Why Enterprise Architecture is must for One-Stop e-Government?

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ABSTRACT

Lack of well-defined and understandable Enterprise Architecture for the Government is a roadblock in the success of e-Governance initiatives in most of the developing countries. There is a lack of awareness of Enterprise Architecture concepts and its advantages. Standards based Architectures are a must for Integration and interoperability of various Citizen Services, within and across the state and the central Government. This paper discusses various issues related to "lack of Enterprise Architecture" and a possible framework towards an Enterprise Architecture enabled e-Governance.

Keywords: *Enterprise Architecture, Integration, Interoperability, and Standards.*

1. Introduction

Enterprise Architecture is the description of the current and/or future structure and behavior of an organization's processes, information systems, personnel and organizational sub-units, aligned with the organization's core goals and strategic direction. Although often associated strictly with information technology, it relates more broadly to the practice of business optimization in that it addresses business architecture, performance management, organizational structure and process architecture as well. (Http://en.wikipedia.org/wiki/Enterprise_architecture)

As a part of National e-Governance plan, Governments of many developing nations like India have a clear vision of making all Government services accessible to the common man in his locality. As a part of this initiative Governments and their departments of Information Technology are promoting and guiding various states and corporations across the country, to set-up and design Wide Area Networks, Citizen Service Centers and Data Centers to host Citizen Services.

Most of these projects are designed and implemented in silos. There is lack of well-defined standards, processes, and architectures for Services and data or at least there is lack of awareness at various levels.
Based on their immediate needs, State Governments across various states are coming up with different requirements, different architectures, and different technologies. There seems to be no long-term vision of interoperability and integration of these services across various Government departments, which span across states and the central locations. There is no one Standard being followed by all. This has been leading to many administrative, Manageability and Security issues.

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This paper lists couple of such issues, followed by recommendation of a standards based Enterprise Architecture to resolve and avoid such issues.

2. Architectural Issues

Most of e-Government projects face one or more of the following issues. These issues have been collated from the feedback and inputs received from various stakeholders from the Government departments, academia and Vendor community, who are directly or indirectly involved in these projects. (ICEG, 2007)

Integration and Interoperability Issues: Lack of Integration of various applications within or across various Government departments leads to silos, with each department having their own set of data, administrators, management procedures and related issues. These applications and projects, which are not based on standards, lead to use of varied technologies, which may not interoperate. This further leads to duplication of work, increased cost of ownership and complexity.

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Lack of Knowledge Sharing: A Successful implementation in one department is rarely shared with other departments. This leads to duplication of effort and resources. Sharing of successful implementations across various Government organizations can also help in possible reuse of technology and ideas, which can cut cost and lead to efficient resource utilization.

Security Issues: Data security, authenticity, integrity and reliability are generally left to the discretion of the Government employees or private partner staff who operate the systems. Many systems lack traceability mechanisms. IT Security, controls the access to Government's sensitive applications and data, it enables secure online transactions between the Government and its Citizens and protects the intellectual property. Ensuring Security of sensitive Citizen Information and maintaining Compliance are amongst the most critical challenges faced by the Governments.

Lack of Standards: There is a lack of adopted policy on key issues such as Open Standards and Open Source, leading to issues related to sustainability, costs, security, independence and e-Governance standards. These issues will have a deep impact on not just the cost of the systems but also the sustainability of the solutions as well as impact on wider IT adoption.

To overcome these issues, there is a need for a Standard based Enterprise Architecture framework with appropriate knowledge and awareness amongst the key stakeholders. Enterprise Architecture for the Government that is Citizen Centric, Open, Standards Based, Interoperable, Transparent, Flexible, Secure , Result Oriented and Dynamic is the need of the hour.

