



TO AFGHANISTAN CONCERNING DATA TRANSPARENCY AMONG
GOVERNMENT AGENCIES

A dissertation submitted

To Institute of Governance Studies, BRAC University in partial

Fulfillment of the requirements for the

Degree of Master of Arts in Governance and Development



Inspiring Excellence



By

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ID No. 17172015

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ABBREVIATIONS

e-Governance	Electronic Governance
ICT	Information and Communication Technology
EGOV.AF	Electronic Government in Afghanistan
ITU	International Telecommunication Union
MCIT	Ministry of Communications and Information Technology
DBMS	Database Management System
eIDAS	Electronic Identification, Authentication and trust Services
SSCDs	Secure Signature Devices
SOAP	Simple Object Access Protocol
WSDL	Web Services Definition Language
OCSP	Online Certificate Status Protocol
HTTP	Hyper Text Transfer Protocol
JMX	Java Management Extension
IS	Information System

III

CA	Certification Authority
MIME	Multipurpose Internet Mail Extensions
ISKE	Intelligent System and Knowledge Engineering
AeGP	Afghanistan Electronic Government Program
AeGPS	Afghanistan Electronic Government Program Strategy
UPU	Universal Postal Union
MCTs	Multipurpose Community Tele-centers
PKI	Public Key Infrastructure
VPN	Virtual Private Network
SSL	Secure Socket Layer

ABSTRACT

This paper describes and introduces the master database system called the X-Road which is invented and initiated in Estonia. The regulations, requirements and structure of X-Road system are explained in this paper. Comparative examples are taken from countries Estonia and India especially concerning data transformation between government agencies. On the other hand, Afghanistan e-government strategies and its goals and objectives are explained and somehow, tried to build or connect this X-Road system to some of pilot e-services projects in Afghanistan or apply the X-Road system to overall e-government structure of Afghanistan. This paper explains some of the ongoing e-services projects such as e-post, eIND, and vehicle registration (VR) in Afghanistan. Issues and challenges are mentioned concerning current Afghan government situation and considering political instability in Afghanistan in addition concerning political ties with neighboring countries.

CHAPTER 1

Introduction

1.1 Background of the Study

Afghanistan is a rural country located in the heart of Asia; it has 34 provinces and 380 districts with five major cities: Kabul, Kandahar, Herat, Jalal Abad and Mazar-e-Sharif. The current population is 34 million however, according to (Mohamad *et al* 2010) the estimated population was 30 million categorized as in table1. Afghanistan total area is 647,500 square kilometers. Its major languages are Pashto, Dari, Uzbek and Turkmen. Its literacy rate is 38.2 per cent of the total population.

Pashton	42%
Tajik	27%
Hazara	9%
Uzbek	9%
Aimak	4%
Turkman	3%
Baloch	2%
Other	4%

Table 1 Population percentage of 30 million

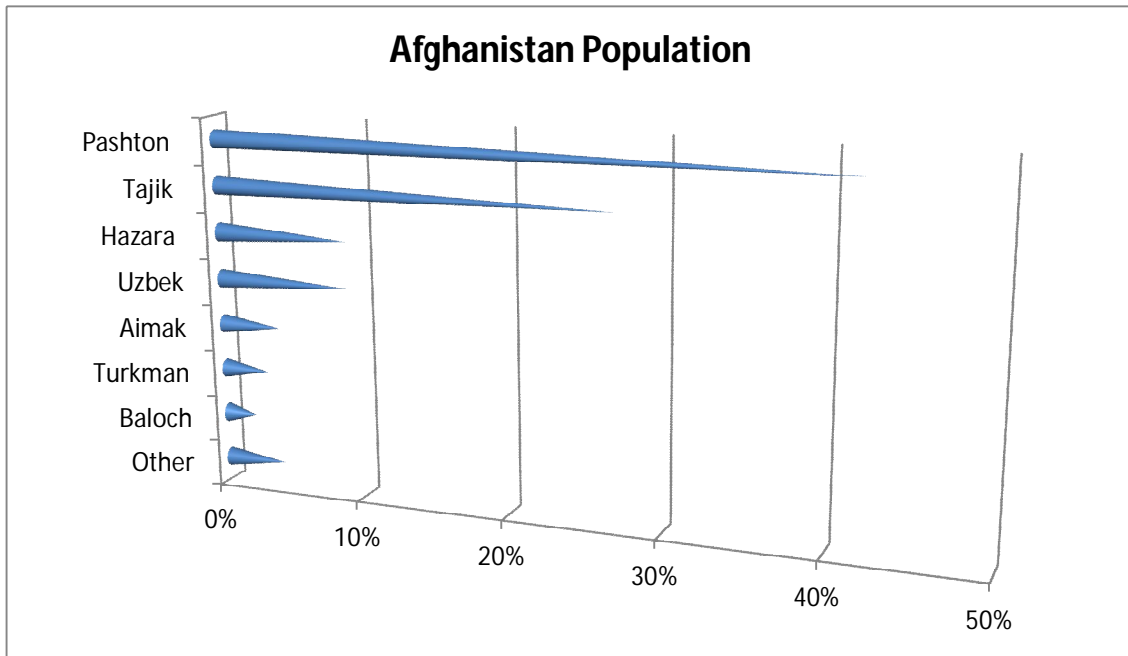


Figure 1 population contribution of different groups on percentage.

