VIRGINIA CENTRAL REGION ITS ARCHITECTURE MAINTENANCE PLAN

Version 1.0

Prepared for:

Prepared by:

June 30, 2009

Table of Contents

1 Introduction

An ITS Architecture is a blueprint for the deployment of ITS. Just as blueprints are critical for constructing a building, an ITS architecture, if kept up-to-date, is valuable for ITS deployment. The Virginia Central Region (CR) ITS Architecture is a living document and must change as ITS projects are implemented, plans and priorities change, and the transportation needs and services of the region evolve. The goal of maintaining the architecture is to keep an up-to-date ITS architecture that is accessible and easily used for planning and deploying ITS.

This Maintenance Plan documents who will maintain the architecture and what the timetable for maintenance is in the next section. The Plan, in the final section, also defines the configuration management process that will be used to maintain the Virginia CR ITS Architecture.

2 Architecture Maintenance Decisions

To properly maintain an ITS Architecture there must be a responsible individual, the Architecture Maintainer and a set timetable for maintenance. These are defined for the Virginia CR ITS Architecture in this section.

2.1 Architecture Maintainer

Just as a group of stakeholders were key to the development of the Virginia CR ITS Architecture, it is imperative that stakeholders stay involved in its on-going maintenance. While a variety of stakeholders must be involved in maintenance, it is important to have a single maintainer to oversee maintenance of the architecture.

The Virginia Department of Transportation deploys and operates numerous ITS systems and has relationships with most of the stakeholders in Virginia so it makes sense for VDOT to maintain the Virginia CR ITS Architecture. Currently, the VDOT Richmond Office will serve as the Virginia CR ITS Architecture Maintainer. Since multiple stakeholders must be involved in architecture maintenance, an Architecture Maintenance Committee will be established to make decisions about revisions to the architecture. The Architecture Maintainer will chair the Architecture Maintenance Committee and will call committee meetings when warranted. The Architecture Maintainer will receive Project Architecture Information Forms via the Architecture website, compile them, and present them to the Architecture Maintenance Committee at their meetings. The Architecture Maintainer will track changes using the Change Control Log. When the Architecture Maintenance Committee decides to revise the architecture, the Architecture Maintainer will ensure that the changes to the architecture are made and that the architecture configuration management process is followed.

2.2 Architecture Maintenance Timetable

It is critical that the Virginia CR ITS Architecture is revised as projects are deployed to ensure that it continues to accurately represent ITS of the region. Additionally, the architecture will need a more thorough update less frequently to ensure that it reflects the future plans of the region.

a. Periodic Project-Related Revisions

When an ITS project is deployed, the architecture may need to be revised to reflect the current deployment of the project. At a minimum, the status of architecture components will need to be changed from planned to existing. Elements, interfaces, and/or other components of the ITS architecture may need to be added, deleted or modified. Because the architecture is meant to describe not only ITS planned for the region, but also the current ITS implementations, it should be updated to correctly reflect deployed ITS projects.

These project-related changes will not be incorporated on a set schedule rather when warranted by the proposed changes either in number or in impact to the architecture. The process for reviewing and incorporating project-related revisions is presented in Section 3.2.1.

b. Updates

In addition to project-related changes, other items may impact the Virginia CR ITS Architecture such as:

- *Changes in needs of the region* - Regional ITS architectures are created to support transportation planning in addressing regional needs. Over time these needs can change and the corresponding aspects of the regional ITS architecture that addresses these needs may need to be updated. These changes in needs should be expressed in updates to planning documents such as the Regional Transportation Plan.

- *New stakeholders* - New stakeholders become active in ITS and the regional ITS architecture should be updated to reflect their place in the regional view of ITS elements, interfaces, and information flows. New stakeholders might represent new organizations that were not in place during the original development of the regional ITS architecture.

- *Changes in stakeholder or element names* - An agency's name or the name used to describe their element(s) undergoes change. Transportation agencies occasionally merge, split, or just rename themselves. In addition element names may evolve as projects are defined. The regional ITS architecture should be updated to use the currently correct names for both stakeholders and elements.

