

# Research on the Design Architecture & Services over a State Wide Area Network: A case of Himachal Pradesh

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**Abstract**— Information Technology and Communication Technology has become the major component of our government system. E-governance has made it possible for the government to implement a transparent and efficient governing system. It has played vital role in simplifying procedures and providing real time information to people. The vision behind implementation of State Wide Area Networks under the National e-Governance Plan by the Government of India played a key role in the success of e-governance system. These projects are now backbone of states and the country as a whole. We present the network architecture and analysis of State Wide Area Network implemented in the state of Himachal Pradesh. Details of various services currently being offered and future scope of services has also been identified and presented.

**Index Terms**— e-governance, ICT, NeGP, Network, SWAN

## I. INTRODUCTION

Governments are proactive in the use of information technology and planning new ways of interacting, improving services, optimizing processes and revitalizing democracy by spending amount on it. The second phase of World Summit of the Information Society held in Tunis in 2005 affirmed its commitment in developing and implementing e-government applications based on open standards in order to enhance the growth and interoperability of e-government systems, at all levels, thereby furthering access to government information and services. Moreover, the Doha Action Plan (DAP) adopted by the World Telecommunication Development Conference (WTDC) in March 2006 has resolved to conduct detailed studies on various ICT applications giving priority to e-government, without however neglecting the other applications [1].

Government of India (GoI) has also recognized the need of standards [2] for implementing a successful e-governance system. Following has been identified as key areas:

- Technical Standards and E-Governance Architecture
- Metadata and Data Standards for Application Domains
- Localization and Language Technology Standards

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- Network and Information Security Standards
- Quality and Documentation Standards

Himachal Pradesh (HP), a state located in the western Himalayan region of India has been identified as a leading state in the successful implementation of e-governance projects. Taking a serious note, the GoI has also given important consideration to the network and information security standards.

Information was obtained using interviews with concerned officers and officials. The interviews attempted to identify the details of technical issues about the HIMSWAN network architecture. Observations were also made by the researchers during the interviews in order to capture some additional information which could not be revealed using interviews.

## II. HIMSWAN

HIMSWAN aims to provide link to Government Offices and Integrated Community Service Centers at State, District, Sub-Divisional, Tehsil and Block headquarters in Himachal Pradesh. There is adequate bandwidth provision to meet the increasing demands of data, voice and video transmission. HIMSWAN connects Sub Division/ Tehsil/ Block headquarters to respective District headquarter and District headquarters to the State headquarter.

Department of Information Technology (DIT), Government of HP (GoHP) has designated Society for Promotion of IT and e-Governance (SITEG) as the implementing agency. State Government through its agency acts as facilitator for implementing the project and subsequently provide horizontal connectivity to various Departments. Besides providing policy, regulatory and other support, State provides site for HIMSWAN points of presence (PoP) and identify applications to be deployed over SWAN. GoI released funds to SITEG for the whole project for a period of five years. Hewlett Packard India Sales Pvt. Ltd. was to supply, install, operate and maintain network for 5 years (Shortlisted through an open tender of Rs. 51.31 crores by DIT, GoI). HIMSWAN is a long term project which is planned to be implemented in various phases.

A local area network has been established in the HP Secretariat with the provision of 600 nodes with an ultimate target criterion of at least one PC for three officials [3]. Rs 1.55 crore have been spent during the completion of the first

phase and the network has successfully started functioning. It has also been connected with Internet.

Secretariat has to largely depend on the Directorates for data. Directorates, in turn, have to rely on their field offices for these inputs. Therefore, this Local Area Network of the Secretariat should expand to become a Wide Area Network for the entire State to retrieve instantaneous, accurate and updated information in the prescribed format.

Secretariat, Departments, District, Sub-Divisional and Tehsil offices shall be linked with one another for immediate availability of data for queries and reports. This also envisages provision of a network from the State-headquarter level down to the Tehsil/ Sub-tehsil level [4].

