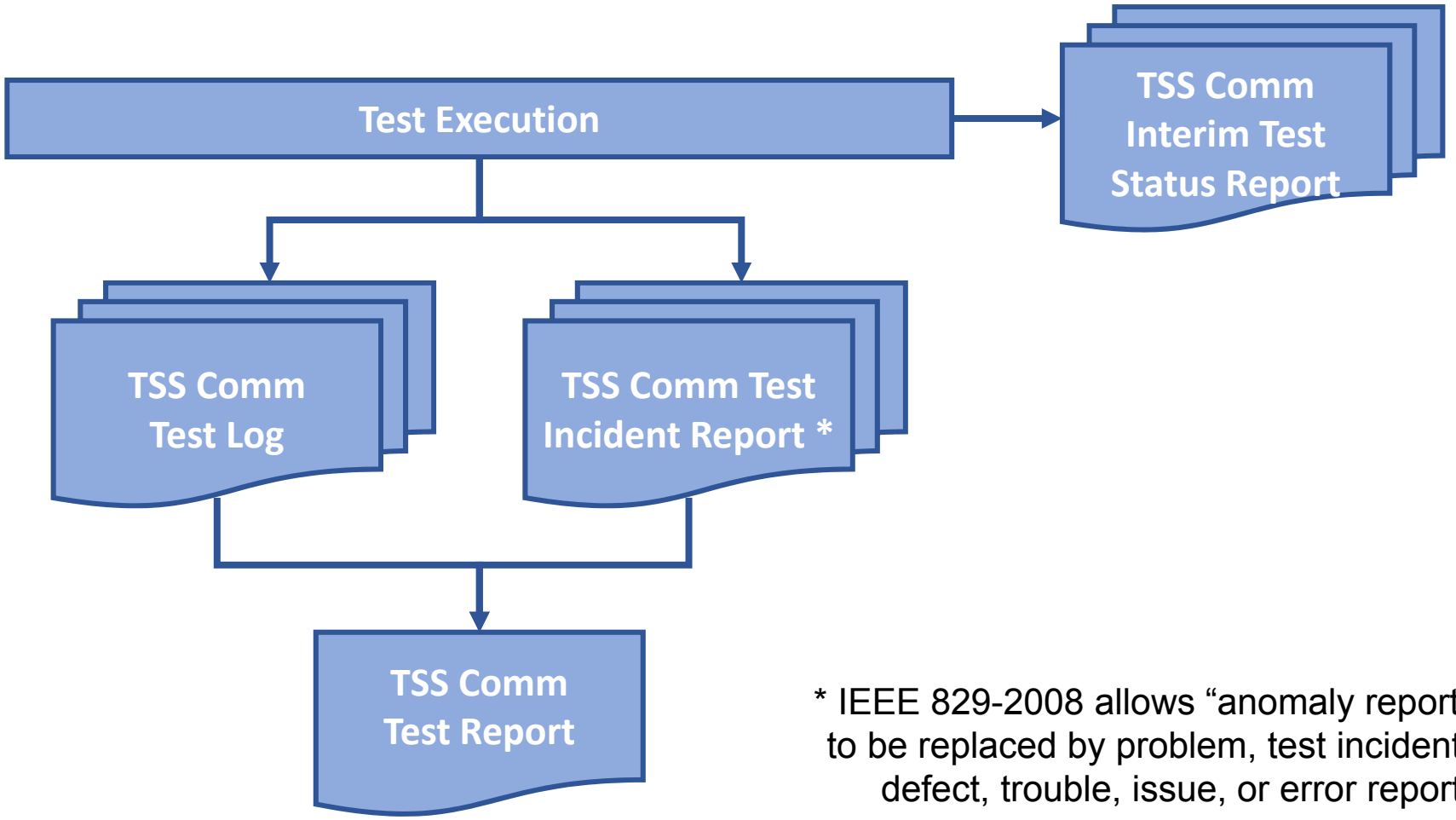
Test Reporting Documents Used in This Module



* IEEE 829-2008 allows "anomaly report" to be replaced by problem, test incident, defect, trouble, issue, or error report.

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Which of the following is a TRUE statement?

Answer Choices

a) There is usually one Level Test Case per Level Test Design
b) Always use the word “Level” in test document names
c) Anomaly Reports provide a chronological record of tests
d) A Level Test Report summarizes the results of testing

Review of Answers

a) There is usually one Level Test Case per Level Test Design

Incorrect. There are typically many Level Test Cases per Level Test Design.

b) Always use the word "Level" in test document names

Incorrect. "Level" refers to the level or type of testing that is to be performed. Replace it with something more descriptive.

c) Anomaly Reports provide a chronological record of tests

Incorrect. Anomaly Reports document any event that occurs during the testing process that requires investigation.

d) A Level Test Report summarizes the results of testing

Correct! A Level Test Report summarizes the results of the designated testing activities.

Summary of Learning Objective #1

Recognize the Purpose, Structure, and Content of Well-Written Test Documentation Based on IEEE Std 829-2008

- Describe the documents used to specify testing
- Describe the documents used for test reporting

Learning Objective #2: Describe TSS Testing and the Role of Test Documentation Within the Context of the Systems Life Cycle

- Identify the types of testing for a TSS
- Describe stages of NTCIP communications testing
- Testing TSS communications in the context of the Systems Life Cycle