- *Changes in architectures of adjacent regions* - A regional ITS architecture covers not only elements and interfaces within a region, but also interfaces to elements in adjoining regions. Changes in the regional ITS architecture in one region may necessitate changes in the architecture in an adjoining region to maintain consistency between the two. Architectures may also overlap (e.g. a statewide ITS architecture and a regional ITS

architecture for a region within the state) and a change in one might necessitate a change in the other.

- *Changes of project status* - During the planning process, projects may be delayed, accelerated, added, deleted or modified due to funding constraints, technological changes or other considerations. Since such changes may impact other projects, they will need to be reflected in the Virginia CR ITS Architecture.

- *Change to the National ITS Architecture* - Just as any ITS architecture, the National ITS Architecture is a living resource; it is expanded and updated from time to time. The current version of the Virginia CR ITS Architecture was based on Version 6.1 of the National ITS Architecture that was released in 2009. When a new version of the National ITS Architecture is released, during the subsequent update of the Virginia CR ITS Architecture the new services, interfaces, and other components of the National ITS Architecture should be considered to see if they are applicable.

Since the Virginia CR ITS Architecture supports long range transportation planning including the Multimodal Transportation Plan and MPO's Long Range Transportation Plan (as described in the Architecture Implementation Plan), the architecture should undergo a formal review to see if it needs to be updated prior to an update to the Transportation Plans. The Architecture Maintainer will review the architecture to see if it needs to be updated for any of the reasons listed two years prior to the Long Range Transportation Plan update (required every four or five years for air quality attainment and non-attainment regions respectively) to allow adequate time for an architecture update if necessary. This will ensure that an up-to-date architecture can be used in development of the Long Range Transportation Plan.

3 Architecture Maintenance Process

To maintain an architecture that is spread across a website, documents and a database, a configuration management process must be applied. The architecture configuration management activities defined in this plan are:

- Architecture Configuration Identification
- Architecture Configuration Control
- Architecture Configuration Status Accounting
- Architecture Configuration Auditing

3.1 Architecture Configuration Identification

The Virginia CR ITS Architecture is defined to include:

A. Virginia CR ITS Architecture Website files (currently at local.iteris.com/virginiaitsarchitecture)
B. Virginia CR ITS Architecture Implementation Plan,
C. Virginia CR ITS Architecture Maintenance Plan, and

    D. Virginia CR ITS Architecture Database (a Turbo Architecture™ and Microsoft Access database).

US DOT's Final Rule/ Final Policy requires that, at a minimum, an ITS architecture include nine components:

    A. Description of the region,
    B. Identification of the participating agencies and stakeholders,
    C. An operational concept that identifies roles and responsibilities of stakeholders,
    D. Any agreements required for operations,
    E. System functional requirements (high level),
    F. Interface requirements and information exchanges with planned and existing systems and subsystems,
    G. Identification of ITS standards supporting regional and national interoperability,
    H. Sequence of projects required for implementation, and
    I. Procedures and responsibilities for maintaining the architecture.

The components of the Virginia CR ITS Architecture are available on the website, in documents and/or in an associated database. Some components of the architecture may require more frequent updates than others, but the entire architecture will need a periodic review for consistency with the vision and goals of the stakeholders.

The key components of the architecture are stored in a Microsoft Access database that was created and can be modified with Turbo Architecture™. It contains the following components of the architecture:

- Description of the region,
- List of ITS stakeholders,
- Inventory of ITS elements,
- List of ITS services and the elements involved in them,
- Functional requirements of the key elements,
- Interfaces between elements (interconnects and architecture flows),
- Applicable ITS standards, and
- Agreements required for deployment.

The architecture diagrams and lists can be produced directly from Turbo Architecture™ so they can be generated when needed.

Since the database contains the majority of architecture components, it will be updated during the periodic project-related revisions and major updates. For a major update of the architecture, all documents will be updated. It is not critical to revise the documents every time the architecture database is modified. They can be updated as necessary for meetings or outreach activities.

The current version of Turbo Architecture™ is Version 4.1 which is based on Version 6.1 of the National ITS Architecture. The Virginia CR ITS Architecture is based on Version 6.1 of the National ITS Architecture.