A total of 3366 Common Service Centers (CSC) have been opened in the state to. Another project called Integrated Community Service Centre (i-CoSC), is an enlarged version of the CSC to be implemented at a much larger scale. It aims at providing a single gateway for various citizen related services. It was launched (on pilot basis) in Shimla, Mandi and Kangra districts in the first instance. Scanners, printers, CD writers etc. can also be shared across the network.

#### A. HIMSWAN Architecture

Architecture of HIMSWAN (Fig 1) contains:

- A Star Topology enabling complete and granted bandwidth availability.
- 4 tiered architecture:
  - o 1st Tier : State Head Quarter (SHQ) - 1 POP
  - o 2nd Tier: District Head Quarter (DHQ) – 12 POP
  - o 3rd Tier : Tehsil Head Quarter (THQ)- 120 POP
  - o 4th Tier : Local Level Departments
- DHQ to SHQ connectivity is termed as a Vertical connectivity and Connectivity of various District level organizations and departments to the DHQ is termed as Horizontal connectivity.
- Vertical connectivity has been done with the help of managed leased lines from Bharat Sanchar Nigam limited (BSNL).
- Initially, a bandwidth of 2 mbps for the vertical connectivity which can be extended to 16 mbps as per requirements.
- Major Government departments have been provided connectivity with optical fiber ensuring reliable horizontal connectivity.
- Mix of wired and wireless technologies has been chosen as connectivity medium. Following standards has been opted for connectivity:
  - o Distance : < 100meters: Cat 6 UTP cable.
  - o Distance: >100meters: LAN extension using UTP if possible; otherwise optical fiber cable (OFC).
- Wireless connectivity has also been used to provide connectivity where wired connectivity was either not possible due to hard geographical conditions or tough terrain or was a costly solution subject to the condition of availability of clear line of sight to POP. Wireless links have been provided with a bandwidth of 54 kbps (in theoretical terms).
- xDSL lines has been used where neither line of site was clear and the distance was greater than 1 km. For

bandwidth hungry applications in such conditions, broadband connectivity is used.

- Locations where neither xDSL line nor broadband was possible, and distance was greater than 1 km, OFC is used.
- Managed layer 2 and layer 3 switching has been used for efficient traffic processing.
- Security factors have been ensured with the usage of current generation firewalls and other physical security measures.
- Disaster recovery mechanism has been ensured by using proper backup solutions in the state data center (SDC).

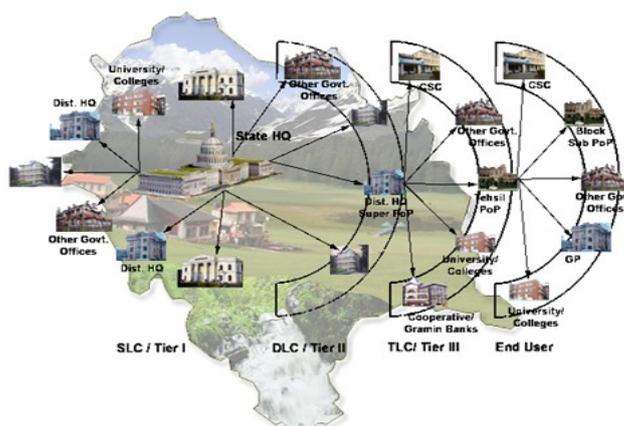


Fig 1: HIMSWAN Architecture

### III. ANALYSIS

#### A. Strengths

- Use of a leading ISP (BSNL) as a major connectivity provider has ensured security of the network.
- Connectivity of important departments over optical fiber has ensured congestion free network and higher quality of service.
- A cost effective solution has been opted by using BSNL's existing network infrastructure for connectivity.
- Block level coverage has ensured maximum utilization and effectiveness of the network.
- Implementation according to the standards framed by DIT-GoHP has ensured compatibility among various network devices used in different cores of the network.
- Standards implementation has also ensured smooth working and monitoring. This has also denied need of highly technical manpower at each level of the HIMSWAN core thus saving budget as well.

#### B. Inadequacies

- Available bandwidth (2 mbps wired or 54 mbps wireless) can become a bottleneck with rising complexity and advancing technology. Low bandwidth may lead to choking of the network, resulting in poor quality of service.
- Redundancy feature is not available at most locations. Tough terrain is prone to cutting of cable due to the landslides, so missing of redundant paths becomes as important issue at times.
- Since a nation-wide ISP has been involved for connectivity at various levels, data security is needed.

