ARIZONA 2018 STATEWIDE ITS ARCHITECTURE UPDATE

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2018 ARIZONA STATEWIDE ITS ARCHITECTURE UPDATE

This project provides a common framework for planning, defining, and integrating intelligent transportation systems.

ITS PLANNING

KEY TRANSPORTATION LEGISLATION FUNDING BILLS

- **1956:** The Federal-Aid Highway Act was signed.
- **1991:** The Intermodal Surface Transportation Efficiency Act (ISTEA) was signed into law by President George H.W. Bush
- **1997:** Transportation Equity Act for the 21st Century (TEA-21) was passed
- **2005:** Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was signed into law by President George W. Bush
- **2012:** Moving Ahead for Progress in the 21st Century Act (MAP-21) was signed into law by President Obama
- **2015:** Fixing America's Surface Transportation (FAST) Act was signed into law by President Obama

FHWA FINAL RULE & FTA POLICY

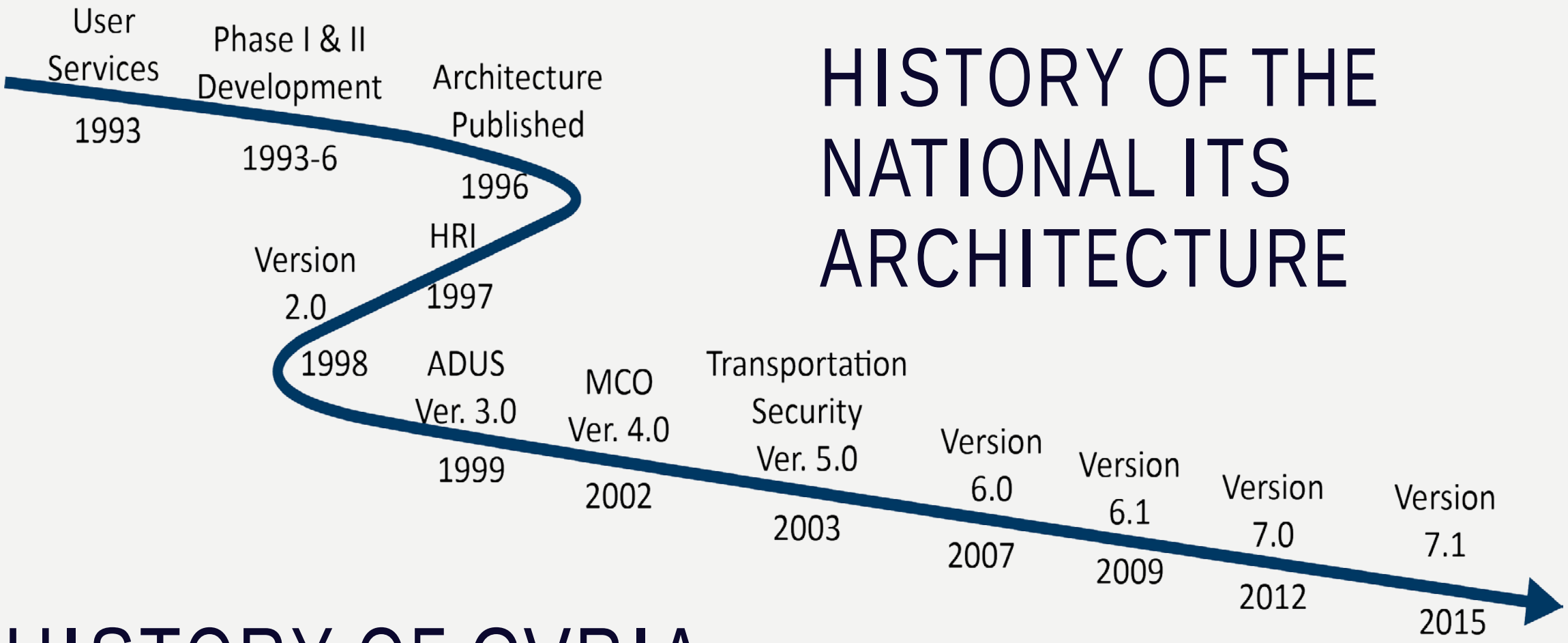
ANNOUNCEMENT January 8, 2001

In order to implement TEA-21, the final rule and policy require that ITS projects funded by the Highway Trust Fund and the Mass Transit Account must conform to the National ITS Architecture.

NATIONAL LEGISLATION – 23CFR940.9

A regional ITS architecture shall be developed to guide the development of ITS projects and programs and be consistent with ITS strategies and projects contained in applicable transportation plans. The National ITS Architecture shall be used as a resource in the development of the regional ITS architecture. The regional ITS architecture shall be on a scale commensurate with the scope of ITS investment in the region. Provision should be made to include participation from the following agencies, as appropriate, in the development of the regional ITS architecture: Highway agencies; public safety agencies (e.g., police, fire, emergency/medical); transit operators; Federal lands agencies; State motor carrier agencies; and other operating agencies necessary to fully address regional ITS integration.

HISTORY OF THE NATIONAL ITS ARCHITECTURE

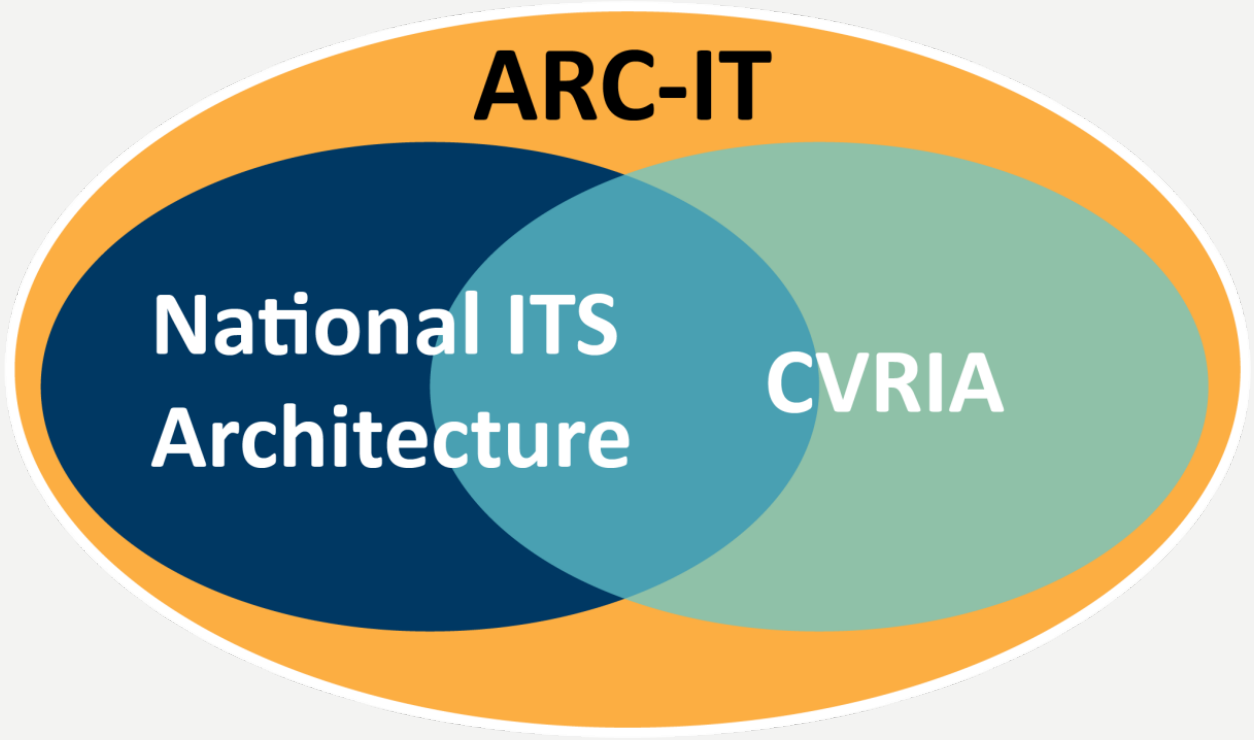


HISTORY OF CVRIA

2014 - Connected Vehicle Reference Implementation Architecture (CVRIA) research effort whose key outcome is a Connected Vehicle Standards Development Plan that will allow identification and prioritization of the standards needed in support of connected vehicle implementation. CVRIA development team has established a website that hosts the architecture viewpoints for 88 connected vehicle safety, mobility, environmental, and support applications.

