Vehicle Infrastructure Integration (VII)

Service Delivery Node (SDN) Subsystem to Road-Side Equipment (RSE) Subsystem [I-06] Software Interface Requirements Specification

U.S. Department of Transportation
Federal Highway Administration

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DOCUMENT CHANGE HISTORY

Date	Author	Description
10/18/2006	Booz Allen Hamilton	1.0 Final Released.
12/12/2006	Booz Allen Hamilton	– Lexicon removed and incorporated in "VII Infrastructure Lexicon 1.0 Document" – ASU9 wording changed. – ASU19 deleted, redundant. – ASU25, ASU26, ASU27, and ASU28 added. – Appendix B: Version column added, versions updated. – Added clarifying text to Section 1.1. – Data Element Dictionary removed and incorporated in "VII Data Element Dictionary 1.0 Document" – Updated IRS125.

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1. INTRODUCTION

The *VII SDN to RSE Software Interface Requirements Specification (IRS)* is based on guidance and information provided by the USDOT, subsequent meetings and discussions, and agreed upon assumptions by the USDOT and VIIC. Every effort has been made to ensure the content and approach in developing this document reflects available guidance from the USDOT and accurately reflects the overall scope and intent of VII's objectives.

1.1. SCOPE

This document, the *Vehicle Infrastructure Integration (VII) Service Delivery Node (SDN) Subsystem to Road-Side Equipment (RSE) Subsystem [I-06] Software Interface Requirements Specification*, addresses the top-level software interface requirements for the I-06 interface as specified in the VII National System Requirements. This specification is one of a series of technical documents detailing the SDN Subsystem and defining the technical characteristics of the VII System. The main focus of this document is the Proof of Concept (POC) system functionality, which will subsequently be implemented in the National System. For further background on the VII System's projected operations, refer to the *VII National System Requirements* (Reference 1) and the *VII Concept of Operations* (Reference 17).

1.2. DOCUMENT OVERVIEW

This IRS captures the comprehensive software interface requirements for SDN Subsystem to RSE Subsystem Interface as part of the Vehicle Infrastructure Integration (VII) project.

The remaining IRS sections are organized as follows:

- **Section 2. Interface Description**: Describes the interfaces between the SDN and RSE Subsystems, in the order of the services they support.
- **Section 3. Interface Requirements**: Lists the requirements for the interfaces between the SDN and RSE Subsystems.
- **Appendix A. Assumptions & Dependencies**: Provides a list of the assumptions and dependencies related to the requirements.
- **Appendix B. Reference Documents**: Lists the SDN to RSE Subsystem reference documents.
- **Appendix C. National System Requirements Traceability:** Traces requirements from this document to their parent requirements in the National System Requirements.

1.3. DOCUMENT CONVENTIONS

The VII System includes many services and components, all of which must communicate with one another. For clarity in discussion, this section provides a convention for describing how these communications occur. The term "unit," as used in this discussion, may refer to a system, a subsystem, a service, a component, or any other entity in the VII System.

Every instance of communication between two units is referred to as a *message*; for example, a subscription request is one type of message, and the response is another. The grouping of all messages that two units send each other in performing a task is called the *interface* between those units. Two units might have multiple interfaces between them depending on the tasks they perform.

An interface's name is made up of the unit the interface belongs to, followed by a period, followed by the task the messages traversing that interface perform. For example, the Lookup Information interface, which belongs to the Information Lookup Service (ILS), is called **ILS.LookupInformation**. Messages that use an interface are specified

with the interface name, followed by the message name in brackets. For instance, the message used to request information in a geographic area is called **ILS.LookupInformation[GeospatialRequest]**, and the response is **ILS.LookupInformation[GeospatialResponse]**.

