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Feasibility Analysis for Deploying a Centralized Information Exchange Infrastructure in Pakistan

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Abstract – *The state of the art technologies today have revolutionized the business processes of an organization by providing effective storage, retrieval and communication mechanisms. The most desirable feature of this technology is the secure data sharing among various business partners. Most of the organizations today rely on standard communication channels to share information among interacting partners. These standalone systems provide the intended benefits to some extent; but the communication between two heterogeneous work processes is a difficult task. To cope with the issue, developed countries like Germany, France, Sweden, Estonia and Denmark have developed centralized communication infrastructures for government and private/business organizations. Such infrastructure serves as a backbone for secure information exchange between G2G (Government to Government) and G2B (Government to Business). In developing countries like Pakistan, Bangladesh and Sri Lanka although the communication system is based on IT but segregated systems/processes are being used for information sharing among various organizations. The communication between governmental and private organizations is done in a traditional manner, which requires a cumbersome process of data formatting and information exchange. In this paper, we will explore and analyze the opportunities and constraints to develop/deploy the centralized communication infrastructure (CIPS: Centralized Information Processing System) in a developing country perspective. The paper presents the case study from Pakistan and analyzes the constraints and opportunities to develop such centralized infrastructure for information exchange.*

KEYWORDS: SECURE COMMUNICATION, INFORMATION EXCHANGE, CENTRALIZED COMMUNICATION INFRASTRUCTURE

INTRODUCTION

IT driven solutions have been incorporated in almost all business environments in today's technological era. Any organization lacking these IT artifacts cannot excel in this globally competitive environment. Therefore hardware and software solutions for business processes are being deployed at rapid pace. The core features of this rapidly growing technology are the information management and secure information exchange among various business partners. Governmental and business organizations are emphasizing to benefit from this technology and therefore considering automation of their data and work processes. The automation in each organization is carried out using its own segregated automated systems, which follow specific data standards/formats according to its organizational policies. Consequently, the communication and information exchange among these heterogamous work processes becomes a difficult task. Communication security, integrity and reliability of the information are the other critical issues. Developed countries have introduced backbone network infrastructure [1][2][4] for secure information exchange among business and government organizations. The brief descriptions of some of these infrastructures are presented later in section 2 of this paper. Developing countries

like Pakistan, Bangladesh and Sri Lanka are using the traditional communication system for information sharing among their governmental and private organizations. The paper highlights the benefits of using centralized communication channel and proposes the centralized information exchange architecture for a developing country i.e. Pakistan. The paper also presents the case study from Pakistan to explore and analyze the possibilities to deploy such infrastructure.

The paper is organized as follows: Next in section 2, various communication infrastructures from developed countries will be elaborated, section 3 presents the holistic view of the existing communication infrastructure in Pakistan and section 4 presents the concept of centralized communication infrastructure (CIPS) for information exchange. Section 5 describes the case study data from NADRA while section 6 presents the analysis of opportunities and highlights the constraints for deploying such infrastructure. Section 7 presents conclusion and the future work of this research.

COMMUNICATION INFRASTRUCTURES IN DEVELOPED COUNTRIES

Developed countries for example Sweden, Germany, France and Estonia have introduced a centralized backbone infrastructure for secure information exchange between government and private authorities. The purpose of providing such infrastructure is to facilitate robust and secure access to data across organizations and to enable secure information exchange through Internet, VPN (Virtual Private Network) and leased lines within and outside the organizations. A brief description of SHS (Sweden), X-Road (Estonia) and RASP (Denmark) is as follows:

A. SHS (Spridnings- och Hämtnings System)

Sweden has developed SHS [1] i.e. a centralized infrastructure for information exchange between public and private organizations in Sweden controlled by Swedish Government's central advisory Agency (VERVA). The model is also extendible to offer secure communication medium for communication and information exchange between governmental authorities and the citizens. Organizations need to configure SHS node at their communicating end that enables them to be the part of SHS communication system. Various projects have been deployed using the SHS functionality like ESAM (E-Society) that provides various electronic services to commune people in Sweden [9].

B. X-Roads (X-tee)

X-Roads [2] was launched in 2001 by the government of Estonia to provide a centralized communication channel through Internet to bridge governmental databases to various other data sharing sources in Estonia. After its initial evaluation/success from this project X-Road was deployed for electronic document sharing and for various E-government services i.e. E-police, E-health, E-election and Internet banking. It was developed and implemented by ASCell network and Cybernetica IT and controlled and maintained by Estonia Informatics Centre and Ministry of Economic Affair and Communications [2]. All Organizations communicating through X-Road need to install MISP (Mini information system portal) on their communicating servers. MISP provides a user-friendly interface to configure X-Road services and manage usage rights. Organizations can freely integrate their existing information system with X-Road services. A security server, which is standard software, is also installed on the communicating server. Security servers perform encryption/decryption, control unauthorized access, maintain usage logs and ensure a secure transfer of data over the Internet [3].