Afghanistan started rebuilding itself after almost three decades of war and destruction, when the Transitional Government came into power in 2002.



Figure 2 Afghanistan Map and its 34 provinces from www.google.com

The country did not have advanced communications system, and even the rudimentary ones were also almost totally destroyed during the war. The importance of rebuilding communication

systems and giving the nation the benefits of latest technologies and advances in the Information Technology for overall growth and reconstruction of the country was immediately realized. Good communication systems and the introduction of IT was found necessary for growth in all other sectors, be it security, governance, reconstruction and development, education or trade/business. Efforts were initiated for infrastructure building for better communication and use of information technology. The Ministry of Communication and Information Technology (MCIT) was given the responsibility to lead the sector to fast growth and development. There has been lot of progress since then. In fact, the communications revolution has been a major success story in the country. The growth of the information and communication technology (ICT) sector has had significant impact on economic growth and development. It has connected the whole country, improved efficiency of the government, and provided impetus to private sector growth. It is important to keep in mind that because of all software is created to solve some particular problem or complete some specific task; every piece of software has a purpose. When discussing a particular piece of software one cannot forget about its context and the initial task that particular software was developed to solve. A frequent confusion about the purpose of X-Road stems from the fact that this software is designed for State institutions and organizations to use in the course of exercising their duties, not for individuals' home use.

For a State to function, several conditions must be met:

- Persons have to be identified (so that d'Artagnan cannot present himself as Swedish King). Each person should have a unique numeric identity.
- A numeric identity must be assigned to land properties, vehicles, businesses and addresses.
- Since persons, addresses, land properties are in constantly changing relationships with one another a lot of data has to be gathered on relationships, deals and procedural interactions (e.g.: who marries whom; whether rents and duties were paid, whether sales permit was issued or military conscription served).

This sort of data is highly complex; a variety of variables must be recorded, for example persons' names and personal data, family data, addresses, business relationships, titles, property maps etc. (<https://www.ria.ee>).

1.2 Statement of the Problem

By transforming the traditional government to digital world or electrifying and speeding up the delivery of government services are the sign of pushing the engine of development to ward modernization.

Running a modern state is data center in diver ensuring the functioning of the state requires administrating very large quantities of data or master database. Data is stored where it is created each agency administer its own data separately and the data is not duplicated at the same time. State authorities and agencies need data outside their previous in order to function.

The question is; how authority can securely exchange important data?

First, the data must be easily accessible by the authorities that are authorized to use. Second, the integrity of the data must be maintained no third party should be able to make any changes to data while it is in transit. Third, the data must remain confidential during its journey it must be protected from the eyes of unauthorized parties.

The X-Road makes life simple for both state and citizens for instance, when a child is born information about the birth is send it directly from the hospital to the population register from there it is send automatically to the health insurance fund, so that the child go health insurance and a family physician, this prevents the creation of excessive paper work and saves time.

The state functioning in the background the X-Road helps authorities make work process more convenient moreover, many activities can be automated which frees employee to deal with matters that requires human involvement.

The knowledge is power i.e. the more data, the bigger power. The main task of a democracy, however, is to distribute power. That leads us to the logical notion that in a democratic society, the databases probably shouldn't grow too large. Each office should have its own database but, leaving entirely aside the issue of pirated copies of illegally collected data, they should not have the copies of the states' remaining databases.

The technology that we today call the X-Road grew out of Estonia's efforts to solve these thorny issues and deal with these trade-offs in the late 1990s and early 2000s. So far, there haven't been any events that have severely hindered the X-Road. This resiliency suggests that the distributed architecture works remarkably well even in critical situations (like cyber war).

1.3 Rationale

One of the basic policies for democratic governance around the globe is to decrease the administrative size and costs and to increase the functionality of government body. This is the motivation behind research activities within governments for utilizing them to new methods and technology. Based on this fact, the target point for this kind of governments can be considered as proper use of information and communication technology in public administrations combined with an organizational change and new skills in order to improve public services and strengthen support to public policies. This will lead us to the concept of designing the system(x-road) which is nothing but modern techniques of e-government commonly defined as continuous and safe execution of the mutual duties and services between government and citizens in the environment of electronic communication and transaction.