2. INTERFACE DESCRIPTION

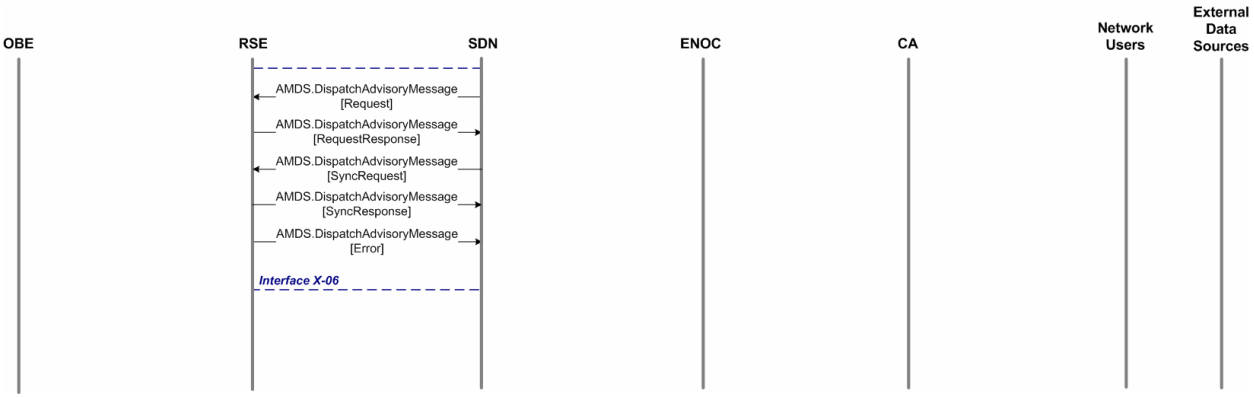
2.1. ADVISORY MESSAGE DISTRIBUTION SERVICE (AMDS)

2.1.1. Interface: AMDS.DispatchAdvisoryMessage

This interface provides the ability for the SDN Subsystem to dispatch authorized user-requested Advisory Messages to targeted RSE Subsystems. Additionally, this interface allows authorized users to query, update, and cancel Active Advisory Messages. This interface also supports the ability to synchronize the Active Advisory Messages from an SDN Subsystem to an RSE Subsystem. If an error occurs during the processing of the Advisory Message request, an error notification is generated and sent from the RSE Subsystem to the SDN Subsystem.

- **Type:** Asynchronous reliable, persistent messaging
- **Message Frequency:** As requested by Advisory Providers, predictably infrequent
- **Network Interface**: Backhaul Transport Interface

Figure 2-1: Dispatch Advisory Message Interface Messages



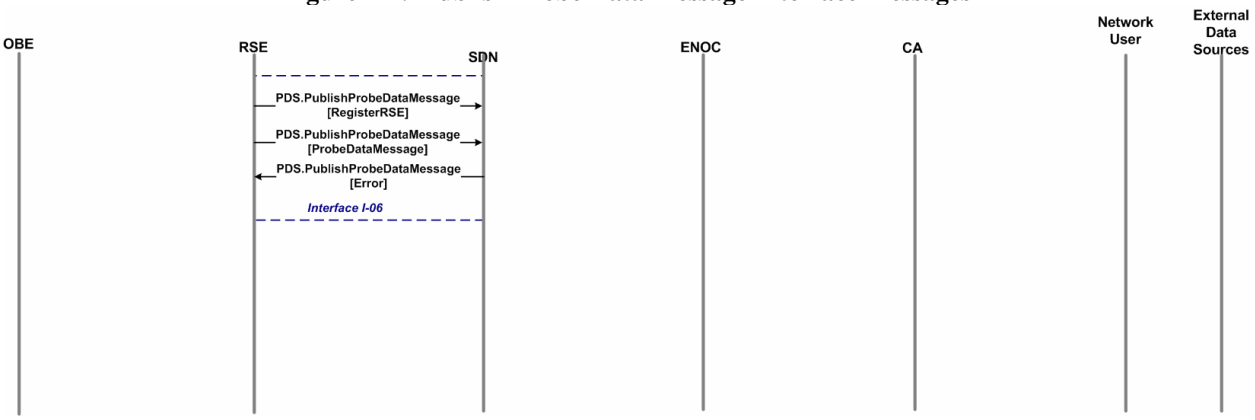
2.2. PROBE DATA SERVICE (PDS)

2.2.1. Interface: PDS.PublishProbeDataMessage

This interface provides the ability for the RSE Subsystem to register and publish Probe Data Messages to the SDN Subsystem. Messages are processed in a continuous first-in, first-out (FIFO) order.