3.1.1   Architecture Specification Identification

To aid in architecture version control, the filename of the documents and database should contain the version and/or date on which it was updated. This will allow the current version to be easily identified and for all items of the same version to be identified. The current version of the Virginia CR ITS Architecture developed in June 2009 is version 1.0. As minor revisions are made, the release number is incremented (i.e. 3.1, 3.2, 3.3, …) The version number is incremented when the architecture undergoes an update (i.e. 3.0, 4.0, 5.0, …)

All items of the current version of the architecture are labeled "V1.0(2009-06-XX)".

3.1.2   Architecture Baselines

The current version of the Virginia CR ITS Architecture completed in June 2009 is established as the baseline architecture. It is numbered version 1.0. The baseline contains:

A. Virginia CR ITS Architecture Website,
B. Virginia CR ITS Architecture Implementation Plan,
C. Virginia CR ITS Architecture Maintenance Plan, and
D. Virginia CR ITS Architecture Database (a Turbo and Microsoft Access database).

The maintenance time frames identified in this Maintenance Plan began upon completion of this version of the architecture.

Only the Architecture Maintainer can set a baseline. A new baseline must be documented in the architecture database and all documents.

3.2 Architecture Configuration Control

The architecture maintenance processes are the procedures that will be used for modifying the architecture for periodic project-related revisions and more substantial updates. For each, the processes include how changes are identified, how they are requested, how they are reviewed and implemented and how the changes will be released. The architecture maintenance processes for the Virginia CR ITS Architecture are specified in the following sections. This section concludes by defining the processes of the Architecture Maintenance Committee and the responsibilities of the parties involved in architecture maintenance.

3.2.1   Architecture Maintenance Processes

As discussed in Section 2.2, the Virginia CR ITS Architecture will need to be revised periodically for project-related impacts and less frequently for updates. The processes for both are described below.

a. Process for Periodic Project-Related Revisions

Any ITS stakeholder in Virginia can propose a change to the Virginia CR ITS Architecture. Using the Project Architecture Information Form on the website, stakeholders should inform the Architecture Maintainer of a change in the status of any ITS-related project. To properly maintain the architecture, the Architecture Maintainer must be informed not only when projects are planned; but also when projects are completed or when changes are made during design or construction that impact the architecture.

The process for reviewing requested changes and implementing them is shown in Figure 1. The Project Architecture Information Form is received by the Architecture Maintainer at VDOT. The Architecture Maintainer reviews the impact of the project on the architecture and enters the project on the Architecture Change Log.   The Project Architecture Information Form includes contact information so the Architecture Maintainer can contact the submitter if questions arise. The Architecture Maintainer compiles changes and when warranted arranges a meeting of the Architecture Maintenance Committee.
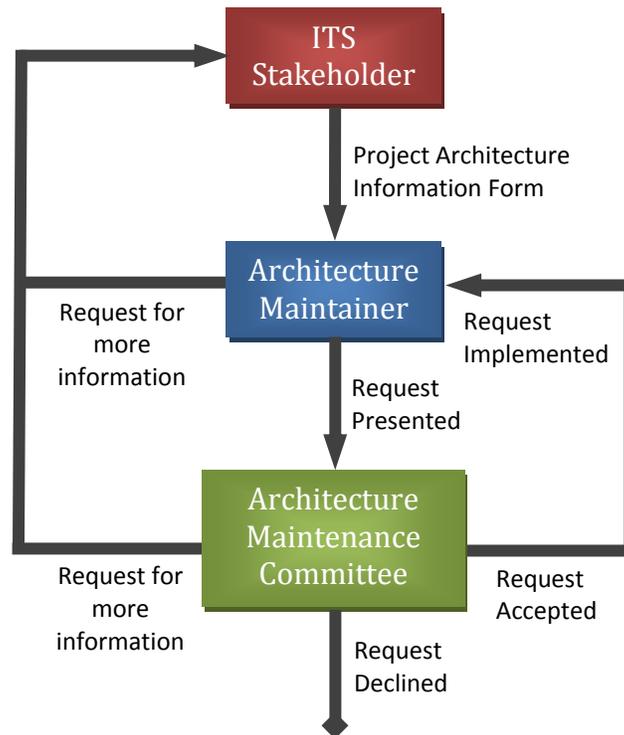
Figure 1. Periodic Project-Related Revision Process

At an Architecture Maintenance Committee meeting the Architecture Maintainer will present all proposed architecture revisions to the committee for their review and consideration. If a proposal for an architecture revision impacts other stakeholders, the Architecture Maintainer will ensure that the impacted stakeholders have been contacted and their agreement with the modification is confirmed. If any issue involves several stakeholders or requires extensive discussion and agreement, a stakeholder meeting/workshop to discuss the modification may be

held. If consensus in favor of the modification is reached, the Architecture Maintainer will recommend the revision to the Architecture Maintenance Committee.