June 2017 – ARC-IT was released

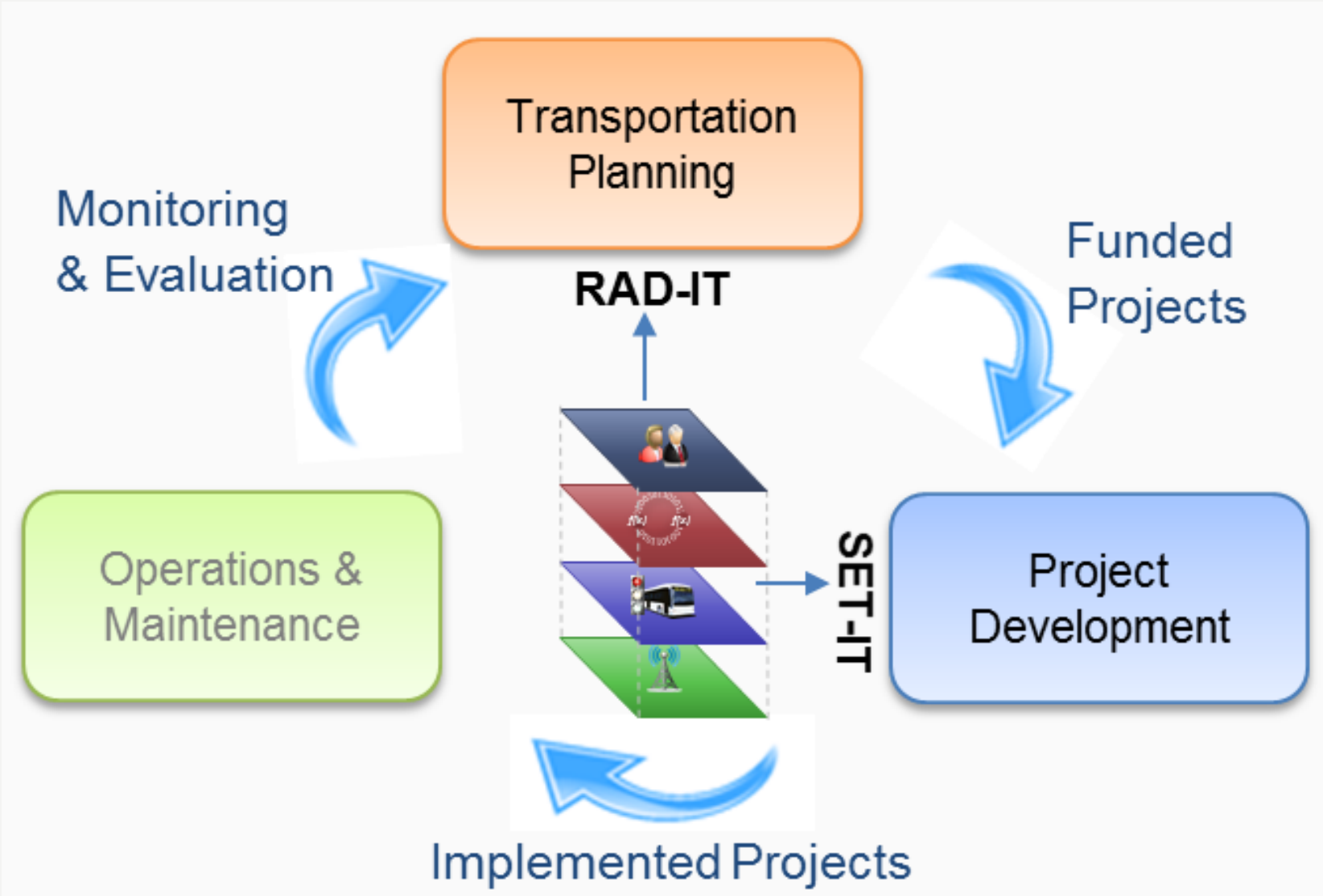
ARC-IT combines services of National ITS Architecture and connected vehicle content of CVRIA



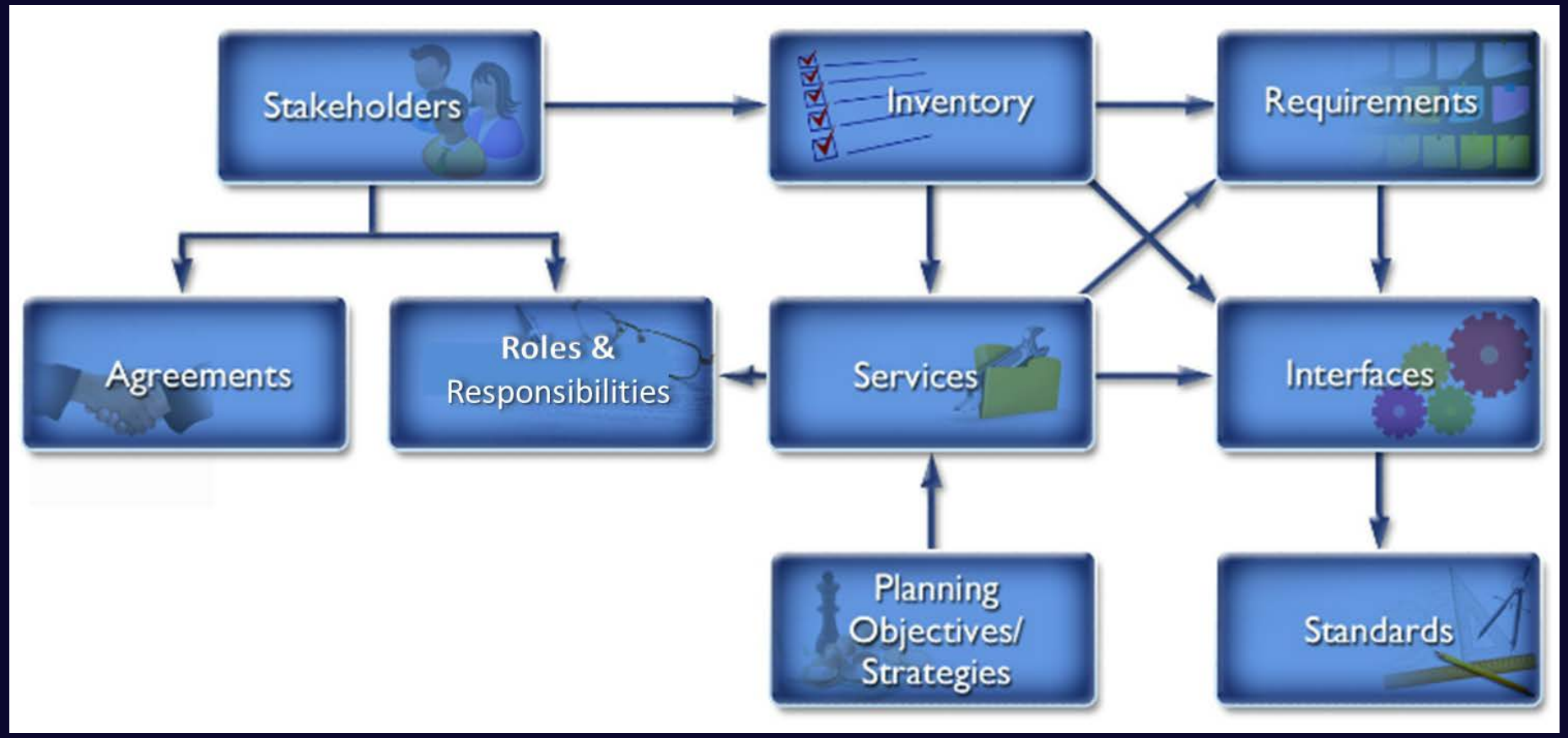
ARC-IT

133 service packages grouped into 12 user services

ARC-IT & THE TOOL BOX



RAD-IT


Stakeholders
Inventory
Requirements
Agreements
Roles &
Responsibilities
Services
Interfaces
Planning
Objectives/
Strategies
Standards

