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NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL (NTCIP)
Applications Profile – Common Object Request Broker Architecture
(AP-CORBA)

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1. Introduction

1.1 OVERVIEW

1.1.1 Purpose

This document identifies protocols supporting the use of the Common Object Request Broker Architecture, CORBA, as a mechanism of information interchange among traffic management and information centers. It is one of two alternative protocols which may be used for center-to-center data interchange. The other is defined in AP-DATEXA, alternatively known as DATEX-ASN, ISO/TC 204/SC, dated 1998-01-19.

1.1.2 Scope

This standard is applicable to communications between any two management subsystems within the Intelligent Transportation Systems (ITS) environment. This standard specifies the requirements for a standard open interface between transportation centers for the specific purpose of interoperability. This standard does not address the needs of center-to-field or field-to-field communications, although, with adequate bandwidth and node processing power, this standard could extend to "smart" controllers. These requirements specify the necessary protocols, services and application interfaces to enable center-to-center communications for small or large-scale enterprises, using the Common Object Request Broker Architecture (CORBA) software. This standard is not meant to support the strict real-time requirements of low-bandwidth field links, nor is it intended for prior-generation, lower-performance processors.

1.1.2 Background

In the early deployment of the Intelligent Transportation Systems (ITS), the need for center to center integration was considered secondary to the center's integration with its own field infrastructure. However, it was just a matter of time before the burgeoning deployment of ITS elevated the need for, not only center to center integration, but center-to-center interoperability in major transportation corridors consisting of multiple Transportation Management Centers (TMC) with large existing field infrastructures. With the designation of four major transportation corridors by the Federal Highway Administration (FHWA), the urgency for corridor-wide integration was confirmed and, along with it, the need for open standards that would make it happen.

At first, the logical starting place for a center-to-center communications protocols standard was the extension of the NTCIP Class C Protocol Specification, which is based upon the ISO (seven-layer) communication stack. It soon became evident that extending the Class C Protocol to handle the multitudinous heterogeneous systems that could typically make up a regional corridor, would be impractical. It would require all layers of the communications stack to be specified and a large number of services would have to be developed on all of the participating systems to ensure inter-operability. As an alternative, a proposal was made for an object-oriented standard designed especially for distributed systems. The result was a proposal for a Center-to-Center protocol specification based upon the Common Object Request Broker Architecture (CORBA). CORBA would provide a framework upon which could be applied specifications for the particular approaches and service requirements that characterize a multi-center transportation network.

A list of services which it was hoped that a general center-to-center communications protocol might support was developed. Attempts were made to identify how the Common Object Request Broker Architecture would support these service requirements.

Two major concerns were raised by the committee membership. First, would the multi-layer, multi-service software mechanisms of CORBA be efficient enough to permit the transfer of near-real-time data

from center to center? Here near-real-time data is intended to mean data objects whose attributes change in value on the order of once-a-second. Representative data includes traffic signal cycle data and video camera-control information. To be useful at a remote center, such data must have a relatively -constant latency of delay, which must be less than the change interval. An alternative approach using sockets was proposed. However, these abandoned many of the desirable standardization and inter-operability features offered by CORBA.

Second, would not "legacy systems," those completed before or under-development/construction during the time this specification became a standard, be "unfairly" required to grossly alter their architecture and interfaces to comply with this specification, or else be stigmatized as "non-compliant" with the standard and not able to inter-operate even in a limited fashion with other, compliant centers? The alternative approach using sockets was proposed based on the notion that most of the in-production or in-development centers would be using a sockets-based approach and that this would require minimal system modification.

There was much concern that these data exchanges would be developed on an as-needed basis, and that all new applications and new center-to-center interactions would require new development at additional cost. The concern was also expressed that centers requiring only limited data exchange with adjacent centers would be required to implement a complete CORBA ORB to support the specification. Some in the committee deemed this a good thing because it would make the center interoperable in the future. Others felt this was an unrealistic development burden.

The conclusion of the NTCIP Center-to-Center Working Group was to develop two applications layer protocols using lower level communications protocols in general use. One is for the CORBA approach and one for a DATEX-ASN implementation. In accordance with the taxonomy defined by the NTCIP Taxonomy Working Group, the profile for inter-center communication utilizing CORBA ORBs is contained in this document, designated AP-CORBA. The profile for inter-center communication utilizing DATEX and ASN is designated in a document titled "Transport Information and Control Systems--Data Exchange Between Traffic Management and Information Centres--Part 3: DATEX-ASN," (ISO/TC 204/SC Date: 1998-01-19 /WD) and called AP-DATEX-ASN. These documents are subordinate to general center-to-center requirements designated in a document entitled "NTCIP Specification -Center to Center Communications", designated DP-C2C, in development by the NTCIP Center to Center WG.

1.1.4 Acknowledgements

Many people have contributed to the development of this profile. Some of these contributors are: the webmaster of the NTCIP web site; NTCIP Center-to-Center Communications Protocols Working Group committee members, especially Jeff Brummond, Greg Mosley, John Wintermute, and Ken Vaughn, whose prior working draft documents have been shamelessly plagiarized; and Bruce Schopp (BS) and Warren Tighe (WT), whose meeting notes provided invaluable information about the thinking and intent of the committee membership and of interested parties not in attendance at working group meetings. The Object Management Group, through the assistance of Mark Lowenstein, and of John Lewis, director of their Transportation Domain Special Interest Group, has been greatly helpful through the provision of CORBA specifications, books and articles, and by providing references to others working in the transportation management domain.

1.2 REFERENCES

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