Steps towards effective eGovernacne framework in India

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A B S T R A C T

Server consolidation based on virtualization technology will simplify system administration, reduce the cost of power and physical infrastructure, and improve utilization in today's internet-service-oriented enterprise data centers. The basic use of virtualization is the optimization of technical resources, improved service delivery with valuable reduction of the cost. The benefits of virtualization are typically considered to be server consolidation, increased availability, isolation, ease of operating system deployment and simplified disaster recovery. As the size and complexity of modern computing systems keep increasing to meet the demanding requirements of performance applications, manageability is becoming an important concern to achieve both performance and productivity computing. Here I am presenting analytical framework for utility computing for effective e-Governance using Virtual Machines to achieve testing and R & D, new effortless deployments, basic system administration, adaptability, scalability, new models of service delivery, efficiency, enhancement, user convenience, sustainability, and leverage of shared government infrastructure. However to deliver the maximum throughput requires careful attention toward system details for the minimal loss of CPU performance and I/O efficiency.

Keywords: Virtualization, Virtual Machine, Service Delivery, resource optimization, e-Governance framework, and throughput

The case study, implementation and analysis carried out for NLRMP MMP by NIC, District Unit, Akola and Collector office, Akola in coordination.

I. INTRODUCTION

Research Problem: Why this research?

Aim of this research is to study, use and analyze virtualization to facilitate the effective e-Governance which involves efficient and optimum use of technical resources for the improved service delivery, throughput, efficiency and cost effective solutions, and to provide concrete framework for e-governance in India

Technique: Virtualization as concept and Virtual Machine as object

Purpose/ Objective:

The basic objective is resource optimization using Virtualization, Server consolidation, leveraging the shared govt. network NICNET for the utility computing to facilitate effective e-governance with increased throughput, improved service delivery.

Background

E-governance means use of electronic and computing technology for efficient and optimum use of electronic resources for improved service delivery, efficient and cost effective framework for governance.
Literature survey shows that following factors are responsible for e-Governance.
ICT, Efficiency (Strength, Load Handling, Reach, stability, disaster Recovery. Capacity, skill , reliability), Productivity, Reachability, Sharing of Information, Welfare
The main parameters affecting to failure / success of e-governance projects are project definition, control system, project estimations, skills, resource management and feasibility analysis. Only 15% of the e-governance projects attain success in all respects.

The major components of e-Governance infrastructure are the Government Data Centre (GDC) for storage of data with application, shared infrastructure that is network for the delivery / collection channel, and the accessibility.

The Government Data Centre (GDC) is the most important component of e-governance infrastructure. The challenges occurred in the designing of a GDC are higher capital cost for infrastructure, higher operating costs in managing and administering various types of servers, storage utilization and recurring deployment of multiple applications on distinct platforms [8]

E-Governance is facing a problem of unproductive investments and it needs to be monitored [9]. To achieve the objectives of National e-Governance Plan (NeGP), the e-Governance framework needs to be improved. Virtualization including cloud computing is the most effective solution to meet all goals of e-governance services to the citizens. Nevertheless there are some security issues but despite of it is capable to ensure faster and cheaper delivery of services through service oriented architecture [10].

In the general virtualization environment, each virtual machine runs several classes of jobs; our task is to estimate the utility in each virtual machine. In around 2011 National Land Record Computerization Program (NLRMP) Mission Mode Project (MMP) were having challenges in the state of Maharashtra like the unavailability of the server hardware and incompatibility of the server operating system with the new latest available computer systems for Property Card Information System (PCIS) and Land Management Information System (LMIS) applications. Due to limited availability of the technical resources, a base line study is carried out and a case study has been conducted and instead of the traditional approach of running single operating system on the single computer system the innovative use of Virtualization is adapted mainly for the efficient and optimized use of technical resources.

