IJCSE International Journal of Computer Sciences and Engineering Open Access
Review Paper Vol. 9, Issue.1, January 2021 E-ISSN: 2347-2693

eGovernment Integration Framework for Fragmented Systems

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DOI: https://doi.org/10.26438/ijcse/v9i1.5155 | Available online at: www.ijcseonline.org

Received: 15/Jan/2021, Accepted: 20/Jan/2021, Published: 31/Jan/2021

Abstract- This paper proposes an integration framework for the Public Institutions / government entities wishing to integration fragmented applications and systems. The existing alternatives of integration falls short of attributes like performance, interoperability, and reliability. This paper proposed a Microservices Based Integration and API driven approach that will achieve the resiliance and scale. We propose a model based on API and microservices framework leveraging API Gateway, API Management, ESB, Orchestrator, and Rules engine. This paper intends to provide a comprehensive list of integration capabilities based on the underlying integration framework. This framework is an enabler to digitally transform in government enterprise and to provide sufficient impetus and acceleration for its digital future.

Keywords- e-Government, Service Orientation, API Management, Government Service Bus, Web Services, Integration Framework, Integraiton Platform.

I. INTRODUCTION

eGovernment interoperability is the ability of constituencies to work together. Interoperability is the ability of diverse systems to seamlessly exchange information. eGovernment interoperability is essential for the enhancement of government and effectiveness for the delivery of public services to all businesses and citizens. EGovernment interoperability provides better decisions and better governance within public sectors. This kind of governance enables citizens and business users an easier and faster access to government information and services.

Interoperability is a key attribute for Government to achieve its full potential. The importance of interoperability is clearly evident in the situation where it does not exist and its deficiency results in an inability to integrate disparate systems to achieve a tangible outcome. eGovernment interoperability is realized by the adoption of standards and architecture. Integration Framework enables a set of standards and best practices that a government uses to specify the way in which public sectors, citizens, and partners interact with each other. The eGovernment interaction model is based on digital interactions between a government and citizens (G2C), government and businesses (G2B), government and employees (G2E), and government and government agencies (G2G).

II. INTEGRATION LANDSCAPE – PROBLEM CONTEXT

The Government institutions consist of various federal government and local government entities. Both federal and local governments provide several services to businesses and citizens. However, these services are typically provided in silos, causing people to carry various documents and travel between different government entities because of dependencies between entities in providing a service. This has caused data duplication issues in every government entity as entities need to collect and store data in multiple places, outdated data due to lack of integration, and data stored & shared in different formats and states. There is a dire need to provide an integration platform at the national level to provide unified and integrated government services to citizens and businesses to address the existing challenges.

The integration platforms has to support continuous onboarding of the government entities and their services on the platform. The integration platform has to support a high number of service transactions and should have the ability to scale to ever increasing needs. The existing platforms had neither the scale of the number of participating entities or all capabilities that was being envisioned for the government integration platform. The existing implementations had to deal with the hierarchy of ESBs. The Integration Platform should also integrate with the local service bus platforms of each entity while ensuring the right set of governance policies are in place to distinguish and support the federal-to--to-federal integration and federal-to--to-local integration.

eGovernment - Interoperablity

Interoperability becomes a main obstacles to further eGovernment development. This problem of interoperability is resolved during the system design stage by levaraging Service Orientation i.e., microservices and API. Microservices provides a framework for an infrastructure to facilitate the interaction and

communication between services. Microservices are more of a paradigm or a style of design that concludes on architecture. In other words, Microservcies is a way of thinking about building software than a software development technique. As Microservcies are being adopted by the government, collections of services as well as specific services will be available for use.

eGovernment interoperability architectures are provided by Microservices Architecture Paradigm.

Microservices provides a solution for shared and distributed services and it achieves high interoperability, flexibility, and standardization by utilizing the description, discovery, and invocation of services. The integration platform leverages API Management and Microservices architecture. Leveraging APIS in e-Government enables government institutions to provide additional services by defining a new service that emerges from existing e-Government services. Service Bus acts as a middleware glue infrastructure that holds microservices parts together and integrates and manages the communication between different API/microservices applications and data tiers.

The key architecture decisions for the centralized platform integration platform are -

- Build a centrally managed and highly available integration platform
- Encourage data sharing and service reuse between government, federal, and local entities
- Maintain, govern, and provide visibility into the life cycle of services
- Govern the integration between government entities to ensure high quality
- Provide a safe and secure platform for the services

Integration platform will be the backbone for integrating between different government entities. The platform will play a crucial role and hence, the infrastructure, application components and services are continuously monitored and governed for any bottlenecks or anamolies. In case of any issues, real-time alerts are generated to handle these abnormalities. The following paragraphs describe the key quality attributes provided by the integration platform.

Microservices is an enterprise-wide architecture that promotes loose coupling, reuse, and interoperability between systems. Microservices paradigm defines the needs and outcomes of eGovernment in terms of services, independent from the underlying hardware platform, operating system, or programming languages that implements them. The distinguishing factor is a microservices platform consists of many services that signify elements of business processes that can be combined and recombined into different solutions and scenarios, as determined by the business needs. This ability to integrate and recombine services is what gives the government the agility needed to respond quickly and effectively to new situations and requirements.