When the Architecture Maintenance Committee approves modifications to the Virginia CR ITS Architecture, the Architecture Maintainer will ensure that the architecture is modified and records the details of the change on an Architecture Change Log – Change Description form.

Change Control Forms Identification

Revisions to the Virginia CR ITS Architecture can be submitted to the Architecture Maintainer on the website using the Project Architecture Information Form. The current version of the form and instruction for using it are given in Appendix A of this Plan.

Revisions to the Virginia CR ITS Architecture will be tracked on the Architecture Change Log by the Architecture Maintainer. The format of the log is given in Appendix B. To allow easy entry, the form will be maintained in Microsoft Excel. Using the naming convention, the file is named "CR ITS Architecture Change Log V2.0 (2009-06-30)".

b. Process for Updates

The architecture update process is a natural result of the architecture being streamlined into the transportation planning process to support development of Long Range Transportation Plans (as presented in the Architecture Implementation Plan). The Architecture Maintainer determines if the Virginia CR ITS Architecture needs to be updated (as described in Section 2.2). The process to update an architecture depends upon the factors driving the update. A typical process to update an architecture is shown in Figure 2.
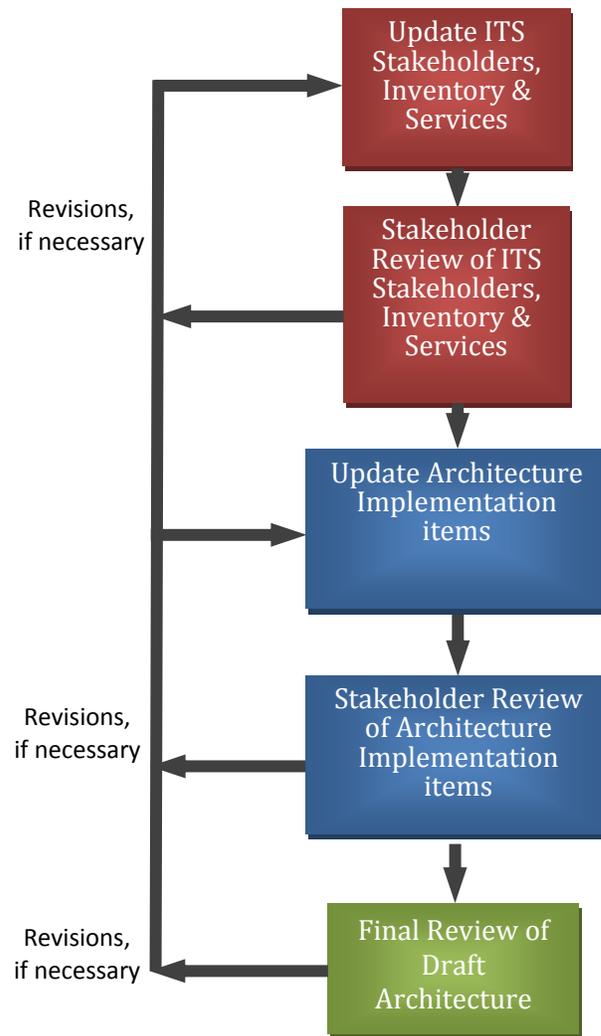
Figure 2. Typical Architecture Update Process

At the time of an update, it is important for all components of the architecture to be examined including stakeholders, inventory, services, interfaces, operational concept, functional requirements, project lists and agreements. Also, during an update, the CR ITS Architecture should be reviewed for consistency with all adjacent architectures.

Stakeholder involvement is key to an architecture update. Stakeholders must provide input and review revisions to the architecture. Architecture update workshops must be held. All relevant stakeholders including any that have recently become involved in ITS will be invited to the workshops.

The Virginia CR ITS Architecture has a ten-year time horizon. When the architecture is updated, the architecture will be extended further into the future.

