Enterprise Architecture for e-Government

Reshma Agarwal
PMP, TOGAF 9.1 certified
Consultant, NeGD, MeitY
6, CGO Complex, New Delhi
110003
+ 91 9910993734
reshma_grwl@yahoo.co.in

Vinay Thakur
Director,
NeGD, MeitY
6, CGO Complex, New Delhi
110003
+ 91 130481618
vinay@gov.in

Radha Chauhan, IAS
President & CEO,
NeGD, MeitY
6, CGO Complex, New Delhi
110003
+ 91 130481637
ceo@digitalindia.gov.in

ABSTRACT
The paper describes an Enterprise Architecture[1] for E-Government[2], for Governments across the world who intend to provide better service delivery for their business, citizens and other stakeholders.

The purpose of Enterprise Architectures for E-Government is to support transactional system interoperability[1], quicker response to Government enterprise[3] wide issues, reduce complexity in IT landscape, enhance enterprise security, facilitate information based decision making while driving efficiency, cost benefits, sharing, reuse, effectiveness and system transformation across government.

CCS Concepts
• Applied computing~E-government

Keywords
Enterprise Architecture; E-Government; E-Governance; interoperability; industry architecture; TOGAF; principle

1. INTRODUCTION
The implementation of eGovernance[4] is fraught with challenges. Some of the Enterprise Architecture related challenges faced by eGovernment leaders across the world are "lack of well-defined and understandable Enterprise Architecture for the Government", "lack of strategic clarity", "lack of awareness of Enterprise architecture concepts and its advantages", lack of legislative framework, "design and implementation of eGovernance" projects[5] in silos, lack of long term vision of interoperability, scalability and integration of services across the country, "lack of knowledge sharing, lack of adopted policy on Open Standards and Open Source", lack of security [2], inadequate use of available technology, incremental impact of e-Governance rather than transformative [3], lack of common standards to ensure optimum usage of government databases [4] etc.

With the advent of information technology the Governance landscapes across the world have changed. Users have become more tech-savy and are demanding faster services which match with the private sector and other eGovernment delivering nations across the world. This paper attempts to address the challenges mentioned in the aforesaid paragraph

This paper presents an Enterprise Architecture model for E-Government, describing a conceptual blueprint which defines the structure and operation of an agile Government. This model shall enable Government organizations to support agile implementation of strategic eGovernance initiatives, while smoothly carrying out day to day operations[6]; especially in the eGovernance domain.

This paper may be of interest to bureaucrats, politicians, leaders in the public domain, Government officials, residents, businesses, citizens and other stakeholders. This paper shall help the readers to envisage the to-be eGovernance model for their country.

While preparing the paper the authors have referred existing Enterprise Architecture frameworks like The Open Goup Architecture Framework (TOGAF), Zachman, Department of Defense Architecture Framework (DoDAF), Federation of Enterprise Architecture Professional Organizations (FEAPO), Pragmatic Enterprise Architecture Framework (PEAF) and

ICEGOV '17, March 07-09, 2017, New Delhi , AA, India
© 2017 ACM. ISBN 978-1-4503-4825-6/17/03...$15.00
DOI: http://dx.doi.org/10.1145/3047273.3047330

[1]**Enterprise Architecture**: "is a conceptual blueprint that defines the structure and operation of an organization. The intent of enterprise architecture is to determine how an organization can most effectively achieve its current and future objectives."[16]

[2]**E-Government**: "the continuous optimization of service delivery, constituency participation, and governance by transforming internal and external relationships through technology, the Internet and new media." Gartner Group

[3]**Government Enterprise:** A federation of Departments, Autonomous Bodies, Councils, Boards, Legislature, Judiciary etc. which work in a coordinated manner to control a country via a set of rules and processes encompassing all of its information and technology services, and infrastructure so as to meet goals and maintain order.[17][4]

[4]**E-Governance:** "E-Governance is the public sector's use of information and communication technologies with the aim of improving information and service delivery, encouraging citizen participation in the decision-making process and making government more accountable, transparent and effective."[18]

[5]**Project**: "A project is a temporary endeavor undertaken to create a unique product, service, or result."[16]

[6]**Operations**: "Operations evolve to support the day-to-day business, and are necessary to achieve strategic and tactical goals of the business. Changes in business operations may be the focus of a dedicated project as a result of new product or service delivery."[16]

specialized country wide enterprise architecture models of countries with advanced eGovernance capabilities like New Zealand [1], Singapore, Estonia, Latvia etc.

This paper attempts to introduce a Government (industry-specific) Enterprise Architecture. This architecture is simpler and more system specific than those proposed earlier. This comprehensive architecture is applicable for all nations irrespective of their political climate.

2. ENTERPRISE ARCHITECTURE FOR E-GOVERNMENT

The proposed Enterprise Architecture for E-Government consists of the following layers:

i. The Legal & Regulatory Framework

ii. Change Management

iii. ICT, Hardware & Network Infrastructure

iv. eGovernance Capabilities or Systems Layer

   a. Core Databases
   b. Productivity Suites
   c. Internal Domain Applications
   d. eServices Delivery Suite
   e. Gateways

v. Delivery Channels

vi. Service Delivery Monitoring

The layers have been logically segregated, so as to provide a clear picture of the proposed Enterprise Architecture to the user.