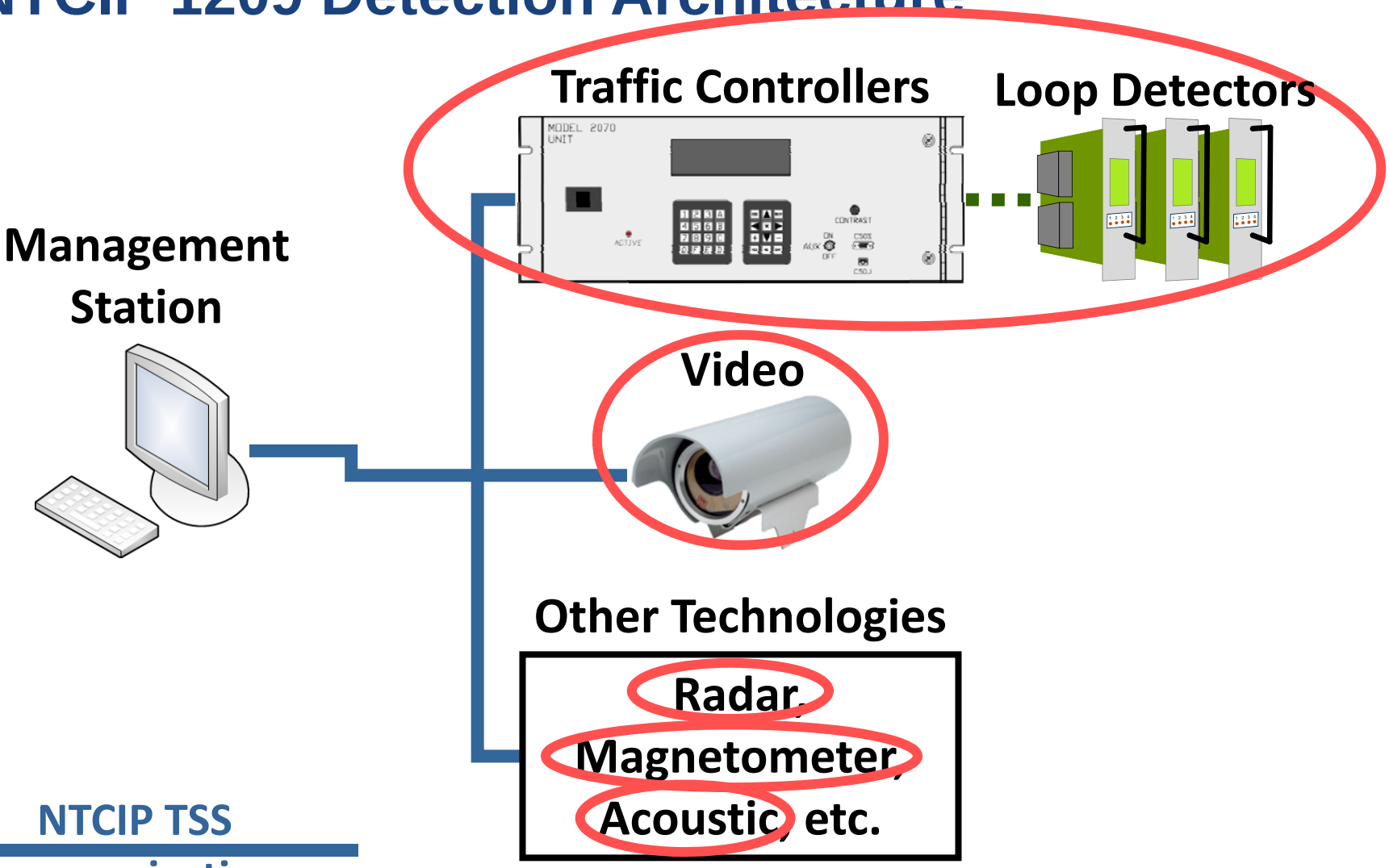
Definition of a TSS Within the NTCIP 1209 Standard

Transportation Sensor System (TSS) is defined as any system or device capable of sensing and communicating near real-time traffic parameters using NTCIP.

Clarification of Terminology

- A Transportation Sensor System (TSS) is considered a **field device** from an NTCIP perspective
- It may be a relatively simple device or a combination of devices working together
- Don't confuse a Transportation Sensor System with the "central system" that manages the TSS

NTCIP 1209 Detection Architecture



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Types of Testing Mentioned in IEEE Std 829-2008

- Acceptance/Qualification Testing
- Development Testing
- Operational Testing
- Component Testing
- Component Integration Testing
- Integration Testing
- Systems Integration Testing
- System Testing

Acceptance/Qualification Testing of a TSS

- Functional
- Performance
- Communications
- Environmental
- Electrical
- Material
- Shock (physical)
- User Interface
- Others

Stages for NTCIP Communication Testing of a TSS (suggested)

1. Bench Communications Testing
2. Integrated Communications Testing
3. Field Communications Testing

Bench Communications Testing for a TSS

- Primary purpose is to exercise as many of the NTCIP 1209 v02 data elements and dialogs as practical
- Typically performed in a lab or workshop using test software running on a PC connected directly to the TSS

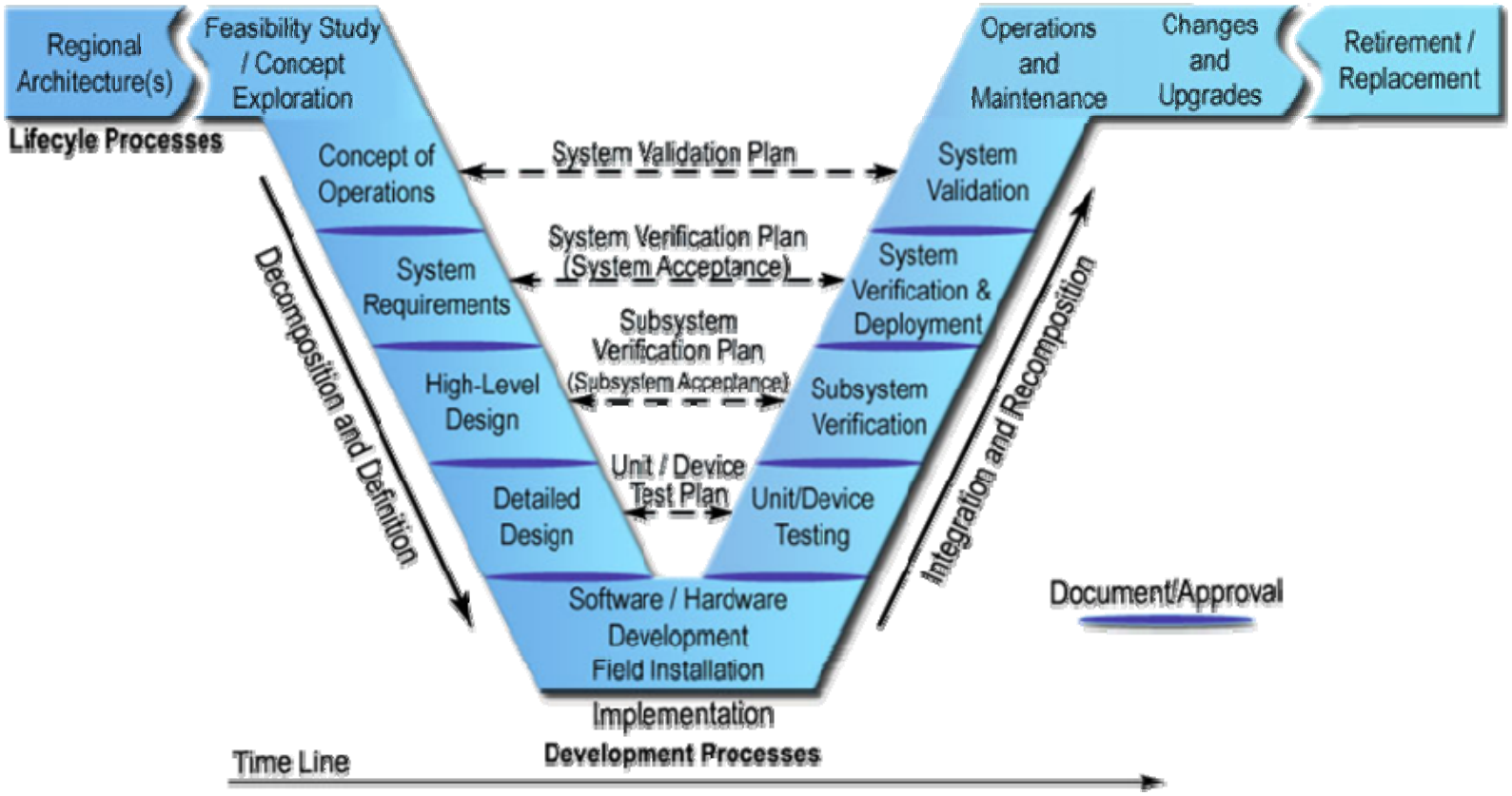
Integrated Communications Testing for a TSS

