NTCIP

FOR

DUMMIES

Presented to TexITE at the Summer Meeting in Midland, TX – June, 2001

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National

Transportation

Communications for

ITS → **I**ntelligent **T**ransportation **S**ystems (formerly IVHS)

Protocol

NTCIP - What Is IT?

- ITS a STANDARD
  - NTCIP is currently 62 STANDARD documents available from http://www.ntcip.org which specify the communication and data requirements for all ITS devices.
- ITS a PROTOCOL
  - NTCIP is a PROTOCOL that governs the data exchange between ITS devices and regional centers over a communications network.
- ITS an ARCHITECTURE
  - NTCIP is the communications component of the National ITS ARCHITECTURE which encompasses all areas and activities of ITS.
- ITS the LAW!
  - Section 5206(e) of TEA-21 requires ITS projects funded from the highway trust fund to conform to the National ITS Architecture, applicable standards and protocols. FHWA final ruling was mandated Jan. 8, 2001 in the Federal Register.

NTCIP - A Win Win For Users & Manufacturers

- To the ITS device user, NTCIP is
  - Expandable – no more planned or unplanned "obsolescence"
  - Interoperable – simplifies the integration process
  - Compatible – no interference with similar ITS devices
  - Nonproprietary – promotes price competition
  - Scaleable – performance does not change as size of project grows
- To the ITS device manufacturer, NTCIP
  - Reduces Manufacturing Costs
  - Reduces Software Maintenance
  - Reduces Unwanted Software Development
  - Converges With Mainstream Technologies
  - Simplifies Training and Support

NTCIP - Where Did It Come From?

- NTCIP evolved from NEMA Standard 11-6-75 (TS1)
- TS1 was adopted in 1975 to provide interchangeability between actuated traffic signal controllers and the signal cabinet
- TS1 specified the cabinet interface (A–B–C connectors)
- TS2 specified an SDLC serial interface to replace this point-to-point wiring with data messages that interconnect devices in the cabinet
- NEMA began development of NTCIP in 1992 as a communications standard for messages between the controller and ATMS to provide interchangeability between the controller and the system.

The National ITS Architecture – An Analogy

Field Device

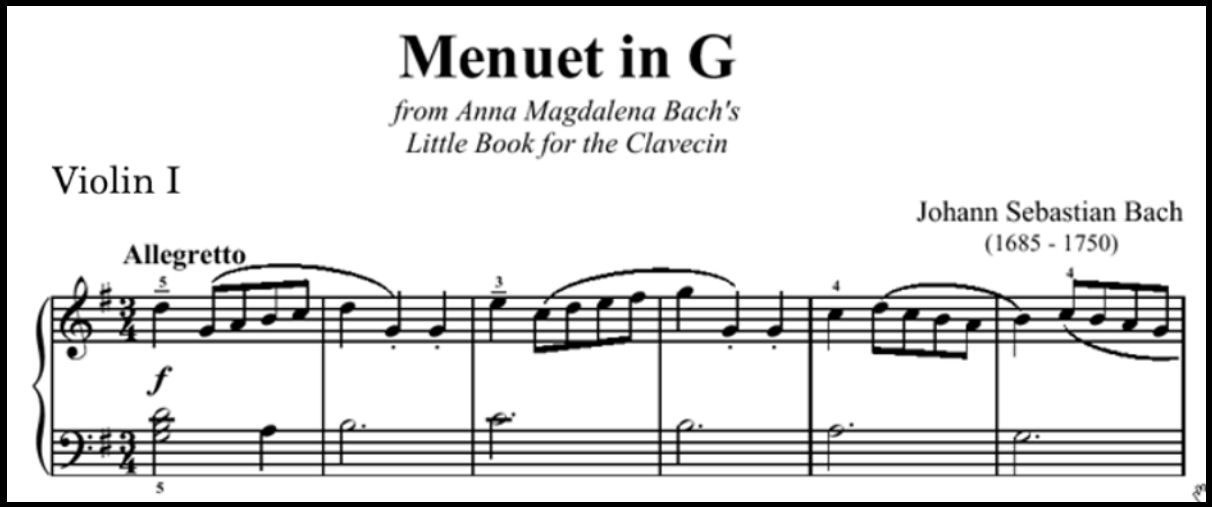
SDO (Standards Developing Organizations)
NEMA, FHWA, ITE, AASHTO, IEEE, SAE, etc.

