Abstract

e-Governance need to be build-up on the top of Good Governance in order to provide effective Service Delivery to citizens. In this paper a new model called e-Governance Service Delivery Platform (eSDP) by offering affordable services as being proposed. The proposed eSDP model is an integrated and unified Service Delivery Platform (SDP) of e-Governance for delivering effective Government services to the society. The platform enables Interoperable services cutting across individual ministries and line Departments. The objective is to deliver optimized services to the end user by re-engineering the way that services are offered using Construction by Configuration (CbC) and Agile Methodologies. The eSDP enables re-usable services to be registered, authored and made available in a secured way with proper authentication, authorization, permissions and privileges. eSDP optimizes the Service Delivery Life Cycle of each domain by way of re-using the shared common pool of service and components. The paper attempts to propose eSDP platform along with the measures of efficiency such as Cost, Resources and Time.

Keywords: Agile Methodologies, Construction by Configuration, e-Governance, Service Delivery Platform, Software Development Life Cycle

1. Introduction

Information and Communication Technologies can enhance the transformation of work culture by serving a variety of ends, better delivery of government services to citizens, improved government interactions with business and industry, citizen empowerment through access to information and participation for decision making and more efficient Government Management.

In India, e-Governance started with National Informatics Centre’s (NICs) efforts at connecting district headquarters through computers in the 1980s and through establishment of pan-India Government to Government, Government to Citizen network. This has provided the backbone to implement several solutions and services around G2G, G2E & G2C. To further utilize the potential of e-Governance to improve the quality of life of the vast population of the country, Government of India has formulated a national programme – the National e-Governance Plan (NeGP). Today Digital India Programme is being planned with three key vision areas 1) Digital Infrastructure and Services, 2) e-Governance...
Services on demand 3) Digital Empowerment of Citizens. eSDP plays a critical role in implementing the Digital India Programme.

1.1 Drawbacks of the Existing Model of Service Delivery

1.1.1 Citizen Based
- Citizen information and data is spread across different systems in multiple formats.
- The various stages and status of the services are not readily available to Citizens.
- Complete Workflow is not build-in and there is a gap between Inter-Departmental Services.
- Citizens are required to furnish the same set of information at different points of time for availing various services.
- Non-standardized interfaces to common services like payment, document verification etc.
- Longer Service Delivery Cycle Time.

1.1.2 Technology Based
- System not flexible for cross sharing of services.
- Tightly Coupled Architecture induces complexity and more time for delivering services.
- The present solution architecture does not allow easy implementation of policy changes.
- High cost of maintenance & integration

1.2 Need for a Unified eSDP
The current state of service delivery be taken to the next level and facilitate the information systems to communicate and interoperate with each other efficiently and effectively. The following features are envisaged as a part of the changed service delivery:

- To establish an integrated single interface for service delivery.
- To promote cross sharing of information.
- To facilitate easy accessibility of services
- To have a single and central point of authentication and verification.
- Sharing re-usable Services and Components.
- Re-engineering Applications to adopt
- Construction by Configuration and Agility.

1.3 Benefits of a Unified eSDP
The following are the benefits that can be realized with a unified eSDP:

I. Shorter service delivery life cycle.
II. Sharing of inter-departmental federated and State services.
III. Availability of Hosted Services based on,
   - Software as a Service (SaaS)
   - e-Governance Standards
IV. Service Tracking and Accountability.
V. Enhanced integrated, federated services with Quality, Scalability, Performance and Maintainability.
VI. Unified SMS & E-Mail alerts.
VII. Saving on Resources, Cost and Time.
VIII. Service availability from anywhere and anytime.

1.4 Service Life Cycle Model
Every e-Governance application enables variety of application services to the citizens over the counters, touch screens, offices at the village, taluk, block, districts and state levels. The application services in turn use the system services in an integrated way to deliver the application services². In service life cycle model Figure 1 has the following four steps in the service life cycle namely Service Creation, Service Execution, Service Integration and Service Maintenance⁵.

Figure 1. Service Life Cycle Model.
Every service is autonomous, has explicit boundaries and abides the policies or Rules.

2. e-Governance Service Delivery Platform

e-Governance Service Delivery Platform (eSDP) is an evolutionary approach to Loosely Coupled Integration of services from variety of applications and systems. With the advent of the highly scalable RESTful Services under Service Oriented Architecture (SOA), eSDP establishes interoperability and scalability. Many solutions implemented are using industry standard Web services and can be easily consumed by eSDP. eSDP architecture allows isolated and loosely connected applications to exist together and exchange information by making their services available to one another. It should be modular to allow integration with heterogeneous technologies.