- Primary purpose is to test the TSS communications with the other components of the system
- Includes use of central system software
- Typically performed in a lab, workshop, or special integration area
- Uses the central system to test the TSS C2F communications
- Exercise the real communications infrastructure as much as practical to be able to differentiate protocol issues from other anomalies

Field Communications Testing for a TSS

- Primary purpose is to test TSS communications under real-world conditions
- Includes use of central system software
- Uses the central system to test the TSS C2F communications
- Limit full deployment until confident of the system and field devices communications AND functionality

Testing TSS Communications in the Context of the Systems Life Cycle

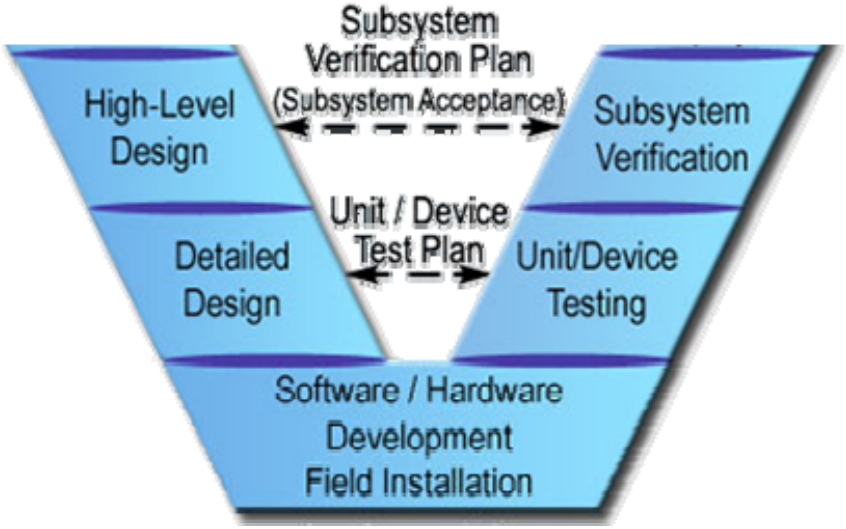


Testing TSS Communications in the Context of the Systems Life Cycle (cont.)

- Unit / Device Test – tests an item and its interfaces
- Subsystem Verification – involves testing the item integrated with all of the other items of the subsystem. There will likely be multiple subsystems to test
- System Verification – ensures that the entire system (including its subsystems) meets the system requirements of the project
- System Validation – shows that the system as implemented meets the original user needs

Testing a TSS in the Context of the Systems Life Cycle

Subsystem Development



Communications Testing

Field Comm Testing

Integrated Comm Testing

Bench Comm Testing

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When bench testing the communications for a TSS, the primary objective is to:

Answer Choices

a) Test the TSS communications with other components

b) Exercise as much of the NTCIP 1209 protocol as possible

c) Test the TSS communications under real-world conditions

d) Test the central system communications to the TSS

Review of Answers

a) Test the TSS communications with other components

Incorrect. Testing other components is a part of integrated testing.

b) Exercise as much of the NTCIP 1209 protocol as possible

Correct! This is usually performed using a software tool.

c) Test the TSS communications under real-world conditions

Incorrect. Testing under real-world conditions is a part of field communications testing.

d) Test the central system communications to the TSS

Incorrect. Testing using the central system communications with the TSS is part of integrated testing and field testing.

Summary of Learning Objective #2

Describe TSS Testing and the Role of Test Documentation Within the Context of the Systems Life Cycle

- Identify the types of testing for a TSS
- Describe stages of NTCIP communications testing
- Testing TSS communications in the context of the Systems Life Cycle

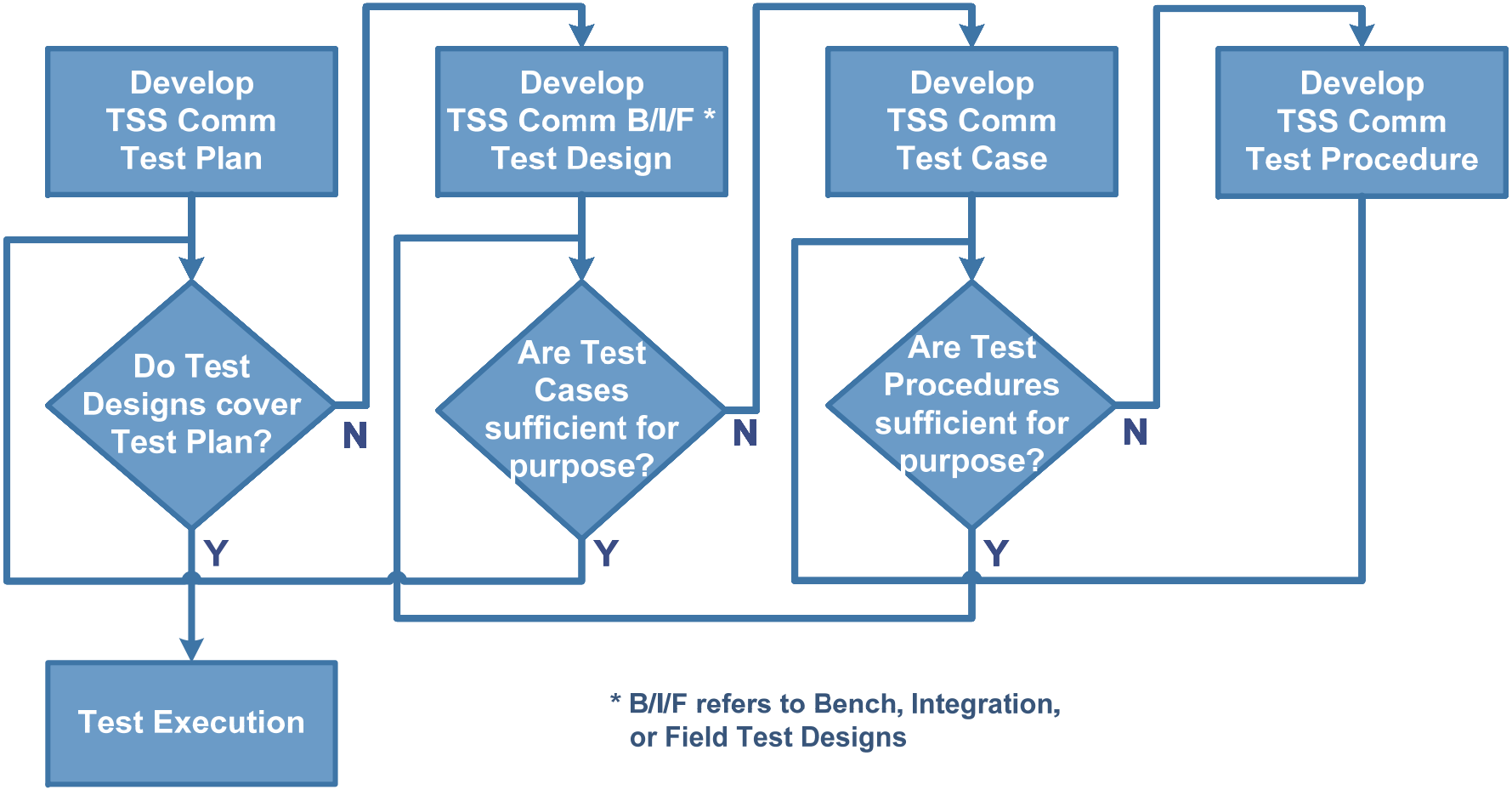
Learning Objective #3: Identify a Process to Develop Test Documentation for a TSS Specification Based on NTCIP 1209 Standard v02

