

Joint AASHTO / ITE / NEMA Standards Publication TS 3.CP-CLA - 1998

*NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL (NTCIP)
Class A and Class C
Class Profiles*

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Foreword

This publication defines two communication class profiles, Class A and Class C, which are a combination of other profiles and standards intended to meet specific requirements for information management and information transfers to and from roadside devices in a networked environment. The Class A and Class C Profiles provide the definition of the protocols and standards to form a complete communication stack. They contain mandatory requirement statements that are applicable to all device claiming conformance to one or both of the class profiles. They may, also, contain optional and conditional requirements which may be applicable to a specific environment in which they are intended.

This standards also provides an informative annex describing the NEMA TS 3.3 NTCIP Class B Profile in terms of Application, Transport, and Subnetwork Profiles. It is not intended to supercede or replace the TS 3.3. Its purpose is to outline requirements when integrated or interoperating with implementations of the Class A or Class C Profile.

The text includes mandatory requirements in Annex A and Annex C which are defined as normative.

The text in Annex B is informative.

The effort to develop NTCIP began in 1992 with the 3-TS Transportation Management Systems and Associated Control Devices Section of the National Electrical Manufacturer's Association (NEMA). Their original desire was to address a user need for extending the TS-2 Standards for traffic control hardware to include standardized systems communication. Under the guidance of the Federal Highway Administration's (FHWA) NTCIP Steering Group, the NEMA effort was expanded to include the development of communications standards for all transportation field devices that could be used in an Intelligent Transportation Systems (ITS) network.

In September 1996, a formal agreement was reached among NEMA, ITE, and AASHTO to jointly develop, approve, and maintain NTCIP Standards. Under guidance of a Joint AASHTO/ITE/NEMA Committee on NTCIP, a Working Group was created in order to develop a method for organizing Class Profiles. The first official meeting of the working group was in August 1997.

After research into how national and international standards organizations combine protocols and standards to address all seven layers of the ISO-OSI Reference Model, the committee adopted the approach defined in the *NTCIP Framework and Classification of Profiles*. Following that approach, a protocol stack or class profile is specified by reference to application, transport, subnetwork profiles. An application profile addresses the application, presentation, and session layers. A transport profile addresses the transport and network layers. A subnetwork profile addresses the data link and physical layers. The *NTCIP Class A and Class C – Class Profiles* (CP-A and CP-C) define combinations of protocols and standards for the full set of communications functions and services prescribed by the reference model. It is applicable to center-to-roadside communications.

In preparation of the Standards Publication, input of users and other interested parties was sought and evaluated. Inquires, comments, and proposed or recommended revisions should be submitted to:

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Introduction

The context of the NTCIP is one part of the Intelligent Transportation Systems standardization activities covering base standards, profiles, and registration mechanisms.

- Base Standards define procedures and rules for providing the fundamental operations associated with communications and information that is exchanged over fixed-point communications links.
- Profiles define subsets or combinations of base standards used to provide specific functions or services. Profiles prescribe particular subsets or options available in base standards necessary for accomplishing a particular function or service. This provides a basis for the development of uniform, nationally recognized conformance.
- Registration Mechanisms provide a means to specify and uniquely identify detailed parameters within the framework of base standards and/or profiles.

Within the Joint AASHTO/ITE/NEMA NTCIP Committee, the Profiles Working Group is concerned with the methodology of defining profiles, and their documentation in Standards Publications. This standard defines two communication class profiles, Class A and Class C, which are a combination of base standards and/or other profiles intended to meet specific requirements for information management and information transfer in roadside devices in a networked environment. This standard also discusses methods for integrating the existing Class B Profile with new profiles. The objective is to facilitate the specification of ITS systems characterized by a high degree of interoperability and interchangeability of its components.

Section 1 General

1.1 Scope

This standard is applicable to transportation devices concerned with operating in a network environment. It specifies a combination of NEMA, Internet, and OSI standards which collectively provide information management services over connectionless and connection-oriented transport and connectionless network services. It also provides a reference to the type of subnetwork to which these services are to be attached.

1.2 Scenario

This standard specifies the provisions of the NTCIP Class A and Class C Profiles. Class profiles define standards and/or other profiles that describe the complete functionality of a communications stack. The concept of a communication stack is based upon the OSI Reference Model and consists of seven layers. These layers represent the logical grouping and functional organization of communications processing. For the purposes of organization and reuse, the requirements for implementation of these layers are organized into application, transport, and subnetwork profiles. An application profile addresses the services and protocols associated with the application, presentation, and session layers. A transport profile addresses the services and protocols associated with the transport and network layers. A subnetwork profile addresses the services and protocols associated with the data link and physical layers.