Musical Notation is a Protocol

Title of Musical Score

Orchestra Section

Composer



Musical notation is a protocol that governs the data exchange between the musician and the musical instrument.

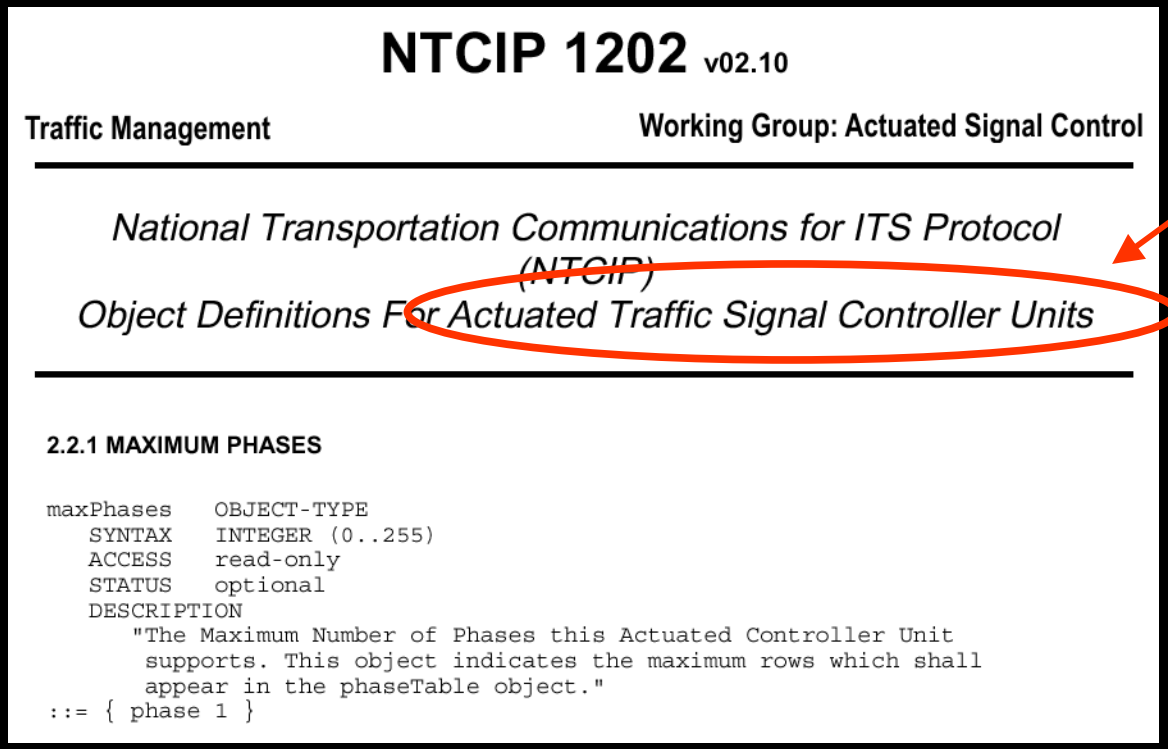
NTCIP Standard Documents Are Protocols

NTCIP Standard Document

ITS Regional Center

Composer

Field Device



NTCIP 1202 v02.10

Traffic Management — Working Group: Actuated Signal Control

National Transportation Communications for ITS Protocol (NTCIP)

Object Definitions For Actuated Traffic Signal Controller Units

2.2.1 MAXIMUM PHASES

```
maxPhases    OBJECT-TYPE
   SYNTAX    INTEGER (0..255)
   ACCESS    read-only
   STATUS    optional
   DESCRIPTION
      "The Maximum Number of Phases this Actuated Controller Unit
       supports. This object indicates the maximum rows which shall
       appear in the phaseTable object."
::= { phase 1 }
```

An NTCIP standard document is a protocol that governs the exchange of data objects between the ITS Center and the Field Devices.

