SunGuide™:

Connected Vehicle System Interface Control Document

SunGuide-CVS-ICD-6.2

Prepared for:

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List of Acronyms

ATMS	Advanced Traffic Management System
DOT	Department of Transportation
FDOT	Florida Department of Transportation
ITS	Intelligent Transportation Systems
ITN	Invitation to Negotiate
RSE	Roadside Equipment
SwRI	Southwest Research Institute
TAM	Traveler Advisory Message
TMC	Traffic Management Center
XML	Extensible Markup Language

REVISION HISTORY

Revision	Date	Changes
5.1.0	March 9, 2011	Initial Release
6.2	February 2, 2016	Updated for Release 6.2

1. Scope

1.1 Document Identification

This Interface Control Document (ICD) describes the interface between individual SunGuide™ clients and the Connected Vehicle System (CVS) subsystem and between the CVS subsystem and the associated drivers. The general base architecture of the XML communications including connection information, byte order and base transaction classes is delineated in this document. This ICD defines Extensible Markup Language (XML) schemas upon which XML requests shall be based in communicating amongst the various processes. Refer to the SunGuide-General-ICD document for details regarding data transfer.

1.2 Project Overview

The Florida Department of Transportation (FDOT) SunGuide Support, Maintenance and Development Contract addresses the necessity of supporting, maintaining and performing enhancement development efforts to the SunGuide software. The SunGuide software is a set of Intelligent Transportation System (ITS) software that allows the control of roadway devices as well as information exchange across a variety of transportation agencies and is deployed throughout the state of Florida. The SunGuide software is based on ITS software available from the state of Texas; with significant customization and development of new software modules to meet the needs of the FDOT. The following figure provides a graphical view of the software to be developed:
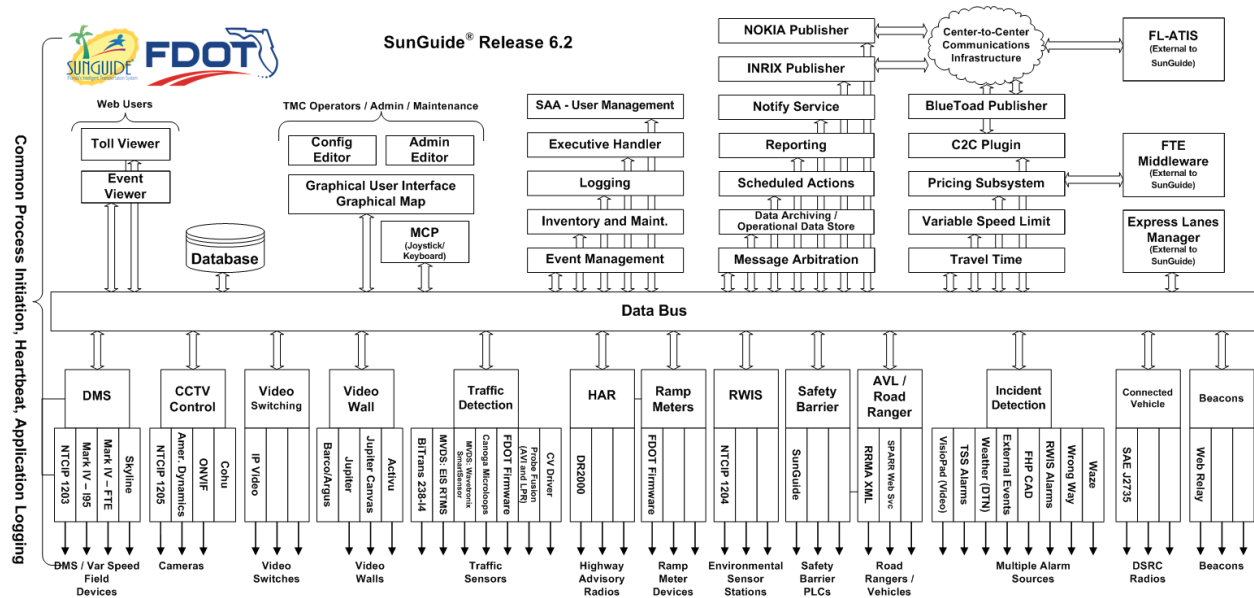