TILR Offices, SDO and Tahsil offices facing strong difficulties related to availability, operability and maintenance of hardware, software resources for LRC, particularly as there is no Server Hardware provided for Red Hat Linux 7.2 Server , the old computers become obsolete and unavailable and new computers are not compatible with RH Linux 7.2 server. NIC district units also facing the similar problem of unavailability of hardware, software resources for Red Hat Linux 7.2 Server and Windows System for the sophisticated LRC applications of data uploading on web site, Agri Census etc

Sophisticated, tedious, technical efforts, time and cost consuming technical installations and support for Red Hat Linux Server 7.2 server and Windows client for PCIS, LMIS, Agri Census, 7/12 and Property Card data hosting on web site, for both LRC users as well as for NIC, district units.

This situation very adversely affecting on service delivery, throughput, efficiency and cost

Beneficiaries:

- **SLR, TILR offices:** for Property Card Information System (PCIS), and Property Card Data Hosting on District Web Site.
- **SDO, Tahsildar Offices:** for Land Management Information System (LMIS), Agri Census, 7/12 Data hosting on District web Site, e-Chawdi and e-Mutation.
- **NIC District Units** for Technical Implementation and Support , Disaster Recovery for PCIS, LMIS, Agri Census, implementation at District, Sub Division and Taluka Level, 7/12 and Property Card Data Uploading on web site, Agri Census, e-Chawdi, e-Mutation, Unicode Data Conversion.

II. STEPS TOWARDS EFFCTIVE E-GOVERNANCE

Effective e-Gov is based on
- **Free and open source software (FOSS)**
- **Virtualization**
  - **Server Consolidation (to Save Server Hardware per location)**
  - **Cloud computing (Live Virtual Machines virtually accessed by users remotely)**
- **Leveraging shared government infrastructures**

FOSS → Virtualization & Consolidation → Leverage shared Govt. Infrastructure → Utility Computing G2G,G2C,G2B&G2E
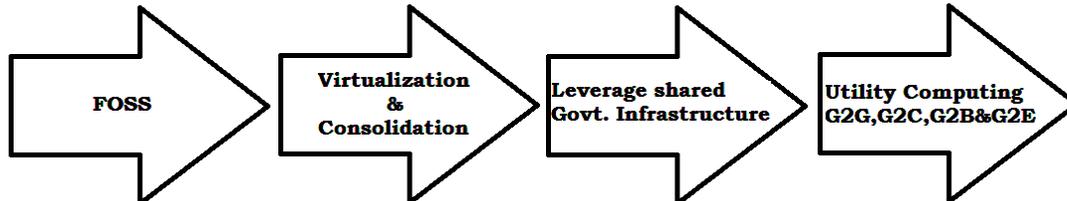
Proposed framework for effective e-Governance

Features

The proposed framework can provide a cost effective solution for e-governance by using Free and Open Access Software for development and deployment of e-governance applications, virtualization and consolidation techniques for management of e-services and cloud computing to deliver the maximum throughput enhancing the accessibility of services among remote locations. The major features of the proposed framework are depicted are under:

- It will help valuably to deliver maximum throughput
- It will help in reducing the cost of hardware incurred in facilitating e-governance services to citizens.
- It helps in reducing cooling requirements in establishment as well as maintenance of Government Data Centers (GDC's).
- It also reduces the total cost of ownership on e-governance projects by reducing the costs incurred on acquiring various types of hardware and software licenses from private vendors.
- It also gives solution to enhance the availability and accessibility of e-services in disadvantaged areas of country.
- It facilitates scalability of e-governance projects as the data volume in e-governance projects increases enormously.
- It promotes interoperability in the e-governance applications for reducing data redundancy and hence increases consistency of data.
- It helps for the backup and disaster recovery, effortless deployments, security, testing and R &D

Motivation

- ➢ Need of efficient and optimized use of technical resources (Hardware, software, network and human resources) due to limited availability for increased throughput, improved service delivery and cost effective framework for e-Governance in India.
- ➢ Use single physical computer system logically as a multiple computer systems : Running multiple OS simultaneously : Instead of using traditional approach of running

single operating system at a time on single physical computer system, the initiative is the Innovative use of virtualization technology to run the multiple distinct OS at time on single computer system for resource optimization

➢ Server Consolidation: Setting up distinct isolated client and/or server operating system on the single computer system to save the server hardware per location

➢ All type of Operations which physical computer system performs on File/Folders as object using operating system, that Virtual Machine software performs on complete virtual computer along with operating system as object including creation, updating, removing, renaming, customizing , move, copy, backup and restore, sharing, Auto start, import/export etc.