- **Type:** Synchronous Communication, Unreliable/Nonpersistent Message Delivery
- **Message Frequency:**
  - Registration occurs only when the RSE Subsystem initially boots up and communicates with the SDN Subsystem or when the RSE loses its network connection and must reconnect.
  - Publishing Probe Data Messages depend on the frequency with which Probe Data Messages arrive to the RSE Subsystem from OBE Subsystems. Message frequency will be related to traffic conditions on the roadways.
- **Network Interface**: Backhaul Transport Interface

Figure 2-2: Publish Probe Data Message Interface Messages



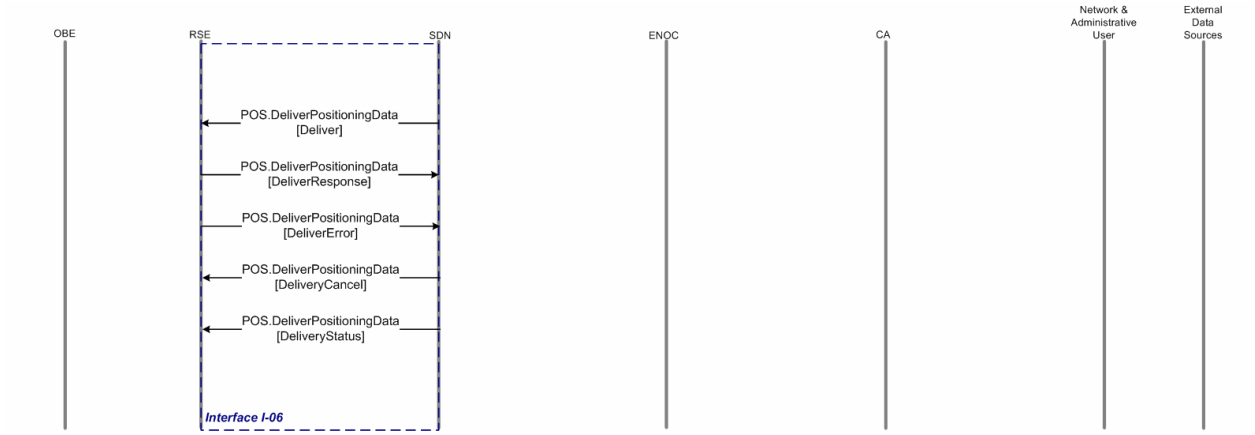
2.3. POSITIONING SERVICE (POS)

2.3.1. Interface: POS.DeliverPositioningData

This interface provides the ability for the SDN Subsystem to deliver correctly formatted positioning data to the RSE Subsystem.

- **Type:** Synchronous, Reliable/Nonpersistent Message Delivery
- **Message Frequency:** Frequent, given changes in differential correction values.
- **Network Interface:** Backhaul Transport Interface.

Figure 2-3: Deliver Positioning Data Interface Messages



3. INTERFACE REQUIREMENTS

3.1. ADVISORY MESSAGE DISTRIBUTION SERVICE (AMDS)

3.1.1. Interface: AMDS.DispatchAdvisoryMessage

REQ #	REQUIREMENT	POC	NATIONAL
IRS125	The AMDS.DispatchAdvisoryMessage[Request] message shall be used to dispatch an Advisory Message create, cancel, update, and synchronization requests to the RSE Subsystem.	Yes	Yes
IRS126	The AMDS.DispatchAdvisoryMessage[Request] message shall support the following parameters: • Request ID • Advisory Message Request Type • Advisory Message ID • Advisory Message Priority • Advisory Message Payload	Yes	Yes
IRS127	The AMDS.DispatchAdvisoryMessage[RequestResponse] message shall provide a response to the AMDS.DispatchAdvisoryMessage[Request].	Yes	Yes
IRS128	The AMDS.DispatchAdvisoryMessage[RequestResponse] message shall support the following parameters: • Request ID • Response Code • Response Description	Yes	Yes
IRS129	The AMDS.DeliverAdvisoryMessage[Error] message shall support the following parameters: • Error ID • Error Description • RSE Subsystem ID • Request ID • Advisory Message ID	Yes	Yes
IRS133	The AMDS.DispatchAdvisoryMessage[SyncRequest] message shall be used to update a RSE Subsystem with Active Advisory Messages.	No	Yes
IRS134	The AMDS.DispatchAdvisoryMessage[SyncRequest] message shall support the following parameters: • Request ID • Advisory Message Payload	No	Yes
IRS135	The AMDS.DispatchAdvisoryMessage[SyncResponse] message shall be used to respond to the AMDS.DispatchAdvisoryMessage[SyncRequest].	No	Yes
IRS136	The AMDS.DispatchAdvisoryMessage[SyncResponse] message shall support the following parameters: • Request ID • Response Code • Response Description	No	Yes

