

USDOT Tools for ITS Standards Deployment

Test Procedure Generator (TPG) and Center-to-Center Reference Implementation (C2C RI)

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What Will You Learn

- What are Intelligent Transportation System Standards?
- Introduction to the Test Procedure Generator (TPG)
 - Why is it important and what are the benefits?
 - How to obtain the software and get support
- Introduction to the Center-to-Center (C2C) Reference Implementation (RI)
 - Why is it important and what are the benefits?
 - How to obtain the software and get support

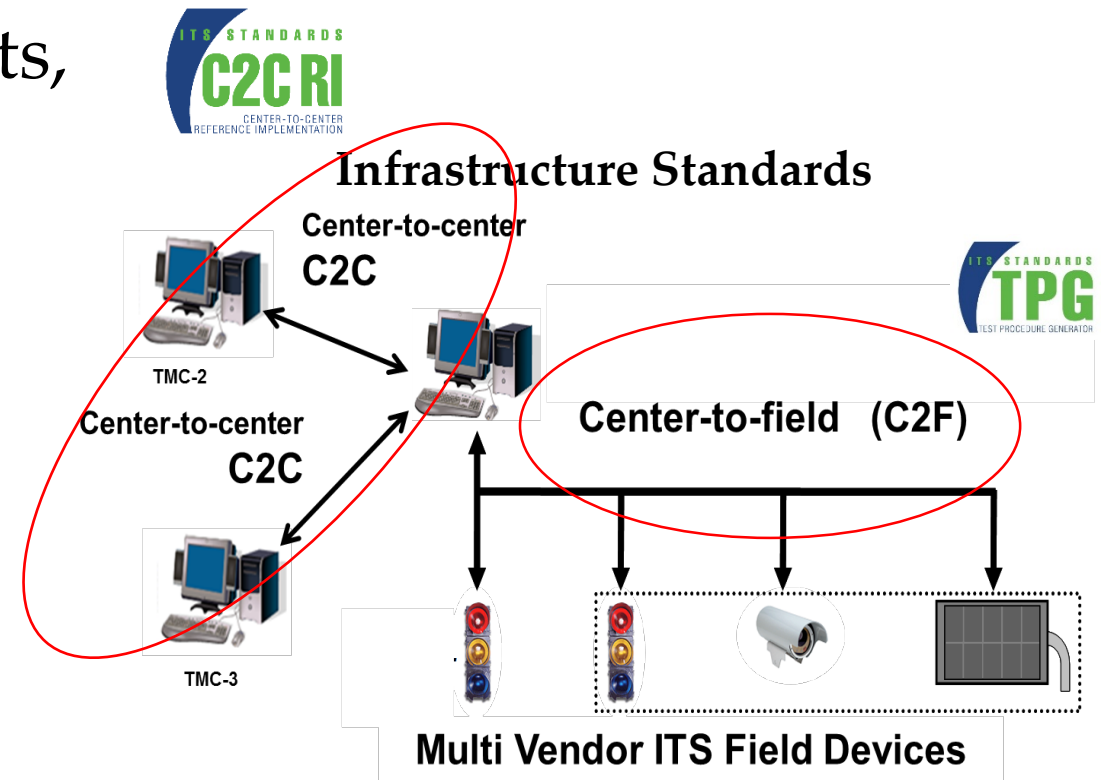


What are Standards?

- Established norm or requirement about technical systems that establishes:
 - Uniform engineering or
 - Technical criteria, methods, processes, and practices
- Most standards are:
 - Voluntary
 - Consensus-based
 - Open

What are ITS Standards?