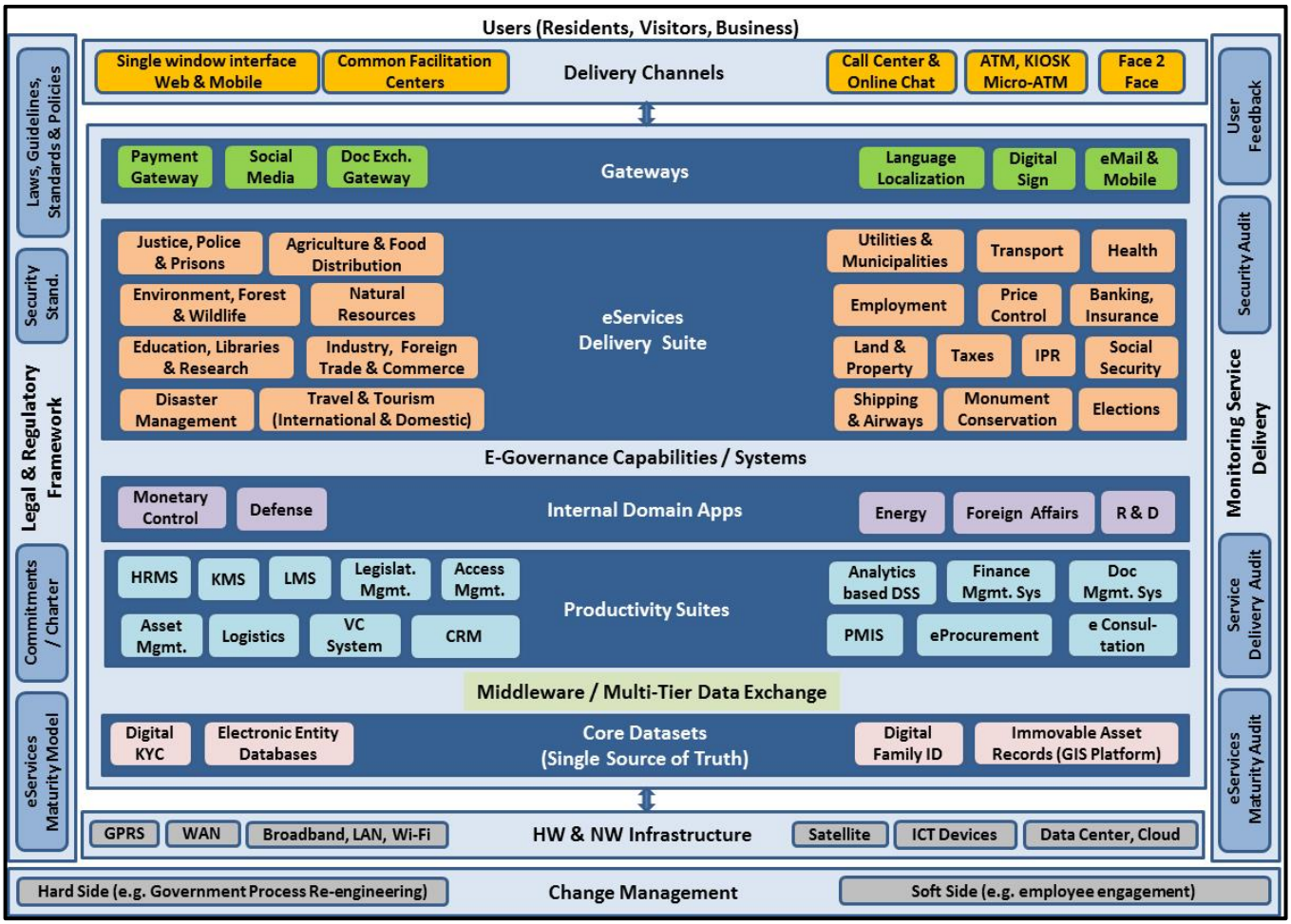

Figure 1. Government Enterprise Architecture

Figure 1 illustrates each of these layers along with their major components. The consequent sections shall describe each of the components in detail.

As per TOGAF[4], an Enterprise Architecture is built following identified guiding principles[7]. The guiding business, data and applications principles identified for government architecture can be as follows.

i. **Primacy of principles** - The principles of information management apply to all member organizations[8]. within the Government.