➢ Software Hardware portability:
   • Sharing the same hardware among many software platforms
   • Allowing software to be "portable" between various operating systems, as well as running older software and OS on a newer computer.

All of these uses of virtual machines are very important to the way that we compute today

Business Process Reengineering (BPR)

Adaptability, Scalability, New models of Service Delivery, Efficiency & Enhancement, User Convenience, sustainability, Leverage of Shared Govt. Infrastructure

Instead of traditional non virtualized approach of running single operating system at a time on the physical computer system, installations of operating system and application software's, data base and network configurations, installation of devices, data backup and disaster recovery, repeated deployments of sophisticated applications at large number of distinct locations, the broad innovative efficient and enhanced, user convenient approach of Virtualization using Virtual Machines of isolated execution of multiple operating system at a time simultaneously is adopted for the efficient and optimized use of the technical , financial and other resources to facilitate effective e-Governance by server consolidation and sharing and replications of complete operating system instead of just files, distribution of sophisticated applications software of client / server completely working with operating system.

Technical Strategy: Research line of action methodology

➢ Developed cloud of Virtual Machines of variety of OS Windows, Linux etc of variety of version, distinct Server and client operating system and physical machines, in order to use single physical computer virtually as multiple computer systems along with server consolidation.

➢ Investigated, implemented and analyzed functionality and utility of the VM's with various operations for our objective resource optimization with saving server hardware per location, increased throughput, Improved Service Delivery, effortless deployments backup & disaster recovery and cost effective framework.

➢ Developed a data centre and hosted cloud of VM's on it.

➢ Distributed readily distributable VM's widely through data centre leveraging shared Govt. network NICNET to the NIC District Units who has downloaded and implemented the same at their respective LRC locations in the district.
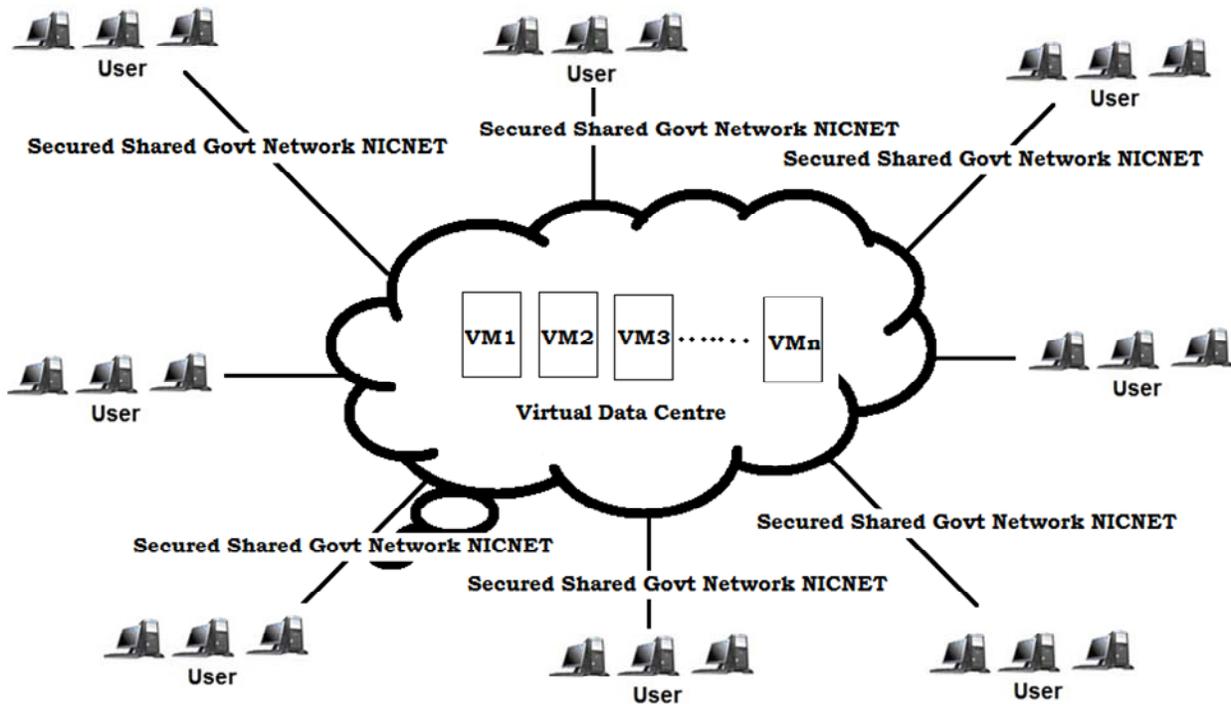
Fig : Technical Strategy/ Methodology: Research line of action