WWW.ARC-IT.NET

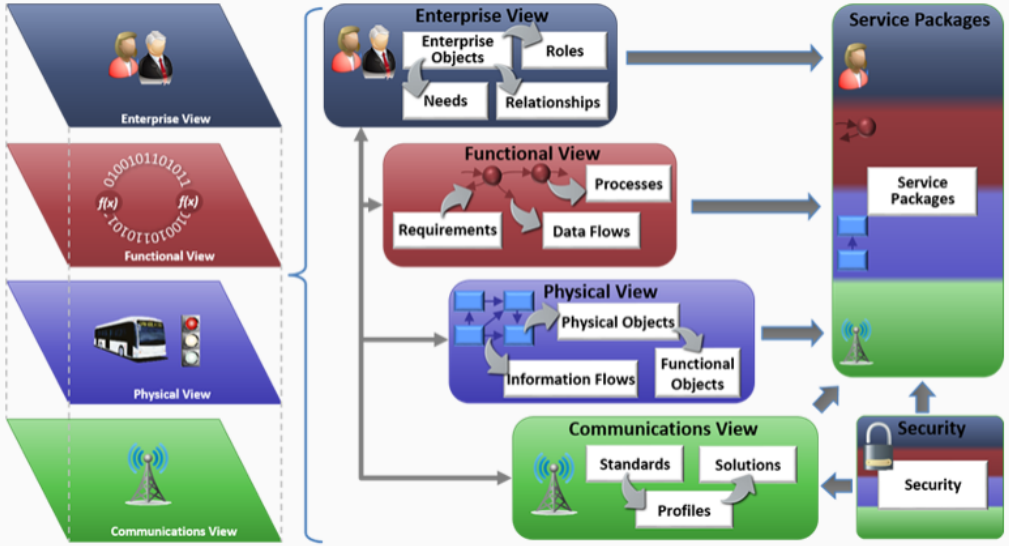
ARC-IT Version 8.1
The National ITS Reference Architecture

Architecture ▼ | Architecture Use ▼ | Architecture Resources ▼ | Architecture Terminology ▼ | Contact The Architecture Team

Home > Architecture Overview

Architecture Overview

The Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) includes a set of interconnected components that are organized into four views that focus on four different architecture perspectives. A variety of entry points shown in the figure allow you to start with any of these components, though most people start with Service Packages. Once in, you can easily navigate from component to component to find what you need. This interconnected presentation is possible because of the traceability that is maintained between each of the architecture components.



ARC-IT is comprised of four views:

SERVICE PACKAGES

Service Packages Grouped by Service Area

Traffic Management

Public Transportation

Maintenance and Construction

Commercial Vehicle Operations

Public Safety

Parking Management

Vehicle Safety

Traveler Information

Data Management

Support

Sustainable Travel

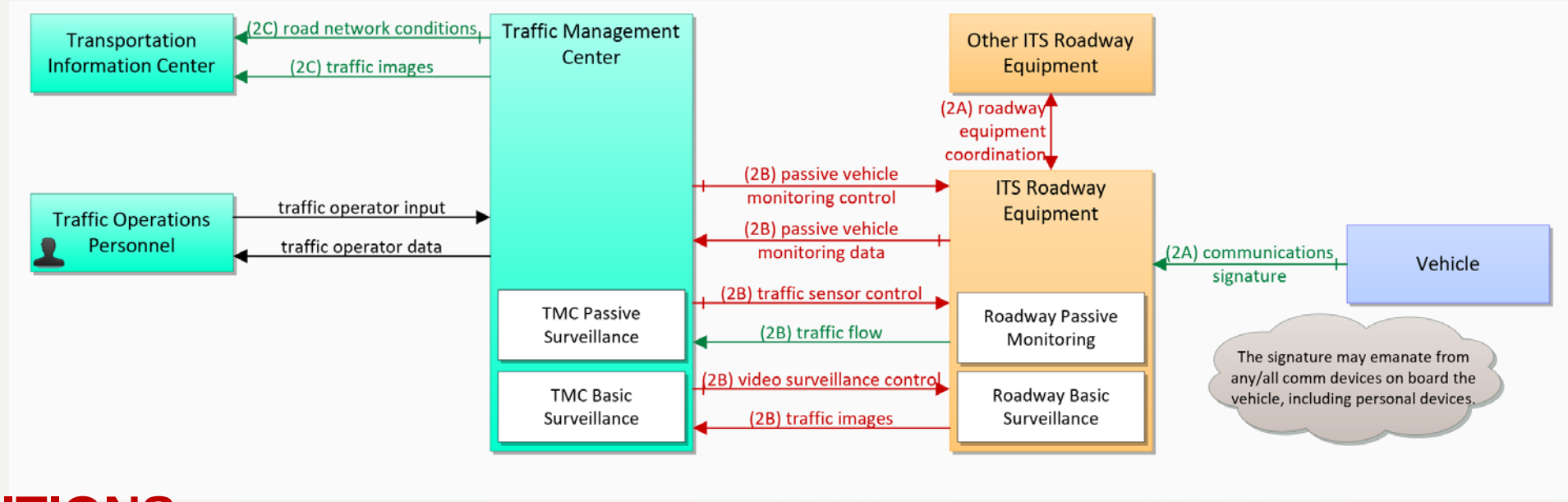
Weather

SERVICE PACKAGES

	ST10	Low Emissions Zone Management
Traffic Management	TM01	Infrastructure-Based Traffic Surveillance
	TM02	Vehicle-Based Traffic Surveillance
	TM03	Traffic Signal Control
	TM04	Connected Vehicle Traffic Signal System
	TM05	Traffic Metering
	TM06	Traffic Information Dissemination
	TM07	Regional Traffic Management
	TM08	Traffic Incident Management System
	TM09	Integrated Decision Support and Demand Management
	TM10	Electronic Toll Collection
	TM11	Road Use Charging
	TM12	Dynamic Roadway Warning
	TM13	Standard Railroad Grade Crossing
	TM14	Advanced Railroad Grade Crossing
	TM15	Railroad Operations Coordination
	TM16	Reversible Lane Management
	TM17	Speed Warning and Enforcement
	TM18	Drawbridge Management
	TM19	Roadway Closure Management
	TM20	Variable Speed Limits
	TM21	Speed Harmonization
	TM22	Dynamic Lane Management and Shoulder Use
	TM23	Border Management Systems

TM01

PHYSICAL DIAGRAM



DEFINITIONS

Physical Object	Class	Description
ITS Roadway Equipment	Field	'ITS Roadway Equipment' represents the ITS equipment that is distributed on and along the roadway that monitors and controls traffic and monitors and manages the roadway itself. This physical object includes traffic detectors, environmental sensors, traffic signals, highway advisory radios, dynamic message signs, CCTV cameras and video image processing systems, grade crossing warning systems, and ramp metering systems. Lane management systems and barrier systems that control access to transportation infrastructure such as roadways, bridges and tunnels are also included. This object also provides environmental monitoring including sensors that measure road conditions, surface weather, and vehicle emissions. Work zone systems including work zone surveillance, traffic control, driver warning, and work crew safety systems are also included.