Figure 1-1 - High-Level Architectural Concept

1.3 How to Use This Document

The ICDs describe the specific interface between two SunGuide subsystems or between a SunGuide subsystem and a SunGuide driver. The relationship of appropriate documents is shown in the Figure 1-2.
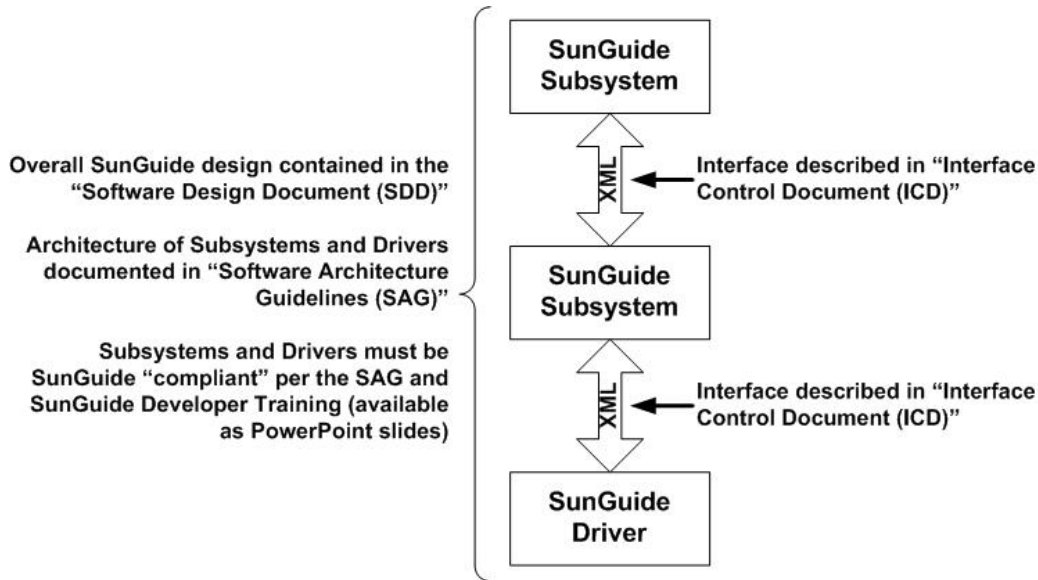
Figure 1-2 - SunGuide Developer Documentation

This document describes an *internal* SunGuide interface. The interface described is between two SunGuide compliant processes. The reader should review the following document to gain an understanding of how SunGuide compliant application is created (this will vary if the application is a driver or subsystem):

> *SunGuide Software Architecture Guidelines* (SAG)

The SAG describes what needs to be included in a SunGuide application to assure that it will work cooperatively in the SunGuide environment. Once the SAG is reviewed, the following document should be reviewed:

> *SunGuide Software Design Document* (SDD)

The SDD will provide an understanding of how individual components of SunGuide were designed. Finally the ICD, along with the associated schema should be reviewed to determine what data needs to be exchanged on the interface being defined in this document.

Additionally, a SunGuide "Developer Training" class is available that provides the students with an introduction into developing SunGuide processes. The SunGuide source code repository has a generic subsystem and a generic driver available that can be used as the basis for developing a new application.

1.4 Related Documents

The following documents were used to develop this document:

- FDOT Scope of Services: *BDQ69, Standard Written Agreement for SunGuide Software Support, Maintenance, and Development, Exhibit A: Scope of Services.* July 1, 2010.