Implementation model: Activities with Methodology adopted:

a. The overall basic concept used is the running distinct isolated multiples operating systems at time on the single computer system using Virtual Machines with saving of server hardware per location. Basically in order to optimize and effective use of the **hardware, software, network and human resources and, technical efforts and exercises to achieve goal in targeted time configured Virtual Machine** of Red Had Linux Server 7.2 and Windows client on the same computer system running simultaneously at a time.

b. Developed cloud of Virtual Machines of **Red Hat Linux Server 7.2, Windows XP client for 7/12 RCIS, Property Card (PCIS), Windows XP , Windows 7 Professional X64, Windows 7 Ultimate X86, X64 and Windows 8 Professional 64 etc** using the variety of Virtualization software's Vmware, Virtual Box, Microsoft Hyper V, Window XP mode, Microsoft Virtual PC etc, of variety of OS Windows , Linux etc of variety of version, Distinct Server and Client Operating System and Physical Machines, in order to use single Computer virtually as multiple computer systems.

c. There was limitation in commonly accessing these developed Virtual Machines by the remote users beneficiary offices at the subdivision and Tahsil levels in the districts of Maharashtra, as there is not a common network available as the NICNET connectivity is not available at subdivision, Tahsil level. Also we have no adequate server infrastructure available to handle the load of complete state. Therefore it is decided to distribute the readily usable Virtual Machines to districts level using NICNET and then to be implemented at remote locations through the respective NIC district units.

d. Customized all the Virtual Machines including Red Hat Linux 7.2 Server and Windows client for the ready distribution in order to simply copy and use. Tested the smooth working of readily distributable LRC VM's of 7/12 and Property Card Red Hat Linux 7.2 server and windows client with neighboring districts Washim and Buldhana

e. Then replicated these tested readily usable Virtual Machines by copying to large number of Computer Systems between host servers, on Various Old, New Computer System and Laptops, for saving the Server hardware Cost per location, backup and Disaster Recopy, Easy and quick Testing and R & D, new effortless deployments and

basic system administration tasks and get the Client Server based E-Gov. activities through minimum trained staff.

This way the single computer system is efficiently optimally used logically as multiple computer systems with various distinct operating systems in hand running simultaneously at any time as guest using Virtual Machine technique using Virtual Machine software of VMware Workstation Server Version 7.x, 9.x and 10.x. Shared the Virtual Machines and auto started it with the local host as well as configured the remote host shared virtual auto start with the respective remote Host.

Investigated, Implemented and analyzed utility of Virtual Machines for LRC LMIS, PCIS and NLRMP with the variety of operations like creation, updating, removing, renaming, customizing, move, copy, backup and restore, sharing, auto start, import/export etc are performed on Virtual Machines using variety of Virtual Machine software's like Vmware, Microsoft Virtual PC, Virtual Box etc. Using this delivered optimized and efficient use of the hardware, software, network, human resources, technical efforts and exercises and achieved goal in targeted time for client server based Land Record Computerization project with saving of server hardware per location for LMIS,PCIS, Agri Census, e-Chawdi and 7/12 data uploading on website, and timely achieved the works for the public service delivery with saving costs for the maintenance and support of the hardware software's and saving Server hardware per LRC locations.

Implemented server consolidation by running Linux Server and Windows Client simultaneously on Single Computer, Server Hardware cost for 7/12 and Property Card per LRC location at District and Tahsil (Block) level is saved.