COMPONENTS OF A REGIONAL ARCHITECTURE – 23CFR940.9

(1) DESCRIBE REGION

(2) IDENTIFY PARTICIPATING AGENCIES AND STAKEHOLDERS

(3) DEVELOP AN OPERATIONAL CONCEPT – ROLES AND RESPONSIBILITIES OF PARTICIPATING AGENCIES AND STAKEHOLDERS

(4) IDENTIFY AGREEMENTS (EXISTING OR NEW) REQUIRED FOR OPERATIONS

(5) IDENTIFY SYSTEM FUNCTIONAL REQUIREMENTS

(6) SHOW INTERFACE REQUIREMENTS AND INFORMATION EXCHANGES WITH PLANNED AND EXISTING SYSTEMS AND SUBSYSTEMS

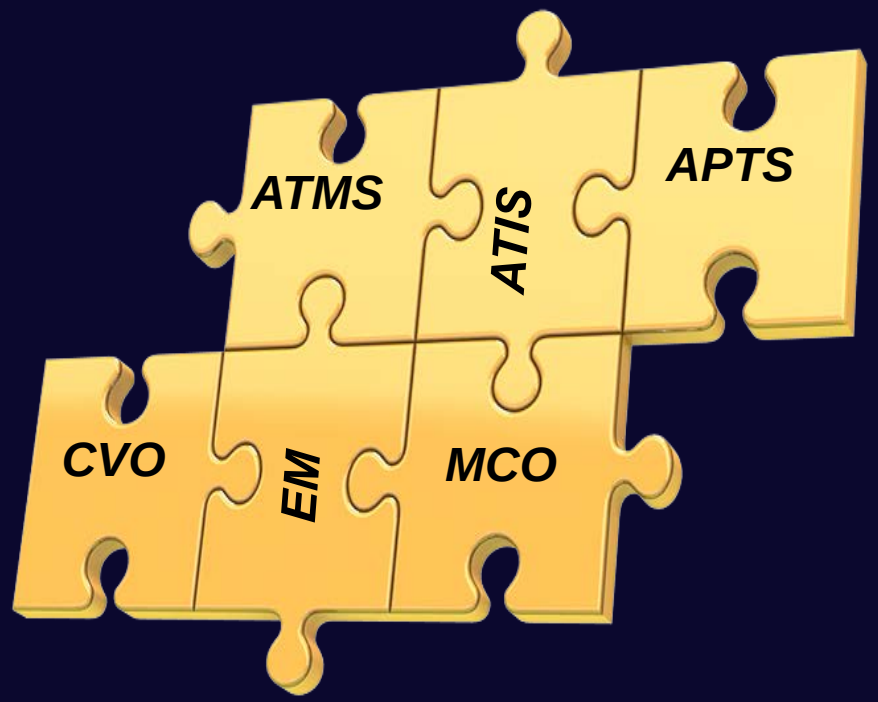
(7) IDENTIFY ITS STANDARDS SUPPORTING REGIONAL AND NATIONAL INTEROPERABILITY

(8) SEQUENCE PROJECTS REQUIRED FOR IMPLEMENTATION

Scope of the ITS Architecture

1. Geographic Area
2. Time Horizon
3. Breadth of ITS Services

DESCRIBE REGION



1. AZ REGIONAL DESCRIPTION

Regional Architecture Attributes

Name

Arizona Statewide ITS Architecture

Description

The Arizona Statewide Architecture includes all ITS elements existing and planned in the state of Arizona. There are currently two existing regional architectures: one in the Tucson region and one in the Phoenix region. Both are included as part of this Architecture as related regional architectures. The Statewide ITS Architecture will interact with these architectures but will be kept separately and focused on statewide ITS elements, rural and ITS elements outside of these two regions. The one exception will be Arizona Department of Transportation's (ADOT) ITS elements. The Statewide Architecture will document all of ADOT's ITS elements including those within the Maricopa Association of Governments (MAG) Regional ITS Architecture and, the Tucson Metropolitan Region ITS Strategic Deployment Plan for the 21st Century developed by the Pima Association of Governments in July 2004.

Timeframe

20 years

Geographic Scope

Boundaries for geographic scope of the Statewide ITS Architecture extend to the state of Arizona as it borders California, Mexico, New Mexico, Utah and Nevada. Much of the statewide architecture includes rural areas. Some of the MAG/ Phoenix and PAG/ Tucson regional architecture elements will be included as related architectures. The Statewide Architecture will document ADOT's ITS elements existing or planned throughout the state.

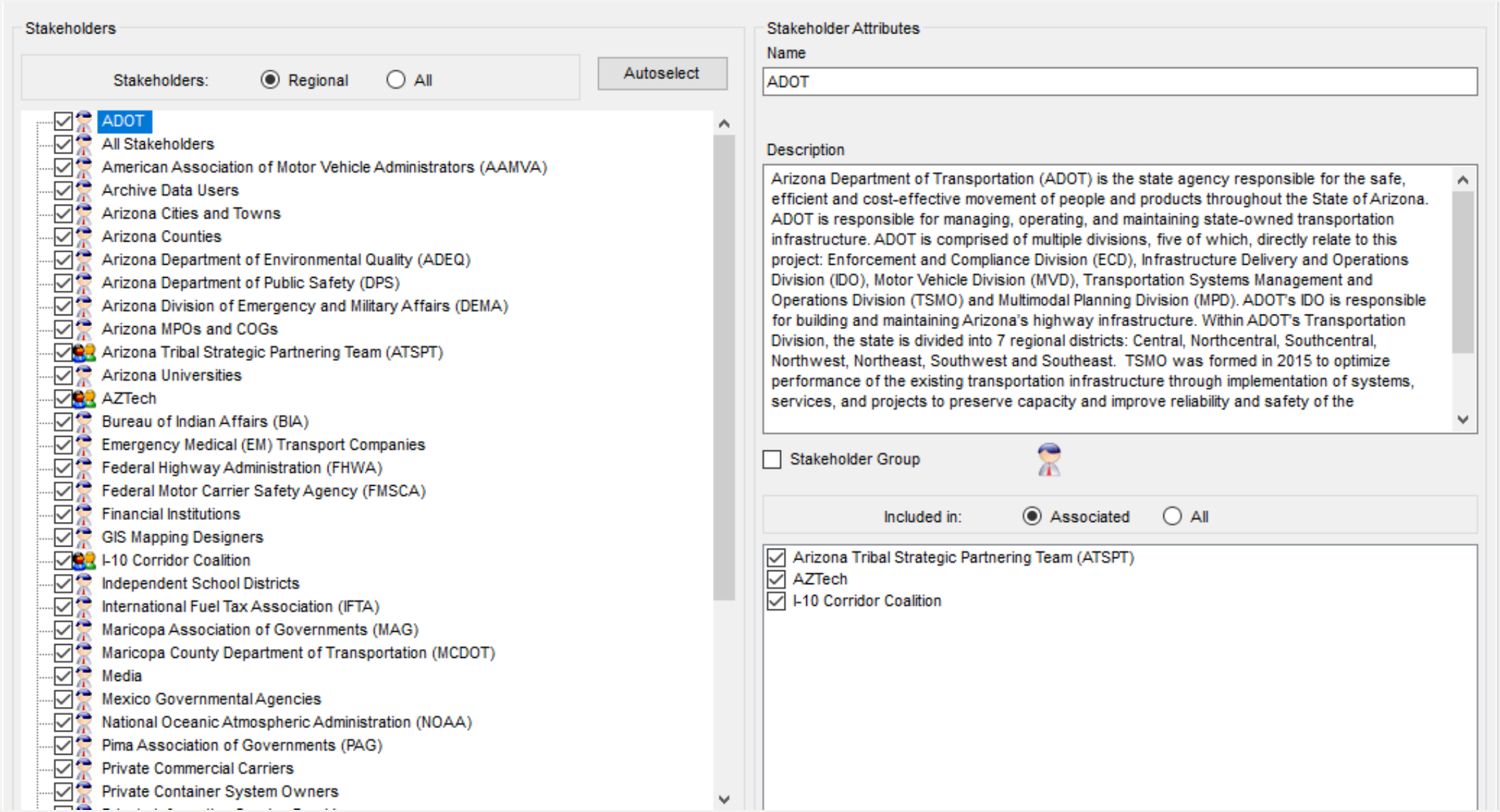
Service Scope

All services: Traffic Management Systems, Traveler Information, Maintenance and ITS Planning, Transportation Planning and Operations, Traffic Incident Management, Construction Operations, Commercial Vehicle Operations, Information Systems, Public Safety (Emergency Management), Archive Data Management, Transit, Weigh in Motion, Safety Inspection Stations, International Border Crossings.

