

## Bandwidth Management Dynamics in India's E-Governance

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**Abstract.** As part of Economic and Administrative reforms in 1991, Indian government embarked upon a very ambitious program to promote its E-Governance ( I.T. in Government ) process in order to bring transparencies and accountability in the public information services system .The prime objective was to provide reliable and timely information to the citizen at the grass root level across all geographies. The public information access system was thoroughly analyzed and series of measures in terms of establishing a robust Broadband Network infrastructure adopted connecting few villages, districts and blocks across India.

As part of this initiative in National e-Governance Program ( 30-Mission mode projects ), government of India allowed public and private sector organizations to set up national Broadband Network ( NICNET) at the center, State Wide Area Networks(SWAN) at the state level and district and block level Citizen Service and data centers (CSC) at grass root level to provide access to all e-Governance functional applications to citizens and the common man

To study the implementation process and various operational impediments in the e-governance program, a research study was undertaken on NeGP Passport Sewa Project, a pilot project launched in India for the first time using Public Private Participation model to facilitate faster issuance of the Passport to the individual. This paper highlights various findings on bandwidth management aspects in implementing an e-governance project with special reference to passport project

With prime objectives of providing seamless exchange of data across all government departments in e-Governance program ,this paper also highlights State-of-the art Fiber Optic Dynamic Broadband Data Communication Networks model to address problems of Bandwidth management and its utility using load balancing tools under extreme complex and multi level government departments . The paper discusses impact of Government policy measures on the Broadband Networks using varied technology architecture like ATM, Frame Relay and MPLS-VPN. This include issues related to the role of the private and the public Bandwidth Service Providers on the bandwidth management, latency, traffic congestion and the quality of service aspects.

**Keywords:** Broadband Networks, Frame Relay, MPLS-VPN,ATM Bandwidth Management, Latency, Traffic congestion

### 1. Introduction

Major reforms, evolution and massive investment took place in Indian e-Governance program through internal and external resources.

More government applications digitized but major crises in data and information transmission to end users due to lack of bandwidth availability

NICNET, NIC's only Broadband Network (IP/ATM Technology), had monopoly was under utilized in the absence of well defined Bandwidth Policy

Telecom Policy regulator -TRAI's Broadband Policy 2004 announced, became a turning point for implementing E-governance program more effectively.

Later NeGP established by DIT, took initiatives for few SWAN's at state level with 2Mbps Bandwidth speed, introduced PPP-model, gave Broadband services license to few Pvt. players

## 2. Study Focus

Study of the Bandwidth pattern in terms of its technology, provisioning and management in India's E-governance program, implementing 30 NeGP mission mode I.T. projects, 'Evolve a model in 'Bandwidth management practices,' which can serve as guiding framework in any E-Governance program.

## 3. Current Bandwidth Providers in India's E-Governance Program

NICNET: NIC's Government Network (512 Kbps), SWAN: State wide Area Network (2Mbps)-under implementation, Common Service Centers: Citizen service centers with a KIOSK for integrated delivery of all government services having bandwidth supply link with local SWAN or NICNET., Private Co's Tata Telecom, Tulip, Reliance Com.... (2-5Mbps)

## 4. Literature Review

TRAI: Till 2004, No literature was available specially in Indian context. Only two white papers published by its internal officials (Gupta, 2005) on norms to follow by licensed private bandwidth providers on QoS.\

## 5. DIT's Mission mode "National e-Governance Plan" (NeGP)

Developed in 2006, for providing services to citizens in their vicinity using Information & Communication Technology NeGP which implements 30 large ICT projects, was facing challenge of making its citizen centric applications available to the grassroot level users. The reason was the Research Gaps being inefficient Bandwidth provisioning. For providing efficient broadband services, Ministry of ICT and DIT decided to collaborate with Private Internet Service Providers.

## 6. Research Objectives

To study current status of bandwidth related practices being followed by government and private Bandwidth providers in E-Governance program.

To analyze various technical and non-technical bandwidth related issues impacting e-Gov. projects.

To identify variations, barriers and bottlenecks in Bandwidth provisioning in Passport Sewa Project.

To study and suggest bandwidth management tools, softwares and devices which if deployed can enhance network efficiency and QoS.

## 7. Research Hypothesis

Null Hypothesis : There shall be no significant changes in Broadband Network infrastructure of private and government Bandwidth providers and there is no impact of bandwidth management in effective implementation of E-Governance projects.

Alternate Hypothesis : Efficient and effective Bandwidth management can impact efficiency in implementing E-Governance projects.

## 8. Research Methodology

Detailed research undertaken using Two broad methodologies

Empirical : Questionnaire based survey at 3-Pilot Passport project sites

SAP-LAP analysis of bandwidth providers of Passport Sewa Project

Empirical Study data collected through two Questionnaires

1. Passport aspirants approaching Passport Sewa Kendras
2. Two bandwidth providers of the Passport Sewa Project.

SPSS S/W was used for hypothesis testing. Non parametric Man Whitney U and Wilcoxon test was used to test hypothesis.

Flexible Systems management methodology has been used to study Bandwidth Management aspects of the two bandwidth providers in the Passport project.

The case study is analysed using SAP-LAP (Situation-Actor-Process) - (Learning-Action-Performance) research tool.

## **9. Findings– Major highlights of two cases**

Empirical data analysis

SAP-LAP Case- study analysis

## **10. Empirical Survey Results**

Nearly 58% of the respondents were satisfied with PSK internet speed while the rest felt frequent disconnection to access Passport application and check their application status.

Queue length of the passport applicants at each PSK counter follow an evenly distribution with 10 applicants at a time.

86% of the respondents were comfortable in accessing Passport application through Internet services at their nearest PSK during the peak-hours

Large number have reported frequent breakdown in internet services during non-peak hours .

