# NTCIP 1104   version v01

## National Transportation Communications for ITS Protocol

## Center-to-Center Naming Convention Specification

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# ACKNOWLEDGEMENTS

# FOREWORD

NTCIP 1104 v01 defines the naming service for CORBA for use in center-to-center communications in the transportation domain. NTCIP 1104 v01 may also be referenced by non-CORBA standards in order to define how certain items should be named.

NTCIP 1104 v01 is an NTCIP Base Standard. NTCIP Base Standards provide formal definitions of protocols or services upon which higher-level applications are dependent for use within NTCIP systems.

NTCIP 1104 v01 uses only metric units, and NTCIP 1104 v01 includes no annexes.

This NTCIP 1104 v01 standard is designated, and should be cited as NTCIP 1104 v01. NTCIP 1104 v01 is a Jointly Approved and published NTCIP Standard, reflecting the resolution of comments received during the development and approval process, when drafts were designated using a major and minor version number (v01.01 through v01.08). To distinguish NTCIP 1101 v01 from previous drafts, NTCIP 1104 v01 also includes NTCIP 1104 v01.09 on each page header.

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**Approvals**

NTCIP 1104 v01 was separately balloted and approved by AASHTO, ITE, and NEMA after recommendation by the Joint Committee on the NTCIP. Each organization has approved this standard as the following standard type, as of the date:

> AASHTO – Standard Specification; November 2005
> ITE – Software Standard; October 2005
> NEMA – Standard; October 2005

**History**

The development history of NTCIP 1101 v01 is noted below:

> NTCIP 1104 v01.06, July 2002 – Accepted v01.05 as a User Comment Draft by the Joint Committee on the NTCIP. October 2002 – NTCIP Standards Bulletin B0080 referred v01.06 for review and comment.

> NTCIP 1104 v01.08, January 2005 – Accepted v01.08 as a Recommended Standard by the Joint Committee on the NTCIP July 2005 – NTCIP Standards Bulletin B0104 referred v01.08c for balloting. Approved by AASHTO in November 2005, approved by ITE in October 2005, and approved by NEMA in October 2005.  Jointly Approved as of November 2005.

> NTCIP 1104 v01.09, May 2008 – Prepared document for publication; edited format and front matter.

**Compatibility of Versions**

To distinguish NTCIP 1101 v01 (as published) from previous drafts, NTCIP 1104 v01 also includes NTCIP 1104 v01.09 on each page header. All NTCIP Standards Publications have a major and minor version number for configuration management. The version number syntax is "v00.00a," with the major version number before the period, and the minor version number and edition letter (if any) after the period.

Anyone using NTCIP 1104 v01 should seek information about the version number that is of interest to them in any given circumstance. The MIB, the PRL, and the PICS should all reference the version number of the standards publication that was the source of the excerpted material.

Compliant systems based on later, or higher, version numbers MAY NOT be compatible with compliant systems based on earlier, or lower, version numbers. Anyone using NTCIP 1104 should also consult NTCIP 8004 v01 for specific guidelines on compatibility.

## INTRODUCTION

NTCIP 1104 v01 provides definitions of the naming service for CORBA for use in center-to-center communications in the transportation domain, as well as other environments that reference NTCIP 1104 v01.

NTCIP 1104 v01 defines requirements that are applicable to NTCIP environments that use CORBA and any other environments that reference NTCIP 1104 v01.

The following keywords apply to NTCIP 1104 v01:  AASHTO, ITE, NEMA, NTCIP, CORBA.

In 1992, the NEMA 3-TS Transportation Management Systems and Associated Control Devices Section began development of the NTCIP. The Transportation Section's purpose was in response to user needs to include standardized systems communication in the NEMA TS 2 standard, *Traffic Controller Assemblies.* Under the guidance of the Federal Highway Administration's 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, an agreement was executed among AASHTO, ITE, and NEMA to jointly develop, approve, and maintain the NTCIP standards. The Joint Committee on the NTCIP formed the NTCIP Center-to-Center Working Group to develop center-to-center protocol standards. The NTCIP Center-to-Center Working Group's first meeting was in July 1996. In May 2000, the Joint Committee approved the work item to draft a CORBA naming specification.