[7]**Principle: "**Principles are general rules and guidelines, intended to be enduring and seldom amended, that inform and support the way in which an organization sets about fulfilling its mission."[4]

[8]**Member Organizations:** A federation of Departments, Autonomous Bodies, Councils, Boards, Legislature, Judiciary etc. which together constitute the Government Enterprise.

ii. Information management decisions should be made to provide **maximum benefit to the Government as a whole.**

iii. **Common use applications** - Development of applications used across the Government should be preferred over development of similar or duplicative applications by member organizations.

iv. **Data is an asset** that has value to the Government and is managed accordingly. A cultural transition "from 'data ownership' to 'data stewardship' thinking is" [5] advocated. Member organizations need to be identified as data stewards for data they are accountable for i.e. they should manage and ensure data quality by implementing suitable procedures and processes, as data is critical to decision making.

v. **Data is shared** - users should have access to data necessary to perform their duties; therefore data should be shared across the Government functions and organizations.

vi. Government officials are identified as **Data trustee**. The Data Trustee is solely responsible for data entry, data accuracy and concurrency of designated data elements.

vii. **Establish common vocabulary and data structures** consistently across the Government.

viii. **Data security** - Data should be classified and confidential data (e.g. "pre-decisional, sensitive, source selection-sensitive and proprietary information" [5]) should be protected from unauthorized use and disclosure.

ix. **Adopt Service Oriented Architecture** - Enterprise Architecture is based on design of services which mirror real-world activities required to conduct the business of the Government. Open standard based service oriented architecture should be implemented in all system implementations to realize interoperability (of hardware and software) and location transparency [2]. The applications should be able to communicate with each other through open APIs.

x. **Ease of Use** - the applications should be easy to use (e.g. Multi-lingual support, consistent look and feel, ergonomic considerations etc.), so that Government users can concentrate on tasks at hand.[5]

xi. **Requirements-Based change** - changes to applications and technology should be in response to business needs. i.e. Changes in strategy, law, regulatory framework and Govt. service commitments should precede changes to application and not succeed them.

2.1 Legal & Regulatory Framework

The primary objective of Government and its member organizations is to deliver services and projects for the benefit of its citizens, businesses, government and other stakeholders.

Information technology is an indispensable tool in the hands of Government enterprises across the world. eGovernance helps to make "administration accountable and citizen friendly" [16], ensure transparency and right to information, reduce corruption and deliver services in a timely and efficient manner.

Thus, Government leaders should strive to strategize and bring in legislations and regulatory framework in order to empower their member organizations for taking up eGovernance initiatives.

Countries like Latvia came up with Public Administration Reform Strategy 2001-2006 [8], Estonia with Estonian Information Society Strategy 2014-2010, Cyber Security Strategy 2014-2017 [9] etc. on the basis of which a well-balanced development of the Information Society was taken up.

i. **Laws, Guidelines, Standards & Policies** - "Together with other laws of the land, the presence of a well-orchestrated IT Act could provide the necessary foundation and benchmark and facilitate the smooth functioning of a country's ICT sector." [10]

In absence of such an Act, business and citizens "remain wary and hesitant to get involved in any electronic communication and transactions[9]. It also makes cyber-crimes and other ICT-related irregularities extremely difficult to combat and privacy and security become hard to ensure in electronic communication and transactions."[7]

Therefore there is a need to legalize IT usage in Government service delivery workflows. The US Govt. enacted E-Government Act 2002, Sarbanes-Oxley Act 2002; the Indian Government enacted the Electronic Commerce Act 1998, Information Technology Act 2000 [11]; the Estonian Government enacted the Public Information Act 2001, Digital Signature Act 2000, Archives Act 1998, Personal Data Protection Act 1996 [9] etc.

The legal framework is supported by the regulatory framework. The regulatory framework consists of the guidelines, standards and policies which should be embodied by all the organizations in the Government enterprise. The guidelines, standards and frameworks generally succeed the legislation, and provide implementation guidance to the member organizations. However, in cases where the legislation approval is in process, the guidelines, standards, and policies may be released in advance so as to prime the member organizations of the upcoming changes.

ii. **Cyber Security Standards** - Cyber Security standards set by the Government enterprise should be followed by all the member organizations. Some of the member organizations may adopt a higher degree of security standards based on the sensitivity of the data being handled. e.g. Defense

The main objective are to increase the cyber security capacity of the Government and raise the population awareness about cyber risks, while ensuring availability of experts and solutions for cyber security.

While implementing security standards, emphasis should be on securing private information of the citizen and confidential Government information rather than trying to secure all Government data. The majority of Government data which the citizens have the right to know e.g. progress of public projects, status of service delivery etc., should be made available on the public domain. The same shall help in increasing public vigilance and improve citizen participation in the government.

[9]**Electronic Transaction: "**sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organizations, conducted over computer-mediated networks."[20]

This shall also reduce the cost of applying data security standards to the Government Enterprise.

International cooperation in the field of Cyber Security can be enhanced by signing MoUs for sharing knowledge and experience e.g. MoU between Estonian Information Systems Authority (RIA) and Organization of United States (OAS) to work out cyber security strategies for United States.

iii. **Delivery Commitments / Charter** - The member organizations of any Government enterprise should formulate and publish their service delivery commitments in the form of charters to their stakeholders. The private sector's equivalent of these charters is service level agreement (SLA). The Prime Minister of UK, John Major had introduced the concept of a citizens' charter in 1991 itself [12]. Countries like UK, India, Hong Kong, Japan, Jamaica and Australia have already endeavored to legalize the same.

While the charter sets the service delivery standards, information and communication technology (ICT) helps to achieve them.

iv. **eServices[10] Maturity Model** - The maturity level of the services being delivered by the member organizations of the Government Enterprise needs to be measured. Thus, standards to measure the maturity level of the eServices being delivered should be established.

