

# **Vehicle Infrastructure Integration (VII)**

**Enterprise Network Operations Center (ENOC)  
to Managed Network Element (MNE)**

**[I-08 and I-11]**

**Software Interface Requirements Specification**



**U.S. Department of Transportation  
Federal Highway  
Administration**

February 26, 2007

Version 1.1

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**DOCUMENT CHANGE HISTORY**

<b>Date</b>	<b>Author</b>	<b>Description</b>
11/20/2006	Booz Allen Hamilton	Released v. 1.0
2/13/2006	Booz Allen Hamilton	<ul style="list-style-type: none"><li>– Lexicon removed and incorporated in “VII Infrastructure Lexicon 1.0 Document”</li><li>– ASU9 wording changed.</li><li>– ASU19 deleted, redundant.</li><li>– ASU25, ASU26, ASU27, and ASU28 added.</li><li>– Appendix B: Version column added, versions updated.</li><li>– Added clarifying text to Section 1.1.</li><li>– Data Element Dictionary removed and incorporated in “VII Data Element Dictionary 1.0 Document”</li></ul>

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## 1. INTRODUCTION

This Software Interface Requirements Specification (IRS) is based on guidance and information provided by the U.S. Department of Transportation (USDOT), subsequent meetings and discussions, and agreed-upon assumptions by the USDOT and Vehicle Infrastructure Integration Consortium (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 the Vehicle Infrastructure Integration's (VII) objectives

### 1.1. SCOPE

This document, the *VII Enterprise Network Operations Center (ENOC) to Managed Network Element (MNE) Interface Requirements Specification*, addresses the top-level software interface requirements for the I-11 and I-08 interfaces 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 complete system requirements for ENOC to MNE Interface as part of the VII project.

The remaining IRS sections are organized as follows:

- **Section 2. Interface Description:** Describes the interfaces between the ENOC Subsystem and the MNE in the order of the services they support.
- **Section 3. Interface Requirements:** Lists the requirements for the interfaces between the ENOC Subsystem and the MNE.
- **Appendix A. Assumptions and Dependencies:** Provides a list of the assumptions and dependencies related to the requirements.
- **Appendix B. Reference Documents:** Lists the ENOC and MNE 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

#### 1.3.1. Message and Interface Naming

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," in this discussion may refer to a system, a subsystem, a service, a component, or any other entity within 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

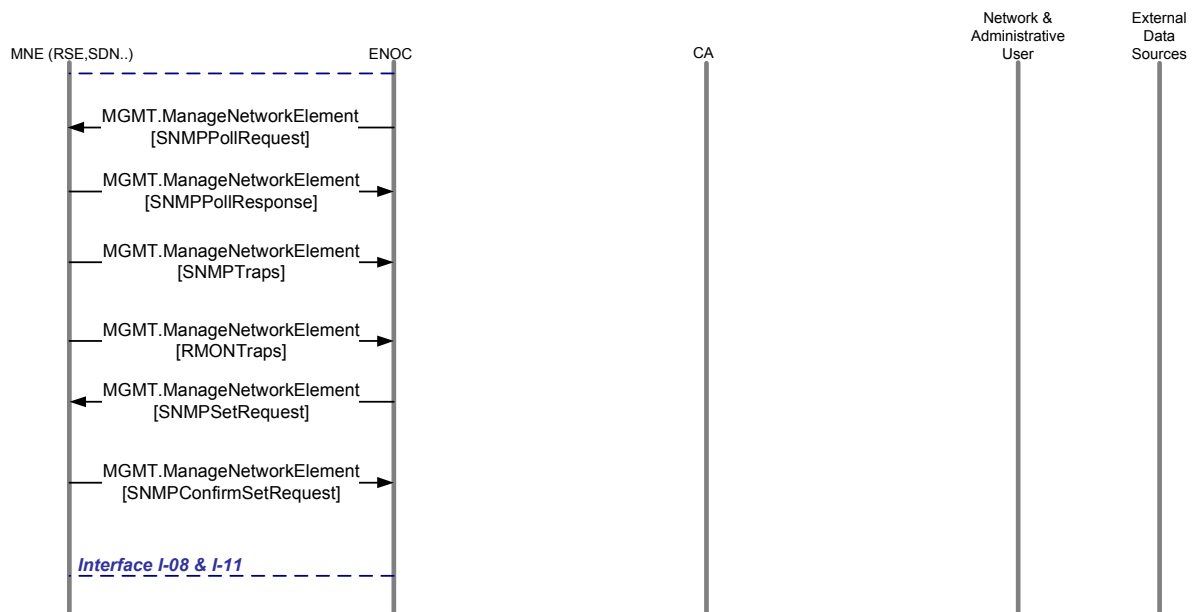
### 2.1. MANAGEMENT SERVICE (MGMT)

