ARC-IT v8 – The New National ITS Architecture & Its Tools

Talking Transportation Technology (T3) Webinar
August 17, 2017
ARC-IT T3

- Describe the integration of the National ITS Architecture, version 7.1 with the Connected Vehicle Reference Implementation Architecture (CVRIA)
- Illustrate how ARC-IT relates to the National ITS Architecture v7.1 and CVRIA
- Tour the Website
- Describe the tools—what they are, what they are used for, and who should use them in planning for deployment
- Discuss how ARC-IT fits into the deployment process and where to find out more

Presenters:
- Steve Sill, US DOT ITS Joint Program Office
- David Binkley, Iteris
- Kingsley Azubike, FHWA Office of Operations
National ITS Architecture is a “Living Document”

- Continuing evolution of the architecture over 20+ years
History Has Led Us Here

- Both the National ITS Architecture and CVRIA support needed activities in ITS
- Version 8 merges both architectures to support all of the stakeholders’ needs
ARC-IT combines services of National ITS Arch with connected vehicle content of CVRIA
Combined/Merged Architecture

- Continue to support regional planning and project implementation

Transportation Planning

Monitoring & Evaluation

Operations & Maintenance

Funded Projects

Implemented Projects

Project Development
Merging Architectures

- Layers → Views
ARC-IT Structure and Organization

- Defined around 4 views:
  - Enterprises to carry out services
  - Functions to implement services
  - Physical objects to implement that functionality
  - Communications protocols required for implementation
- Organized by Service Packages
ARC-IT Service Packages

- Service Packages grouped by 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
ARC-IT Physical View

- Depicts:
  - Physical objects that interact to deliver services
  - Interfaces and flows of information between those physical objects

- Identifies options for...
  - Interfaces to support ITS services
  - Allocation of functionality
  - Security safeguards
Physical View - Physical Objects

- Organized into 5 Classes

<table>
<thead>
<tr>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
<th>Class D</th>
<th>Class E</th>
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<tbody>
<tr>
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Layer 0: Classes and Primary Interconnects

<table>
<thead>
<tr>
<th>Layer</th>
<th>Class</th>
<th>Date</th>
<th>Status</th>
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<tbody>
<tr>
<td>0</td>
<td>Physical View</td>
<td>Mar 21, 2017</td>
<td>NAT</td>
</tr>
</tbody>
</table>
Service Package Example – Transit Signal Priority

Traffic Management Center
- TMC Signal Control
- TMC Multi-Modal Coordination

ITS Roadway Equipment
- Roadway Signal Control

Connected Vehicle Roadside Equipment
- RSE Intersection Management

Transit Management Center
- Transit Center Priority Management

Transit Operations Personnel
- Transit Operations personnel input

Transit Vehicle Operator
- Transit vehicle operator input
- Transit vehicle operator display

Transit Vehicle OBE
- Transit Vehicle Signal Priority

PT09: Transit Signal Priority
7 | Physical | Oct 14, 2016 | NAT

U.S. Department of Transportation
ITS Joint Program Office
ARC-IT Communications View

- Depicts:
  - Layered communications protocols that support communications between physical objects

- Identifies options for each interface:
  - Appropriateness of protocols at all layers
  - How these protocols ensure or support:
    - Security
    - Privacy
  - Status of protocols as standards and the implications of their use
# ARC-IT Communications View Example

<table>
<thead>
<tr>
<th>DSRC-WSMP</th>
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<tr>
<td>local signal priority request --&gt;</td>
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## Transit Vehicle OBE

<table>
<thead>
<tr>
<th>Layer</th>
<th>Protocol</th>
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</thead>
<tbody>
<tr>
<td>ITS Application Information Layer</td>
<td>SAE J2735</td>
</tr>
<tr>
<td>Application Layer</td>
<td>Undefined</td>
</tr>
<tr>
<td>Presentation Layer</td>
<td>ISO ASN.1 UPER</td>
</tr>
<tr>
<td>Session Layer</td>
<td>Undefined</td>
</tr>
<tr>
<td>Transport Layer</td>
<td>IEEE 1609.3 WSMP</td>
</tr>
<tr>
<td>Network Layer</td>
<td>IEEE 1609.3 WSMP</td>
</tr>
<tr>
<td>Data Link Layer</td>
<td>IEEE 1609.4, IEEE 802.11</td>
</tr>
<tr>
<td>Physical Layer</td>
<td>IEEE 802.11</td>
</tr>
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</table>

## Connected Vehicle Roadside Equipment

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Using ARC-IT: Framework for ITS Standards

- Interfaces defined in ARC-IT identify what to standardize
  - Many ITS standards documents contain a section mapping their outputs to the interfaces of ARC-IT
- Use of Architecture as a framework for standardization continued with CVRIA and connected vehicle standards
- ARC-IT pulls all of these standardization efforts into one common framework

- ARC-IT is compatible with current international standards harmonization efforts
ARC-IT Website

Just type arc-it.net

Architecture Reference for Cooperative and Intelligent Transportation

The Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) provides a common framework for planning, defining, and integrating intelligent transportation systems. It is a mature product that reflects the contributions of a broad cross-section of the ITS community (transportation practitioners, systems engineers, system developers, technology specialists, consultants, etc.).