3. Enterprise Architecture

Enterprise architecture is a comprehensive framework used to manage and align an organization's Information Technology (IT) assets, people, operations, and projects with its operational characteristics.
Well Defined Enterprise Architecture can lead to many benefits including:

- Open and Interoperable Solutions
- Built-in systemic Security and Compliance
- Accelerated Network Service Deployment
- Simplification and Standardization
- Service Oriented Architectures
- Technology Simplicity
- Technology Reuse
- Secure Access
- Mobility

- Standards based IT Enterprise Architecture Policies
- Primacy Of Principles
- Shared Business Responsibility

Governments in most of the developing nations, like the one in India are a complex multi-tier organization, having departments at central, state and project levels within each state. Government's initiative to enable citizen services across the country using IT enabled resources is huge and complex. With the diversity of people, cultures, incomes, backgrounds and with different levels of expectations across different demography's, this task becomes even more complex. Unless there are standards and well-defined guidelines, this complexity can lead to confusion and may be chaos.

Although Government of most of the developing countries, through their National e-Governance initiatives, are laying down standards and rules and a broad framework to achieve goals, lot of effort and thinking needs to be put in to arrive at a standards based rules leading to an enterprise architectural framework.
Enterprise architectures have design trade-offs and give and take requirements. It is a common mistake to envision that all stakeholders can equally meet all the requirements of enterprise architectures. Finding the right balance, the right level of interaction, the right layer of service-component granularity, the right governance models, and other attributes are enormously complex challenges at the Federal and DoD level. (Bass & Mabry, 2004)

A Well defined Enterprise Architecture can help the Government to align its IT resources to its Strategic plan of enabling Citizen Services using these IT resources. It helps in cutting costs and complexity and also enabling business flexibility and process optimization.

Enterprise Architecture can improve IT agility by standardization, consistency and scalability at the same time increasing security and supporting compliance. (CIO Handbook Sun Microsystems, 2006)

The enterprise architecture is a promising tool that the U.S. e-government initiatives have thoroughly tested and deployed. (Guijarro , 2006). Similar initiatives should be taken by the developing nations and are also highly recommended for countries like India, where there is a clear prioritized focus of enabling e-Government.

E-Government Enterprise Architecture generally consists of following components (Figure 1):

- Business Process Architecture
- Services Architecture
- Technology Architecture
- Data and Information Architecture

Business Process Architecture: Business architecture helps us enable communication across business units within the enterprise. This Architecture lists various processes to be followed for doing various services, independent of their association with one or more services. The Business Process Architecture defines the business operations of the Government, independent of agencies that perform them. These processes are further grouped into categories and detailed rules are defined for executing each of these processes. This standardizes the process, leading to interoperability and reuse. Examples of these processes can be IT Enabled flexible, transparent, dynamic, efficient and effective Citizen Services. Well-defined process architecture enables communication across various departments.

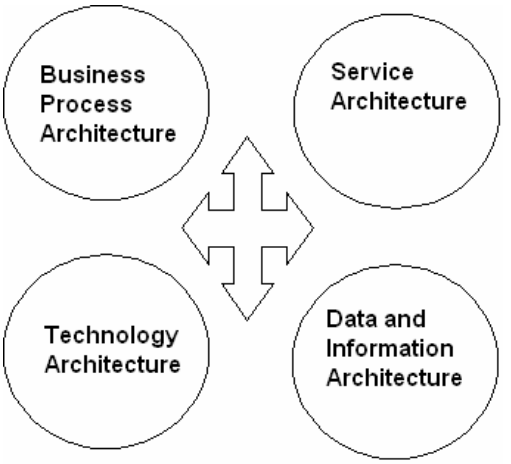

Figure 1: Components of Enterprise Architecture

There should be a well-defined framework describing the Government processes, communication process across various departments and, means and channels of communication and implementation.

Service Architecture: This defines the set of services offered by the Government, processes to be followed for each service, relationship and dependencies of services. The examples of these services could be Web Enabled Services like Vehicle registration, License registration, passport issuance etc The Application Architecture is also defined here, which separates the Data logic, Business logic, and the Presentation layer in different tiers. Each tier is a separate module, with standards based interface to interact with the other tier.