3.2.2   Architecture Maintenance Committee

Getting input from the stakeholders guarantees that the architecture continues to reflect the desires of the stakeholders in the region; therefore, the Architecture Maintenance Committee

must be made up of a wide array of stakeholders. The Committee will be chaired by the Architecture Maintainer. The members of the Committee will be representatives from the MPOs and municipalities and transit properties in the region. While a change will not always impact the entire region, it is advantageous for representatives from around the region to have input to architecture changes.

The Architecture Maintainer as committee chair will call a meeting when change requests warrant it or when the architecture is being updated. A meeting is warranted when there are over 10 project-related changes requested or there is a change request that is urgent since the project is ready for deployment. At a minimum, the Architecture Maintenance Committee will meet at least once per year.

At an Architecture Maintenance Committee meeting, the Architecture Maintainer will present all change requests. The committee will discuss. If the stakeholders impacted by the change are not present and have not submitted their comment on a change, the change should be tabled for a future meeting when their input can be gathered. The Committee will vote on whether each change request should be accepted or rejected.

When the CR ITS Architecture is updated, the Committee will support the update process by serving as draft reviewers.

3.2.3   Architecture Maintenance Responsibilities

Maintenance of the Virginia CR ITS Architecture involves three parties which have distinct responsibilities as listed below.

ITS Stakeholder:

- Propose revisions to the architecture when ITS projects are deployed.
- Participate in Architecture Maintenance Committee meetings when appropriate.

Architecture Maintainer:

- Serve as chairperson of the Architecture Maintenance Committee.
- Schedule Architecture Maintenance Committee meetings when required.
- Investigate all requested project-related changes.
- Contact stakeholders impacted by a change request and invite them to the Architecture Maintenance Committee meeting or gather their input.
- Present project-related requested changes to the Architecture Maintenance Committee.
- Track all change requests and changes to the architecture in the Architecture Change Log.
- Ensure that the architecture is modified for all approved changes.
- Update architecture documents when needed.
- Plan and execute configuration audits prior to releasing a baseline.
- Send an announcement of an architecture modification to all stakeholders.

Architecture Maintenance Committee Members:

- Attend committee meetings.
- Review proposed architecture revisions prior to meeting.
- Vote on proposed architecture revisions at meeting.

3.3 Architecture Configuration Status Accounting

Configuration status accounting is the process of ensuring that all of the relevant information about an item – documentation and change history – is up-to-date and as detailed as necessary. This includes the status of requested changes. Configuration status accounting also includes the dissemination of configuration information. Configuration Status Accounting for the Virginia CR ITS Architecture is detailed in the following sections.

3.3.1   Architecture Media

To allow stakeholders to use the architecture for their planning and deployment activities, the current Virginia CR ITS Architecture must be readily available. The Virginia CR ITS Architecture is available to all stakeholders on the VDOT CR ITS Architecture website (currently at local.iteris.com/virginiaitsarchitecture).

Once the Virginia CR ITS Architecture (or any part of it) has been modified, the stakeholders in the region will be notified. The Architecture Maintainer will maintain the list of ITS stakeholders and their contact information. The stakeholders will be notified via e-mail of the architecture revisions when the current version of the architecture is available on the website.

3.3.2   Document Status Accounting

The Architecture Maintainer will track all proposed and approved changes to the Virginia CR ITS Architecture using the Virginia CR ITS Architecture Change Log. The format of the log and instructions for using it are given in Appendix B.

To ensure that stakeholders have the current architecture configuration, the current version of all components will be available to be downloaded from the architecture website. The current configuration of the architecture documents is:

Architecture Component	File
Implementation Plan	CRITSArchImplementationPlanV1.0(2009-06-23).doc
Maintenance Plan	CRITSArchMaintenancePlanV1.0(2009-06-30).doc
Database	VirginiaCRArchitectureV1.0 (2009-06-29).tbo

3.4 Architecture Configuration Auditing

Configuration auditing is the process of analyzing configuration items and their respective documentation to ensure that the documentation reflects the current situation. A configuration audit should be performed when a baseline is set. The audit does not have to be performed by the Architecture Maintainer but he or she should ensure that one is performed.