IDENTIFY PARTICIPATING AGENCIES AND STAKEHOLDERS

“Someone who deploys, owns, operates, maintains, or is impacted by, an ITS system”

2. AZ STAKEHOLDERS



DEVELOP OPERATIONAL CONCEPT

Identifies the roles and responsibilities of stakeholders in the operation, implementation and maintenance of the ITS systems.

Roles – ITS functions of a stakeholder

Responsibilities – Duties or obligations of a stakeholder in delivering one or more ITS services in a region

INCIDENT MANAGEMENT (SIMPLIFIED)

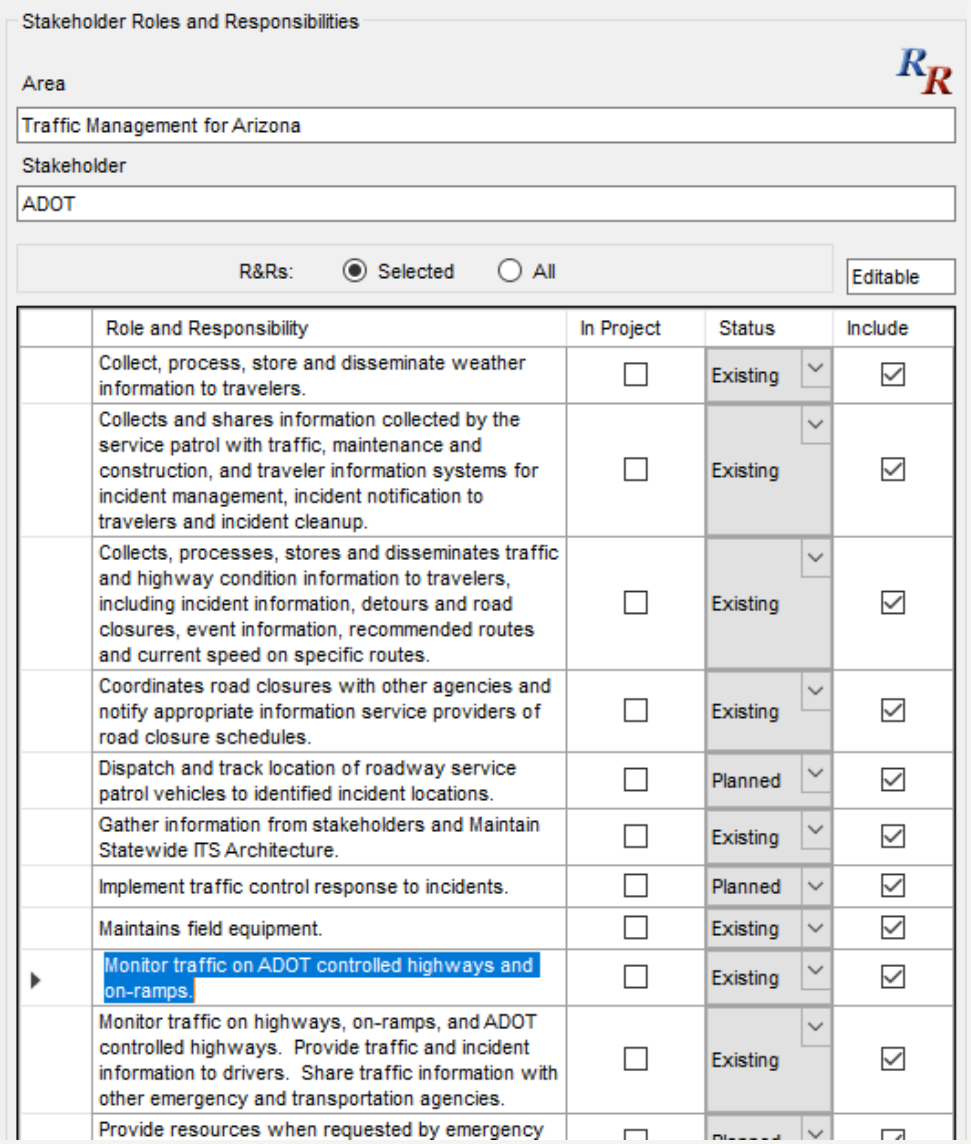
County Emergency Services

- Provide incident information to State DOT TMC
- Dispatch emergency vehicles to incident

State DOT

- Monitor roadways and provide incident information to Emergency Services
- Share CCTV control with Emergency Services

3. AZ ROLES AND RESPONSIBILITIES



Stakeholder Roles and Responsibilities

Area

Traffic Management for Arizona

Stakeholder

ADOT

R&Rs: (•) Selected ( ) All

Editable

	Role and Responsibility	In Project	Status	Include
	Collect, process, store and disseminate weather information to travelers.	☐	Existing	☑
	Collects and shares information collected by the service patrol with traffic, maintenance and construction, and traveler information systems for incident management, incident notification to travelers and incident cleanup.	☐	Existing	☑
	Collects, processes, stores and disseminates traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes and current speed on specific routes.	☐	Existing	☑
	Coordinates road closures with other agencies and notify appropriate information service providers of road closure schedules.	☐	Existing	☑
	Dispatch and track location of roadway service patrol vehicles to identified incident locations.	☐	Planned	☑
	Gather information from stakeholders and Maintain Statewide ITS Architecture.	☐	Existing	☑
	Implement traffic control response to incidents.	☐	Planned	☑
	Maintains field equipment.	☐	Existing	☑
▶	Monitor traffic on ADOT controlled highways and on-ramps.	☐	Existing	☑
	Monitor traffic on highways, on-ramps, and ADOT controlled highways. Provide traffic and incident information to drivers. Share traffic information with other emergency and transportation agencies.	☐	Existing	☑
	Provide resources when requested by emergency	☐	Planned	☑

IDENTIFY AGREEMENTS

- Handshake agreement
- Memorandum of Understanding (MOU)
- Interagency agreement
- Intergovernmental agreement
- Operational agreement
- Funding agreement
- Master agreement

4. AZ AGREEMENTS

Number	Title
AG #:KR04-1793TRN	ADOT and DPS Intergovernmental
AG #KR98-0521TRN	HCRS - ADOT and ADEM Interagency Agreement
C-64-15-049-M-00	ADOT and McDOT Master ITS Agreement
C-64-15-049-M-00-Five	Phase I Loop 101 Mobiity Project
C-64-15-049-M-00-Four	AZTech Visioning Project
C-64-15-049-M-00-One	ADOT-MCDOT - Fiber for Three Project Locations
C-64-15-049-M-00-Three	ADOT-MCDOT - CVISN WZ Notification Project
C-64-15-049-M-00-Two	ADOT-MCDOT - Third party Probe Data and Analysis
C-64-15-051-M-00	AZTech ATS Control at L101 to L303 West Valley
C-64-18-089-M-00	IGA for research of Traffic and ITS studies
C-91-09-052-M-02-Amen...	MCDOT and U of A Research and CV
IGA /JPA 14-0004086-I	ADOT/Mohave County LED Enhanced Speed Limit Signs
IGA/JPA 09-076I	Phoenix - ITS Equipment
IGA/JPA 09-077I	Phoenix ITS Equipment II
IGA/JPA 09-102I	Glendale - CCTV Camera Installations
IGA/JPA 09-2051	ADOT and Glendale 2010
IGA/JPA 10-058-1	Gilbert Statewide Traffic Signal Coordination Program and Traffic Safety
In Process	MCDOT and ASU Research and CV
January 2006	AZTech RADS Agreement
JPA 06-016	ADOT and Glendale 2006 - Shared use of FMS
JPA 98-119	Highway Closure and Road Restriction Subsystem (HCRS)

Functional Requirements:

- Shall allow soda selection
- Shall accept payment
- Shall dispense soda pop
- Shall display inventory status