United Nations has developed a four stage maturity model for ranking the UN member states on the basis of online service development. It is defined as follows:

"Stage I: emerging information services"-"Government websites provide information on public policy, governance, laws, regulations, relevant documentation and types of government services provided. They have links to ministries, departments and other branches of government." [13]

"Stage II: enhanced information services"- "Government websites deliver enhanced one-way or simple two-way e-communication between government and citizen, such as downloadable forms for government services and applications. The sites have audio and video capabilities and are multi-lingual, among others." [13]

"Stage III: transactional services"-"Government websites engage in two-way communication with their citizens, including requesting and receiving inputs on government policies, programmes, regulations, etc. Some form of electronic authentication of the citizen's identity is required to successfully complete" [13] the financial or non-financial eTransactions.

"Stage IV: connected services"- "E-services and e-solutions cut across the departments and ministries in a seamless manner. Information, data and knowledge are transferred from government agencies through integrated applications. Governments have moved from a government- centric to a citizen-centric approach, where eservices are targeted to citizens through life cycle events and segmented groups to provide tailor-made services."[13]

Similarly, governments across the world can rank their member organizations according to the maturity level of eServices being delivered by them.

2.2 Change Management

"Change management is a structured approach to transitioning individuals, teams, and organizations from the current state to the desired future state (Sacheva, 2009, p. 109). Change management has been widely acknowledged as a critical success factor in software systems (Apostolou, Mentzas, Stojanovic, Thoenssen and Pariente Lobo,2011).

In the context of organizational change, change management consists of a hard side and a soft side. (Dias de Lima, 2009)."[14]

i. In Government sector, the **hard side** of change management involves change in legislations, regulatory framework and service / project delivery commitments (Charters); process re-engineering exercises resulting in changes to service delivery workflow; information management; skill development of users and introduction of technologies that will help to implement changes.

Member organizations must be empowered by the legal and regulatory framework to make changes in the service delivery rules and workflow, for meeting and exceeding service delivery expectations. Thus, Change management should be taken up top-down and not bottom up.

ii. In order to address the **soft side** of change management involving employee engagement; Vasudev Murthy & Dr. Vashima Shubha have proposed the "TYOC" methodology (i.e. Tracing of organizational history and evoking pride in it, the proper communication of 'Why', use of familiar communication styles like Government Orders and the need for continuous change management efforts (tuned to the special dynamics within the Government).[15]

"One of the biggest responsibilities of insufficient addressing change management issues stand on the leadership of e-government that hand over responsibility for e-government to the professional IT experts instead of preparing strategic planning and considerable change management strategy for e-government. It must become clear that e-government is more an organizational change issue than a technological issue."[11]

Incomplete implementation of hard or soft changes results in failure to achieve the envisaged transformational impact e.g. incomplete implementation of hard changes like government process reengineering results in workflow automation instead of intended workflow transformation. Thus, each member organization of the Government Enterprise should be empowered to undertake the hard and soft changes essential for successful change management.

2.3 Hardware and Network Infrastructure

To realize the benefits of eGovernance, setting up of an underlying ICT infrastructure backbone is essential for any Government enterprise. The ICT backbone would chiefly consist of:

i. Application hosting infrastructure i.e. data centers, cloud infrastructure etc.

[10]**eService: "**services that are produced, provided, and / or consumed through the use of ICT-networks such as for example Internet-based systems and mobile solutions"[21]

ii. Availability of required ICT devices (e.g. computers, laptops, smart phones, routers, bar code readers, biometric readers, digital signature tokens, LED/LCD etc.) at service delivery centers and offices of member organizations.

iii. Internet connectivity via Broadband, LAN, satellite or Wi-Fi for service delivery premises and offices of the member organizations.

iv. Secure wide area network (WAN) providing internet and Government intranet facilities within and among member organizations. Intranet connectivity may not be required for all service delivery premises.

v. GPRS infrastructure for support on data over mobile, support, VoIP support etc.

2.4 E-Governance Capabilities / Systems Layer

2.4.1 Core Data Sets

A set of core databases is essential for member organizations within the Government enterprise to identify its users and work seamlessly. In other words, the core data bases help in linking the databases of member organizations and derive decision making inputs from the same.

Each Core data set should be maintained by an identified member organization / IT department as designated by the Government Enterprise. These member organizations should act as data stewards and their officials as data trustees for core data sets. The core data sets should be accessible to all member organizations within the Government Enterprise.