NTCIP Working Groups Are The Composers

Abbreviation	SDO: Working Group
ASC	NTCIP: Actuated Signal Control WG
BSP	NTCIP: Base Standards and Protocols WG
C2C	NTCIP: Center-to-center Profiles WG
CCTV	NTCIP: Closed Circuit TV WG
DCM	NTCIP: Data Collection and Monitoring WG
GOWG	NTCIP: Global Objects WG
STRGRP	NTCIP: Joint Cmte on the NTCIP WG
PRO	NTCIP: Profiles WG
RMC	NTCIP: Ramp Metering WG
SCP	NTCIP: Signal Control and Prioritization WG
TSS	NTCIP: Transportation Sensor Systems WG

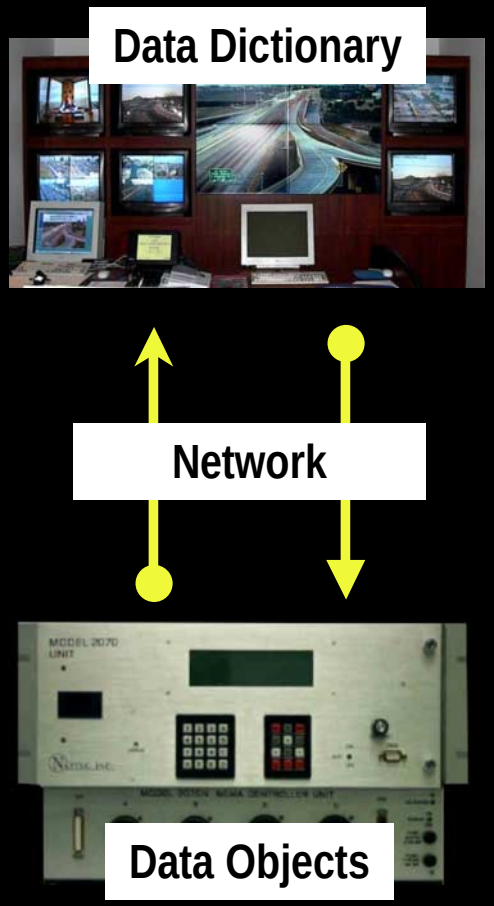
The Builder's Craft

The master craftsman builds each instrument to exact specifications so the musician can perform the function intended by the conductor.

Manufacturers craft ITS field devices that conform with ITS and NTCIP standards to achieve the design intended by the SDO

NTCIP Allows YOU to Play in the ITS Orchestra

NTCIP Protocol – How It Works



NTCIP is a PROTOCOL that governs the data exchange between ITS devices and regional centers over a communications network.

Works just like WonkaVision!!

The Open Systems Interconnect (OSI) Model

Data Dictionary → Information Level

Application Layer
Presentation
Session Layer → Application Level

NTCIP 1101 - STMF
Simple Transportation
Management Framework

Transport Layer
Network Layer → Transport Level

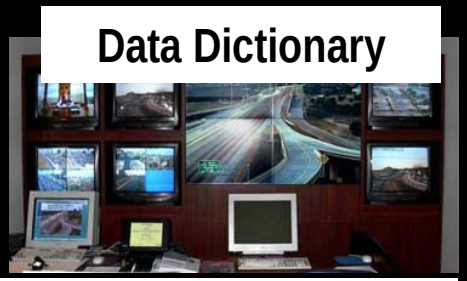
NTCIP 2001 – Class B

Data Link Layer
Physical Layer → Sub-Network Level

NTCIP 2002 – Class A & C
(withdrawn)

Data Objects → Object Level

Object Level



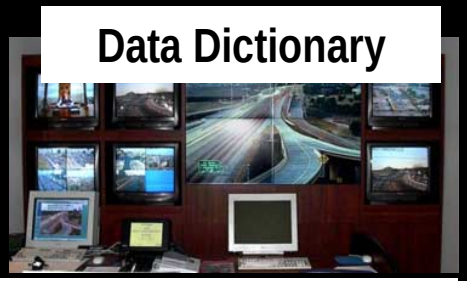
The Object Layer defines the database in the field device in terms of optional and mandatory objects (conformance groups).

The required NTCIP documents defining objects for Actuated Signal Control (ASC) are:

- NTCIP 1201 – Global Object Definitions
- NTCIP 1202 – Actuated Signal Controller (ASC)

The NEMA Working Group on "Field Management Stations" is currently developing NTCIP 1210 – "NTCIP Objects for Signal System Masters" – 1st draft available in third quarter of this year.