Performance Requirements

- Shall hold 30 cans of each type
- Shall keep soda between 45° F and 50° F

Cost Requirements

- Shall cost less than $X/year to operate

Implementation Requirements

- Shall operate on 120V power

IDENTIFY SYSTEM FUNCTIONAL REQUIREMENTS

Functional requirements define *what* a system will do

5. AZ FUNCTIONAL REQUIREMENTS

TMC Traffic Metering

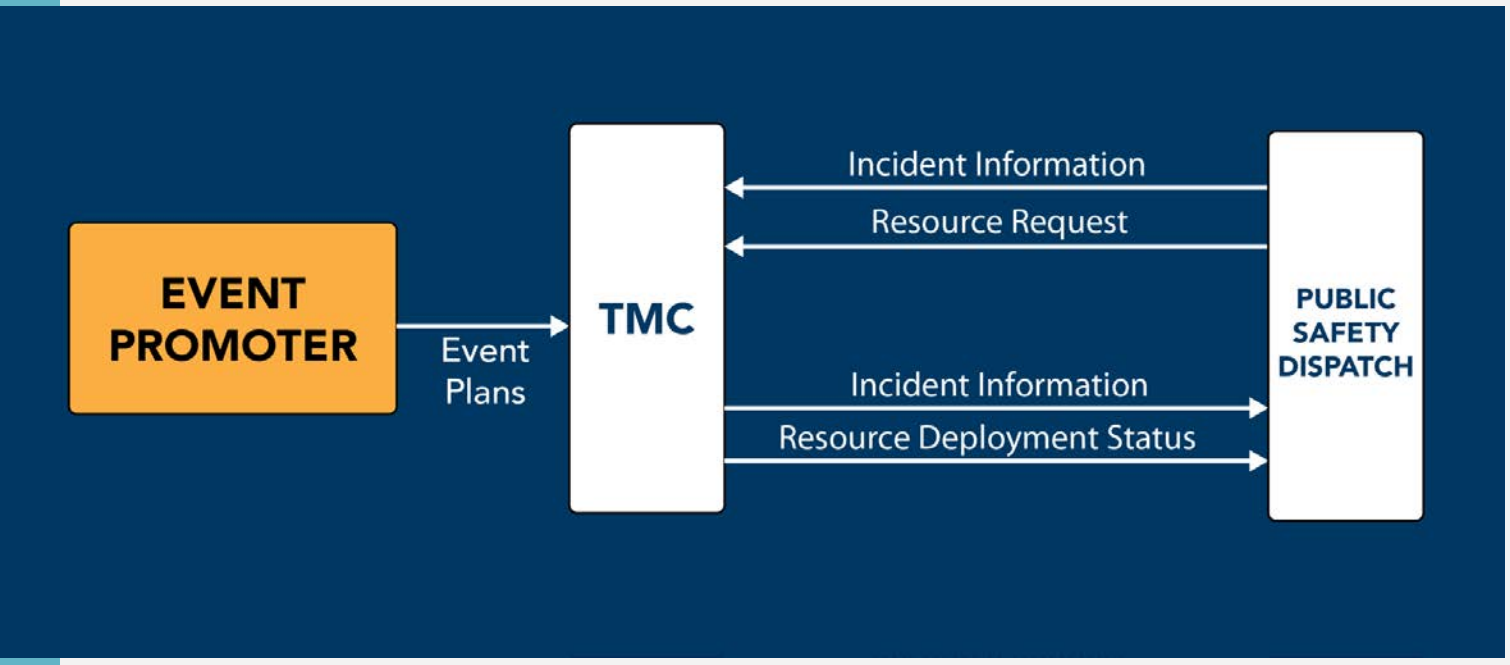
Physical Object: Traffic Management Center

Overview | **Requirements** | Information Flows

Requirements

#	Requirement
01	The center shall remotely control systems to manage use of the freeways, including ramp, interchange, and mainline metering.
02	The center shall collect operational status from ramp meters, interchange meters, and mainline meters and compare against the control information sent by the center.
03	The center shall collect fault data from ramp meters, interchange meters, and mainline meters.
04	The center shall implement control strategies, under control of center personnel, on some or all of the freeway network devices (e.g. ramp meters, interchange meters, and mainline meters), based on data from sensors monitoring traffic conditions upstream, downstream, and queue data on the approaches to the meters.
05	The center shall be able to, under control of center personnel, use collected environmental and vehicle emissions data to regulate the flow of traffic on ramps, interchanges, and the mainline.

SHOW INTERFACE REQUIREMENTS & INFORMATION EXCHANGES



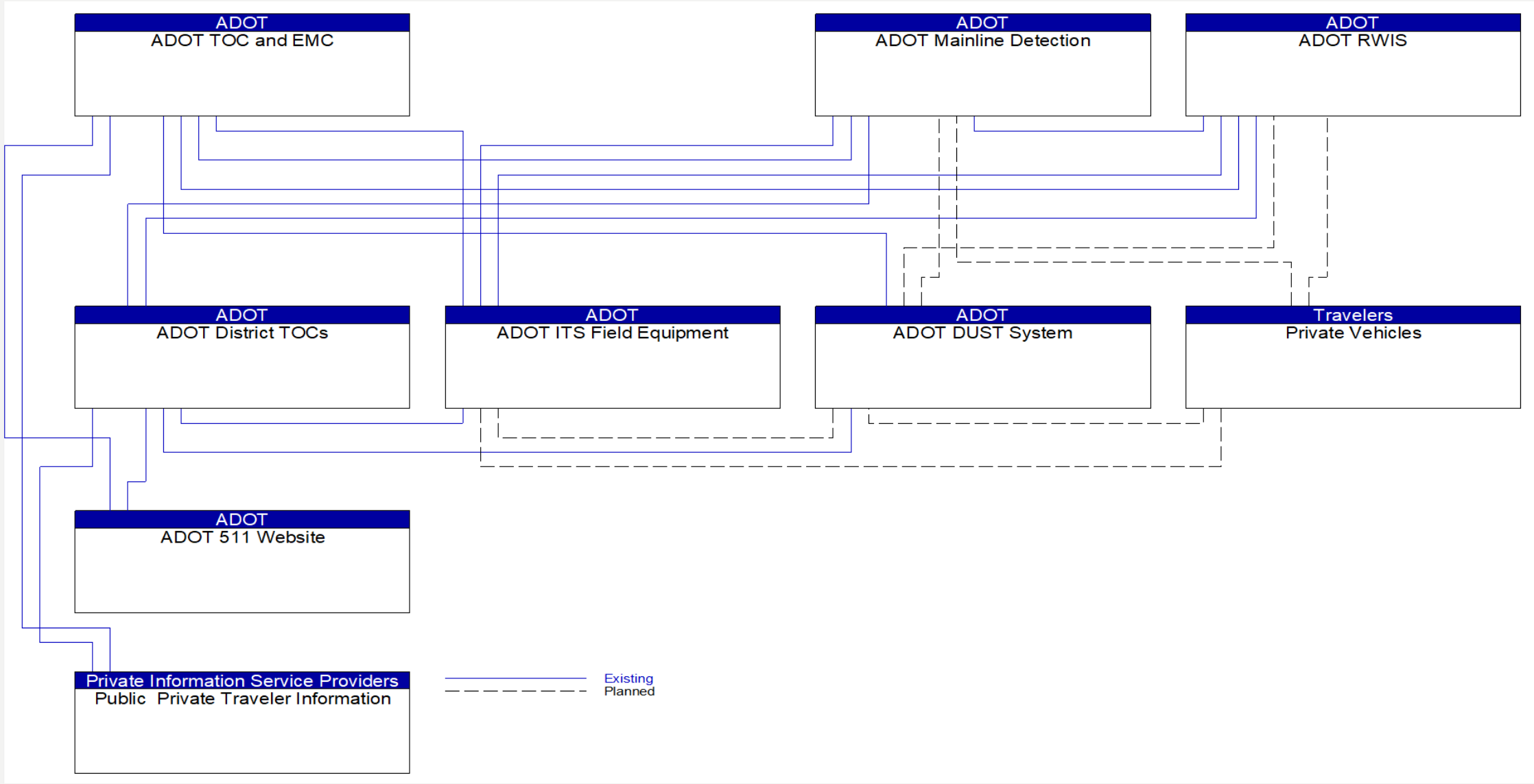
Identify Interconnects

Which systems will share information?