- Identify key elements of NTCIP 1209 Standard v02 and the agency specification
- Describe a process to develop test documentation based on an NTCIP 1209 v02 specification
- Create a Test Traceability Matrix (TTM)
- Describe test tools available for NTCIP communications

Key Elements of NTCIP 1209 Standard v02 and the Agency Specification

- User Needs / Features
- Requirements
- Protocol Requirements List (PRL) (template in standard)
- Requirements Traceability Matrix (RTM)
- Management Information Base (MIB) / Data Objects
- Dialogs
- Protocol Requirements List (PRL) (completed in specification)

Developing Test Documentation Based on an NTCIP 1209 v02 Specification



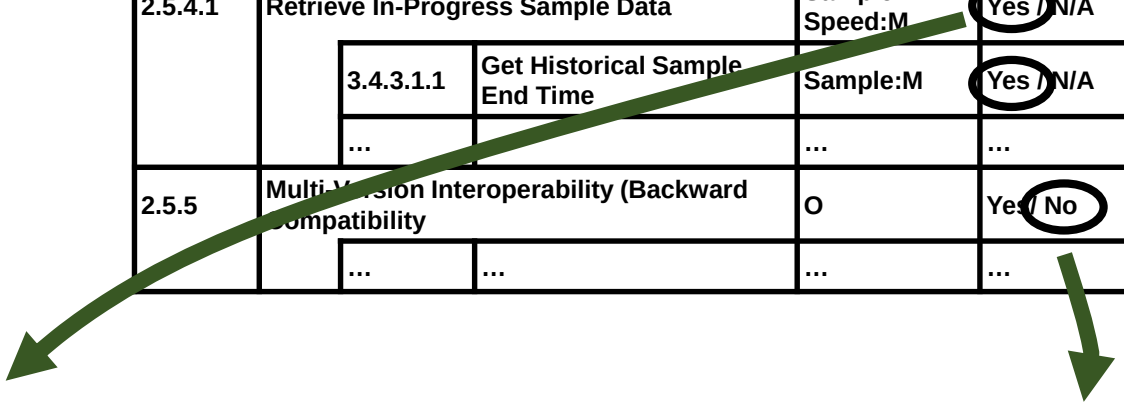
Graphics: Ralph W. Boaz

Develop a TSS Communications Test Plan

- Prescribes the Scope, Approach, Resources, and Schedule for the testing
- Some of the testing aspects covered:
  - Item(s) to be tested
  - Features to be tested
  - Features not to be tested
  - Testing tasks to be performed
  - Personnel responsible for each task
  - Risks associated with the plan

Use the PRL to Identify the Features to Be / Not to Be Tested

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Specifications
2.5.4.1	Retrieve In-Progress Sample Data			Sample:M Speed:M	Yes / N/A	
		3.4.3.1.1	Get Historical Sample End Time	Sample:M	Yes / N/A	
		…		…	…	
2.5.5	Multi-Version Interoperability (Backward Compatibility			O	Yes / No	
		…	…	…	…	



Features to be Tested

2.5.4.1 Retrieve In-Progress Sample Data

Features not to be Tested

2.5.5 Multi-Version Interoperability (Backward Compatibility

Develop TSS Communications Test Designs

- Specifies the detailed approach (design) for exercising a collection of tests
- Identifies the features to be tested by the test design
- Identifies the requirements to be tested by the test design
- Identifies the tests (test cases) associated with the design

Use the PRL to Identify the Features and Requirements

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Specifications
2.5.4.1	Retrieve In-Progress Sample Data			Sample:M Speed:M	Yes / N/A	
		3.4.3.1.1	Get Historical Sample End Time	Sample:M	Yes / N/A	
		…		…	…	
2.5.5	Multi-Version Interoperability (Backward Compatibility			O	Yes / No	
		…	…	…	…	

Features to be Tested

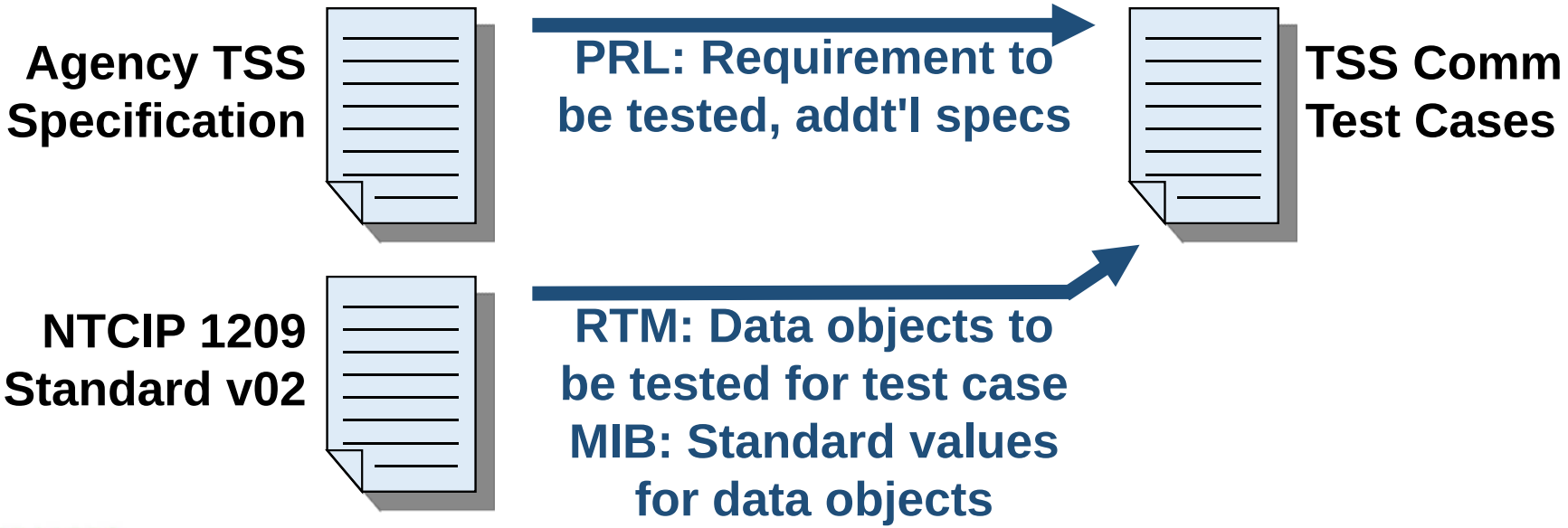
2.5.4.1 Retrieve In-Progress Sample Data