C. RASP (Reliable Asynchronous Secure Profile)

Reliable Asynchronous Secure Profile (RASP) is the Danish infrastructure for secure organizational communication developed by Danish National IT and Telecom Agency [4]. RASP provides a secure and reliable mechanism to exchange business documents among various organizations via Internet. The infrastructure was developed based on the input from various workshops from governmental and private organizations in Denmark.

EXISTING COMMUNICATION INFRASTRUCTURE IN PAKISTAN

Developing countries are emphasizing automation of their information exchange processes among various government and private organizations. Their existing communication and information exchange infrastructures are based on standard protocols and mechanisms using segregated systems. Although the information processing and storage is automated within the organization but each organization follows their specific data formats and standards. Therefore information sharing through this traditional way requires cumbersome procedures to make data mutually accessible. Automated data extraction among the organizations is a complicated task through these standard procedures. Figure 1 depicts the example of such traditional information processing architecture from Pakistan.
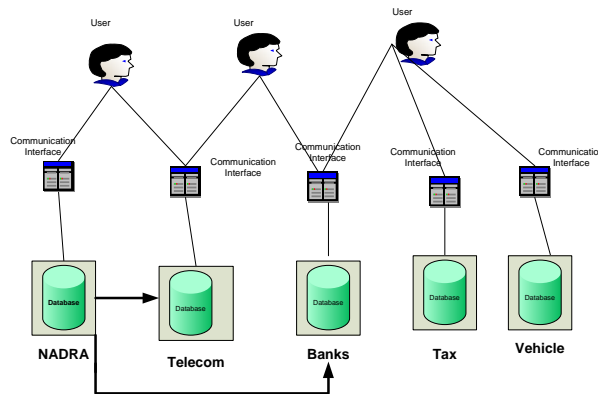

Figure 1. Existing Communication Infrastructure of Pakistan

In Figure 1, user access to data for each organization i.e. NADRA1, Telecom operators, Banks, Taxation Authority and Vehicle Department is segregated through their provided communication interface. Some organizations share the basic data but follow their own heterogeneous work processes which require lengthy data conversion procedures. For example, NADRA sharing limited citizenship information with banks through their online access system emphasizes the specific data formats used by NADRA.

PROPOSED INFRASTRUCTURE FOR INFORMATION EXCHANGE IN PAKISTAN

The proposed infrastructure for information exchange in Pakistan is based on a strong background study [9][10] of the various developed countries information exchange infrastructures. These infrastructures are already implemented and providing the intended benefits of secure, robust and efficient information exchange among various parties. SHS was considered for detailed exploration of the various components and analyzed for information processing and communication details. It provided basic rule of thumb to analyze the facts and to propose the infrastructure for Pakistan. The

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[1] National Database and Registration Authority, Pakistan

infrastructure is named as CIPS (Centralized Information Processing System) and its abstract level architecture is depicted in Figure 2 as follows:
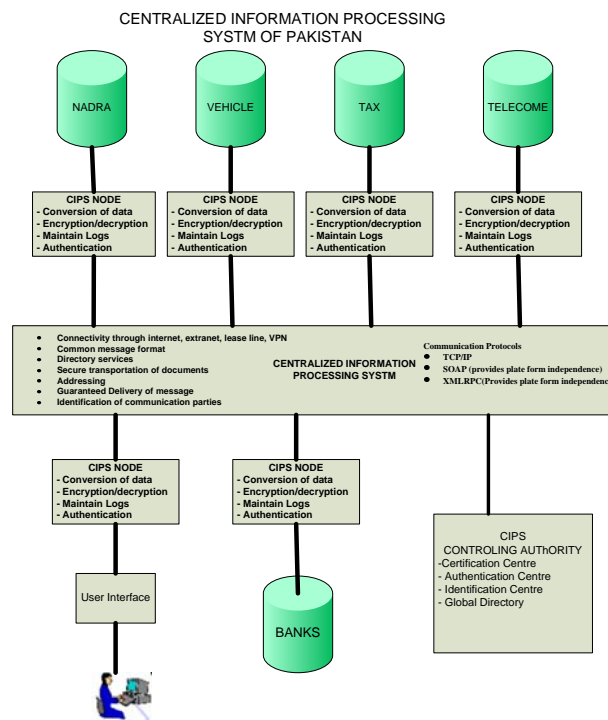

Figure 2. Proposed infrastructure for a centralized information exchange system

In Figure 2, for the proposed infrastructure the organizations are anticipated to communicate through CIPS that will act as a middleware for communication. A controlling authority responsible for development and maintenance will manage the system. Each organization will connect to CIPS system through CIPS node that will define the protocol for their communication.