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**Section 1
GENERAL**

### 1.1    Scope

NTCIP 1104 v01 is applicable to communications between two (or more) management systems within the Intelligent Transportation Systems (ITS) environment.

NTCIP 1104 v01 lists the requirements for establishing names for management systems and for the objects managed by those systems. The term object is used loosely to include not only physical equipment such as ramp meter controllers and portable message signs, but also other data categories about which centers might desire to exchange information, such as incidents, as well as other data classes within the center.

### 1.2    References

For revision information on NTCIP 1104 v01, contact:

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For draft revisions to NTCIP 1104 v01, and recommended revisions of the NTCIP Joint Committee, visit www.ntcip.org.

### 1.2.1    Normative References

The following standards (normative references) contain provisions that, through reference in this text, constitute provisions of NTCIP 1104 v01. Other documents and standards (other references) which are referenced in NTCIP 1104 v01 might provide a complete understanding of the entire protocol and the relations between all parts of the protocol. 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.

| | |
|---|---|
| ISO 3166-1:2006 | Codes for the representation of names of countries and their subdivisions – Part 1: Country codes, November 20, 2006 |
| ISO 3166-3:1999 | Codes for the representation of names of countries and their subdivisions – Part 3: Code for formerly used names of countries, March 11, 1999 |
| The Object Management Group, Inc. | The Common Object Request Broker:  Architecture and Specification, Revision 2.3, July 1995, last revised October 7, 1999 (CORBA version 2.3) |
| The Object Management Group, Inc. | Common Facilities Architecture, John Wiley & Sons, Framingham, Massachusetts, November 1995, last revised June 15, 1997 |

| The Object Management Group, Inc. | Common Object Services Specifications, John Wiley & Sons, Framingham, Massachusetts, 1995, last revised December 2, 1997 |
| --- | --- |
| The Object Management Group, Inc. | Interoperable Naming Service Specification, Framingham, Massachusetts, November 2000 |

### 1.2.2 Informative References

| ISO 7498:1984 | Information Processing Systems – Open Systems Interconnection – Basic Reference Model |
| --- | --- |

### 1.3 Definitions

For NTCIP 1211 v01 purposes, the following definitions shall be used:

| **Application Layer** | That portion of an OSI system responsible for transferring information over the communications stack. |
| --- | --- |
| **Center** | A computer system that exchanges data with one or more other such systems within the scope of the National ITS Architecture. |
| **Client** | An object or program which accesses a server through one of its interfaces |
| **Communication Network** | A collection of interconnected equipments that provides a data communications service for devices called nodes, often computers, attached to the equipments. |
| **Data Link Layer** | The level of protocol as defined by ISO that provides service to transfer data between network layer entities in communicating nodes. The data link layer provides error detection (and may provide error correction) for errors occurring in the physical layer. |
| **Device** | Physical equipment managed by a center, such as ramp meter controllers, portable message signs, environmental sensors, etc. |
| **Domain Name Authority** | A private or public entity given a contract or assigned responsibility by IANA or its successor ICANN to administer a portion of the Internet name space. |
| **Domain** | A collection of interconnected computers. |
| **Factory** | An object that creates and manages other objects. |
| **Federation** | A collection of trader services. |