The architecture defines:

- The functions (e.g., gather traffic information or request a route) that are required for ITS
- The physical entities or subsystems where these functions reside (e.g., the field or the vehicle)
- The information flows and data flows that connect these functions and physical subsystems together into an integrated system

If you would prefer a summary document that you can print and read over coffee, a brief document is available that presents the key architecture concepts.

The information contained on these web pages (www.its.dot.gov and its sub-pages) were developed for the U.S. Department of Transportation and are in the public domain. The information is free from copyright restrictions except where noted.
ARC-IT Website: Architecture Pull-Down

The Architecture Reference for Cooperative and Intelligent Transportation Systems (ARC-IT) provides a common framework for planning, defining, and integrating intelligent transportation systems (ITS) as a broad cross-section of the ITS community (transportation practitioners, systems developers, etc.).

It expresses and integrates the different views, functional and physical perspectives, of ITS sub-systems into an integrated system.

For more details, a brief document is available that presents the key architecture concepts.
LET’S TOUR THE WEBSITE

arc-it.net
ARCHITECTURE TOOL SET
ARC-IT Tool Suite

- Two free downloadable software tools available to apply ARC-IT to regions and projects
  - Regional Architecture Development for Intelligent Transportation (RAD-IT)
  - Systems Engineering Tool for Intelligent Transportation (SET-IT)
What is *RAD-IT*?

- Formerly known as *Turbo Architecture*
- Supports ARC-IT
- To create and maintain ITS architectures
- Includes conversion utilities for current regional architectures
- Free tool available at [www.arc-it.net](http://www.arc-it.net) (select Resources / Tools)
- Training available under Resources / Training
RAD-IT – new Look & Feel, familiar steps

<table>
<thead>
<tr>
<th>Architectures</th>
<th>Regional</th>
<th>Marinara County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>MCDOT Saucetto Traffic Coordination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MCDOT Traffic Monitoring Expansion Project</td>
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<td></td>
<td>MCDOT V2I Safety Initiative</td>
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<td>TOMATO</td>
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**Current Region: Marinara County**

**Regional Architecture Attributes**

- **Name**: Marinara County
- **Description**: This simple architecture originated as an exercise in the National ITS Architecture Public Sector Training Course. It illustrates how many of the Turbo Architecture, Regional Architecture Development for Intelligent Transportation (RAD-IT), features can be used to highlight features of the tool as well as part of the Architecture Reference for Cooperative & Intelligent Transportation

**Project to Region**

- **New**
- **Delete**

**Related**

**Timeframe**

- Through 2036 (next 10 to 15 years)

**Geographic Scope**

- The Marinara County transportation region encompasses rural and urban areas, including the rapidly expanding city of Saucetto. The regional boundary coincides with the metropolitan planning area. The total regional population of 675,000 is demographically diverse: 5% continue the traditional regional farming activities, 62% are Saucetto residents, and over 50% of the

**Service Scope**

- The intelligent transportation system for the Marinara region consists of freeways, managing surface street systems, and transit services that are managed by the county and local agencies. There is now a growing interest in traveler information systems that use new technologies to collect traffic data and develop traveler information concerning traffic as well as

**Developer**

- Bob Olley (MCDOT)

**Maintainer**

- WILL ABE (MCTPB)

**Version**

- v2017-a

**Date/Time**

- 6/6/2017 9:35:27 AM

**Change Log**

- Apply
- Cancel
RAD-IT includes all of ARC-IT
What is SET-IT?

- Systems Engineering Tool for Intelligent Transportation (SET-IT)
- Originally to support tailored CV project architecture development (using CVRIA)
- Expanded to include all ITS
- Creation of diagram based project architectures covering the Physical, Enterprise and Communications Viewpoints
- SET-IT Training at [www.arc-it.net](http://www.arc-it.net) (select Resources / Training).
Purpose of SET-IT

- Support project’s systems engineering analysis
- Develop project architectures for ITS deployments, pilots, and test beds
SET-IT – visually customize a project’s architecture
Scope of Tools

- **RAD-IT** focuses on regional planning and the development of Operations Concepts,
  - Stakeholders, Physical Objects, Service Packages, Interfaces for the region

- **SET-IT** is project-focused
  - scope specified in the regional architecture
  - graphical tool,
    - providing visual feedback and tools to manipulate service package diagrams
    - develop communications stack templates, specify standards at all protocol layers,
  - Outputs – documents, diagrams, tables
ARC-IT Tool Set Supports Application & Usage of Architecture