The core data sets shall help in deduplication of the beneficiaries and plugging pilferages, while saving resources for the development of the country.

i. Digital KYC- consists of electronic identification and contact detail of the user (whether resident or organization) who shall be interacting with the Government Enterprise. The digital identity shall serve as an enabler for **Single sign on** for the residents, emigrants, citizens, businesses and other stakeholders. The digital KYC consists of:

   a) **Digital Identification** i.e. unique digital identity for all the residents, emigrants etc. of the country. The digital identity may include biometric details apart from photograph and basic demographic details. E.g. The UIDAI authority in India issues an Aadhaar number to every Indian resident and provides multi-modal authentication services to the public and private sector.

   b) The **authenticated contact details** of the resident consisting of mobile number, email-id and address may be a part of the Digital Identification or may be linked to Digital Identification. e.g "Estonia started issuing national ID cards in January 2002. The card, which fulfils the requirements of Estonia's Digital Signatures Act, is mandatory for all Estonian citizens and residing foreigners over 15 years of age."[9]

   c) **Digital Identification for organizations** i.e. unique registration identity for all organizations within the country with their contact details, unique taxation id and registration id (s).

ii. **Digital Family ID**- consists of a group id linked to the Digital Identification ids of all the household members. The digital family id may be issued in the form of a card / number, so that benefits to the household may be provided and monitored. e.g. grant for construction of home.

iii. **National GIS Portal**- All immovable assets of the Government Enterprise such as Govt. offices, member organization offices, service delivery centers, public amenities etc. should be marked on a country-wide GIS based platform. They should be uniquely identifiable and have standardized nomenclature.

iv. **Electronic Entity Databases** - Traditionally, each of the member organizations within the Government have issued their own unique identity number or cards to the beneficiaries. E.g the Election Commission of India issues voter ID cards to Indian citizens. With the advent of a unique digital identity, many of the organization specific id numbers may be done away with. E.g. The citizenship details may be linked to the digital identification number in the SRDH. This shall also help in the easy identification of immigrants. However, some member organizations may continue to issue unique identities, in order to ensure privacy of sensitive data such as medical records, criminal records, bankruptcy records etc. However, these ids should also be mapped to Digital KYC records, through the multi-tier data exchange layer. Thus, the Government Enterprise should thoughtfully designate the responsibility of data stewardship to its member organizations.

2.4.2 Multi-Tier Data Exchange Layer or Middleware

This layer of standardized APIs enables Government enterprise databases to communicate with each other. The multi-tier data exchange layer can provide valuable inputs for planning and doing cross departmental analytics.

i. The digital KYC should act as unique identifier while connecting with multiple entity databases. e.g. The State Residents Data Hub (SRDH) being developed under the aegis of respective State Governments of India, contains the digital identification Id (Aadhaar), demographic, socio economic details of the residents and unique identifiers from the entity database of member organizations.

ii. The core databases exchange data with all the other application layers i.e. Gateways, eServices Delivery Suite, Internal Domain Apps, Productivity Suites and Delivery Channels as requested from an authorized source.

iii. The core database layer shall interact with other layers as per the permissions assigned by the access management layer in the productivity suite.

Examples of required data exchange across multiple tiers has been touched upon throughout the paper.

2.4.3 Productivity Suites

These are **common use applications** which should be shared among all the member organizations of the Government Enterprise. These applications should be developed and maintained by designated member organizations or IT Department who can provide system services to other member organizations.

The major ones and their interaction with other components are described as follows.

i. **Human Resource Management Suite (HRMS) -** The HRMS should uniquely identify the employees, contractors etc. working for the government enterprise based on their Digital KYC. The HRMS modules should include entry and exit processes, allocation of designation and roles, bench management, attendance and leave management, expense reimbursement, performance and appraisal management, management of postings and transfers, salary and income tax management, recruitment management etc.

ii. **Knowledge Management Suite (KMS) -** The KMS should act as a repository of approved Govt. documents, projects, lessons learnt, case studies, best practices, research papers, discussion forum etc. so as to maintain a shared knowledge repository for the Government Enterprise.

iii. **Learning Management Suite (LMS) -** The learning management system should manage the trainings of all employees / contractors working, beginning from induction, mid-career training, online learning content, sponsorship of employees /contractors to universities etc.

iv. **Legislations Management Suite -** The legislation management suite should enable development of legislations, sharing of important and relevant legislations with member organizations, case management on behalf of the member organizations, legal approvals, legal formats etc. This suite may interface with eConsultation, Finance Management System and eProcurement modules for hiring of legal consultants, fee management etc.

v. **Asset Management Suite -** The asset management suite should link with the GIS platform in the Core Data set layer, and manage all the movable and immovable assets belonging to the member organizations of the Government enterprise. Some of its functions should be management of assets, allocation of assets to member organizations, maintenance of assets, allocation of assets to employees / contractors, office facilities management etc. The Asset Management suite should interface with eProcurement for procurement of assets, disposal of assets etc.

vi. **Access Management Suite -** The access management suite should have modules to manage single sign–on access of all visitors, employees / contractual worker to various office facilities, data centers etc. The suite should also manage roles and access to Internal Domain applications, Productivity suites, eService delivery applications, core data sets etc. This identity and access management suite shall also allow the citizens, residents, businesses and other stakeholder to gain role based access to Govt. enterprise applications. The Access Management productivity suite should be linked to Digital KYC, HRMS and other applications.

vii. **Logistics Management Suite -** The logistics management suite should manage all the logistics related operations for the enterprise, including tracking of vehicles, purchase and maintenance of locomotives, allocation of locomotives, booking of tickets etc. It should interface with eProcurement suite for selection and management of logistic vendors etc.