The entire platform is a highly secure platform designed to satisfy the security requirements of the inter-governmental communication by having multi-layered security covering the infrastructure as well as the application components.

The authenticity, confidentiality, integrity, and non-repudiation of exchanged data are maintained.

Interoperability

Integration Platform platform hosts the service registry and repository, which provides the web-based user interface for users from government entities to access the service catalog. The service catalog has all information about the services hosted on the platform, thereby promoting interoperability and re-use across the government organizations. These Microservices are based on open standards and protocols like RESTful and SOAP, hence not based on any legacy or properity technology.

Scalability

Integration platform does not have a single point of failure. All the components of the platform have redundancy (hardware and software) and the platform is immune to any disasters by way of having a separate Disaster Recovery environment. The platform is capable of handling transactions of services across multiple entities. The platform is built in a way that it can be easily scaled vertically or horizontally.

Performance

The platform is able to cater to more than million+ transactions per day coming from across federal and local government entities. The platform has to be tuned to be able to respond with least latency, by utilizing features such as caching and effective memory management.

III. INTEGRATION FRAMEWORK

The proposed framework enables seamless exchange of information between Government entities in various geographical locations by means of the interoperability aspect. In this framework, the service-centric framework made use of microservices as a sub-domain. This comprises a presentation channel which is a platform for all stakeholders to interact with the e-Government agencies or Government departments.

The stakeholders are service consumers and these departments are service providers. The presentation channel is a logical front-end of the overall integration platform. The framework executes the interoperation between the service consumers and the service providers through the portal. The basic mechanism for delivering government services in the proposed framework is shows in Figure.

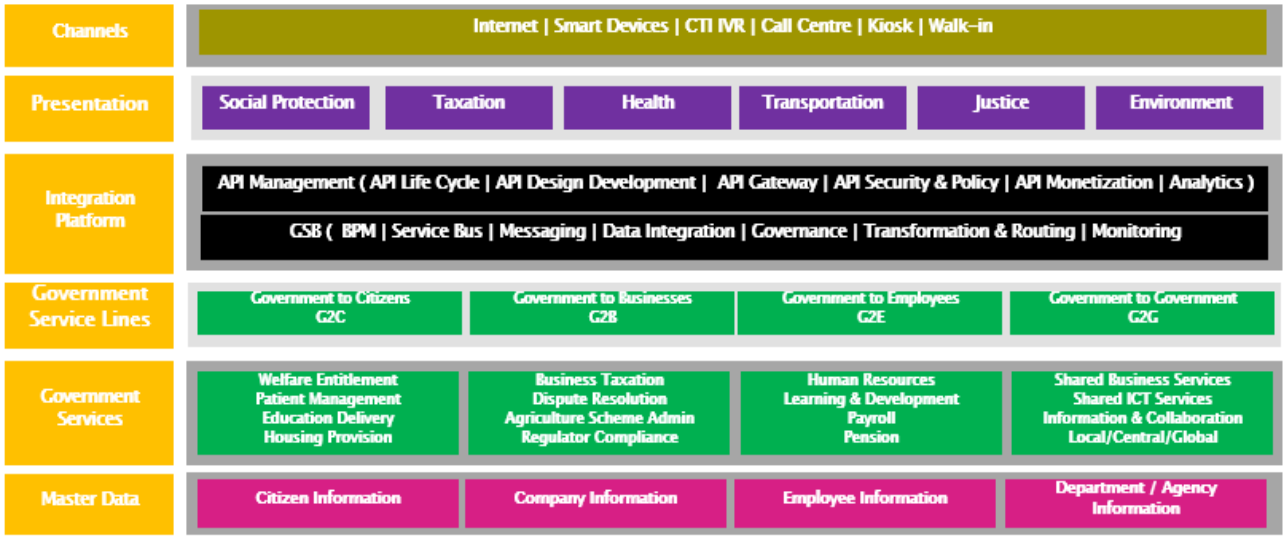

Fig. 1

The main entities of the proposed framework are:

eGovernment Models & Stakeholders

The main stakeholders of the eGovernment system are citizens, business, employees, and government. Thus, the main functions of eGovernment system are the communication between Government and these stakeholders i.e., G2C, G2B, G2E, and G2G.The communication channel is internet and they can request for the Government services through a common platform, a presentation channel where the stakeholders are service consumers.

Presentation Channel

A Microservices based architecture and presentation channel consisting of portal, CTI, IVR, Call Centre, Walk-In provides an easy way for availing Government services. This presentation channel has the efficiency to act as the front-end of the overall ecosystem. This operates as the facilitator between stakeholders and eGovernment agencies or departments. This may help to provide integrated eGovernment services to quickly combine and deploy new services across different departments. It is a platform for plug-in reusable components which are defined and published as service repositories.

The Government agencies including the state, centre and local administrative bodies in the country are the service providers in this ecosystem. The Government agencies provide the public services by the request of the stakeholders through the presentation channel.