Used Virtual Machines of Red Hat Linux 7.2 as Server and Windows XP SP2 client on the single computer system, for LRC 7/12 and property card data conversion and uploading on District web site, Agri Census works, property card Implementation for all the Tahsils in the district as there are no servers provided for property card . Copied and used these Virtual Machines for uploading LRC 7/12 abstract data of multiple Tahsils at a time. Used the same Virtual Machines with Agri Census utility for Agri census work at Tahsils.

f. In order to distribute the ready Virtual Machines to other districts, the stable , secured ftp server is developed, and hosted the cloud of tested ready usable Virtual Machines of Red Hat Linux Server 7.2, Windows XP client for 7/12 RCIS, Property Card (PCIS), Windows XP , Windows 7 Professional X64, Windows 7 Ultimate X86, X64 and Windows 8 Professional 64 on the ftp server over leverage of Shared Government infrastructure NIC's secured and stable high speed NICNET Network 34/100 MBPS lease line connectivity for download and use by the District in Maharashatra.

g. Districts in Maharashtra has downloaded readily usable Virtual Machines through ftp and using it smoothly and implemented it at the LRC locations in the respective District in Maharashtra, with effortless deployments, server consolidation and optimization of the technical, financial and other resources.

h. The technical implementation of this project "Virtual Machines" for Land Records Computerization is smoothly executed with the optimum use of the available technical Hardware, Software, Network and human resources without any fund and expenses.

The full Project Details with Research Papers with R & D ,Analysis and findings are available on the District Website of Akola Titled as **Virtual Machine : NIC Akola** in E-Governance menu, with the link http://akola.nic.in/vm1.html

III. ANALYSIS RESULTS

We have adopted Virtualization and around 500 servers are saved with server consolidating by installing Red Hat Linux 7.2 and Windows client on the single physical computer system. There was a great enhanced and efficient benefit in throughput, effortless deployments, easy backup and disaster recovery, sustainability, user convenience, adaptability, reachability and scalability, software hardware portability, new models of service delivery. There is a major saving nearly 30% in technical human resources and in space, furniture and electricity.

Based on these observations and detail utility analysis, we can conclude that

a. The overall basic scope for the service is the running distinct isolated multiples operating systems at a time on the single physical computer system. The single computer system is logically used as multiple computer systems with various distinct operating systems running isolated to each other at a time simultaneously, using Virtual Machines:

b. This is practically very useful when we have to do the processing /data entry on client and server Environment at large number of distinct locations and where the server is just required as a background service. Under such situation we can install the client and server on single system and process the work and this way save the cost of the server hardware per every location.

c. Virtual Machines are very useful to optimize the technical efforts and exercises, under the situation where a typical complex sophisticated application software is to be used at large number of distinct locations., to achieve the output target within less time with optimal use of the Hardware / software and resources.

d. The Virtual Machine software handles the guest operating system Virtual Machines as an instance for basic operations like creation, updating, removing, renaming, customizing , move, copy, backup and restore, sharing, Auto start, import/export etc. between the large number of computer systems between host servers with distinct old and new compatible/ incompatible software's and hardware's.

e. It is very useful to run the application on the computer system which contains the non supporting host operating system. Under this situation we can get the same application running and operational by installing the supporting guest operating system installed using the Virtual Machine.

f. Virtual Machines can also be easily moved, copied, and reassigned between host servers to optimize hardware resource utilization. Also we can customize the shared hardware configuration settings allotted to the Virtual Machine as per the need and requirements. and availability of hardware, software and network resources.

g. Virtual Machines are very useful to optimize the technical efforts and exercises, under the situation where typical complex sophisticated application software is to be used at large number of distinct locations, to achieve the output target within less time with optimal use of the hardware / software and resources.

h. Faster booting and processing**:** Another advantage is that booting and restarting a virtual machine can be much faster than with physical machine, since it may be possible to skip tasks such as hardware initialization.

i. Imagination to Guest VM as a physical server hardware: Typically, guest operating systems and programs are not aware that they are running on a virtual platform and, as long as the VM's virtual platform is supported, this software can be installed in the same way it would be deployed to physical server hardware

j. Virtual Machines are very useful for backups and disaster recovery and effortless deployments.

k. Useful for Testing and R & Purposes under client server environment

l. Import and export Virtual Machine: We can import / export Virtual Machines between the various virtual machine

m. It is very useful to run the application on the computer system which contains the non supporting host operating system. Under this situation we can get the same application running and operational by installing the supporting guest operating system installed using the Virtual Machine.