#### 2.1.1. Interface: MGMT.ManageNetworkElement

This interface carries messages used to maintain and administer the VII Network. It provides messages for the following: (a) Fault Management—discovering the existence of a problem in the network, identifying the source of the problem, and repairing the problem; (b) Configuration management—identifying, tracking, and modifying the setup of Network Elements; (c) Accounting management—the gathering of usage statistics for users and using the statistics to bill users and enforce usage quotas; and (d) Performance Management—measuring the performance of Network Elements and taking measures to optimize the network for maximum system performance.

- **Type:** Asynchronous or Synchronous depending on chosen methodology
- **Message Frequency:** Very frequent
- **Network Interface:** Transport Interface: this interface provides transport ability to move messages between the ENOC Subsystem and the MNE

**Figure 2-1: Manage Network Element Interface Message**



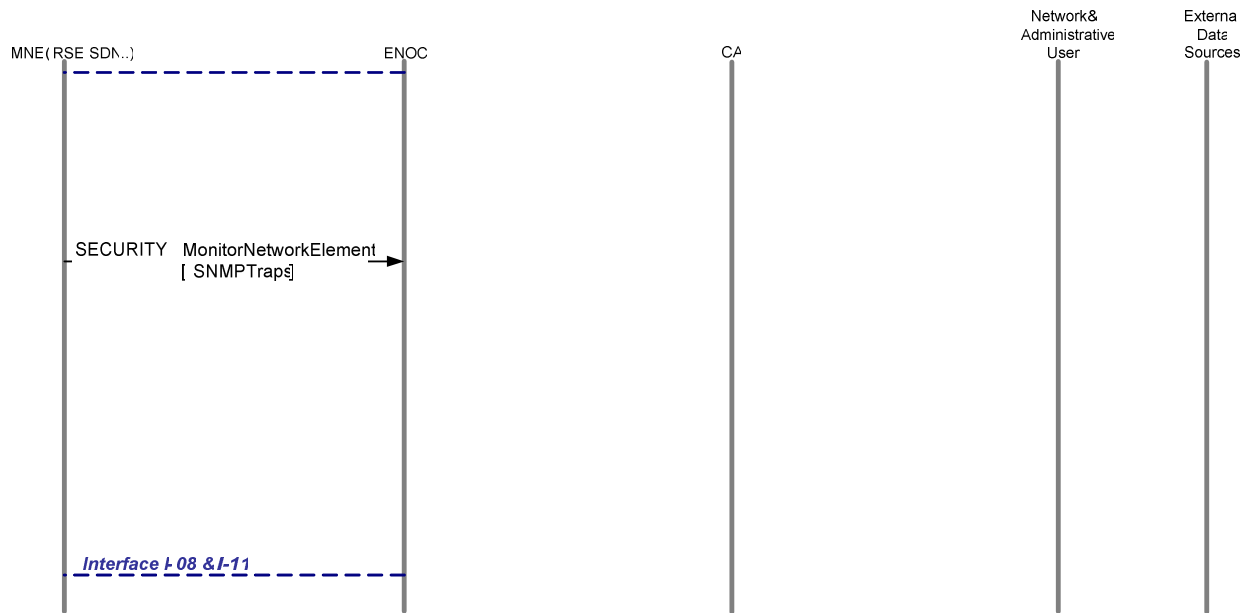
### 2.2. SECURITY SERVICE (SEC)

#### 2.2.1. Interface: Security.MonitorNetworkElement

This interface provides the ability for the ENOC Subsystem to receive security event data from MNEs. The collection of security event data allows for the ENOC to centralize, correlate, and respond to potential security threats.