Requirements to be Tested

3.4.3.1.1 Get Historical Sample End Time

Develop TSS Communications Test Cases

- TSS Communications Test Cases
  - Defines a test case identified by a test design specification
  - Input and Output specifications



Use the PRL, RTM, and MIB to Develop Test Cases

User Need Section Number	User Need	FR Section Number	Functional Requirement	Conformance	Support / Project Requirement	Additional Specifications
2.5.4.1	Retrieve In-Progress Sample Data			Sample:M Speed:M	Yes / N/A	
		3.4.3.1.1	Get Historical Sample End Time	Sample:M	Yes / N/A	
		…	…	…	…	
		3.4.3.1.7	Get Zone Class Label	Sample:M	Yes/ N/A	
		…	…	…	…	

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.3.1.7	Get Zone Class Label				
		4.3.3.5	Retrieve Sensor Zone Class Labels		
				5.2.4	maxSensorZones
				5.2.10	functionalCapabilities
				5.4.5.1	zoneClassLabel

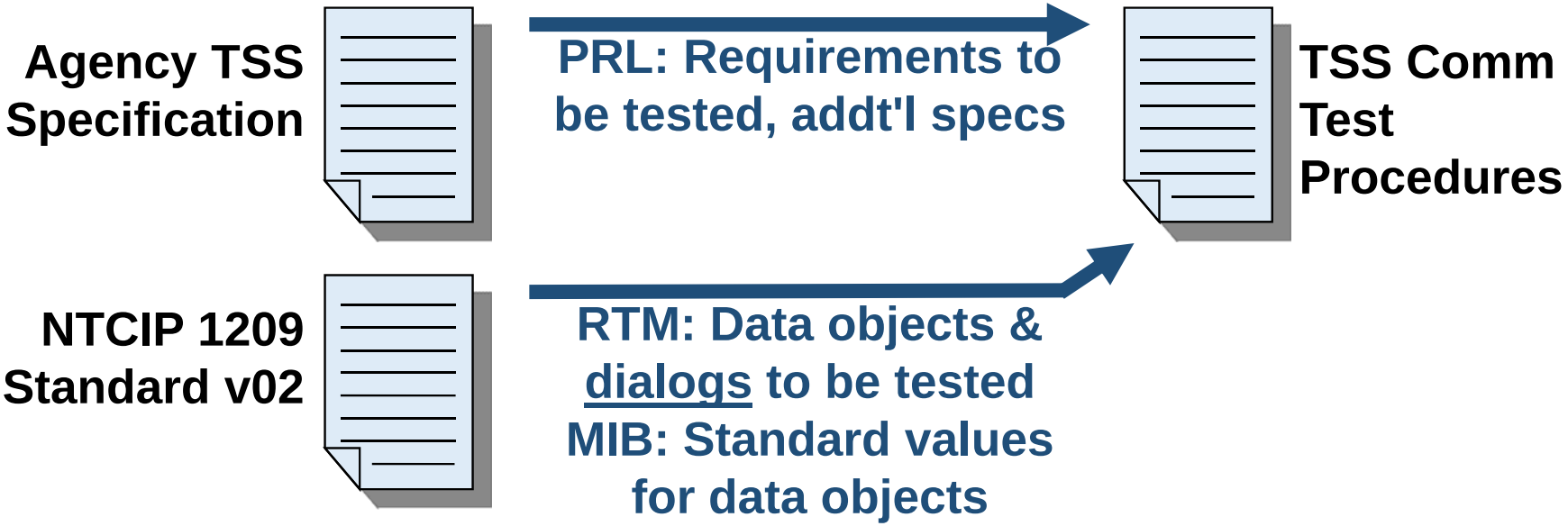
Test Case

Verify Zone Class Labels

zoneClassLabel OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (1..255))

Develop TSS Communications Test Procedures

- TSS Communications Test Procedures
  - Specifies the steps for executing one or more test cases



Use the PRL, RTM, and MIB to Develop Test Procedures

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.3.1.7	Get Zone Class Label				
		4.3.3.5	Retrieve Sensor Zone Class Labels		
				5.2.4	maxSensorZones
				5.2.10	functionalCapabilities
				5.4.5.1	zoneClassLabel

Where: x = sensorZoneNumber; y = sampleZoneClass

a) (Precondition) The management station shall determine that the sensorZoneNumber is less than or equal to the maxSensorZones. The TSS supports sampling features

b) The management station shall GET zoneSequenceTableEntry:numSensorZoneClass.x

c) sampleZoneClass = zoneSequenceTableEntry:numSensorZoneClass.x from Step b

d) The management station shall GET zoneClassLabel.y.x

e) If zoneClassEntry is greater than 0, then zoneClassEntry = zoneClassEntry - 1 and go to Step d

f) Retrieval of class labels for this sensor zone is complete

zoneClassLabel OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (1..255))

Test Procedure

Verify Zone Class Labels Procedure

Create a Test Traceability Matrix (TTM)

- TTM provides traceability from requirements to test cases to test procedures
- Each TSS Test Design has a TTM for the requirements and test cases applicable to the Test Design

Req ID	Req	Test Case ID	Test Case	Test Proc ID	Test Procedure
3.4.3.1.7	Get Zone Class Label				
		TC3.4.3.1.7-1	Verify Zone Class Labels		
				TP3.4.3.1.7-1	Verify Zone Class Labels Procedure
3.4.3.1.8	Get Number of Sample Data Entries				
		TC3.4.3.1.8-1	Get Number of Sample Data Entries Nominal		
				TP3.4.3.1.8-1	Get Number of Sample Data Entries Nominal Procedure 1
				TP3.4.3.1.8-2	Get Number of Sample Data Entries Nominal Procedure 2

Create a Test Traceability Matrix (TTM) (cont.)

- TTM provides traceability from requirements to test cases to test procedures
- Each TSS Test Design has a TTM for the requirements and test cases applicable to the Test Design

Req ID	Req	Test Case ID	Test Case	Test Proc ID	Test Procedure
3.4.3.1.7	Get Zone Class Label				
		TC3.4.3.1.7-1	Verify Zone Class Labels		
				TP3.4.3.1.7-1	Verify Zone Class Labels Procedure
3.4.3.1.8	Get Number of Sample Data Entries				
		TC3.4.3.1.8-1	Get Number of Sample Data Entries Nominal		
				TP3.4.3.1.8-1	Get Number of Sample Data Entries Nominal Procedure 1
				TP3.4.3.1.8-2	Get Number of Sample Data Entries Nominal Procedure 2

Create a Test Traceability Matrix (TTM) (cont.)