Next section will analyze the opportunities and constraints for the development/deployment of CIPS; based on the case study results from various organizations in Pakistan.

ANALYZING CONSTRAINTS AND OPPORTUNITIES

To explore the possibilities to deploy such an infrastructure, firstly it was needed to analyze the existing ICT (Information and Communication Technology) infrastructure of Pakistan. Because ICT infrastructure is the basic ingredient of the centralized backbone infrastructure. The strength of ICT infrastructure of a country can be determined by its ICT polices, telecom sector, Internet usage, broadband services availability and the IT industry. The literature review for the existing ICT infrastructure of Pakistan revealed the following facts.

Pakistan's ICT policy in public sector is defined through Electronic Government Directorate (EGD) since year 2002 to establish and promote ICT use in government sector [5].

Pakistan's IT sector shows a tremendous growth in last few years and total Teledensity is about 62%. Cellular Networks, WLL (Wireless Local Loop) networks and fixed lines are covering 91% of the Pakistan's population [6].

The number of Internet users in Pakistan has significantly increased i.e. up to 18 million till June 2009 and the broadband subscribers are about 1.68 million [7].

Pakistan Software Export Board (PSEB) was established in 1995 to promote IT industry (software development and export business in the private sector) in Pakistan. The various statistics about IT industry in Pakistan is available at [8].

The data helped to identify the facts i.e. i) most of the public and private organizations have automated information available ii) people have the access to internet through broadband and mobile phones carriers iii) most of the organizations are connected through robust communication channels.

In second phase of the study, interviews and surveys were performed in various governmental and private organizations in Pakistan. Four Governmental organizations i.e. NADRA, Police, NBP (National Bank of Pakistan), PTCL (Pakistan Telecommunication Company Limited) and a private organization i.e. UBL (United Bank Limited), were selected to analyze various parameters that include technological, economical, legal and social factors. The detail of the organizational study from NADRA is presented below:

A) NADRA (National Database & Registration Authority)

NADRA is a governmental organization responsible for issuing ID-cards and passports for Pakistani citizens. NADRA plays an important role for population's record maintenance and interacts with various government organizations to provide required information. NADRA was anticipated as potential candidate for controlling authority for CIPS and was considered in this perspective during the study to explore the opportunities and identify the constraints. Interviews with technical staff and study at NADRA revealed the following facts as described below:

NADRA's Existing Communication Infrastructure

NADRA is facilitating many public and private organizations for information access and data sharing. NADRA is inter-connected with its branches and other organizations through VPN2, DSL3, ISDN4, Dial-Up, and DVB-RCS5. Its data storage, processing and flow are partially automated during communication with other organizations while the inter-organization communication is fully automated. NADRA follows a coherent mechanism for storage, processing and data flow. Currently it communicates with banks and telecom companies for the verification of their customers by following the same data formats for communication. NADRA's authorities showed their interest for the deployment of centralized system for secure sharing of information that will facilitates different other government offices, financial institutes and private organizations.

Following constraints and opportunities were discovered from the study [11]:

I) **Constraints**

 a) **Technological Issues**

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[2] Virtual Private Network

[3] Digital Subscriber Line provides digital data transmission over the wires of a local telephone lines.

[4] Integrated Services Digital Networkis a set of communications standards for simultaneous digital transmission of voice

[5] Digital Video Broadcasting - Return Channel via Satellite is a standard specification for interactive satellite communication

The technological issues include;

- **Interconnection methods among organizations**

The interconnection methods among different organizations are the issue because private organizations i.e. banks prefer dedicated lines due to security concerns. While small and medium sized organizations require a cost effective method for communication through public network with the use of Virtual Private Network (VPN).

- **Communication software compatibility at both ends**

Communication software compatibility is required and needs to be ensured.

- **Data types/ format**

Data types and policies need to be framed coherently for each organization.

- **Managing historical data**

Audit logs, access control and data synchronization need to be ensured among the organizations.