74% of the respondents felt the response time to restore internet link was 5 minutes

## **11. SAP-LAP Concept**

The flexible systems framework (Sushil, 2000a) consisting of six steps of analysis : Situation, Actors, Process and Learning, Action, Performance (SAP-LAP). The methodology helps to understand change mechanisms in a systematic way through stepwise implementation and thinking over problem under six steps. Through E-Governance transformation we can bring complete change that further brings flexibility in the public services business and can be explained under the model given in the flow chart for detailed analysis. Table provides the SAP-LAP model used to analyse both the cases for E-Governance Transformation.

The dynamic SAP-LAP framework is helpful to compare the situations over the time. The comparison is made between brick and mortar to click and brick situations of Tata Teleservices and TULIP. Based on traditional situation, an action is taken which creates new e-services situation and leading to e-governance transformation model.

## **12. Major Findings**

The following technical parameters impacting Bandwidth Management both from user and stakeholders' point of view in both the situations were considered and studied in detail within SAP-LAP framework in the Pilot Passport Sewa Project at three locations, where both above mentioned situations exists.

Bandwidth Speed ,Traffic, traffic congestion, Load sharing and balancing, contention ratios, bandwidth latency, Network capacity, performance and infrastructure architecture, Bandwidth demand and utilisation, transmission medium i.e. Fibre/ Copper or co-axle cables and the QOS. The parameters details are taken from literature and supported by the Pilot case study and trial run undertaken at three locations where bandwidth availability is in load sharing basis and independent supply by the stakeholder is available.

The flexible and Dynamic SAP-LAP framework is used to systematically understand utility and allocation of required Bandwidth to access citizen-centric applications in Passport E-Governance project .

The case studies of Tata Tele-services and TULIP ( Stakeholders) were analysed through Dynamic SAP- LAP framework - based on different situations when these stakeholders are providing bandwidth directly through their Pipe to users independently to access passport application

Test Statistics		
Test	Speed	Queue
Mann Whitney U	113.00	71.50
Z (Asymp.Sig (2-tailed)	-0.704	-2.00
Asymp. Significance	0.481	0.045

### 13.Test Results

Null Hypothesis : There is no difference between the Single bandwidth provider (ISP) and Shared bandwidth provider(ISP) on the basis of ‘Speed’ or ‘Queue’ length.

Alternate Hypothesis : There is a significance difference as the results show that the significant value for speed is 0.481 and for Queue length is 0.045.

Hence null hypothesis is not rejected in ‘Speed’ because for rejection it should be < 0.050 in ‘speed’ but rejected in ‘Queue’. This implies that shared bandwidth provider is having lesser ‘Queue’ then with single bandwidth provider even when both have similar bandwidth Speed at any given time a passport applicant approaches a PSK .

### 14.Recommendations ( Empirical study)

TRAI, DIT and Ministry of ICT to frame policy guidelines on all aspects of bandwidth separate for private and government bandwidth providers.

As a learning process outcome ,bandwidth providers should establish in house training facilities to conduct skill enhancement programs for its staff to handle bandwidth related issues efficiently.

### 15.Recommendations (based on SAP-LAP analysis)

Both bandwidth providers associated with Passport project should use latest available bandwidth management devices and tools such as bandwidth sharing, load balancing, media conversion devices.

Both bandwidth providers to make coordinated efforts preferably with strategic alliance to share bandwidth with each other in any NeGP project.

Both needs to use latest Network monitoring device to detect any link failure at multiple hops.

### 16.SAP-LAP analysis Results

The Network Architecture of both Tata Tele-services and Tulip must use the following for speedy services to the passport users :Specialised software for Bandwidth Shaper , Traffic shaper and Rate Limiter.Media Conversion device to convert transmission from copper to fibre from POP to next demarcation point.ipMux Multiplexer- an optimum bandwidth allocation device among many concurrent users across several locations simultaneously in the Network Broadband Service Router (BSR 64000 ) for Dynamic Load balancing to balance traffic between two bandwidth providers PSK’s, Police Department and MEA centre nodes.Cyberroam, an automatic traffic blocking device for regulating information flow in accordance with Network pre-defined bandwidth management policies.StoneGate a specialised software for assessing and evaluating bandwidth requirements quality ( QOS) and Monitoring of traffic.InfiniBand Switch to control and optimise Latency solution across Network nodes & Cisco’sBroadband Network Performance Monitoring solution.

Synthesis of Results

<p>Strategic Initiatives</p> <p>TRIA and DIT to frame BW management policy guidelines</p> <p>Old technology ATM, FR, Networks to be upgraded to MPLS by SWANs</p>	<p>Strategy: R&amp;D efforts</p> <p>BB Network Technologist to step up R&amp;D on new technologies with BW management tools</p>
<p>Strategy: Limited efforts</p> <p>Synthesis results on comparison of ATM, FR &amp; MPLS-VPN network technologies</p>	<p>Strategy: No efforts</p> <p>BW providers to upgrade their networks with appropriate BW management software.</p>

### **17. Based on the above the study suggested the followings for future research work:**

Implement results of this study to other similar national level NeGP project in phased manner Macro level study on bandwidth related issues may be encouraged through upcoming research scholars DIT should upgrade existing ATM / Frame Relay based SWANs to more technically efficient, low cost and fast speed with better QoS MPLS-VPN networks at the earliest for speedy implementation of E-Governance projects TRAI to frame policy guidelines on various aspects of bandwidth including bandwidth sharing and load balancing arrangement among government and private bandwidth providers Bandwidth providers of Passport project are advised to frame and implement bandwidth sharing policy with the other bandwidth providers like SWAN / NICNET.

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