- Define how ITS systems, products, and components:
 - Interconnect
 - Exchange information
 - Interact
 - Within a transportation network



Benefits

- Supports interoperability
- Supports Rule 940 compliance
- Minimizes future integration costs
- Facilitates regional integration
- Supports incremental measurable development
- Prevents technological obstacles
- Minimizes operations and maintenance costs
- Prepares for emerging technologies
- Makes procurements easier
- Easier and more robust test for conformance

Test Procedure Generator (TPG)



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NTCIP Purpose

- National Transportation Communications for ITS Protocol (NTCIP) Standards provide:
 - Rules for communicating (protocols)
 - Vocabulary (objects and dialogs) for electronic traffic control equipment among different manufacturers to interoperate
- NTCIP Standards
 - Promote vendor independence
 - Reduce life-cycle costs
- NTCIP Standards address communication between
 - Field Devices
 - Management Centers and Field Devices
 - Two or more Management Centers

Test Procedure Generator (TPG)



- A survey of state and local transportation agencies in 2006-2007 indicated a need for assistance from the USDOT in developing procurement and testing documents when implementing ITS Standards.
- The ITS Standards Program determined one way to assist would be to develop a tool that generates test procedures for the center-to-field (C2F) ITS Standards in a consistent manner.
- To develop complete and correct test procedures, ITS Standards must contain requirements and other System Engineering content.



What is the TPG and How Does it Work?

- Windows based software tool that processes NTCIP Standards and outputs Test Procedures.
- Supports ITS Standard developers as well as deployers (local and state agencies) of NTCIP C2F Standards.
- TPG guides the development of test procedures by:
 - Loading and processing standard to be implemented including requirements, dialogs, and objects
 - Test Procedures based on user selected requirements in NTCIP C2F Standard

What is the TPG and How Does it Work?



- Uses standardized and consistent language for Test Procedures development:
 - Standard keywords, variables, and object names imported from standard
- Outputs an XML file for consistent interpretation for test suites
- Standards Developers use the TPG to create consistent Test Procedures and verify standards

The TPG is not a testing tool

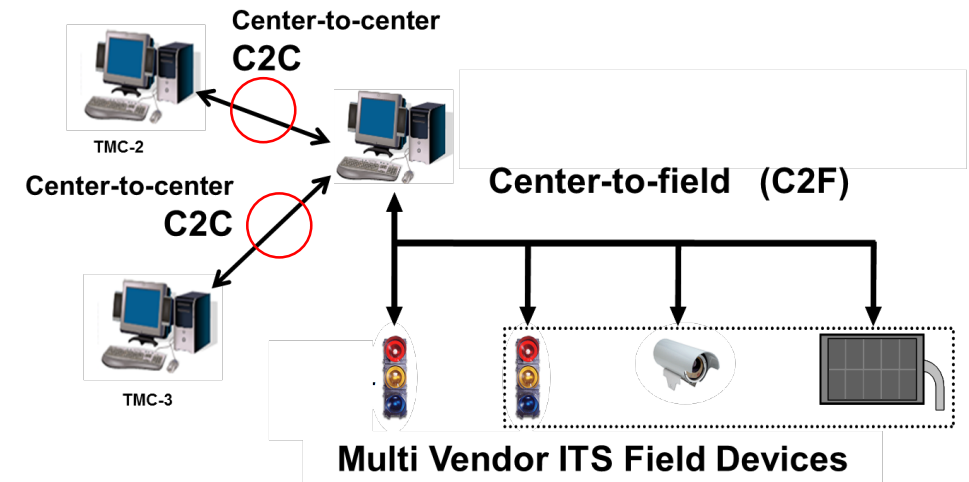
Center-to-Center Reference Implementation (C2C RI)



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What is C2C and Why is it Important?

- Center-to-Center (C2C) communications
- Coordination between centers
 - Incident management between agencies
 - Traffic coordination
 - Transit coordination
 - Status of network
 - Integrated Corridor Management
 - Smart Region/Smart Cities
- How do we achieve interoperability
 - Needed for exact and prompt coordination
 - Protocol must be the same
 - Message contents must have same meaning
- Proprietary implementations do not achieve off-the-shelf interoperability



Why was the C2C RI Needed?