In the case of the Virginia CR ITS Architecture, the architecture database contains most components of the architecture. The Implementation Plan contains the list of projects which reference the services (a.k.a. market packages) of the architecture; therefore verifying that they are in sync must be done manually.   Once the configuration audit is complete, the architecture baseline can be released.

Appendix A: Project Architecture Information Form

Instructions for Using the Project Architecture Information Form:

The stakeholder requesting the change will complete the form. Once the form is received,

1. Confirm that the form is complete. If not, return it to the stakeholder to complete.

2. Once it is complete, assign it a unique Change Request Number. Change Request Numbers should be assigned with Year and Month of request and the sequential number of the request in the format YYMMNN. For example the second request received in March of 2010 is Change Request 100302.

3. Identify additional stakeholders that would be impacted by the change. It is critical to have input from the impacted stakeholders on the requested change.

4. Once the Architecture Maintenance Committee has acted on the request, record their action (accepted, rejected or deferred a date.)

5. Record the date of the disposition of the request.

6. Record any special comments about the disposition. For example, the change request may have been approved for the next major update of the architecture.

Submit Project Architecture Information

Please fill out this form and submit it to the ITS Architecture Maintainer. With your participation, the ITS Architecture can be updated accordingly and everyone else may use the most up-to-date architecture via this website because of your contribution. Based on the impacts to the regional architecture, you may be contacted for additional information.

* Required Fields

*Architecture Name:

*Name:

*Organization:

*Phone:

*e-mail:

Period of Performance:

Project Owner:

Project Scope and Location:

How is the project funded (fully federal, partially federal, etc.):

Is the project Turbo Architecture file available: ☐ Yes   ☐ No

Turbo Architecture and Systems Engineering Process and Outputs:

Are the following outputs available for the project?

   Associated Systems and Subsystems: ☐ Yes   ☐ No

   Operational Concept: ☐ Yes   ☐ No

   Functional Requirements: ☐ Yes   ☐ No

   Information and Interface Flows: ☐ Yes   ☐ No

   Applicable ITS Standards: ☐ Yes   ☐ No

   Alternative System Configuration Analysis: ☐ Yes   ☐ No

   Testing Procedures: ☐ Yes   ☐ No

   Procurement Options: ☐ Yes   ☐ No

   Procedures for Operations and Maintenance: ☐ Yes   ☐ No

Other Comments:

Reset   Submit

Appendix B: Architecture Change Log

Instructions for Completing the Architecture Change Log:

Enter all change requests on the Architecture Change Log. For each request enter:

Change Request #: Number assigned to the Project Architecture Information Form

Date Received: Date the Project Architecture Information Form was received

Maintenance Committee Action: Three Options:
- Awaiting action of the Architecture Maintenance Committee
- Change was approved so enter date of approval
- Change was rejected so enter date of rejection

Status: Four Options:
- Change is on-hold for the next major update
- Impact of change is under investigation
- Change description has been entered on a Architecture Change Log Change Description form
- Change is being made so it is in-progress
  - ▸ Once the change is started, record the target date for completion
  - ▸ Once the change is complete, record the completion date

For each approved Change Request, record the details of the change on an Architecture Change Log – Change Description form. On the form include:

Change Request #: Number assigned to the Project Architecture Information Form

Change Request Description: Brief description of the Proposed Change (Either the description from the Project Architecture Information Form or a summary of it)

Impact(s) of Change: For each architecture component impacted by the change, record the impact of the change on the component

If an architecture component is not impacted by the change, enter "n/a".

Resolution(s) of Change: For each architecture component impacted by the change, record how the component will be modified for the change

If an architecture component is not impacted by the change, enter "n/a".

Change Control Log – Change Description

Change Request Number: 1	Change Request Description:	
Architecture Component	**Impact(s) of Change**	**Resolutions**
Description of Region		
Stakeholders		
Elements		
Services		
Operational Concept		
Agreements		
Functional Requirements		
Interfaces		
Standards		
Projects List		
Maintenance Plan		
Implementation Plan		

Change Control Log

Change Request Number	Date Received	Maintenance Committee Action			Status					
		Awaiting Action	Change Approved	Change Rejected	On Hold (for future update)	Under Investigation	Change Description Complete	Change In-Progress	Target Date	Date Complete