- TTM provides traceability from requirements to test cases to test procedures
- Each TSS Test Design has a TTM for the requirements and test cases applicable to the Test Design

Req ID	Req	Test Case ID	Test Case	Test Proc ID	Test Procedure
3.4.3.1.7	Get Zone Class Label				
		TC3.4.3.1.7-1	Verify Zone Class Labels		
				TP3.4.3.1.7-1	Verify Zone Class Labels Procedure
3.4.3.1.8	Get Number of Sample Data Entries				
		TC3.4.3.1.8-1	Get Number of Sample Data Entries Nominal		
				TP3.4.3.1.8-1	Get Number of Sample Data Entries Nominal Procedure 1
				TP3.4.3.1.8-2	Get Number of Sample Data Entries Nominal Procedure 2

Create a Test Traceability Matrix (TTM) (cont.)

- TTM provides traceability from requirements to test cases to test procedures
- Each TSS Test Design has a TTM for the requirements and test cases applicable to the Test Design

Req ID	Req	Test Case ID	Test Case	Test Proc ID	Test Procedure
3.4.3.1.7	Get Zone Class Label				
		TC3.4.3.1.7-1	Verify Zone Class Labels		
				TP3.4.3.1.7-1	Verify Zone Class Labels Procedure
3.4.3.1.8	Get Number of Sample Data Entries				
		TC3.4.3.1.8-1	Get Number of Sample Data Entries Nominal		
				TP3.4.3.1.8-1	Get Number of Sample Data Entries Nominal Procedure 1
				TP3.4.3.1.8-2	Get Number of Sample Data Entries Nominal Procedure 2

Create a Test Traceability Matrix (TTM) (cont.)

- TTM provides traceability from requirements to test cases to test procedures
- Each TSS Test Design has a TTM for the requirements and test cases applicable to the Test Design

Req ID	Req	Test Case ID	Test Case	Test Proc ID	Test Procedure
3.4.3.1.7	Get Zone Class Label				
		TC3.4.3.1.7-1	Verify Zone Class Labels		
				TP3.4.3.1.7-1	Verify Zone Class Labels Procedure
3.4.3.1.8	Get Number of Sample Data Entries				
		TC3.4.3.1.8-1	Get Number of Sample Data Entries Nominal		
				TP3.4.3.1.8-1	Get Number of Sample Data Entries Nominal Procedure 1
				TP3.4.3.1.8-2	Get Number of Sample Data Entries Nominal Procedure 2

Describe Test Tools Available for NTCIP Communications

- Many generic Simple Network Management Protocol (SNMP) test tools available for Ethernet communications
- Data Analyzers
- NTCIP Testing Tools
  - Test both Ethernet and serial communications
  - Test all objects within the MIB with Set/Get operations
  - Verify that read-only objects are not settable
  - Test scripting
  - Logs (various levels)
  - Reports (various levels)
  - Performance Testing (may or may not have this capability)

Describe Test Tools Available for NTCIP Communications (cont.)

- Test Procedure Generator (TPG)
  - Tool developed by USDOT to help develop consistent and robust test procedures for implementation of NTCIP standards
  - NTCIP 1209 Standard v02 needs modification to use this tool

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True or False: The best way to start developing your test documentation is with a Test Design.

Answer Choices

a) True

b) False

Review of Answers

a) True

Incorrect. The test design is developed after the test plan and it may only cover a portion of the testing to be performed.

b) False

Correct! The test plan (not the test design) is the best starting point for developing test documentation. It covers the scope, approach, resources, and schedule for testing.

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What is the most appropriate test document in which to include a Test Traceability Matrix (TTM)?

Answer Choices

a) TSS Communications Test Cases

b) TSS Communications Test Procedures

c) TSS Communications Test Design

d) TSS Communications Test Report

Review of Answers

a) TSS Communications Test Cases

Incorrect. A test case defines the input and output specifications for a test identified in a test design.

b) TSS Communications Test Procedures

Incorrect. A test procedure specifies the steps for executing one or more test cases.

c) TSS Communications Test Design

Correct! A test design identifies the features to be tested and the test cases associated with the design.

d) TSS Communications Test Report

Incorrect. A test report summarizes the results of the designated testing activities.

Summary of Learning Objective #3

Identify a Process to Develop Test Documentation for a TSS Specification Based on the NTCIP 1209 Standard v02

- Identify key elements of NTCIP 1209 Standard v02 and the agency specification
- Describe a process to develop test documentation based on an NTCIP 1209 v02 specification
- Create a Test Traceability Matrix (TTM)
- Describe test tools available for NTCIP communications

Learning Objective #4: Describe the Testing of a TSS Using Sample Test Documentation

- TSS Communications Test Plan
- TSS Communications Test Design(s)
- TSS Communications Test Cases
- TSS Communications Test Procedures

See the Participant Supplement for the outlines of the Test Reporting documents.