3.2. PROBE DATA SERVICE (PDS)

3.2.1. Interface: PDS.PublishProbeDataMessage

REQ #	REQUIREMENT	POC	NATIONAL
IRS130	The PDS.PublishProbeDataMessage[RegisterRSE] message shall support the following parameters: • RSE Subsystem ID	Yes	Yes
IRS131	The PDS.PublishProbeDataMessage[ProbeDataMessage] message shall support the forwarding of SAE J2735 Probe Data Messages to the SDN Subsystem.	Yes	Yes
IRS132	The PDS.PublishProbeDataMessage[Error] message shall support the following parameters: • Error ID • Error Description	Yes	Yes
IRS220	The PDS.PublishProbeDataMessage[RegisterRSE] message shall be used to register an RSE Subsystem with the SDN Subsystem.	Yes	Yes

3.3. POSITIONING SERVICE (POS)

3.3.1. Interface: POS.DeliverPositioningData

REQ #	REQUIREMENT	POC	NATIONAL
IRS377	The SDN Subsystem shall utilize the POS.DeliverPositioningData interface to request delivery of positioning data to the appropriate RSE Subsystem.	Yes	Yes
IRS378	The SDN Subsystem shall utilize the POS.DeliverPositioningData interface to cancel delivery of positioning data to RSE Subsystem.	Yes	Yes
IRS379	The SDN Subsystem shall utilize the POS.DeliverPositioningData interface to request status of the delivery of positioning data to the RSE Subsystem.	Yes	Yes

APPENDIX A: ASSUMPTIONS & DEPENDENCIES

ASSUMPTIONS

ASSUMPTION ID	ASSUMPTION TEXT
ASU3	The Proof of Concept will have no more than 100 concurrently connected RSE Subsystems for each SDN Subsystem
ASU4	The Proof of Concept will have no more than three (3) concurrently connected SDN Subsystems.
ASU5	An RSE Subsystem will collect and aggregate no more than 375 Probe Data Messages per second. This assumes (5 vehicles / lane / sec) * (10 lanes) * (30 Probe Data Snapshots / vehicle) / (4 Probe Data Snapshots / Probe Data Message)
ASU6	The Proof of Concept will have no more than one (1) ENOC Subsystem.
ASU9	The ENOC will consist of the Management Service and the Security Service
ASU10	The ENOC subsystem shall use network management protocols which comply with recognized internetworking management standards
ASU11	The ENOC subsystem shall use recognized internetworking management standards for fault, configuration, accounting and performance management
ASU12	The ENOC subsystem shall use non standard network management protocols if necessary to manage specific managed network elements
ASU13	The ENOC subsystem shall be a platform comprised of multiple sub-components which together complete the requirements of the ENOC subsystem
ASU14	The ENOC subsystem shall capture and process configuring orders for all types of service and managed network elements
ASU15	ENOC operators will be able to access standard process documentation for handling reported incidents and requests for service
ASU16	ENOC operators will be trained to follow standard process for handling reported incidents and requests for service
ASU17	Roadside Equipment (RSEs) will support two types of digital certificates: IEEE 1609.2 for wireless communication and X.509v3 for network communication requirements.
ASU18	CA to SDN, CA to ENOC, RSE to SDN, and SDN to ENOC communication will use X.509 v3 compliant certificates for certificate-based activities.
ASU20	The VII wireless infrastructure (OBE, RSE) will use IEEE 1609.2 compliant certificates for certificate-based activities.
ASU21	Bridging of X.509 and IEEE 1609.2 Certificate Authorities will not be required.
ASU22	The VII CA Subsystem shall consist of two separate CA certificate systems: the X.509 CA, and the IEEE 1609.2 compliant CA.
ASU23	VII Infrastructure systems and devices will use X.509 certificates for digital signatures, encryption, and identification.
ASU25	All connections internal to the SDN and the NAP shall use Ethernet.
ASU26	A separate document will be created to specify requirements regarding electrical power supply, surge protection, physical space, humidity control, temperature control and similar environmental factors for the supporting facilities.
ASU27	The VII POC Environment shall have no more than 50 Network and/or Administrative

	Users.
ASU28	RSE Backhaul traffic flowing to and from RSE Backhaul Gateways will be aggregated by service providers.