- **Type:** Asynchronous
- **Message Frequency:** Frequent
- **Network Interface:** Transport Interface: this interface provides transport ability to move messages between the ENOC Subsystem and the MNE

**Figure 2-2: Security Monitor Network Element Interface Message**



### 3. INTERFACE REQUIREMENTS

#### 3.1. MANAGEMENT SERVICE (MGMT)

##### 3.1.1. Interface: MGMT.ManageNetworkElement

REQ #	REQUIREMENT	POC	NATIONAL
IRS434	The ENOC to MNE interface shall support the transmission of remote monitoring messages using the RMON standards RFC 2819 and RFC 4502 over an SNMP connection.	Yes	Yes
IRS435	The ENOC to MNE interface shall be capable of supporting the following RMON groups: Statistics, History, Alarms, Hosts, Host Top N, Traffic Matrix, Filters, Packet Capture, and Events.	Yes	Yes
IRS436	The ENOC to MNE interface shall support the transmission of the following network management messages using SNMP Protocol: GET REQUEST, GETNEXT REQUEST, GETBULK REQUEST, GET RESPONSE, SET, TRAP, and INFORM.	Yes	Yes
IRS437	The ENOC to MNE interface shall support the transmission of network management messages using SNMPv1 protocol as defined in RFCs 1155, 1156, and 1157.	Yes	Yes
IRS438	The ENOC to MNE interface shall support the transmission of network management messages using SNMPv2c protocol as defined in RFCs 1901 through RFC 1908.	Yes	Yes
IRS439	The ENOC to MNE interface shall support the transmission of remote management messages using SNMPv3 protocol as defined in RFCs 3411 through RFC 3418.	Yes	Yes
IRS440	The ENOC to MNE interface shall support messages as defined in RFC 3584.	Yes	Yes
IRS443	The ENOC to MNE interface shall support the transmission of configuration change command messages.	Yes	Yes

#### 3.2. SECURITY SERVICE (SEC)

##### 3.2.1. Interface: SECURITY.MonitorNetworkElement

REQ #	REQUIREMENT	POC	NATIONAL
IRS455	The ENOC to MNE interface shall support the transmission of security event management messages using the BSD syslog protocol defined in RFC 3164	Yes	Yes
IRS456	The ENOC to MNE interface shall support the transmission of security event management messages using the reliable delivery of syslog protocol defined in RFC 3195.	Yes	Yes
IRS457	The ENOC to MNE interface shall support the transmission of security event management messages using SNMPv1 protocol as defined in RFCs 1155, 1156, and 1157.	Yes	Yes

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REQ #	REQUIREMENT	POC	NATIONAL
IRS458	The ENOC to MNE interface shall support the transmission of security event messages using SNMPv2c protocol as defined in RFCs 1901 through RFC 1908	Yes	Yes
IRS459	The ENOC to MNE interface shall support the transmission of security event messages using SNMPv3 protocol as defined in RFCs 3411 through RFC 3418.	Yes	Yes
IRS460	The ENOC to MNE interface shall support the transmission of security event messages between the ENOC and the Managed Network Element's element manager via a flex agent.	Yes	Yes

## APPENDIX A: ASSUMPTIONS AND 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 Service (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	A Network management agent is running in each managed network element and network 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	<i>Service Provider Management Systems to SDN Subsystem Software IRS [X-061]</i> <i>Not in scope for POC</i>	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**

<b>SUBSYSTEM SPECIFICATION ID</b>	<b>NSR SPECIFICATION ID</b>
IRS434	VF-MGM-02
	VF-MGM-04
	VF-MGM-09
IRS435	VF-MGM-02
	VF-MGM-04
	VF-MGM-09
IRS436	VF-MGM-02
	VF-MGM-04
	VF-MGM-09
IRS437	VF-MGM-02
	VF-MGM-04
	VF-MGM-09
IRS438	VF-MGM-02
	VF-MGM-04
	VF-MGM-09
IRS439	VF-MGM-02
	VF-MGM-04
	VF-MGM-09
IRS440	VF-MGM-02
	VF-MGM-04
	VF-MGM-09
IRS443	VF-MGM-02
	VF-MGM-04
	VF-MGM-09
IRS455	VF-SEC-07
IRS456	VF-SEC-07
IRS457	VF-SEC-07
IRS458	VF-SEC-07
IRS459	VF-SEC-07
IRS460	VF-SEC-07