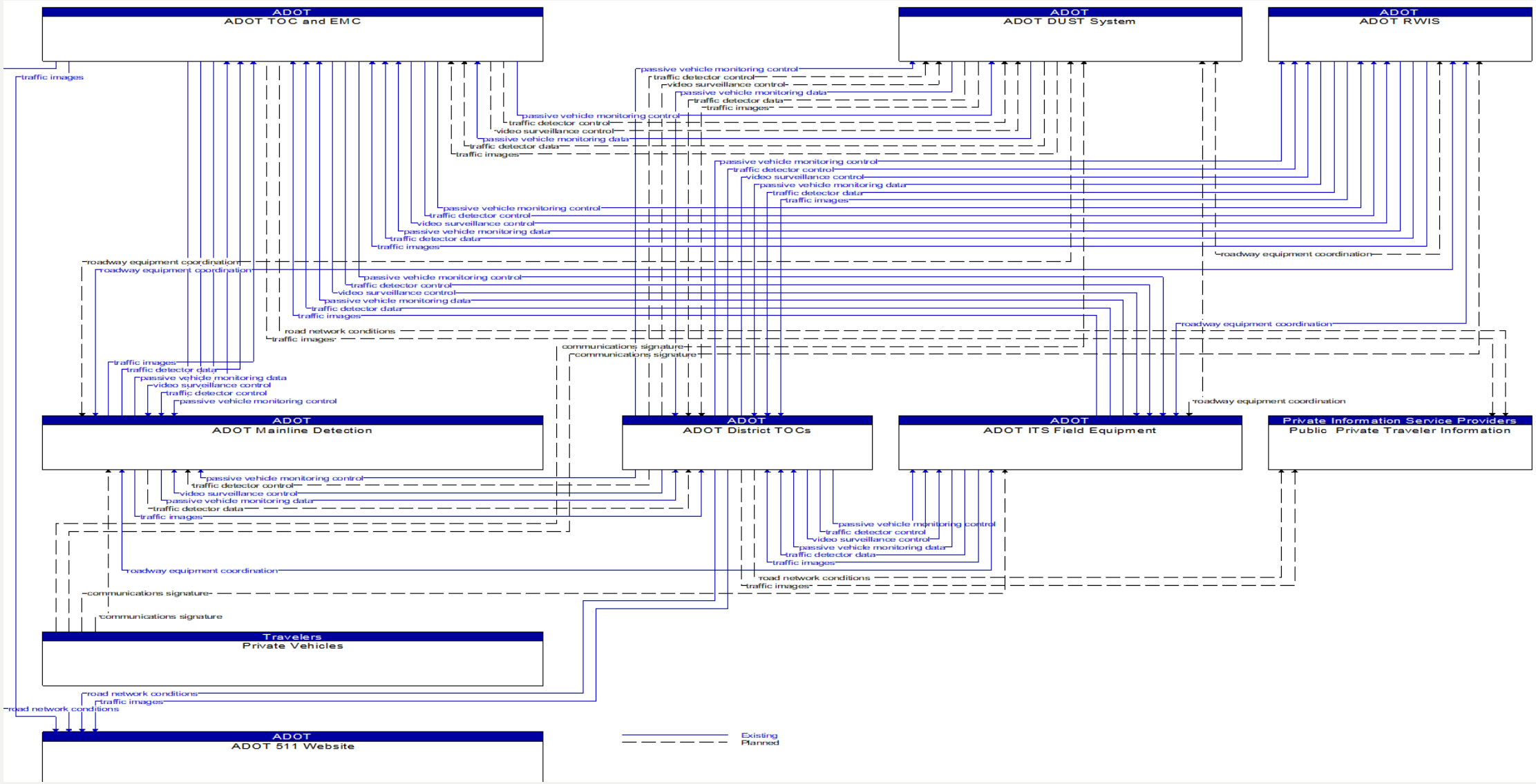
Define Information Flows

What information will they share?

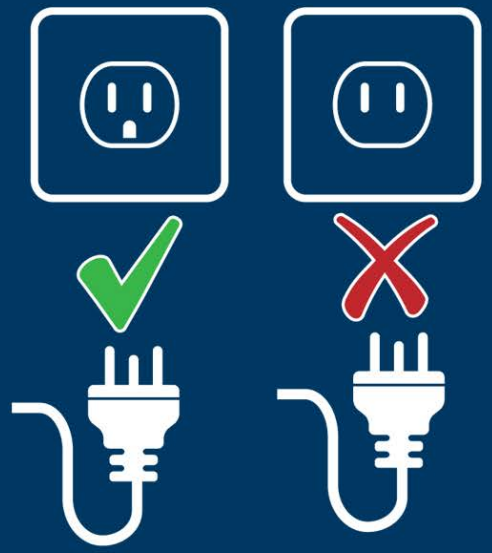
6. AZ INTERCONNECTS



6. AZ INFORMATION FLOWS



Standard, n.
something established by authority, custom, or general consent as a model



Why are they needed?

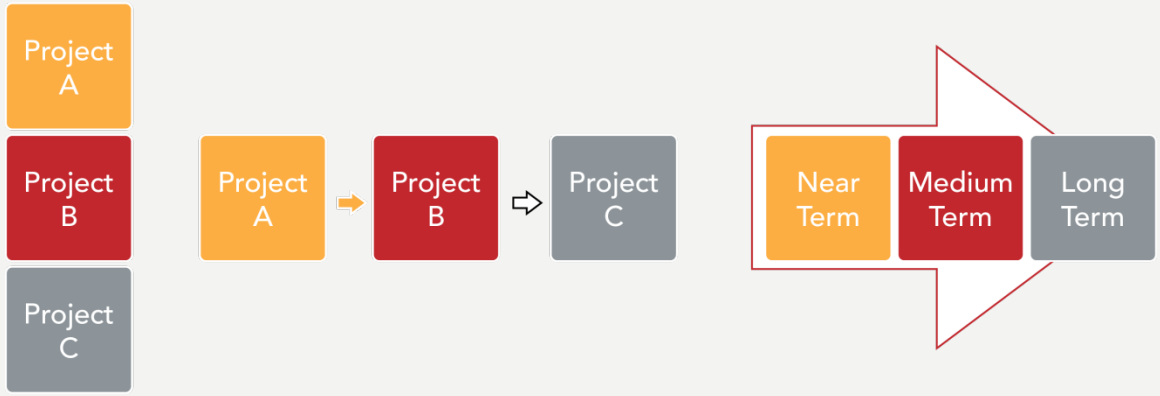
IDENTIFY ITS STANDARDS

- Over 80 ITS Standards
- Cover Transit, Traffic, CVO, Toll, Traveler Information,
- RAD-IT/SET-IT will map and connect options

7. AZ STANDARDS

	☐	ANSI TS813	Electronic Filing of Tax Return Data	American National Standards ...	☐	☑
	☐	APTA TCIP-S-001 3.0.4	Standard for Transit Communications Interface Profiles	American Public Transportatio...	☐	☑
	☐	ASTM E2468-05	Standard Practice for Metadata to Support Archived Data Management Systems	American Society for Testing ...	☐	☑
	☐	ASTM E2665-08	Standard Specifications for Archiving ITS-Generated Traffic Monitoring Data	American Society for Testing ...	☐	☑
	☐	GTFS	General Transit Feed Specification (GTFS) Static	General Transit Feed Specific...	☐	☑
	☐	GTSF-Realtime	General Transit Feed Specification (GTFS) Realtime	General Transit Feed Specific...	☐	☑
	☐	IEEE 1512 -2006	Standard for Common Incident Management Message Sets for use by Emergency Management Centers	Institute of Electrical and Elect...	☐	☑
	☐	IEEE 1512.3-2006	Standard for Hazardous Material Incident Management Message Sets for Use by Emergency Management C...	Institute of Electrical and Elect...	☐	☑
	☐	IEEE 1570-2002	Standard for the Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Inter...	Institute of Electrical and Elect...	☐	☑
	☐	ITE TMDD	Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Co...	Institute of Transportation Eng...	☐	☑
	☐	J2945/1	On-Board System Requirements for V2V Safety Communications	Society of Automotive Engine...	☐	☑
	☐	NTCIP 1201	Global Object Definitions	Consortium of AASHTO, ITE, ...	☐	☑
	☐	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller (ASC) Units	Consortium of AASHTO, ITE, ...	☐	☑
	☐	NTCIP 1203	Object Definitions for Dynamic Message Signs (DMS)	Consortium of AASHTO, ITE, ...	☐	☑
	☐	NTCIP 1204	Object Definitions for Environmental Sensor Stations (ESS)	Consortium of AASHTO, ITE, ...	☐	☑
	☐	NTCIP 1205	Object Definitions for Closed Circuit Television (CCTV) Camera Control	Consortium of AASHTO, ITE, ...	☐	☑
	☐	NTCIP 1206	Object Definitions for Data Collection and Monitoring (DCM) Devices	Consortium of AASHTO, ITE, ...	☐	☑
▶	☐	NTCIP 1207	Object Definitions for Ramp Meter Control (RMC) Units	Consortium of AASHTO, ITE, ...	☐	☑
	☐	NTCIP 1208	Object Definitions for Closed Circuit Television (CCTV) Switching	Consortium of AASHTO, ITE, ...	☐	☑
	☐	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems (TSS)	Consortium of AASHTO, ITE, ...	☐	☑
	☐	NTCIP 1210	Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters	Consortium of AASHTO, ITE, ...	☐	☑