| | |
|---|---|
| **Identifier String** | Legal Naming Service characters as defined in the Interoperable Naming Service (INS) specification, excluding forward-slash, and period. Implementations are case sensitive and accommodate uppercase letters, but users should avoid use of names that differ only in case. |
| **Intelligent Transportation Systems** | A major national initiative to improve information, communication and control technologies in order to improve the efficiency of surface transportation. |
| **Interface Definition Language (IDL)** | A descriptive language used in CORBA to specify the interface through which clients may access servers to obtain access to objects. |
| **Interface Repository (IFR)** | Standard CORBA Service for storing IDL definitions. Most especially, a national repository or registry, connected to the internet, containing in a database, descriptions for objects and their attributes, including that data attributed to data dictionaries and message catalogs. |
| **International Organization for Standardization (ISO)** | An international standards organization. ANSI is the primary interface to ISO within the United States. Often thought to be International Standards Organization because of the usage ISO for short. |
| **Internet Assigned Numbers Authority (IANA)** | The international overall authority for IP addresses, domain name structures, and many other parameters used in the Internet |
| **Internet Corporation for Assigned Names and Numbers (ICANN)** | The non-profit government corporation formed to administer IP address space allocation, domain name structures and Internet root server systems management, replacing IANA. |
| **Interoperable Naming Service (INS)** | A means for servers to advertise their object resources under a name for clients to retrieve them. |
| **Interoperable Object Reference (IOR)** | A unique reference to an object. |
| **Layer** | A group of services, and functions that is conceptually complete, that is one of a set of hierarchical levels forming a complete domain, and that extends to all system nodes which are compliant with the network architecture. |
| **Level** | See Layer. Most commonly used in European Communications Standards. |
| **Name Space** | The set of all possible names allowable by a naming convention. |
| **Network** | A collection of nodes, domains, clients, servers, communications channels interfaces, and applications connected together physically and logically. |
| **Naming Service (NS)** | Standard CORBA Service for location of objects by name. |

**Object**                              The system representation of the information known about a device, event, center, vehicle, person, etc.

                                        NOTE — The definition of the word "object" here is different from that used in NTCIP center-to-field standards.

**Object Management Group (OMG)**       Industrial consortium working to standardize open distributed object-based computing.

**Object Reference**                    Instance of an interface, defined in IDL. A client holding it may use it to access the server that provides the implementation object to obtain access to its attributes.

**Open Systems Interconnection**        An international effort to facilitate communications among computers of different manufacture and technology.

**OSI Reference Model**                 The 7-layer model that describes the conceptual organization of protocols for communications and interconnection of computer systems.

**Service**                             In communications, a series of messages defined between applications level protocols, which, in the aggregate, carry out a single activity understandable to a user of the communications system.

**Trader Service**                      A directory service that enables a computer system to find objects based on attributes of the objects.

**Traffic Management Data Dictionary (TMDD)**   A standard that defines data elements and messages for use in traffic management systems.


## 1.4     Abbreviations and Acronyms

The acronyms used in NTCIP 1104 v01 are defined as follows:

**ANSI**            American National Standards Institute

**CORBA**           Common Object Request Broker Architecture

**DATEX-ASN**       Data Exchange in ASN.1

**FTP**             File Transfer Protocol

**HTTP**            Hypertext Transfer Protocol

**NTCIP**           National Transportation Communications for Intelligent Transportation Systems (ITS) Protocol

**OSI**    Open Systems Interconnection

**PRL**    Profile Requirements List

**PICS**   Profile Implementation Conformance Statement

**TCP**    Transport Control Protocol. An Internet Transport layer protocol using sessions.

**TMC**    Transportation Management Center, also called Center

**URL**    Uniform Resource Locator. A standard name for a resource on a network.

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## Section 2
## REQUIREMENTS


NOTE — The Naming Service in CORBA is a utility, which permits a name string to be bound to or associated with an object. The Naming Service allows an object to be found by "resolving" the name within the Naming Service. Servers holding object references can register them with the Naming Service, providing a string name that can be used by other systems and system components to subsequently find the object.

### 2.1     Center Domain Naming

Compliant transportation centers shall obtain and maintain a Center Domain Name. The Center Domain Name string shall be a standard Internet Domain Name. It shall be the responsibility of the Center obtaining a Center Domain Name to ensure that it is globally unique.