Defining service architecture standards, with recommendations on the platform, which are based on open systems and open standards can be useful.

Data and Information Architecture: This defines the data associated with various services, as defined in the services architecture. In Data Architecture, we enlist all the data elements needed/associated with above service and then define metadata about each data element. This metadata information includes the standard Nomenclature for each data elements, their type, size, format, default value, valid value range, owner etc. Use of such a standard definition by all government applications shall facilitate interoperability among various applications as well their integration which shall go long way in delivery of integrated/ one stop services to the citizens and businesses. It is strongly recommended to have standards based open data systems. This will enable easy integration and interoperability across departments and states.

Technology Architecture: Technology Architecture forms the foundation of the overall Enterprise Architecture and defines the software and hardware technology platforms based on standards for interoperability, security, flexibility and modularity. The Technology Architecture consists of many subcomponents, including the ones listed below (Figure 2). A Well-defined set of specifications should be defined against each of these parameters to achieve standardization, interoperability, integration and flexibility. The Technology Architecture consists of (CIO Handbook, Sun Microsystems, 2006):

- Client
- Network
- Portal
- Service Oriented Architecture (SOA)

- Data Center
- Storage

The Technology Architecture describes how technology is supporting the delivery of service components, including relevant standards for implementing the technology. Together, the architectures are intended to facilitate government wide improvement through cross-agency analysis and the identification of duplicative investments, gaps, and opportunities for collaboration, interoperability, and integration within and across government agencies.

The Technology vision should be to provide secure access to data and services on the enterprise network, giving access of information, to Any Authorized person, from Any Device, Anywhere and at Any Time. (AAAA)

This could be achieved using end-to-end authentication and encryption of data and the network, using an integrated user view with portal services delivery, enabling mobile computing, Using the single operational data store, and leveraging of open standards and open source.

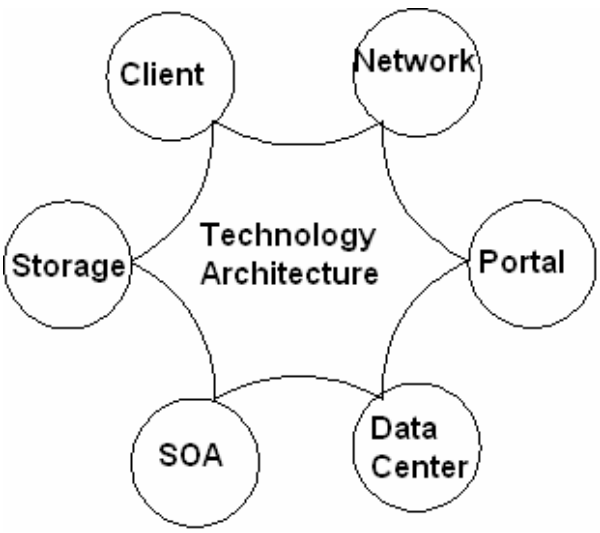

Figure 2: Technology Architecture

Each component of the Technology Architecture should be designed and chosen with the above objective in mind. Enclosed is a brief recommendation for each of the components of Technology Architecture.

- Client: The goals of the client element are to provide access that is both open and secure. The client devices should be easy to maintain and administer, should not require frequent upgrades and should be cost effective. There should be standards defined so that all States and departments have similar looks and feels at the client end. The Client devices should be based on Java, which is platform independent. They should have provision for a secure web enabled access, based on standards. The client device should not have any local data or application and should be able to display any operating environment.
- Network: The Network Architecture and design should be well defined and standardized. It should provide secure access of resources to the authorized clients.
- Portal: The Access of Citizen Services should be through a Secure Portal. The Portal's looks and feel should be same across all secure access devices. The Portal server should provide secure, role-

based access to information from anywhere, at any time, on any device.