viii. **Video Conferencing Suite -** The video conferencing suite should manage all the video conferencing facilities across the member organizations in a secure manner.

ix. **Customer Relationship Management (CRM) -** The customer relationship management suite should help the member organizations to build relationship with the citizens, residents, businesses and other stakeholders. The CRM shall provide a consolidated statement of all benefits, services availed and taxes paid by the user (citizen / resident / businesses etc.). The CRM should also provide insights to the Government regarding user behavior while interfacing with Analytics based DSS.

x. **Analytics based Decision Support System -** The Analytics based decision support system shall provide reports and insights based on database analytics performed on databases of member organizations. The system should provide the member organization with planning inputs, GIS based analytics and reports.

xi. **Financial Management Suite -** The financial management suite should provide enterprise wide budget allocation details to member organizations for performing services, executing projects etc. The suite shall help member organizations maintain expenditure, revenue details etc. This suite shall interface with most of the Enterprise systems.

xii. **Document Management Suite -** The document management suite shall provide a system for storing, classifying, archiving and managing documents. The system should enable member organizations to monitor approval workflows and work in progress documents. This suite may be integrated with other applications involving work in progress document workflows.

xiii. **Program[11] and Project Management Suite -** The program and project management suite should provide a program and project management software for tracking the project lifecycle, milestones, budget and schedule slippages, purchase orders etc. for member organizations within the enterprise.

xiv. **eProcurement -** The eProcurement system should allow member organizations within the government enterprise to purchase materials and services. The system should allow price discovery, bid management, reverse auctioning etc. The Procurement System should interface with all the Enterprise systems to enable its use for all member organizations.

xv. **eConsultation -** The eConsultation system should enable electronic engagement of the users (i.e. residents, citizens, businesses etc.) to avail online consultation from officials of the member organizations. This should enable minimum face to face visits for the users.

2.4.4 Internal Domain Applications

The internal domain applications involve services which are mostly G2G, and require little or no interaction with the citizens. These applications should interface with the Productivity Suite and Core data sets wherever applicable. The chief applications include:

[11]**Program**: "A group of related projects, subprograms, and program activities manage in a coordinated way to obtain benefits not available from managing them individually."[16]

i. **Monetary Control** - The system shall include modules related to national and international monetary control, money printing, coinage, money laundering control, inflation monitoring, interest rate monitoring, index monitoring, related analytics and decision making support.

ii. **Defense** - The system should help in deployment and tracking of security forces on land, sea and air, defense related international procurements etc.

iii. **Energy** - monitoring of power generation, sale of power, international technology agreements etc. The system should interface with eProcurement, Natural Resources system etc.

iv. **Foreign Affairs** - management of international communication, extradition, international deals etc.

v. **Research & Development** - management and funding of R&D developments etc. taken up by the Government.

2.4.5 eServices Delivery Suite

The eServices Delivery suite should consist of domain specific applications providing services to users (i.e. citizens, residents and businesses etc.). The users should be granted limited single sign-on access to these applications so that they are able to raise and track their requests and observe dashboards.

The systems within the eServices Delivery suite should interface with Core data sets, productivity suites, gateways and delivery channels wherever applicable.

The applications in the eServices Delivery suite have been chosen so as to provide seamless user experience. Thus, the traditionally separate member organizations delivering services with inter-related workflows, have been envisaged to use interoperable set of services. The ownership of the system should be designated to a member organization by the enterprise.

The proposed systems of the eServices Delivery Suite are:

i. **Judiciary, Police and Prisons** - should provide seamless workflow for requesting and monitoring civil and criminal procedures, obtaining judgements, lodging FIRs, complaints, enable video conferencing with criminals etc.

ii. **Agriculture & Food Distribution** - should provide seamless workflow beginning from agriculture planning, incentivizing the farmers, providing inputs and subsidies, crop insurance, weather alert issuance, procurement of produce, storage, distribution of produce, monitoring of crop purchase price etc.

iii. **Utilities & Municipality** - should include modules for requesting, receiving and paying for services like electricity, water, parking lots etc., garbage collection and disposal; town planning, fire services, provision of urban amenities, street lighting, issuance of birth, death, marriage certificates etc.

iv. **Transport Management** - should include modules for vehicle registration, issuance of driving license, management of local transport including metro, road-ways and water – ways, transport planning, traffic management etc.

v. **Health** - should include modules related to management of government health facilities, interfacing with medical insurance, patient record management, disease surveillance, hospital management etc.

vi. **Environment, Forests & Wildlife** - should include modules related to classification and management of forest reserves, sanctuaries, monitoring of air quality, water quality, conservation of wildlife etc.

vii. **Natural Resources** - should include modules for estimation, maintenance and auctioning of natural resources like oil, natural gas, telecom spectrum etc.

viii. **Employment** - should include modules for registration of employment seekers and employment providers, profile maintenance, intelligent search, filtering on the basis of education, location etc.

ix. **Price Control** – should include modules for calculation of inflation index, monitor international and domestic prices, provide predictive and historic pricing information etc. while interfacing with Monetary Control and Judiciary, Police and Prison systems.