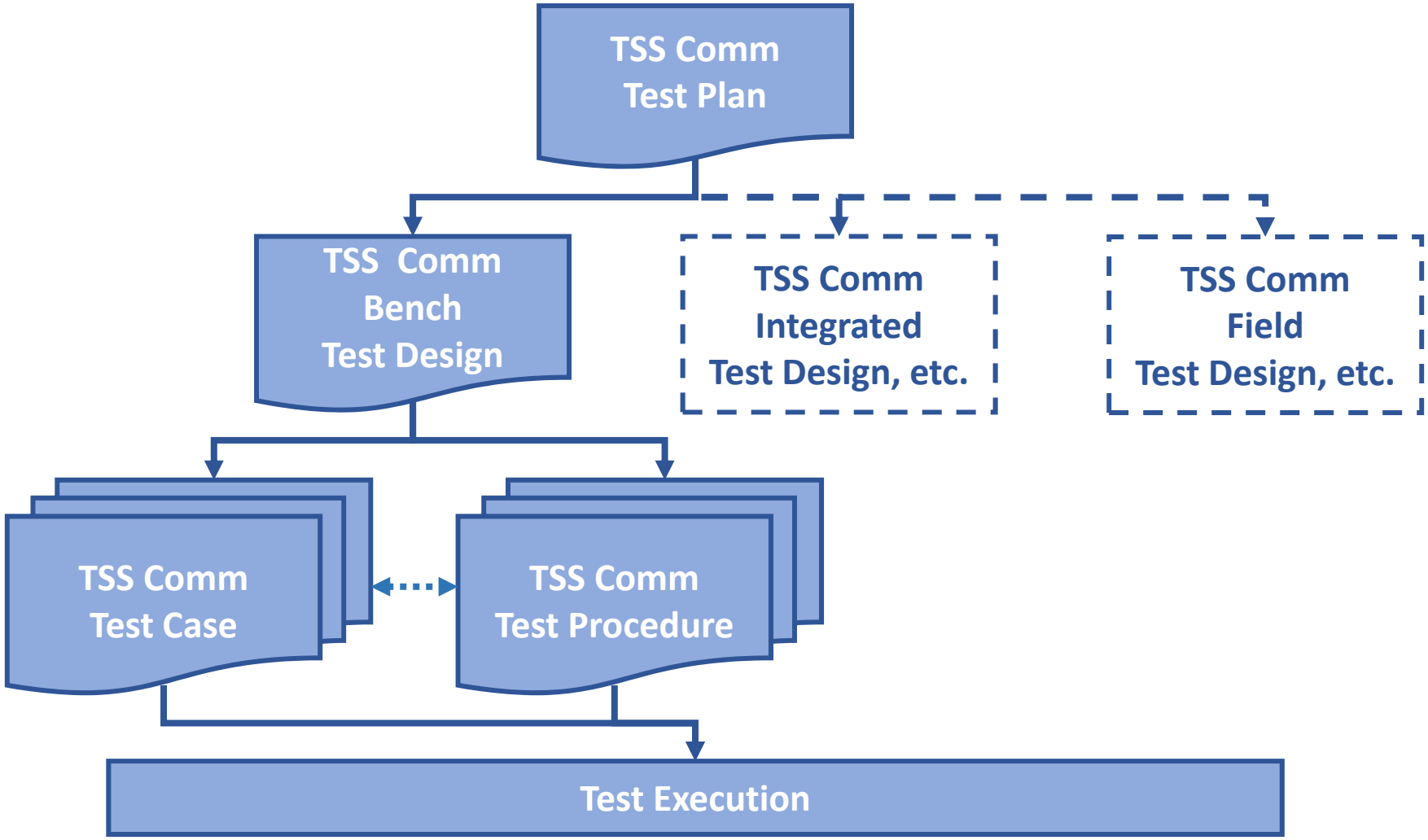
Variations

- This module presents the test documentation as described in IEEE Std 829-2008
- The outlines of the test documents may be tailored to a given project in order to improve their ***effectiveness***
- In practice, if only one test design is being used, the test plan and test design may be in one document
- Test cases may be combined with test procedures, especially when an NTCIP testing tool is used
- Multiple test cases may have a single test procedure
- A single test case may have multiple test procedures

Example of TSS Deployment

The city of Buena Vida, CA, has a central system that uses NTCIP communications to communicate with their signal systems and dynamic message signs. The city wants to be able to manage its video detection systems from the same central system. The city developed a TSS Communications Specification based on NTCIP 1209 Standard v02. One of the current equipment providers, ICU Detection Systems, implemented NTCIP 1209 Standard v02 for its video detection system products. The city needs to test the communications to verify compliance to the specification.

Test Specification Documents



Graphics: Ralph W. Boaz

TSS Communications Test Plan

1 Introduction

This document is a TSS Communications Test Plan as part of the Buena Vida Central System Project. This Introduction includes the following subsections: Document Identifier, Scope, References, etc.

1.1 Document Identifier

TSSCommTP v01.04
TSS Communications Test Plan v01.04
30 March 2015

1.2 Scope

This test plan covers the communications for video detection devices as part of an overall acceptance process for traffic control field equipment under the Buena Vida Central System Project.

TSS Communications Test Plan (cont.)

1.3 References

Buena Vida TSS Communications Specification
Buena Vida Central System Project Management Plan
Buena Vida Video Detection Acceptance Test Plan
NTCP 1209 Standard v02
IEEE Std 829-2008

1.4 Level in the Overall Sequence

1.5 Test Classes and Overall Test Conditions

This test plan covers the NTCIP communications for a TSS. Testing will be performed in both a laboratory environment with test software and in integrated testing with the city's central system both in the lab and in the field.

TSS Communications Test Plan (cont.)

2 Details for this level of test plan

2.1 Test items and their identifiers

VIDS Model 2020 from ICU Detection Systems
VIDS Model 2020 User's Manual
VIDS Model 2020 Installation Guide

2.2 Test Traceability Matrix

[Including this in the TSS Communications Test Designs]

2.3 Features to be tested

2.5.1 Configure the TSS
2.5.1.1 Determine the TSS Identity
2.5.1.2 TSS Capabilities
2.5.1.2.1 Determine TSS Support for Sampling

TSS Communications Test Plan (cont.)

2.4 Features not to be tested

2.5.5 Multi-Version Interoperability (MVI-Backward Compatibility)
2.5.5.1 NTCIP 1209:2005 (v01) Conformant
2.5.5.1.1 Retrieve NTCIP 1209:2005 (v01) Conformant Most Recent Sample Data

2.5 Approach

This testing will include: a) bench testing the TSS in the city's lab using a test tool, b) integrating the TSS with the city's system within the lab and exercising the communications using the central system software, and c) field testing the TSS at the city's test intersection using the central software.

2.6 Item pass/fail criteria

The test item will be considered to have passed if it successfully completes all test cases and their associated test procedures.

TSS Communications Test Plan (cont.)

2.7 Suspension criteria and resumption requirements

There are four major feature areas of the TSS communications: a) Configure the TSS, b) Control the TSS, c) Monitor the TSS and d) Collect data from the TSS. If there are more than five failed test cases in any one major area, testing for the area will be suspended until the issues are resolved.

2.8 Test deliverables

TSS Comm Test Plan
TSS Comm Test Designs
TSS Comm Test Cases
TSS Comm Test Procedures
TSS Comm Test Logs
TSS Comm Test Incident Reports
TSS Comm Interim Test Status Reports
TSS Comm Test Reports (one for each test design)

TSS Communications Test Plan (cont.)

3 Test management

3.1 Planned activities and tasks; test progression

The TSS Comm testing will not be performed until the item under test passes the Video Detection Acceptance Test Plan.

3.2 Environment/infrastructure

For bench TSS communications testing, the city's lab will be equipped with a laptop running NTCIP Tester Software, loaded with the NTCIP 1209 MIB, test cases, and test procedures. For integration communications testing, …

3.3 Responsibilities and authority

The overall TSS communications testing is under the management of Jane Doe, the city's Deputy Traffic Engineer. Testing Consultants, Ltd, has been hired to produce the test documents and carry out the testing process.

TSS Communications Test Plan (cont.)

3.4 Interfaces among the parties involved

No additional interfaces required.

3.5 Resources and their allocation

No additional resources required.

3.6 Training

No additional training required.

3.7 Schedules, estimates, and costs

The time frame for TSS Communications Testing is determined by the project schedule in the Buena Vida Central System Project Management Plan.

3.8 Risk(s) and contingency(s)

Risks are being tracked as part of the project risk management plan.

TSS Communications Test Plan (cont.)

4 General

4.1 Quality assurance procedures

The testing quality will fall under the Testing QA Procedures established by the city and Testing Consultants, Ltd.