- Notice to Proceed: Letter to Southwest Research Institute® (SwRI®) for BDQ69, July 1, 2010

- Letter of Authorization 005: Letter to SwRI for BDQ69, November 9, 2010.
- SunGuide Project website: http://sunguidesoftware.com.

1.5 Contacts

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2. Data

The following sections detail the XML transactions that can be exchanged between client and server applications.

2.1 Schema

The schemas for these transactions may be located in the Schemas directory. The objects directory contains common data schemas that are used by the various request, messages, and responses. Schemas are organized in the following tree structure:

cvs
- messages
  - addRseMsg.xsd
  - deleteRseMsg.xsd
  - modifyRseMsg.xsd
  - rseProbeReportMsg.xsd
  - rseUpdateMsg.xsd
  - setOpStatusMsg.xsd
  - tamReportMsg.xsd
- objects
  - boundingPolygon.xsd
  - detectionZoneConfig.xsd
  - onlineStatus.xsd
  - rseConfig.xsd
  - status.xsd
  - tam.xsd
- requests
  - addRseReq.xsd
  - addTamReq.xsd
  - deleteRseReq.xsd
  - deleteTamReq.xsd
  - modifyRseReq.xsd
  - modifyTamReq.xsd
  - retrieveDataReq.xsd
  - setOpStatusReq.xsd
  - subscribeReq.xsd
- responses
  - addRseResp.xsd
  - addTamResp.xsd
  - deleteRseResp.xsd
  - deleteTamResp.xsd
  - modifyRseResp.xsd
  - modifyTamResp.xsd
  - retrieveDataResp.xsd
  - setOpStatusResp.xsd

- subscribeResp.xsd

Requests may be sent from a client to a subsystem or from a subsystem to a driver. Responses may be sent from a driver to a subsystem or a subsystem to a client. A message can be sent from any process to another process.

2.1.1 Subsystem communication

Initial communication to a subsystem is described in the general ICD. For CVS, the RSEs and active TAMs are retrieved from the database on startup, including any detection zone information for an RSE. Once a client has initiated the connection to CVS, additional RSEs may be added, existing RSEs may be modified, deleted, or have the online status modified.

When CVS receives an rseProbeReportMsg from a driver, it is passed directly to clients who are subscribed for raw probe reports. Additionally, CVS will parse the probe reports for speed and position reports, compare them against the detection zones defined by all RSEs, and generate new speed information for the detection zones. This information will be broadcast in an rseUpdateMsg.

When CVS receives a tamReportMsg from a driver, it is passed directly to clients who are subscribed for raw TAM reports. Additionally, CVS will examine the IDs of messages being broadcast to each tam and send an updated rseUpdateMsg to notify clients of changes to the list of TAMs being broadcast by a device.

The following table shows the various subscriptions a client may request. The last column shows the XML updates that will be received if a client has subscribed to this data.

Subscription	Description	Updates Received
rseConfig	Receive updates to RSE configuration information.	addRseResp, modifyRseResp, deleteRseResp
rseData	Receive updates to RSE status and zone reports.	rseUpdateMsg
tamData	Receive updates to active TAMs.	addTamResp, modifyTamResp, deleteTamResp
rawProbeData	Receive raw formatted probe information reported from RSEs.	rseProbeReportMsg
rawTamData	Receive raw formatted TAM information broadcast to RSEs.	tamReportMsg
userData	Receive notification of changes to user permissions.	updateSystemDataMsg

2.1.2 Driver communication

Initial communication from a subsystem to a driver is described in the general ICD. For CVS, an addRseReq is sent to each driver containing the RSEs which belong to the driver. After receiving this request, the driver begins accepting data from the RSEs. The driver will receive and queue data reports from vehicles, and then send them in a single message to the subsystem based on a configurable timer.

An additional replaceTamListMsg will be sent to initialize the list of TAMs to broadcast. After receiving this request, the driver begins broadcasting TAMs to RSEs. The TAMs will be broadcast to each appropriate RSE based on a separate configurable timer. Upon receiving a replaceTamListMsg (either initially or later in execution), the driver will generate an XML representation of the TAMs being broadcast on the next broadcast timer cycle, and send all current TAMs back to the subsystem in a raw format.