- Service Oriented Architecture: Application and service delivery through the dynamic portal is made possible, in part, by Services Oriented Architecture (SOA). By implementing a pragmatic SOA, one seeks to extensively leverage the core business logic, using and re-using it to achieve greater enterprise flexibility and business capabilities. By decoupling business logic from applications and then re-combining those components to create new applications and systems, one can take greater advantage of and more easily share existing information assets, as well as more rapidly integrate new assets.
- The adoption of a service-oriented architecture (SOA) provides businesses with the ability to rapidly deploy new applications and easily integrate with other component applications both inside and outside the organization. (Taylor, 2005)

A Service Oriented Architecture approach will resolve most of the present day issues. SOA helps design Services that are combined to create reusable business components accessible from a variety of client devices. The Business logic is separated from presentation logic and delivered via services. This leads to increased end user productivity and flexibility, reduces costs, enables seamless integration with portal and roles based access control leading to overall better return on assets.

Much of the e-Government movement is the evolution from static, undocumented, rigid stovepipe systems to dynamic metadata-driven and navigated agile business lines comprised of reusable components residing in a Service-Oriented Architecture (SOA). The SOA allows the redeploying of legacy applications as XML-encapsulated, trusted components and solutions with native XML logic providing the encapsulation and componentization. (Dodd et. al, 2003)

- Storage: Ubiquitous storage area network and network-attached storage instead of device-attached storage using hierarchical Storage Manager is recommended. This Storage should be Standards based, Modular, Flexible and Scalable.

It is also recommended to have a storage architecture, which Classifies, manages, and moves information to the most cost-effective data repository based on the value of each piece of information at that exact point in time. This helps: Reduced complexity through automation, Reduced costs, Achieve compliance by archiving data according to its regulatory requirements

- Data Center: A Data Center should provide a secure, scalable, cost-effective infrastructure for the deployment of infrastructure for enabling Citizen Services. The data center architecture should be scalable, modular service delivery network design, which enables one to deploy multi-tier applications.

At the foundation of the service delivery network should be services, established as resource enclaves. The Layer 2 switches in the distribution layer enable services access governed by access control lists (ACLs). A little further up the stack, load balancers balance network load and provide service virtualization, SSL (secure sockets layer) capabilities, and TCP (transmission control protocol) termination.

The service delivery network design is critical to implementing services oriented architecture, enabling, as it does, the necessary network scalability. Additionally, this design, with its protected resource enclaves, allows client devices access only to those resources to which they are entitled.

Another recommendation for data center architecture is the appropriate provisioning of both stateful and stateless systems for services. This provisioning can help drive down costs and result in performance benefits.

The Data Center infrastructure components should have secure foundation, with security built-in not bolt on. The Operating System for the server components should be open source, robust, highly available, Secure with Multi Level Security and Cryptographic framework, should be binary and source compatible, should have provision for auto correction of hardware resources. The infrastructure components should be based on standards.

Virtualization is strongly recommended as a part of Data Center Design. The Virtual Data Center should hide the hardware and software components behind an abstraction layer and present computing environment as a collection of managed services rather than a collection of hardware. Possibility of deploying efficient, low power, low space, ready to use virtualized data centers should be considered.

4. Concluding Remarks

The upcoming e-Governance projects of the developing countries should be based on Enterprise Architecture. Enterprise Architecture defines a set of business processes and Technology standards to be followed throughout the Government enterprise, providing services which are Citizen Centric, based on Open Standards, Interoperable, Transparent, modular, Dynamic, Secure and Result Oriented. Enterprise Architecture addresses most of the architectural issues and leads to following benefits:

- Improves business flexibility, and at the same time, business process and system optimization
- It helps reduce process, system, and infrastructure costs and complexity
- It helps ensure enterprise security and compliance
- And it drives standardization, consistency, and scalability

Governments of the developing countries should design policies for Enterprise Architecture and should possibly draft reference Architectural recommendations. These recommendations should be adopted and used by various Government departments for their e-Governance projects.

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