- C2C identified in National ITS Architecture
- **Regional coordination is occurring (driven by congestion issues)**
- **No consistent means to verify standards conformance**
- The C2C standards were still a moving target
- Extensions common for C2C breaking standardized capabilities – not invented here common
- **Interoperability not being achieved**
- **Agencies asking how to test for conformance**
- USDOT sponsored development of C2C RI to encourage deployments and interoperability

C2C RI



- The Center-to-Center Reference Implementation (C2C RI) is a test tool designed to test for conformance to ITS Standards for center to center communications
- Sponsored development and provided for free by USDOT to help promote implementation of center to center communications standards

How Does the C2C RI Work?

- C2C RI currently works with:
 - Traffic Management Data Dictionary (TMDD) v3.03c and v3.03d
 - NTCIP 2306 v1.69
- Can verify both transmissions from owning centers and requests from external centers
- Emulates devices (version 2)
- Provides test for SAFETEA-LU Section 1201
- Verifies formats, protocols, and performance requirements

How Does the C2C RI Work?



- Can be configured to test for only your center's requirements
- Provides test reports and logs test results
- Can be used for debugging, conformance testing, and acceptance testing

C2C RI Capabilities Summary



C2C RI Capabilities

- | | | |
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| <ul style="list-style-type: none">• Verifies TMDD v3.03c and 3.03d• Supports request/response operations• Supports Publication/Subscription operations• Provides Emulation of devices (DMS, ESS, Traffic Controller, Ramp Meter, CCTV control, Vehicle Detector, HAR, Lane Closure Gate, Lane Control Signal, Signal Section & Video Switch)• Provides Emulation of Events• Allows for local extensions as per TMDD v3.03c• Supports debugging and conformance | <ul style="list-style-type: none">• Configures for project needs and requirements• Automatically selects test cases and procedures• Logs test activities and results• Provides tester the ability to confirm key content in an automated testing environment• Generates test reports for conformance• Generates SAFETEA-LU section 1201 conformance report• Provides test suspension and termination capabilities | <ul style="list-style-type: none">• Verifies NTCIP 2306 v1.69• Supports XML Text, GZIP, SOAP encoding• Supports XML over HTTP, XML over FTP, SOAP over HTTP• Supports WSDL & WSDL for SOAP Request-Response messaging• Supports WSDL & WSDL for SOAP Subscription-Publication messaging |
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How to Obtain the Tools

- TPG v3 is now available updates include:
 - Compatibility with Windows 7 and 10 Professional
 - Compatibility with Microsoft Office 2010
- TPG Support: TPGSupport@noblis.org
- C2C RI v2.1 is now available updates include:
 - Test Case and Test Procedure Reports
 - Section 1201 Conformance Reports
 - Support for 32-bit operating systems
 - Entity Emulation Mode Option
- C2C RI Support: c2crisupport@transcore.com



For more information and to acquire the Tools please visit:

<https://www.standards.its.dot.gov/DeploymentResources/Tools>

Benefits of the TPG and C2C RI

TPG

- Agencies can use the TPG to develop consistent test procedures for verifying conformance and compliance.
- Using the TPG tool reduces developmental risks, effort, and cost of developing standards and project test procedures.



C2C RI

- Reduces development risks, and Costs to achieve interoperable systems.
- Easier and more robust test for conformance to standards.
- Allows you to select the requirements you want to verify.



Summary

- Agencies can use the TPG to develop consistent and reusable test procedures for verifying conformance and compliance.
- Using the TPG and C2C RI tool will reduce risks, effort, and the cost of developing test procedures.
- Promoting off-the-shelf interoperability.
- USDOT is actively seeking local or state agencies to partner with in deployment of NTCIP C2F Standards or C2C Standards using the Tools
 - Use the experience to make any necessary updates to the software
 - Get the tool into the hands of the agencies to prove its worth in the field and encourage more agencies to use the software

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<https://www.standards.its.dot.gov/DeploymentResources/Tools>