- **Insufficient Bandwidth**

Many regions in Pakistan might face the issue of insufficient bandwidth that also needs to be considered for rural areas.

b) **Human Resource Issues**

NADRA has qualified staff with network management expertise for CIPS deployment. Although special training sessions will be required to train the staff.

c) **Social Issues**

Change management for the new technology and the people's resistance could be as issue that had been previously experienced by NADRA. For example, KIOSIC6 machines, which were developed by NADRA and replaced by KIOSIC offices; initially people were reluctant to use them.

d) **Legal Issues**

 Legal framework regarding electronic transactions, information security, cyber crimes, cyber vandalism etc have been prepared and implemented since 2007 in Pakistan. But its enforcement is still a challenge due to lack of resources and inefficient tools.

e) **Political Issues**

People assume that the computerization of organizational data or information systems brings transparency in organization's work processes. These factors may bring in the political interference with vested interests and create hurdles in acquisition and implementation of computerized system for governmental organizations. While in the private sector this is not a major problem.

II) Opportunities

- **Government's willingness**

Government of Pakistan is encouraging organizations to automate their work process and benefit from the state of the art technology. Government has allocated huge funds for the advancement and adaptation of IT mechanisms in organizations. It could be anticipated from the interviews with personnel (with positive response) that the government will encourage to develop/deploy a

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[6] An interactive computer terminal that provides information access via electronic methods

centralized information sharing system as it is working in developed countries to facilitate their citizens.

- **Availability of ICT infrastructure and professionals**

Pakistan's government has invested huge amount for ICT infrastructure development in the country. Pakistani institutes are producing highly competent professionals each year and the literacy rate is tremendously increasing. NADRA already has skilled workers responsible for development and maintenance of their existing systems. Thus the skilled experts hiring for the development of CIPS will not be a problem.

- **Availability of Funds**

As the business competition is growing among the organizations. Government has allocated sufficient funds for the automation process in governmental organization. Private organization like UBL, NBP, PTCL are also willing to invest for developing a centralized information sharing system in order to enhance their information sharing capabilities.

SURVEY RESULTS

In order to evaluate the efficacy of the proposed approach and to explore the acceptability of this centralized communication system, we also have conducted surveys in different private and government organizations. As a result of discussion under the concerns shown, we have represented the aggregated opinions quantitatively in Figure 3 below. Survey results show most of the officials from both public and private sector organizations agreed to implement such system in Pakistan. Somehow there were few people found in public organizations countering the idea due to fear of bad consequences revealed by disclosing sensitive data. This ratio of reluctance was very extinct among the private officials, who can foresee long term benefits yielded by implementation and adaption of centralized information exchange system [11].
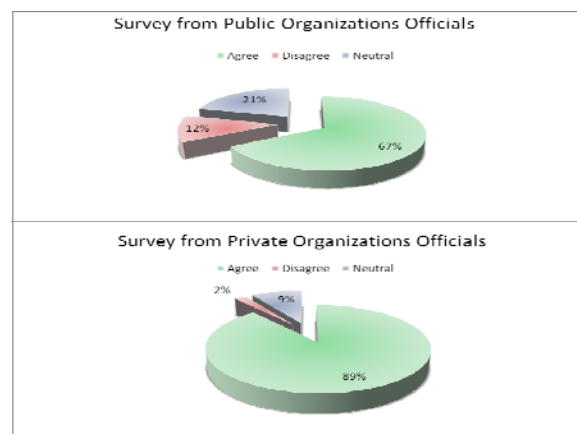

Figure 3. Survey results from public and private organizations [11]

Constraints, opportunities analysis and the survey results for adaptation of centralized infrastructure for information exchange in Pakistan shows the significant possibilities to develop such infrastructure. Conclusively stating, as these goals are shared with almost all players in today's economy, it requires large investments because a whole new infrastructure has to be created in Pakistan. However, its success factors rely on bringing together all-important actors

from the administration and private sectors and make them share the same vision. It will help to integrate public administration services with private sector and consequently offering citizens and customers with improved services. Each administration and private service provider have to make an agreement with a single party (CIPS Controlling Authority) and open only one (electronic) interface to the platform, while CIPS system will be responsible for bundling the services in a user-oriented fashion.

CONCLUSION AND FUTURE WORK

In this technological era, it has become inevitable for business organizations to automate their work processes. Information technology in almost every country; is rapidly being deployed in organizations for automaton of their business processes. A critical aspect of this technology giant is the secure information access/sharing among various business partners. Developed countries like Sweden, Estonia, Denmark and Germany have deployed centralized communication system for secure information exchange among governmental and private organizations. Developing countries like Pakistan are using the traditional communication system based on cumbersome procedures. The paper proposes the concept of secure information exchange medium "CIPS" and presents the case study to explore and analyze the opportunities and constraints for the deployment of such infrastructure in Pakistan. The study will help in strategy formulation for CIPS deployment as well as other developing countries to have an idea about the factors that need to be considered. The future intention of this research is to develop a framework for CIPS and evaluate the CIPS components for deployment process.

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