Vehicle Infrastructure Integration
Proof-of-Concept
Technical Description — Infrastructure

Final Report

Cover Page Photos Source: Booz Allen Stock Photos

You will need the Adobe Reader to view the PDFs on this page.

PDF (4.8 MB)

Volume 2b

U.S. Department of Transportation
Research and Innovative Technology Administration

TABLE OF CONTENTS

- NOTICE
- TECHNICAL REPORT AND DOCUMENTATION
- 1.0 VEHICLE INFRASTRUCTURE INTEGRATION PROOF OF CONCEPT TECHNICAL OVERVIEW
  - 1.1 Concept of Operations
1.2 POC System Architecture Description
1.3 Dedicated Short-Range Communications
1.4 Security Subsystem
  1.4.1 Security Subsystem Objectives
  1.4.2 Security Architecture
2.0 INFRASTRUCTURE NETWORK DESCRIPTION
  2.1 Service Delivery Node
    2.1.1 SDN Architecture
    2.1.2 SDN Interfaces
    2.1.3 SDN NAP
    2.1.4 Physical SDN Setup
  2.2 ENOC
    2.2.1 Managed Entity
  2.3 Roadside Equipment (RSE)
    2.3.1 Electrical/Mechanical Architecture
    2.3.2 RSE Processing Unit
    2.3.3 RSE Software Architecture
  2.4 Infrastructure Services
    2.4.1 Communications Service
    2.4.2 ILS
    2.4.3 AMDS
    2.4.4 PDS
    2.4.5 MEDS
    2.4.6 IdAM/Security Services
    2.4.7 NMS
    2.4.8 POS
  2.5 Security Subsystem
    2.5.1 IdAM
    2.5.2 Security Services
    2.5.3 Certificate Authority
  2.6 DTE
    2.6.1 Physical Layout/Map
    2.6.2 RSE Installations
    2.6.3 Backhaul Distribution
    2.6.4 Backbone Network
3.0 PUBLIC APPLICATIONS
  3.1 Signal Timing Optimization
    3.1.1 Signal Timing Optimization Application Objectives
    3.1.2 Signal Timing Optimization Overall Architecture
    3.1.3 Signal Timing Optimization Flow of Events
  3.2 Ramp Metering
    3.2.1 Ramp-Metering Application Objectives
    3.2.2 Ramp-Metering Overall Architecture
    3.2.3 Ramp-Metering Flow of Events
  3.3 Traveler Information
    3.3.1 Traveler Information Application Objectives and Use Cases
    3.3.2 Traveler Information Overall Architecture
  3.4 Weather Information
3.4.1 Weather Information Application Objectives

3.4.2 Weather Information Application Overall Architecture

3.5 Corridor Management Planning Assistance (CMPA)

3.5.1 CMPA Application Objectives

3.5.2 CMPA Application Overall Architecture

3.6 Corridor Management Load Balancing (CMLB)

3.6.1 CMLB Application Objectives

3.6.2 CMLB Application Overall Architecture

3.7 Public Applications Developed and Tested in the POC

4.0 SUMMARY

APPENDIX A: ACRONYMS

Table of Figures

- Figure 1-1: POC VII System Architecture
- Figure 1-2: Overall System Structure
- Figure 1-3: DSRC Channel Management Concept
- Figure 1-4: Identity and Access Management Conceptual Architecture
- Figure 2-1: Network Subsystem
- Figure 2-2: Network Access Point
- Figure 2-3: Overall VII Network
- Figure 2-4: SDN Architecture
- Figure 2-5: SDN Software Architecture
- Figure 2-6: SDN Interfaces
- Figure 2-7: NAP
- Figure 2-8: Herndon SDN
- Figure 2-9: Herndon SDN Close-up
- Figure 2-10: ATT OptiMan Node
- Figure 2-11: Detroit SDN
- Figure 2-12: ENOC Workstation
- Figure 2-13: Fault Management Screen
- Figure 2-14: Network Traffic Monitoring Screen
- Figure 2-15: RSE Status Monitoring Screen
- Figure 2-16: RSE Interfaces
- Figure 2-17: RSE Assembly Mounted on Pole for Test
- Figure 2-18: RSE Electrical Architecture
- Figure 2-19: RSE Assembly Components
- Figure 2-20: MCNU and Power Supply
- Figure 2-21: RSE Mounted to Pole in DTE
- Figure 2-22: RSE Software Architecture
- Figure 2-23: Proxy Manager Architecture
- Figure 2-24: Radio Handler Architecture
- Figure 2-25: DSRC/WAVE Radio Architecture
- Figure 2-26: DSRC Radio Architecture
- Figure 2-27: DSRC Radio Mini-PCI Card
- Figure 2-28: WAVE Upper Layer Software Architecture
- Figure 2-29: HMM Service
- Figure 2-30: Publish and Subscribe Architecture
- Figure 2-31: ILS Architecture
- Figure 2-32: Large-Scale AMDS Architecture
- Figure 2-33: Local AMDS Architecture
- Figure 2-34: AMDS Proxy Components
- Figure 2-35: PDS Architecture
- Figure 2-36: Probe Data Proxy Architecture
- Figure 2-37: Probe Data Message Structure
- Figure 2-38: Probe Data Representation of a Freeway Interchange
- Figure 2-39: MEDS Architecture
- Figure 2-40: POS Architecture
- Figure 2-41: VII Network Security Architecture
- Figure 2-42: Arterial RSE Locations
- Figure 2-43: Freeway RSE Locations
- Figure 2-44: RSE Regions Used for PDC Test
- Figure 2-45: RSE Regions Used for Advisory Message Delivery and Presentation Test
- Figure 2-46: RSE Regions Used for Tolling Test
- Figure 2-47: WiMAX RSE Installation
- Figure 2-48: 3G RSE Installation
- Figure 2-49: T1 RSE Installation
- Figure 2-50: Typical RSE Field Installation
- Figure 2-51: POC Backhaul Networks
- Figure 3-1: Ramp Metering Application Architecture
- Figure 3-2: Traveler Information Application Architecture
- Figure 3-3: CMPA Application Architecture