Example center domain names are:

| | |
|---|---|
| city.toronto.on.ca | "ca" is country code |
| d12.caltrans.dot.ca.us | "ca" is subdomain indicator |
| fhwa.dot.gov | gov top-level domain |
| nevadadot.com | state DOT using COM domain |
| mission-viejo.com | city using COM domain |
| kcbs.com | radio station with com domain |
| ocair.com | orange county airport with com domain |

### 2.2     Interface Repository (CORBA Implementations Only)

All objects registered in the naming service shall be registered in a publicly available Interface Repository (IFR). This IFR shall comply with Chapter 10 of the CORBA Architecture and Specification standard.

### 2.3     Object Naming

The CORBA Interoperable Naming Service (INS) provides a means for servers to advertise their object resources under a name for clients to retrieve them. Centers that use the CORBA Naming Service to advertise center-to-center resources shall use the naming convention as specified in the CORBA INS and NTCIP 1104 v01.

This naming convention should be used by center-to-center protocols other than CORBA, in order to facilitate interoperability.

### 2.3.1    Object Name Hierarchy

Center-to-center (C2C) object names shall be organized into a hierarchy analogous to a file system tree, and similar to an Internet URL. This hierarchy is referred to as the object's naming context and is one branch in the name space occupied by the all names within the collection of communicating systems. According to the CORBA INS, object names are expressed as a name-structure, a stringified-name, or a uniform-resource-locator (URL).

### 2.3.2    C2C Object Names

C2C object names shall be comprised of seven parts: country ID, state ID, owner (e.g., agency) ID, center ID, object kind, object type, and object instance, separated by forward slashes. The following

syntax defines the naming convention for the stringified-name and URL, but also pertains to the information stored in the name-structure.

{Object Name} ::= {CountryID}"/"{StateID}"/"{OwnerID}"/"{CenterID}"/"{ObjectKind}"/"{ObjectType}"/"{ObjectInstance}

Where:

{CountryID}          ::= {identifier string}
{StateID}            ::= {identifier string}
{OwnerID}   ::= {identifier string}
{CenterID}   ::= {identifier string}
{ObjectKind}          ::= {identifier string}
{ObjectType}          ::= {identifier string}
{ObjectInstance}      ::= {identifier string}

### 2.3.3    Country Identifier

The CountryID part shall be the two-character code as defined in ISO 3166-1, in lowercase. Example – for the United States the string is "us", for Canada the string is "ca", for Mexico the string is "mx".

Country codes are administered by a governing authority in each country for which an ISO 3166-1 country code has been defined. Country codes identified in ISO 3166-3 as discontinued shall not be acceptable as country designators.

### 2.3.4    State Identifier

The StateID part shall be the two-character code selected from the available ISO 3166-3 state and country sub jurisdictional codes, in lowercase.

Where a jurisdiction assigned a United States "StateID" Code under ISO 3166-3, also maintains its own ISO 3166-1 country code designation, (Guam, US Virgin Islands, Marshall Islands, etc.) the country designation shall supersede the United States state designation and the state designations shall be "those of the issuing country".

Where a center is national in scope, or alternatively supports multiple states, the center shall select the StateID where the center is physically located or use one of the state codes applicable for its jurisdiction.

### 2.3.5    Owner Identifier

The OwnerID part shall be an identifier string that identifies the organization that owns the center or objects being defined in the name space.

### 2.3.6    Center Identifier

The CenterID part shall be an identifier string that identifies the particular center or hardware platform supporting the Naming Service.

### 2.3.7    ObjectKind Identifier

The ObjectKind part shall be an identifier string such as: device, event, service, person, vehicle, or center.

NOTE — The valid values of the ObjectKind Identifier correspond to the values of EntityKind defined in the reference data dictionary or model for the object being named.