DEPENDENCIES

DEPENDENCY ID	DEPENDENCY
DEP1	Probe Data Serveice (PDS) performance requirements are dependent upon the structure and size of the SAE J2735 Probe Data Message.
DEP2	Advisory Message Distribution Service (AMDS) performance requirements are dependent upon network transport availability.
DEP3	The implementation of ENOC management services is dependent on the establishment of network connectivity between the ENOC and the managed network elements.
DEP4	The implementation of ENOC security services is dependent on the establishment of network connectivity between the ENOC and the managed security elements
DEP5	Network management agent is running in the managed network elementNetwork connectivity exists between the managed network element and the ENOC
DEP6	The ENOC has connectivity to the managed network elements
DEP7	Connectivity with the ENOC Subsystem.
DEP8	The existence of a VII CA certificate repository.
DEP9	Hardware Security Modules (HSMs) capable of supporting required certificate assurance levels.
DEP10	A VII CA Certificate Practice Statement (CPS) describing the practices and standards to which the CA shall be managed.
DEP11	The VII System will support Lightweight Directory Access Protocol (LDAP) Version 3.0.
DEP12	The VII System will support Secure Lightweight Directory Access Protocol (LDAPS).
DEP13	The VII System will support Hypertext Transfer Protocol (HTTP).
DEP14	The VII System will support Secure Hypertext Transfer Protocol (HTTPS).

APPENDIX B: REFERENCE DOCUMENTS

REF #	REFERENCE	VERSION
1	VII National System Requirements	Version 1.2.1
2	Road Side Equipment (RSE) Subsystem Specification	Version 1.0
3	Enterprise Network Operations Center (ENOC) Subsystem Specification	Version 1.1
4	Certificate Authority (CA) Subsystem Specification	Version 1.1
5	ENOC to Administrative User Subsystem Software IRS [X-011]	Version 1.1
6	Network User to SDN Subsystem Software IRS [X-031, X-032, X-033]	Version 1.1
7	ENOC to Managed Entity Subsystem Software IRS	Version 1.1
8	ENOC to Managed Network Element Software IRS	Version 1.1
9	Reference Maps – TBD	TBD
10	Navstar GPS Space Segment/Navigation User Interfaces, ICD GPS 200	Revision C
11	SDN to RSE Subsystem Software IRS [I-06]	Version 1.1
12	ENOC to CA Subsystem Software IRS [I-13]	Version 1.1
13	ENOC to SDN Subsystem Software IRS [I-11]	Version 1.1
14	*Service Provider Management Systems to SDN Subsystem IRS [X-061] Not in scope for POC*	Not in Scope
15	VII USDOT Day-1 Use Case Descriptions (May 2006)	Version 1.0
16	Network Subsystem Specification	Version 1.0
17	VII Concept of Operations	Draft 1.2
18	VII Systems Security Plan	Version 2.1
19	SDN Subsystem Specification (SSS)	Version 1.1
20	Internet Engineering Task Force (IETF) Request for Comments (RFC) 2510 Internet X.509 Public Key Infrastructure Certificate Management Protocols	© 1999
21	Internet Engineering Task Force (IETF) RFC 3280 Internet X.509 Public Key Infrastructure (PKI) Proxy Certificate Profile	© 2004
22	VII Infrastructure Lexicon	Version 1.0
23	Draft SAE J2735 Dedicated Short Range Communications (DSRC) Message Set Dictionary	Rev. 15
24	POC Additions & Exceptions to the POC Version of SAE J2735	APP190-02
25	VII x.509 Certificate Authority Certificate Practice Statement (CPS)	TBD

APPENDIX C: NATIONAL SYSTEM REQUIREMENTS TRACEABILITY

SUBSYSTEM SPECIFICATION ID	NSR SPECIFICATION ID
IRS125	VF-AMDS-04
IRS126	VF-AMDS-04
IRS127	VF-AMDS-04
IRS128	VF-AMDS-04
IRS129	VF-AMDS-05
IRS130	VF-PDS-01
IRS131	VF-PDS-01
IRS132	VF-PDS-01
IRS133	VF-AMDS-06
IRS134	VF-AMDS-06
IRS135	VF-AMDS-06
IRS136	VF-AMDS-06
IRS220	VF-PDS-01