ISO Layers	Base Standards	Profile Taxonomy	
APPLICATION LAYER	IAB STD 15 (SNMP) IAB STD 33 (TFTP)	AP-STMF AP-TFTP Application Profiles	CP – A Class Profile
PRESENTATION LAYER			
SESSION LAYER			
TRANSPORT LAYER	IAB STD 6 (UDP)	TP – INTERNET Transport Profile	
NETWORK LAYER	IAB STD 5 (IP)		
DATA LINK LAYER	ISO/IEC 3309 ISO/IEC 4335 ISO/IEC 7809 TS 3.3 Class B Profile	SP-PMPP232 Subnetwork Profile	
PHYSICAL LAYER	EIA/TIA 232-E		

Figure 1
Class A - Class Profile Scenario

The Class A Profile consists of the Simple Transportation Management Framework (STMF) and Trivial File Transfer Protocol (TFTP) Application Profiles, the User Datagram Protocol (UDP/IP) configuration of the Internet Transport Profile, and the Point-to-Multipoint Protocol using RS-232 (PMPP232) Subnetwork Profile. The STMF Profile provides basic information management services. The TFTP Application Profile provides a simple connectionless, block or file transfer mechanism. The UDP/IP configuration of

the Internet Transport Profile provides connectionless transport and network services. The PMPP232 Profile provides an unacknowledged connectionless delivery service on a serial interface subnetwork. The layer, base standards, and profile taxonomy that make up this profile are shown in Figure 1.

The Class C Profile consists of the STMF and FTP Application Profiles, the Transmission Control Protocol (TCP/IP) and UDP/IP configuration of the Internet Transport Profile, and the PMPP232 Subnetwork Profile. The STMF Profile provides basic information management services. The FTP Application Profile provide a connection-oriented file transfer mechanism. The TCP/IP configuration of the Internet Transport Profile provides connection-oriented transport and connectionless network services. The UDP/IP configuration of the Internet Transport Profile provides connectionless transport and network services. The PMPP232 Profile provides an unacknowledged connectionless delivery service on a serial interface subnetwork.

The Class C Profile requires implementation of the SNMP portions of the STMF Profile and UDP/IP for the purposes of managing the communications stack. SNMP is used to set up and modify the programming entries for the communications layers. It is also used for monitoring the statistical information related to how messages are being processed by the communications layers. The layer standards and profile taxonomy that make up this profile are shown in Figure 2.

ISO Layers	Base Standards	Profile Taxonomy		
APPLICATION LAYER	IAB STD 15 (SNMP) IAB STD 9 (FTP)	AP-STMF AP-FTP Application Profiles	CP – C Class Profile	
PRESENTATION LAYER				
SESSION LAYER				
TRANSPORT LAYER	IAB STD 7 (TCP) IAB STD 6 (UDP)	TP – INTERNET Transport Profile		
NETWORK LAYER				IAB STD 5 (IP)
DATA LINK LAYER	ISO/IE 3309 ISO/IEC 4335 ISO/IEC 7809 TS 3.3 Class B Profile	SP-PMPP232 Subnetwork Profile		
PHYSICAL LAYER	EIA.TIA 232-E			

Figure 2
Class C - Class Profile Scenario

It is important for a user or specifier to understand the distinction between these two profiles. The Class A Profile is based upon the connectionless delivery service. This service moves data across a network on a best effort basis. It ensures that no erroneous data will be delivered, but offers no other guarantees. Data may be lost or arrive out of order and the sender cannot query the service as to whether the data got there or not. Messages are simply sent and received with no relationship to any other message.

A connect-oriented delivery service guarantees that all data sent will be received correctly and in order. It does this by establishing a virtual circuit between the sender and intended recipient. The network may experience some fault condition where that circuit is broken, but the sender will be able to find out that the data was not delivered.

Both connectionless and connection-oriented services have their uses. Connectionless delivery minimizes overhead and requires less processing. Connectionless services can provide a broadcast capability wherein a message is sent to multiple recipients. This is not possible with a connection-

oriented service. Connection-oriented services require additional overhead to establish and tear down the virtual circuit.

1.3 References

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For draft revisions of this document, which are under discussion by the relevant NTCIP Working Group, and recommended revisions of the NTCIP Joint Committee, visit the World Wide Web at <http://www.ntcip.org>.

The following standards (normative references) contain provisions which, through reference in this text, constitute provisions of this Standard. Other documents and standards (other references) are referenced in these documents, which might provide a complete understanding of the structure and use of profiles. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standard listed below.

1.3.1 Normative References

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Joint AASHTO / ITE / NEMA Standards Publication TS 3.AP-TFTP – 1998 *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL (NTCIP) Trivial File Transfer Protocol - Application Profile*

Joint AASHTO / ITE / NEMA Standards Publication TS 3.AP-STMF – 1998 *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL (NTCIP) Simple Transportation Management Framework - Application Profile*

Joint AASHTO / ITE / NEMA Standards Publication TS 3.TP-INTERNET1 – 1998 *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL (NTCIP) Internet (TCP/IP and UDP/IP) - Transport Profile*

Joint AASHTO / ITE / NEMA Standards Publication TS 3.SP-PMPP232 – 1998 *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL (NTCIP) Point-to-MultiPoint Protocol using RS-232 Connections- Subnetwork Profile*