### 2.3.8    ObjectType Identifier

The ObjectType part shall be an identifier string valid for the Object Kind. For example, if the Object Kind is "device", valid Object Types would be the data dictionary's formal names for devices such as CCTV Camera, Dynamic Message Sign, Environmental Sensor Station, Gate, Highway Advisory Radio, Ramp Meter, Vehicle Detector, Traffic Signal, etc.

NOTE — The valid values of the ObjectType Identifier correspond to the values of EntityType defined in the reference data dictionary or model for the kind of object being named.

### 2.3.9    ObjectInstance Identifier

The ObjectInstance part shall be an identifier string, which shall designate the string name for an object instance, which has been created by a CORBA factory or other means within the designated center. The length of this string shall be limited to 32 characters.

### 2.3.10   Object Name Example

An example complete object name is:

*US/CT/CDOT-D1/Bridgeport_Ops_Center/Device/DMS/CMS12_i95NB-jeffrey*

In this example name, the owner has chosen to form the ObjectInstance part by combining the type of dynamic message sign (in this case a changeable message sign – could have been a portable message sign or a blank-out sign for example), the agency's numerical number for this CMS (in this case #12), and the sign's location (in this case northbound Interstate 95 near Jeffrey Road). The sign number alone, the location alone, or any other not-too-long and locally unique (for that device type) string would also be a valid choice for the ObjectInstance part.

NOTE—An exchange of information about this sign would likely include data fields that include the sign type and its location, but including such information within the ObjectInstance can be useful anyway.

### 2.3.11   Obtaining an Initial Naming Service Reference (CORBA Implementations Only)

Centers shall make their Naming Service reference (Interoperable Object Reference) visible via HTTP or FTP. The IOR shall be stored in file ns.ior.

NOTE — The ns.ior can change whenever the Naming Service is restarted; therefore it is important that the ns.ior can be read dynamically. Choice of HTTP and FTP is provided to accommodate center security policies.

### 2.4     Trader Services (CORBA Implementations Only)

NOTE — The Trader Service in CORBA is a service that permits external centers to locate objects in pre-defined categories, by passing object attributes.

Servers holding object references can register them with associated categories in the Trader Service. Trader Services are normally federated whereby a request to one Trader Service can return results from a group.

CORBA centers shall export service offers for their public objects to the Trader Service. A remote client finds objects by importing service offers through a query that is sent to the Trader Service.

### 2.4.1    Service Offer

The Trader Service's "service offer" represents the advertisement of a service by a service provider. A service offer has the following characteristics:

a)  Service type – name that associates the offer with a particular service type.
b)  Object reference – object pointer that provides a CORBA object reference.
c)  Service offer properties – object properties that describe the service offer.

### 2.4.2    Service Types

Trader Service Types are used to name the categories of services. Service type names are stored in the service type repository of each Trader Service. Each service type shall have a unique name as defined in the reference model. All exporters of public service offers shall associate their services with standard service types. The standard Trader Service types shall be the ObjectKind identifiers defined in Section 2.3.7.

### 2.4.3    Service Offer Properties

The service offer properties are defined in the reference model for the particular object.

### 2.4.4    Trader Federation

The Trader Service shall support links between Trader Services for the propagation of query requests between centers. Whenever a center queries a Trader Service, the Trader Service searches its local set of service offers then forwards the query to other linked Trader Services. Matching local offers plus any offers found by linked Trader Services are returned to the requesting center.

The Trader Service shall be configured as either a self-maintained or an affiliated Trader Service.

### 2.4.5    Self-maintained Trader Service

The center shall install and maintain its own Trader Service and register its objects with it. The Trader Service should be federated with any other Trader Services containing information for which the CORBA center has access rights.

### 2.4.6    Affiliated Trader Service
Alternatively, the center shall use the Trader Service of another center with which the center is affiliated and shall then register their classes with the Trader Service of the other CORBA center.

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