Architectural Domains

Integration Platform constitutes differnet architectural domains like Data and Information Architecture, Services Architecture, Business Process Architecture and Technology Architecture. Business Process deals with listing various operational procedures of services, defining cross-agency services, enabling departmental communication, and standardizing the processes for interoperability and reuse. Service Architecture deals with defining a set of services, their relationships and dependencies, and the processes to be followed for each service offered by the different government agencies. It also defines the application architecture of each service for different tiers as modules. Data and Information concerns enlisting all data elements associated with services, the data and meta-data associated with it, and the standards facilitates integration and interoperability. Technoogy Architecture defines infrastruture technology platforms based on standards for reliability, security, interoperability and modularity and describes how the technology will support the delivery of microservices and standards for implementing the technology.

IV. GATEWAY

The heart of the integration platform is Service Bus and is a platform for standards-based information flow between the Government departments. This is the backbone and facilitate the interface for messaging, communication, and security. The foundation for an integration platform is a service gateway and acts as a mediator or broker between service providers and consumers. This also provides access to all microservices of various government entities through the presentation channel. Thus, the gateway helps to provide single window access for a consumer who wants to get the public services from any of the Government department. Gateways provide a standards-based interoperability among heterogeneous entities in the Centre, State or local bodies of the Government. Gateway acts as an intelligent hub and messaging middleware for eGovernment services and provides seamless interoperation by exchanging information between eGovernment application silos. Gateway routes service requests from different stakeholders to the service providers and return responses back to the stakeholders as microservices. The below table depicts the integration platform key capabilities.

Table 1: Integration Platform Capabilities

	Tier	Capability
Integration Platform	API Management	API Gateway
		API Life Cycle Management
		Messaging infrastructure
		Stream Processing
		Throttling & Rate Limit
		Key Management
		Mediation
		Caching
		API Development Portal
		Circuit Breaker & Fault Management
		Usage Tracking
		Authorization & Authentication
		Loadbalancing
		Analytics & Monitoring
		Policy Management & Security
	Service Bus	Service Composition
		Service Registry
		Service Discovery
		Error Management
		Contract Service Provider
		Orchestration
		Message Broker
		Policy Management
		Application, Data and UI Integration
		Platform Governance
		Service Bus
		B2B Integration
		Protocol transformation

V. RELATED WORK

The paper [1] builds a SOA-based framework for the Palestinian e-Government Integrated Central Database that achieves interoperability, flexibility, and manageability.
This paper [2] presents a framework to guide users on technologies to be used, skills needed for the task, goals, outcome and output of integration.

The research [3] focuses to build architecture model using SOA and deployment services via private cloud computing with cooperated e-government environment.

The study [4] shows eGovernement interoperability in the context of European Interoperability Framework and the proposed solution of connecting portal of eGovernement and Ministry of Interior Affairs - MOI Republic of Serbia through Enterprise services bus - ESB.

The paper [5]: 1) analyzed the needs for eGovernment Interoperability in India and investigate the leeway of Enterprise Architecture in Indian context and 2) proposed a framework and Service Oriented Government Enterprise Architecture to achieve the eGovernment Interoperability for one-stop service delivery in Indian perspective.

This paper [6], proposes a cloud framework for integrating data from different sources of government sector's databases into a unified repository, which is deployed in the cloud.

This paper [7], discusses SOA framework for web service architecture paradigm to be used in eGovernment integration portals and aims towards achieving higher interoperability in e-Government.

This paper [8] presents a eGov-Bus is based on adaptable proc-ess management technology, allowing for virtual services which are dynamically combined from existing national eGovernment services.

The research proposes [9] a framework to guide the design of the integrated national health patient-based information system.

VI. CONCLUSION AND FURTHER WORK

This research paper proposes an e-Government integration framework that is designed to reduce the amount of time and effort spent as part of the integration process between government organizations. The framework is comprised of three layers: API Management and the Government Service Bus as the key building blocks. It aims at automating the integration and monitor and control processes in e-Government initiatives by adopting an open standardized framework and reliable technologies. The proposed framework should help in minimizing the time and effort spent in the integration process and it is ready to be implemented by eGovernment initiatives worldwide. The proposed framework delivers several eServices to the

government, citizens, and business communities. This framework primarily tackles challenges such as reliant, scalability and interoperability. Deploying governmental data and providing eGovernment services via prem or cloud yields several benefits to the government itself, citizens, business communities, and the whole society.

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AUTHORS PROFILE

Sameer S. Paradkar is an enterprise architect with more than 20 years of extensive experience which spans System Integration, Product Development, and advisory organizations. Sameer works as an SME on architecture modernization and transformation initiatives. He has worked on multiple digital transformations, engagements, and large complex deals in North America, Europe, Middle East, and ANZ regions that presented a phased roadmap to the transformation maximizing business value while minimizing costs and risks. Sameer is certified and competent in different methodologies and frameworks including: TOGAF, NGOSS (e-TOM & SID), ITIL, COBIT, Agile, Scrum, DevOps, Scaled Agile Framework – SAFe and Business Capability Modeling. Sameer is part of the Architecture Group in AtoS. Prior to AtoS, he has worked in top tier SI and consulting organizations.