x. **Banking & Insurance** - should include modules regarding banking regulations, insurance regulations, monitoring, tracking of violations, setting up and monitoring standards for micro-finance, ATMs etc., resolving grievances etc.

xi. **Education, Libraries and Research** - should include modules for providing scholarships, affiliating institutions and universities, monitoring education quality and standards, designing of syllabus for primary and higher secondary education, monitoring of syllabus, vocational training, management of Government schools, management of libraries, online libraries, grants to research scholars etc.

xii. **Industry, Foreign Trade and Commerce** – should include modules to allow registration of businesses, bankruptcy monitoring, license and permit management, classification of industry, incentives to industry, support to small and medium scale industries, markets for cottage industry, monitor indigenous products w.r.t international, facilitate exports, promote and monitor ecommerce etc.

xiii. **Land & Property** - should include modules for maintaining land and property records, mutations, registration etc. while interfacing with applications like Judiciary, Police and Prisons.

xiv. **Taxes** - should include modules to facilitate and monitor tax collection from individuals, organizations, monitoring of tax evasion etc.

xv. **Intellectual Property Rights** - provide intellectual property rights, monitor IPR violations in the international and national arena etc.

xvi. **Social Security** - should include modules for management of monetary benefits such as health insurance, un-employment allowance, old age pensions, disability allowance etc.

xvii. **Disaster Management –** should interface with the GIS platform for disaster identification, estimation, interfacing with agencies for disaster relief etc.

xviii. **Travel & Tourism (International & Domestic)** –should include modules for promotion of tourism, estimation of tourists, monitoring medical tourism etc.

xix. **Shipping & Airways** - should include modules related to import and export of cargo, monitor international trade routes via sea, maintain ports, air route control, airway traffic

management, provide airline license, issuance of pilot licenses etc.

xx. **Monument Conservation** - should include modules for monument records, historic records, preservation of historic buildings, conservation lab management etc. while interfacing with eProcurement for hiring of vendors etc.

xxi. **Elections** - should include module for electronic voting, election monitoring and management etc.

2.4.6 Gateways

These are common use products[12] which interface with eServices Delivery Suite, Productivity Suites, Internal Domain app etc. These products may belong to the Government enterprise or an authorized private enterprise.

i. **Payment Gateway** - provides an interface for conducting financial transactions. The same should be linked to payment gateways of banks etc. to allow net-banking, payment via cards, e-valets etc.

ii. **Social Media Gateway** - The social media handles allow the user to share their eGovernance experience with other users. The social media handles should allow the Government enterprise to interact with users and update them about the latest developments in eGovernance etc.

iii. **Digital Signature** - The digital signature interface should allow the digital KYC based unique authentication for documents as required by the users. The digital signature interface should allow digital signature via tokens to officials of member organizations etc.

iv. **Document Exchange Gateway** - should allow authenticated document exchange between issuers (member organizations) and requesters (member organization, citizen, resident, businesses etc.) having the requisite permissions. This gateway should interface with Digital signature interface to allow users to digitally sign documents for requisite submissions etc..

v. **Language Localization** - should enable on-the-fly translation and transliteration of applications and other website text into the desired local language etc.

vi. **eMail & Mobile Gateway** - should issue email ids based on digital KYC, manage SMS and OTP communication for member organizations, facilitate email and sms exchange between member organizations and users (citizens, residents, businesses) etc.

2.5 Delivery Channels

These delivery channels should help to enhance accessibility and availability of eServices to the users (citizens, residents, businesses etc.)

i. **Single Window web and mobile Interface** - should interface with eServices Delivery suite, Gateways, Core data sets etc., provide a single point of contact for availing services to users (residents, citizens, businesses), interface with GIS platform to guide users to the nearest required service delivery center, grievance redressal etc.

ii. **Common Facilitation Centers** – should provide assistance and training to users while using single window web and mobile interface, handle user enquiries, act as common service delivery centers for majority of G2C eServices, may be utilized by member organizations as service centers etc.

iii. **Call Center & Online Chat Support** – should provide telephonic consultation and online chat support to users (residents, citizens, businesses etc.) interested in availing eServices, provide domain consultation to users regarding process of availing eServices etc.

iv. **ATM, KIOSK, Micro-ATM** – interfaces with payment gateways, service delivery gateways, banking institution gateways, micro finance institutons, mobile valets etc. to facilitate financial transactions.

v. **Face to Face** – the users may also avail the Services by physically visiting the member organization premises, or specified service delivery centers of member organizations.