- Lack of awareness among people. All officials/ residents of the state are not familiar about the usage of HIMSWAN connectivity.
- Lack of a proper feedback and usage monitoring mechanism.
- Maintenance and implementation has been provided to a third party. This may create a problem if the same agency does not get renewal of the work to maintain continuity.

### C. Opportunities

- GoHP may start building its own State Wide optical fiber network to solve problems of bandwidth, security, congestion etc. This shall also save the cost of leased line to be paid yearly to the ISP.
- Encourage use of cloud computing environment [5] as it helps enabling E-Governing services faster and cheaper thereby accelerating the adoption and use of Information Technology for e-services [6]. Cloud architectures allow rapid deployment of turnkey test environments with little or no customization [7].
- In house technical support team to maintain such a crucial infrastructure.
- In house quality and security assurance team.

## IV. SERVICES

### A. Current Services

GoHP has various services over HIMSWAN:

- Online Bus Reservation (Himachal Road Transport Corporation)
- Integrated web interface for transport services (Vahan & Sarathi)
- e-Registration for Electoral Lists
- Water/ Electricity/ Phone bills payment through SUGAM Integrated Community Service Centers
- Weekly pricing of essential commodities - Economics & Statistics Department.
- Online registration/ Fee payment for various recruitment examinations - HP Public Service Commission
- Court Case Monitoring System Software for Divisional Commissioner office
- Factory database for Labour & Employment Department involving employment status and opportunities
- Statistical Data of Colleges
- Computer Call Monitoring System based Services
- Web Server (<http://hp.gov.in>) to host websites/ applications
- Database Server (SQL Server) to store data of various web based applications, thus saving money of individual departments to buy databases for their applications and to hire technical people to maintain servers.
- Mail Server ([hpmail.gov.in](mailto:hpmail.gov.in)) to create email accounts of officers/ officials and departments. Users get email addresses as [username@hp.gov.in](mailto:username@hp.gov.in)
- Antivirus Server to protect all the PCs connected with HIMSWAN from virus attacks and relieve individual user departments to spend money for buying Antivirus software
- Internet Connectivity is being provided over HIMSWAN. Therefore, there is no need to take broadband connection or any other connectivity in government departments for internet access.

- Domain Controller: In order to make efficient use of HIMSWAN, this facility has been created to define various policies for different users/ offices connected to HIMSWAN depending upon their requirements (ie internet facility with limited access to avoid misuse, disablement of CD/ floppy drives/ USB drives in all those PCs which are being used for front-end operations and being operated by contractual manpower).

### B. Proposed Services

Following some services, if provided over HIMSWAN, shall lead to better utilization of the network infrastructure ensuring efficient and transparent e-governing system:

- E-Learning system to provide quality education to students living in various distant locations in the state. This can also be a solution to the problem of lack of availability of quality teaching staff.
- Artificial Intelligence based systems for delivering citizen friendly services using techniques like genetic algorithms [8] etc.
- Online Shopping Portal for various products produced by either government agencies or small scale units or house hold societies (MSMEs). This will benefit both the producer and consumer in term of availability and price.
- Environmental Monitoring System to provide early warning system. This will also help preventing natural disasters.
- Student information portal providing information on various aspects such as latest technology, job market trends, test dates, syllabus etc. to students in planning carrier options.
- e-OPD centers to provide consultancy to patients. Some work in the related domain can be found in [9], [10].
- Online availability of free/ open source software for download purpose to reduce traffic over SWAN.

## V. CONCLUSION

Worldwide revolution in technology is changing our lives in terms of the way we work, learn and interact. These changes naturally reflect the way government functions in terms of its organization, relationship with citizens, institutions, businesses and cooperation with other governments. E-Governance applications have the capability to transform the nation into an Information Society. It delivers cost-effective services, which can drive growth of the economy and government productivity. Himachal Pradesh has led forward the nation in adopting its use through the HIMSWAN.

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