2.1 Loosely Coupled Architecture

Tightly Coupled Infrastructure and services are constrained by underlying monolithic applications that require long period to implement a change. Hence loosely coupled architecture with distinct services is recommended to be more open to changes and bringing flexibility in the system. A Loosely Coupled is an attribute of systems, referring to an approach to design interfaces across several layers (modules) to reduce the interdependencies across modules or components – in particular, reducing the risk that changes within one module will create unanticipated changes within other modules [wiki]. In the Architecture we included the several application layers and each layers are separately operable.

In Loosely Coupled Architecture Figure 2 has different layers and each layer can have different technology. The layers are made interoperable using Open Standard RESTful web services following Service Oriented Architecture. The payload uses XML which can be consumed by every layer using multiple technologies. The XML schema supports the features that are offered by eSDP model.

2.2 eSDP Model Architecture

Figure 3 eSDP model architecture has the participating domains on one side, the deliver channel and consumers on the other side. The participating domains include Federal and State Departments who register and share services in eSDP. The delivery channels include call centers, citizen touch point, portals, IVRS, Service counters etc. The Business Accounts Manager (BAM) layers between the delivery channel and core elements.

eSDP model architecture has the following core elements.

2.2.1 eSDP Inter-operable Service Repository

All reusable services from different domains are registered here with relevant policy for sharing. This includes Registration Services, Authentication Services, Authorization Services, Verification Services, Barcode
verification services, Alert based services, Web Map Services, Dashlet Services, OTP Services, Digital Signature Services\(^{10,11}\), BI Services, BAM Services\(^7\), Locational Services etc. These services will grow over time as they will be added as and when a new requirement comes up.

2.2.2 eSDP Hosted Services including SaaS

The Hosted services include the applications which follow the SaaS model. It also includes the common elements which are shared across domain such as Land Region, Biometrics Standards, Digital preservation Standards, Localizations and Language Technology Standards, Metadata and Data Standards. All these code directories and standards are made available as hosted services in eSDP to enable application interoperability.

2.2.3 eSDP Governance Structure and Policy

It includes Authentication, privileges, Payment terms, sharing policy etc. This also includes the governance structure which will drive the model implementation and moderate policies.

2.3 Innovate Services using eSDP Service Registry

In the above Figure 4 describes the some of the domain process and their services offered to the departments. At first, the services are Re-defined as per the Service Oriented Architecture and provide RESTful services for interoperability. Once the service has been re-defined and registered in the eSDP service registry. Then those services will reusable. The Re-usable services will be registered in eSDP service registry for maximum reusability and to deliver optimized services to every department by re-engineering the way the services are offered. Every domain application is re-engineered to offer/adopt RESTful services which are Inter-operable. The eSDP service registry which is part of eSDP Inter-operable service repository is depicted in Figure 4. The service registry includes registering services along with the key for Interoperability enabling innovation of new services to the end-users. The service registry has the federal services, state services, re-usable components and query builders. The interoperability of services can be established using the common and standardized key elements could be based on geography (state code, district code, taluks, block code, village code etc.), time (year, quarter, month etc.), metadata standards, standardized domain key fields such as Aadhar number, vehicle number, voter ID, PAN ID, PIN number, deriving license number, Ration card number, Telephone number, Mobile number, email ID, Bank account number etc., using standardized key elements innovated new service can be made available using query builders.

NIC has built more than 4,000 e-Government services that are installed across the country. This knowledge library allows us to customize and rapidly redeploy proven e-Government solutions rather than designing every solution from the ground up\(^8\). The national e-Transaction count as on 1st January 2015 exceeds 93 crores with growth rate of 3.3 crores per month. Service innovation using 93+ crores will lead to variety (diversified response) and velocity (timely response) of new services. The classical example is citizen digital locker containing all reference documents using Aadhar ID announced by government of India. Identification mechanism, G2C Verification Service G2CVerification service and Person Identification mechanism, G2G Service request to be filled online/offline and submitted with one or more verifiable/non verifiable attachments G2C can make use of citizen digital locker. Standard re-usable components of eSDP consumed as a service by the departments G2G SMS Services G2C Payment Services G2G & G2C\(^6\). The re-usable components such as 2D Barcode can also be used to eliminate the typo graphical error, Automatic Input, Genuine-ness of the services.

![Figure 4. eSDP service registry.](image-url)
data and Re-usability thereby improving service quality as well.

3. Reengineering Application Architecture

Government process re-engineering is a radical improvement approach that critically examines, rethink
ts and re-designs mission product and service processes within e-Governance space9. e-Governance becomes an important technological input and tool while undergoing this process.