2.6 Monitoring Service Delivery

This is the most important layer of the proposed Government Enterprise Architecture. The responsibility of this layer should be assigned to particular member organization e.g. IT Department in the Government Enterprise. This module monitors the efficiency, ease and reliability with which eServices are being delivered to the end user. It encompasses important components like:

i. **User feedback** – An application seeking proactive user feedback should be developed. The feedback should be sought through multiple channels during and immediately after the user has availed the service.

ii. **Security audit** - The security audit should ensure that the all the applications together constituting the eGovernance Capabilities are abiding by the decided security standards (e.g. Single sign on).

iii. **eService maturity audit** - The audit shall review whether the claimed maturity level of service delivery are being maintained by the member organizations.

iv. **Service Delivery audit** - An eServices evaluation matrix should be formulated for scoring the eServices on the basis of citizen friendly parameters like ease of use, awareness about available eServices, round the clock eService availability, accessibility via multiple service delivery channels (both financial and non-financial), easy and secure authentication, transparency of workflow through timely notifications, minimum requirement of physical interaction, action taken on user feedback etc. This shall enable member organizations and eService users to assess the efficiency of services delivery and identify areas of improvement.

3. CONCLUSION

This paper introduces a well-defined and understandable Enterprise Architecture for Governments across the world. The paper presents a methodology for implementing eGovernance in an integrated manner wherein the interested country:

i. prepares an eGovernance strategy,

[12]**Product: "**A good idea, method, information, object or service created as a result of a process and serves a need or satisfies a want." [20]

ii. brings in the required legislations and amends existing legislations to enable eGovernance,

iii. prepares the required regulatory framework consisting of guidelines, standards (e.g. security, eServices Maturity Model) and policies (e.g. open source, open standards),

iv. makes service / project delivery commitments via Charters to users (citizens, businesses, residents etc.),

v. adopts Enterprise Architecture principles,

vi. takes up change management beginning from hard changes like process reengineering,

vii. strategically assigns ownership of integrated applications to member organizations,

viii. sets up HW & NW infrastructure, and prepares a set of core data sets (including. Digital KYC, GIS platform etc.),

ix. develops common use productivity suites (e.g. access management),

x. develops integrated eServices delivery applications (which are interoperable, scalable, service oriented, user friendly) and integrate with gateways to deliver eServices through multi-modal delivery channels.

xi. and monitors service delivery through audits and user feedback.

By following the above Enterprise Architecture methodology for E-Government the transformative impact of eGovernance may be realized by interested Governments across the world[13].

4. REFERENCES

[1] New Zealand Government - *Government Enterprise Architecture*- GEA-NZ v3.1Context Document, June 2015

[2] CRITICAL ISSUES IN e-GOVERNANCE- Summary of Discussion using Issue Process Methodology; Panel discussion in 5th International Conference on e-Governance (ICEG 2007)

[3] http://www.eldis.org/go/topics/resource-guides/governance/key-issues/e-government/challenges-for-e-government#.V-t_N_l97IU; IDS 2016

[4] Dr. Pardeep Mittal, Amandeep Kaur-E-Governance - A challenge for India; International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 2, Issue 3, March 2013

[5] The Open Group- *TOGAF version 9.1;* 2009-2011

[6] The Secretary to Government, A.P. Hyderabad-*AP State Enterprise Architecture*, 2014.

[7] Subhajit Basu, *E-Governance and Developing Countries: An Overview;* International Review of Law Computers & Technology, Volume 18, No.1, March 2004

[8] European Commission- *eGovernment in Latvia;* Feb 2016

[9] European Commission- *eGovernment in Estonia;* Feb 2016

[10] As_Saber, Srivastava & Hossain, 2006. *Information technology law and e-government: A developing country perspective*, JOAAG, Vol. 1. No. 1

[11] ARC- 11th Report- *Legal Framework for eGovernance*

[12] John Mullen, Université de Paris 12 Val de Marne- *John Major's Citizens Charter - fifteen years late;* Nov 2005

[13] United-Nations. (2012). *UN E-Government Survey 2012*: *E-Government for the People*. Retrieved from http://unpan1.un.org/intradoc/groups/public/documents/un/unpan048065.pdf

[14] Nograšek, J. - *Change Management as a Critical Success Factor in e-Government Implementation*, 2011

[15] Vasudev Murthy & Dr. Vashima Shubha- *Applying Change Management Practices in Government Organizations: A view from the field*; Volume 21, No. 2, July 2011

[16] EA in transition: Guide to keeping up with disruptive technologies; 2007-2016, TechTarget6 http://searchcio.techtarget.com/definition/enterprise-architecture

[17] Lesson Transcript, Political Science 102: American Government; 2003-2016, Study.com http://study.com/academy/lesson/what-is-government-definition-role-functions.html#transcriptHeader

[18] UNESCO 1995 - 2010; http://portal.unesco.org/ci/en/ev.php-URL_ID=3038&URL_DO=DO_TOPIC&URL_SECTION=201.html

[19] Project Management Institute- *A Guide to Project Management Body of Knowledge(PMBOK Guide)*-Fifth Edition, 2013

[20] OECD Glossary of Statistical Terms; OECD Expert Group on Defining and Measuring E-commerce, April 2000 - https://stats.oecd.org/glossary/detail.asp?ID=758

[21] Ada Scupola (Roskilde University, Denmark)- *The Role of E-Services in the Library Virtualization Process*; Handbook of Research on Electronic Collaboration and Organizational Synergy, 2009

[22] Business Dictionary- http://www.businessdictionary.com/definition/product.htm

[13] The views expressed here are solely those of the author in his / her private capacity and do not in any way represent the views of the Indian Government.