4.2 Metrics

The percentage of test cases passed per test design will be recorded.

4.3 Test coverage

All data elements specified by the PRL and RTM shall be included in at least one test using nominal values.

4.4 Glossary

4.5 Document change procedures and history

TSS Communications Bench Test Design

1 Introduction

1.1 Document identifier

TSSCommBenchTD v01.02
TSS Communications Bench Test Design v01.02
30 March 2015

1.2 Scope

This test design describes the TSS bench communications testing for the TSS Communications Test Plan.

1.3 References

TSS Communications Bench Test Design (cont.)

2 Details of the Level Test Design

2.1 Features to be tested

2.5.1 Configure the TSS

2.5.1.1 Determine the TSS Identity

2.5.1.2 TSS Capabilities

2.5.1.2.1 Determine TSS Support for Sampling

2.2 Approach refinements

The bench testing will be conducted using laptop running NTCIP Tester Software, loaded with the NTCIP 1209 MIB, test cases, and test procedures. The TestCo NTCIP Tester Software will be used to drive the testing and capture results.

2.3 Test identification

[Test Traceability Matrix]

TSS Communications Bench Test Design (cont.)

2.4 Feature pass/fail criteria

The test item will be considered to have passed the testing under this test design if it successfully completes all test cases and their associated test procedures.

2.5 Test deliverables

TSS Comm Bench Test Design

Associated test documents resulting from this test design:

- **TSS Comm Test Cases**
- **TSS Comm Test Procedures**
- **TSS Comm Test Logs**
- **TSS Comm Test Incident Reports**
- **TSS Comm Interim Test Status Reports**
- **TSS Comm Test Report**

TSS Communications Bench Test Design (cont.)

3 General

3.1 Glossary

3.2 Document change procedures and history

TSS Communications Test Cases

1 Introduction (once per document)

1.1 Document identifier

TSSCommBenchTC v01.02
TSS Communications Test Cases v01.02
30 March 2015

1.2 Scope

This document contains all of the test cases used for the TSS Communications Test Design.

1.3 References

1.4 Context

No additional context necessary.

TSS Communications Test Cases (cont.)

1.5 Notation for description

Test cases have identifiers that are associated with a feature being tested having the form *TCf-n.vv,* where: *TC* indicates the identifier is a test case, *f* indicates the feature paragraph number within the NTCIP 1209 Standard, -*n* is a sequential number uniquely identifying the test case for the feature, and *.vv* is the two digit version number of the test case.

TSS Communications Test Cases (cont.)

2 Details (once per test case)

2.1 Test case identifier

TC3.4.3.1.7-1.03 Verify Zone Class Labels
TSS Comm Test Case 1 Version 03 for Feature 3.4.3.1.7
30 March 2015

2.2 Objective

This test case validates that the TSS has zone classification labels according to the city's specification.

2.3 Inputs

File containing the vehicle classification labels from the city specification: "Classes 11-13," "Classes 8-10," "Classes 4-7," "Classes 2-3," and "Class 1." Each entry is on a single line in file ClassLabels.txt.

TSS Communications Test Cases (cont.)

2.4 Outcome(s)

Self-validating test case

2.5 Environmental needs

Windows 7 PC with i5 Intel CPU @ 2 GHz processor, 8 GB RAM, and 200 GB available storage

TestCo NTCIP Tester Software v02.05

2.6 Special procedural requirements

None

2.7 Intercase dependencies

None

TSS Communications Test Cases (cont.)

3 Global

3.1 Glossary

3.2 Document change procedures and history

TSS Communications Test Procedures

1 Introduction

1.1 Document identifier

TP3.4.3.1.7-1.08 Verify Zone Class Labels Procedure
TSS Comm Test Procedure 1 Version 08 for Feature 3.4.3.1.7
17 May 2015

1.2 Scope

This test procedure is used to validate that the TSS has zone classification labels according to the city's specification.

1.3 References

TC3.4.3.1.7-1.03

1.4 Relationship to other procedures

None

TSS Communications Test Procedures (cont.)

2 Details

2.1 Inputs, outputs, and special requirements

Inputs: See TC3.4.3.1.7-1.02
Outputs: Logs, Pass/Fail

2.2 Ordered description of the steps to be taken

Step 1: Open FILE = ClassLabels.txt;
Step 2: SZCLASSENTRY = Get zoneSequenceTableEntry:numSensorZoneClass.0;
Step 3: Read FILEENTRY from FILE;
Step 4: SZCLASSLABEL = Get zoneClassLabel.SZCLASSENTRY.0;
Step 5: If (FILEENTRY = SZCLASSLABEL) Then
log ("Step:6 Pass Label", SZCLASSLABEL; Pass)
Else log ("Step:6 Pass Label", SZCLASSLABEL; Fail);
Step 6: If (SZCLASSENTRY > 0) Then
SZCLASSENTRY = SZCLASSENTRY – 1
Goto Step 3
…

TSS Communications Test Procedures (cont.)

3 General

3.1 Glossary

3.2 Document change procedures and history

ACTIVITY

STANDARDS ITS TRAINING

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

Which of the following is a TRUE statement?

Answer Choices

a) Only manufacturers need to be concerned with testing

b) Well-written agency TSS specifications facilitate testing

c) Good testing is easy

d) The only thing that matters is the level test report

Review of Answers

a) Only manufacturers need to be concerned with testing

Incorrect. Agencies and their consultants cannot rely on the manufacturer to be sure that a product meets the specification.

b) Well-written agency TSS specifications facilitate testing

Correct! This has been demonstrated through this module and the entire Professional Capacity Building (PCB) program.

c) Good testing is easy

Incorrect. Good testing can be difficult and tedious but it is necessary. In the long run, it saves the agency money, reputation, and shows public accountability.

d) The only thing that matters is the level test report

Incorrect. While some people want to hold to the bottom line, understanding and performing good testing practices are essential.

Summary of Learning Objective #4

Describe the Testing of a TSS Using Sample Test Documentation

- TSS Communications Test Plan
- TSS Communications Test Design(s)
- TSS Communications Test Cases
- TSS Communications Test Procedures

What We Have Learned

1) IEEE 829-2008 provides for test documents that are used in test specification and test _reporting_.

2) There are many types of testing can be performed on a TSS. When testing a TSS for compliance to an NTCIP 1209-based specification, we are concerned with _communications_.

3) Both NTCIP 1209 Standard and the agency's _specification_ are critical in developing good test _documentation_.

4) A _Test_ Traceability Matrix is a key element of a TSS Communications Test _Design_.

5) In practice, the IEEE Std 829-2008 recommended document outlines may be tailored to improve their _effectiveness_ on a given project.

Resources

- *IEEE Std 829-2008 IEEE Standard for Software and System Test Documentation*
- *NTCIP 1209 National Transportation Communications for ITS Protocol Object Definitions for Transportation Sensor Systems (TSS) Version 02*
- *ITS PCB Training*
  http://www.pcb.its.dot.gov/

QUESTIONS?

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Research and Technology