IV. CONCLUSION

This work suggests a deigned framework to deliver the maximum throughput using technical resource optimization with improved and cost effective e-governance services. The involvement of technologies like virtualization, consolidation and cloud computing and adoption of free and open source software in designing and deploying e-governance will lead towards maximum throughput using resource optimization with reduction in total cost associated with both hardware as well as software. Therefore it reduces the financial burden abide by the state and central governments. For ensuring the effectiveness of e-governance projects the traditional framework and approach of delivery mechanism needs to be reengineered. The impact of any e-governance project depends upon its utilization by the concerned group and hence there accessibility needs to be enhanced drastically.

AWARDS AND RECOGNITION

1. Received the e-Maharashtra 2013 Excellence Award for best G2G initiative for the project Virtual Machine.

2. Recognized at e-Governane recognized as eGovernance Champion for year 2013-14 on the occasion of UN public service day, 23rd June 2013 in the presence of Ms. Lise Grande, UN Resident Coordinator, India.

3. Winnder of Manthan South West India Awards 2014 in e-Governance Category.

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APPENDIXES

Appendix A: Resources

(Hardware, Software's, Network and Human Resources used for Implementation.)

- **Windows Server 2008 r2** as the Host Operating System on Dell PowerEdge 715 Rack Mounting Server for both LRC Red Hat Linux 7.2 Server and Windows Client
- **Windows XP SP2** : For Host as well as Guest LRC Client Virtual Machine with Crystal Reports and IBM Db2 7.2 Personal Edition on Old and New Computer Systems, Laptops. Also as Guest Virtual Machine on Host Windows Server 2008 on Dell PowerEdge 715 Rack Mounting Server.
- **Red Hat Linux 7.2** as Guest Server Virtual Machine with IBM Db2 7.2 Server DBMS for 7/12 rcis and pcis databases on Old and New Computer Systems, Laptops and on Dell PowerEdge 715 Rack Mounting Server.
- **Windows 7 X64** Professional Operating System as Host operating System for both LRC Red Hat Linux 7.2 Server and Windows Client
- **Windows 7 X64 Ultimate** Operating System as Guest Virtual Machine Operating System for LRC eMutation and eChawdi Unicode Conversion, Golu Character removal and Validation Application Software's
- **Windows 8 Pro X64** Operating System as Guest Virtual Machine Operating System for General Purpose Guest Virtual Machine Operating System with Common applications software
- **VMware-workstation-full- version 7, 9,10** for Developing Virtual machines as Guest Operating System of Red Hat Linux Server 7.2 and Windows XP and Windows 7 X64 Operating System.
- **Virtual Box and Microsoft Virtualization software's Hyper V server ,Virtual PC, Windows XP mode**
- **Network: Leveraged Shared Government infrastructure NICNET : NIC's secured and stable high speed NICNET Network 34/100 MBPS lease line connectivity for download and use Ready Virtual Machines by the District in Maharashatra.**
- **Human Resources: NIC District Unit Officials, Database Administrators (DBA's) of Tahsils's for LMIS and NLRMP , TILR computer operators for PCIS.**

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Appendix C: <u>Virtual Recorded Presentation with live Virtual Machines</u>

AUTHORS PROFILE

Nitin V. Choudhari completed his M.Sc. Computer Science degree from Dr. Babasaheb Ambedkar Marathwada University, Aurangabd in 1995. This author is working in premier S & T orgnization NIC of Govt. of India, from 1996 and presently working as Scientist C and District Informatics Officer at Akola, Maharashtra. He received the e-Maharashtra 2013 Excellence Award for Best G2G initiative for the project Virtual Machine initiated and implemented by him. He also recognized as eGovernance Champion for year 2013-14 on the occasion of UN public service day, 23rd June 2013 in the presence of Ms. Lise Grande, UN Resident Coordinator, India.