1. Identify and define projects
2. Evaluate project dependencies
3. Sequence projects over time



IDENTIFY AND SEQUENCE PROJECTS

Order in which ITS projects should be implemented

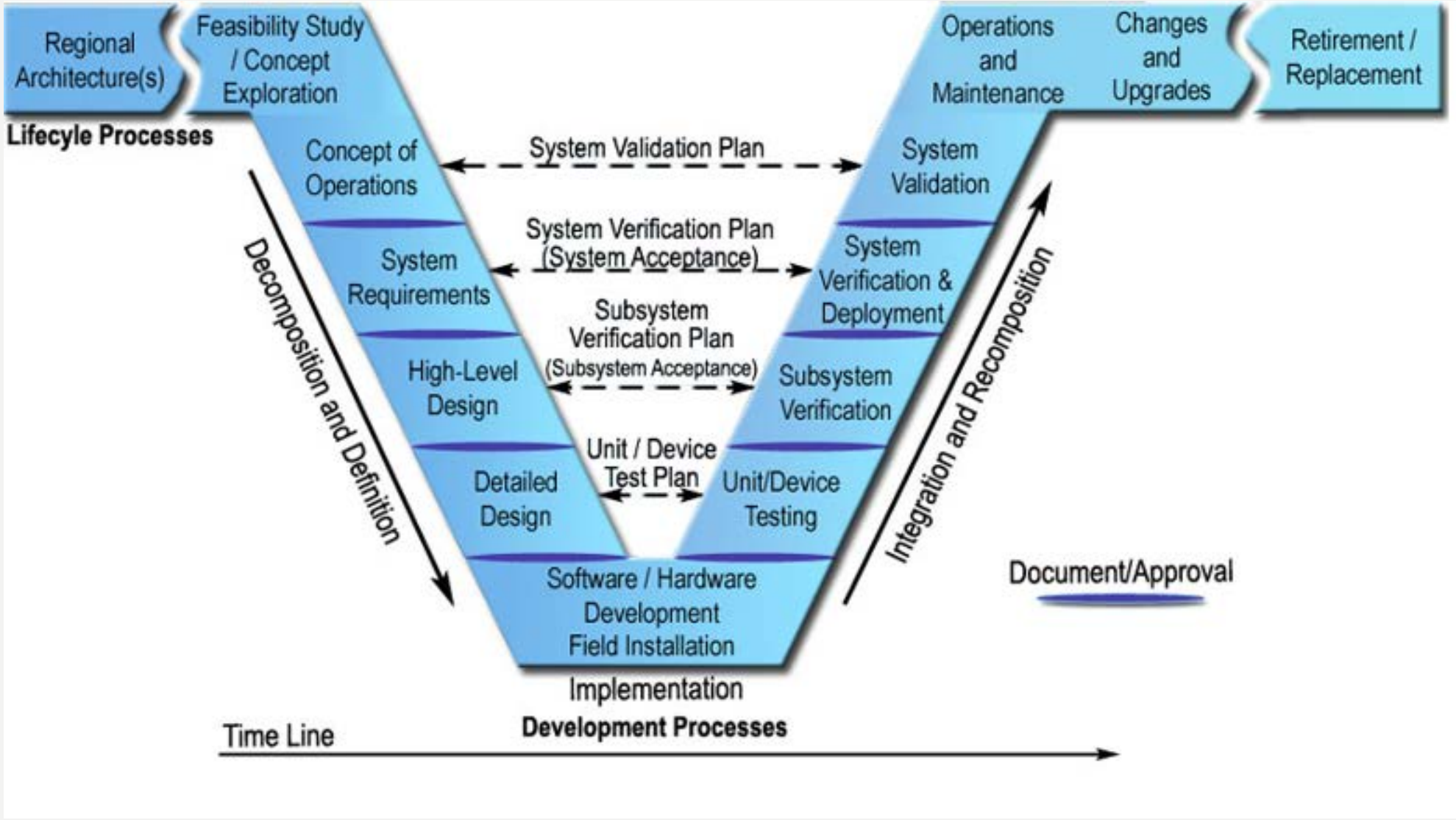
Impacted by:

- Technical issues
- Institutional issues

8. AZ SEQUENCE PROJECTS

Name	Description	Status	Timeframe	Geographic Scope	Service Scope	Developer	Maintainer
ADOT Active Traffic Management on I-17: SR101L to I-10	This project equips I-17 from SRL101L to I-10 with active traffic management methods and field elements to increase peak capacity, smooth traffic flows and enhance safety. Methods may include variable speed limits, adaptive ramp metering, queue protection, lane management, wrong way detection and traveler information. Source: FY2018 ADOT STIP 2017-2021.	Planned	SHORT: 2017-2021	I-17: SR101L to I-10	Active Traffic Management (ATM)	ADOT	ADOT
ADOT Active Traffic Management on US60: I-10 to Higley	This project equips US60 from I-10 to Higley with active traffic management methods and field elements to increase peak capacity, smooth traffic flows and enhance safety. Methods may include variable speed limits, adaptive ramp metering, queue protection, lane management, wrong way detection and traveler information. Source: FY2018 ADOT P2P Master Project List - TSMO	Planned	MEDIUM: 2022-2025	US60: I-10 to Higley	Active Traffic Management (ATM)	ADOT	ADOT
ADOT Adaptive Ramp Metering on SR101L	This project enhances the existing ramp metering capabilities to improve throughput and reduce congestion by controlling access onto the freeway using real-time data. Adaptive ramp metering balances traffic volumes on the local arterials considers queues on the entrance ramps and monitors freeway conditions. The arterials, freeway, and ramps are equipped with detectors that collect traffic data which is processed using complex algorithms. This project converts the existing system to adaptive ramp metering in the Phoenix Metropolitan Area. Source: Loop 101 Mobility Partnership funded by the Federal Highway Administration 2017 Advanced Transportation and Congestion Management Technologies Deployment Grant	Planned	SHORT: 2017-2021	SR101L Corridor	Adaptive Ramp Metering	ADOT	ADOT

V-DIAGRAM


Regional Architecture(s)
Feasibility Study / Concept Exploration
Operations and Maintenance
Changes and Upgrades
Retirement / Replacement
Lifecyle Processes
Concept of Operations
System Validation Plan
System Validation
System Verification Plan (System Acceptance)
System Requirements
System Verification & Deployment
Subsystem Verification Plan (Subsystem Acceptance)
High-Level Design
Subsystem Verification
Unit / Device Test Plan
Detailed Design
Unit/Device Testing
Decomposition and Definition
Integration and Recomposition
Software / Hardware Development Field Installation
Document/Approval
Implementation
Development Processes
Time Line

HTTPS://APPS.AZDOT.GOV/FILES/ITS-ARCHITECTURE/INDEX.HTM