The applications that use eSDP are re-engineered for optimizing resources, cost and time. The re-engineered application is based on Agile SDLC model and redefined making the best use of eSDP service repository containing the eSDP re-usable domain services, eSDP generic components, eSDP hosted services, eSDP new innovated services. Agile SDLC model is a combination of iterative and incremental process models with focus on process adaptability and customer satisfaction by rapid delivery of working software product. Every iteration involves cross functional teams working simultaneously on various areas like planning, requirements analysis, design, coding, unit testing, and acceptance testing.

The above Figure 5 defines the Agile model processes. The application has several processes, in each process. Once the request has arrived, it has to start the process again and fulfill the project based on the last request4. As per the agile method each process has been developed.

Figure 5. eSDP Implementation model for an application.

Once the requirements are specified, then based on such requirements the project has been developed in an iterative form.

4. Benefits of the Model: Analysis

eSDP minimizes the processes optimizing the resources, cost and time associated with each process by making the best use of eSDP service repository containing the eSDP re-usable domain services, eSDP generic components, eSDP hosted services, eSDP new innovated services. An e-Governance application goes through the Software Development Life Cycle that defines all the tasks required for developing and maintaining the software. In SDLC each step has a process and cost, time and resources associated to it4. Figure 6 is an example online passport service with the SDLC steps Requirement, Analysis, Design, Development, Testing, Implementation etc. by making use of the eSDP resources application is re-engineered and the processes are redefined. Assuming that there are m processes p1, p2, p3…pm and each process take time t1, t2, t3…tm then the effective time taken for the existing application is If we re-engineer the application using eSDP model and reduce the number of processes from m to n, then the time taken for the new application is the effective time saved in reengineering the application is Optimize (Processes ~ Resource, cost, time)

\[
\text{Optimize (Processes ~ Resource, cost, time)} = m \sum_{i=1}^{n} p_i t_i - \sum_{j=1}^{n} p_j t_j, n < m
\]

Common Integrated Police Record Update System (CIPRUS) means software being developed by NIC for implementation in TN Police instead of Centre provided CAS (State) suite. CIPRUS is a comprehensive software solution in monitoring the day-to-day activities of the police station. Under this project, FIRs in police stations concerned and case details will be uploaded online. This system can use many of the re-usable domain services from Jail Application System and Court Application System at every stage of the case processing right from the case registration to all the prison activities and court activities.
In general every application under eSDP will make use of re-usable domain services, components and hosted services. In the Figure 6 re-usable services and components are indicated for N number of applications. Thus effective time saved for reengineering N number of applications of eSDP is if we consider an example of an application taking 24 months normally can now be analyzed using the eSDP components, services and hosted services. Assuming that these are released during different quarters over two year period, the following table depicts the data of distribution of the release of these components, services and hosted services.

| Qr1 | 3 2 2 24 24 |
| Qr2 | 5 4 1 24 22 |
| Qr3 | 9 5 2 24 17 |
| Qr4 | 15 10 4 24 15 |
| Qr5 | 15 15 5 24 15 |
| Qr6 | 18 10 6 24 15 |
| Qr7 | 18 8 2 24 13 |
| Qr8 | 18 9 2 24 11 |

Figure 6. Re-usable processes in e-Governance.

Table 1. Time Schedule of an Application Services
*All data indicated are in months

Figure 7. Time difference of an Application by using eSDP.
services are not re-usable. And also, the total number of processes as \( P_a \) and Re-usable processes as \( P_r \). For innovation services combining only the re-usable services and processes the cost is totally saved.

If we assume Cost of service \( i \) is \( (C_S)_i \), Cost of process \( j \) is \( (C_P)_j \) and Cost of re-usable service \( i \) is \( (C_{RS})_i \), Cost of re-usable process \( j \) is \( (C_{RP})_j \), then the derived total cost for non-eSDP and eSDP cases can be written as where \( S_r < S_a \) and \( P_r < P_a \).

5. Conclusion

The usage of Loosely Coupled Architecture with eSDP model will minimize the workflow and optimize Cost, Time and Resources for the efficient services delivery to stakeholders through the e-Governance across various devices. Citizen enjoys quick services with less cost, reduced workflow and easy delivery of services by using Interoperable Components, services and offer eSDP service registry across various domains. And also enables service availability from anywhere anytime to the citizens. The Application Service Provider also drives benefits from eSDP by reducing the development life cycle and leveraging re-usable services and components. ASP can innovate new services by judiciously combining the available reusable services and components. Central Ministries and State Departments can leverage eSDP by way of quickly designing and deploying the applications, quick implementation period within less time and lower cost. Information and services is anywhere, anytime monitorable. Proposed system also provides an effective tracking and accountable federated services with quality, scalable performance and maintainability of new services. Thus all Stakeholders can leverage eSDP model for effective service delivery with minimum of Cost, Time and Resources. (eSDP- e-Governance Service Delivery Platform)

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