Sub-Network Level



Application Layer

Presentation

Session Layer

Transport Layer

Network Layer

Data Link Layer

Physical Layer

The Physical Layer transmits raw data bits over a communication channel (the “interconnect”)

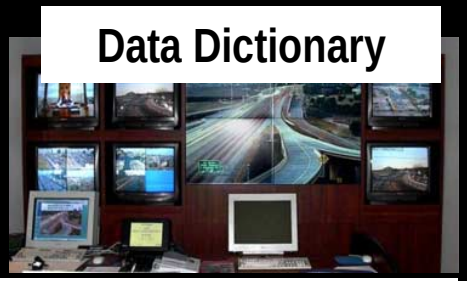
The Data Link Layer guarantees to the network layer that there are no transmission errors by breaking the input data stream up into frames and sending back acknowledgement frames

NTCIP 2101/2102 – Subnet Profiles is required to implement this level for ASC.

Optional NTCIP documents related to this layer are:

- NTCIP 2101 - SP-PMPP/RS232
- NTCIP 2102 - SP-PMPP/FSK
- NTCIP 2102 - SP-PPP/RS232
- NTCIP 2104 - SP-Ethernet

Transport Level



The Network Layer uses TCP/IP to send the data packets from a source to a destination.

- NTCIP (Class A) supports "routing" as used by the Internet to pass data between sub-networks.
- NTCIP (Class B) is designed for a single network.

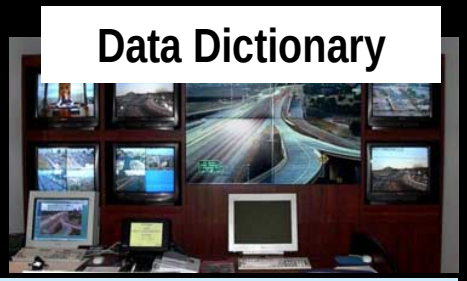
The Transport Layer splits up data from the session layer to ensures that all the pieces arrive correctly after they pass over the network.

The required NTCIP standard supporting this level is:

- NTCIP 2201/2202 – Transport Profiles

This specification is built upon the same RFC standards that define TCP/IP and the Internet

Application Level



Application Layer

Presentation

Session Layer

Transport Layer

Network Layer

Data Link Layer

Physical Layer

The Application Level defines the syntax, or grammar of the protocol. A good analogy is the way we used sentence diagramming in grade school to study the underlying framework of the English language.

NTCIP 2301 - AP-STMF (Simple Transportation Management Framework) is required and defines:

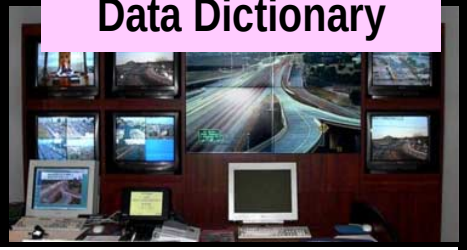
- SNMP – Simple Network Management Protocol
- STMP – Simple Transportation Management Protocol

Optional NTCIP documents related to this layer are:

- NTCIP 2302 - AP-TFTP
- NTCIP 2301 - AP-FTP
- NTCIP 2301 - AP-DATEX-ASN
- NTCIP 2301 - AP-CORBA

Information Level

Data Dictionary



Application Layer

Presentation

Session Layer

Transport Layer

Network Layer

Data Link Layer

Physical Layer

Data Objects

ITE, FHWA and AAHSTO are working together to develop a comprehensive database for ITS called the Traffic Management Data Dictionary (TMDD).