As in Section 2.1.1, additional RSEs may be added, existing RSEs may be modified, deleted, or have the online status modified.

2.2 Subsystem Schemas

The tables below show which requests can be sent from client to subsystem and subsystem to driver. The responses sent from driver to subsystem and subsystem to client are also specified. Messages are sent when a response is not required.

FC (From client),TC (To client), TD (To driver), FD (From driver)

Usage Description	Requests	FC	TD	Responses	FD	TC	Messages	TD	FD	TC
Used for a client to add a new RSE to the subsystem.	addRseReq	X	X	addRseResp	X	X	addRseMsg	X		
Used for a client to remove an existing RSE from the subsystem.	deleteRseReq	X	X	deleteRseResp	X	X	deleteRseMsg	X		
Used for a client to modify an existing RSE in the subsystem.	modifyRseReq	X	X	modifyRseResp	X	X	modifyRseMsg	X		
Used for a client to add a new TAM to the subsystem.	addTamReq	X		addTamResp		X				
Used for a client to remove an existing TAM from the subsystem.	deleteTamReq	X		deleteTamResp		X				
Used for a client to modify an existing TAM in the subsystem.	modifyTamReq	X		modifyTamResp		X				

Usage Description	Requests	FC	TD	Responses	FD	TC	Messages	TD	FD	TC
Used to modify the online status of an RSE, possible settings are Active or Out of Service	setOpStatusReq	X	X	setOpStatusResp	X	X	setOpStatusMsg	X		
Used to retrieve data from CVS, data includes RSEs, TAMs, and users	retrieveDataReq	X		retrieveDataResp		X				
Used to subscribe to updates from the system. Data includes RSEs, TAMs, user updates, raw probe data, and raw TAM data.	subscribeReq	X		subscribeResp		X				
Broadcasts updates regarding RSE and zone status changes.							rseUpdateMsg			X
Broadcasts updates regarding raw probe reads from RSEs.							rseRawProbeReport Msg		X	X
Broadcasts updates regarding raw TAMs broadcast to RSEs.							tamReportMsg		X	X

2.3 Driver Schemas

For items which have a request, response, and message, typically actions will be performed using only the request and response pair. The message version of the operation is reserved for instances where the subsystem has successfully reported a change to the driver, but had a later portion of the update fail; in these cases the message is used to revert the change in the driver, and is not expected to fail as it is restoring a previously valid configuration.

TD (To driver), FD (From driver)

Usage Description	Requests	TD	Responses	FD	Messages	TD	FD
Used for a client to add a new RSE to the subsystem.	addRseReq	X	addRseResp	X	addRseMsg	X	
Used for a client to remove an existing RSE from the subsystem.	deleteRseReq	X	deleteRseResp	X	deleteRseMsg	X	
Used for a client to modify an existing RSE in the subsystem.	modifyRseReq	X	modifyRseResp	X	modifyRseMsg	X	
Used to modify the online status of a detector, possible settings from the subsystem are Active or Out of Service	setOpStatusReq	X	setOpStatusResp	X	setOpStatusMsg	X	X
The subsystem sends this message to instruct the driver tor replace the list of TAMs being broadcast to RSEs.					replaceTamListMsg	X	

Usage Description	Requests	TD	Responses	FD	Messages	TD	FD
The subsystem receives this message from the driver and generates updated speed information.					rseVehicleReportMsg		X
The subsystem receives this message from the driver and forwards it to subscribers.					rseRawProbeReport Msg		X
The subsystem receives this message from the driver and forwards it to subscribers, additionally generating any necessary rseUpdateMsg.					tamReportMsg		X

3. Notes

Information about XML and schemas can be found at the World Wide Web Consortium (W3) website at http://www.w3.org.