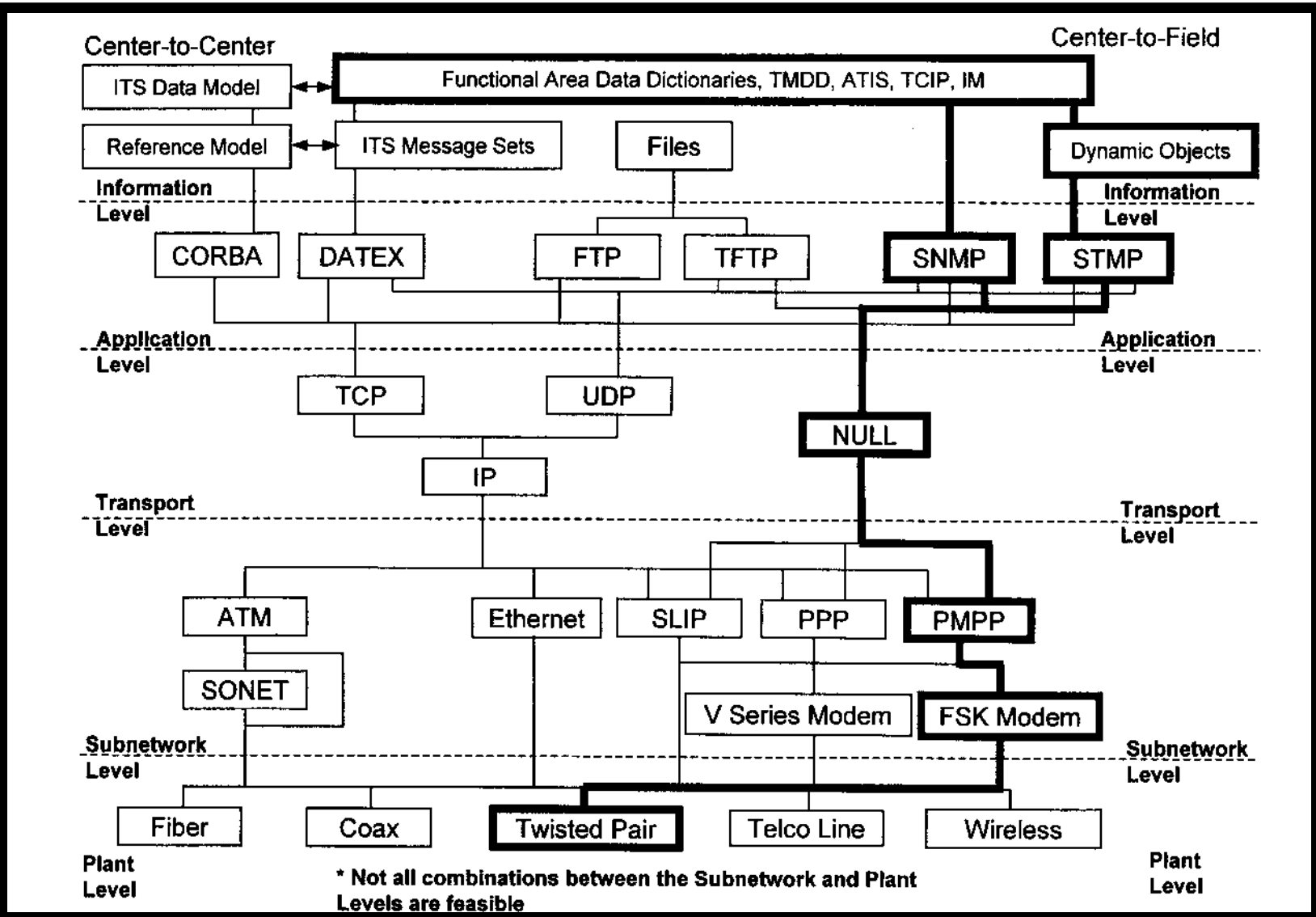
The TMDD includes all the object definitions for the field devices. The following documents are used to define an Actuated Signal Controller (ASC) in the TMDD:

- NTCIP 1201 – Global Object Definitions
- NTCIP 1202 – Actuated Signal Controller (ASC)

Visit the following site to get more information on the TMDD. You can also download Microsoft Access databases and view html files for each dictionary.

http://www.ite.org/tmdd

ITS Framework Example



Recommended Reading

- Download document 9001 – "NTCIP Guide" from the NTCIP web site at:
  - http://www.ntcip.org
- Sign up to receive the ICDN Newsletter (through e-mail)
  - http://www.nawgits.com
- Learn more about ITS Architecture, Standards & Testing:
  - http://www.its.dot.gov/aconform/Policy.htm
  - http://www/its-standard.net
  - http://www.ite.org/standards/index.html

Conclusions

- NTCIP is here to stay and mandated on all federally funded projects
- NTCIP is a Win/Win for users and developers of ITS devices
- NTCIP is a protocol that provides standard data exchanges between regional centers and field devices
- NTCIP standard documents follow the OSI 7 layer model (WonkaVision) which is the foundation of the Internet