1.4 Research Questions

The aim of this Master thesis is to introduce the new and modern technological based data transferring system among government agencies that is known as X-road system. The thesis will also explain some of the projects related to x-road system or based on x-road concept. On the other hand it will also describe the regulation of x-road system with its advantages and disadvantages.

The Questions are

1. How does x-road system ensure significant data transfer among agencies?
2. What are the components of x-road system?
3. What are the major challenges to adopt x-road system in Afghan government agencies?

1.5 Objectives

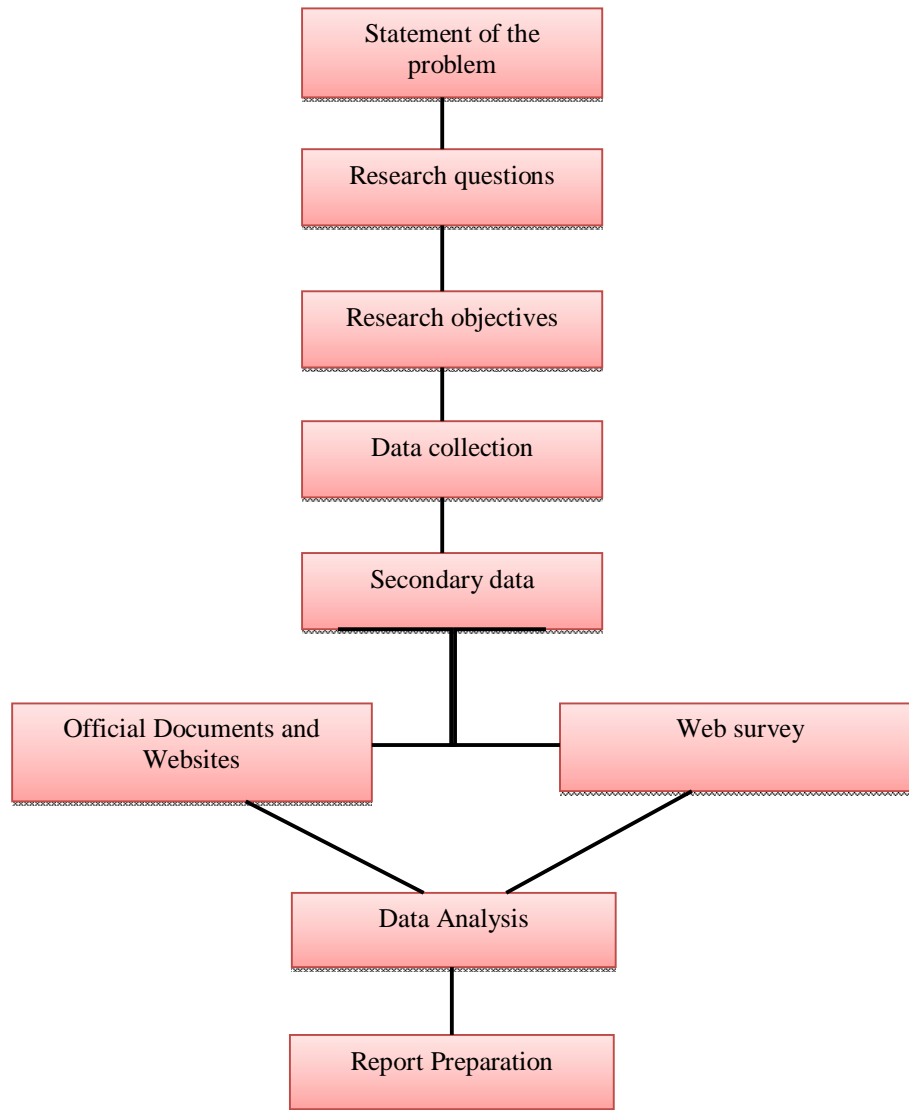
- To know How x-road helps secure data transfer and promote transparency among government agencies
- To identify the structure of x-road system
- How X-Road system help shortening the distance between people and government in Afghanistan
- How this x-road system can help transparency between people and Afghan government

1.6 Research Methodology

This research paper is based on secondary data type and aim is to explain and describe the X-Road system, X-Road regulations, and its importance among not only government agencies but, also private agencies. This research paper further, explains Afghanistan e-government strategy and some e-government pilot projects in Afghanistan. The collection of data or sources of information are as bellow;

- Previous research
- Official statistics
- Government reports
- Web information and
- Historical data and information

1.6.1 Research Design



Research design and data flow figure

1.7 Organization of the Report

This dissertation research report has structured with four chapters. The first chapter explains the study background, problem statement and rationale of the problem. Moreover, it specifies the research questions, objectives with the scope and limitations of the study.

The second chapter reviews the relevant literatures and introduction to x-road system. Furthermore, it explains the importance, functions, and data exchange mechanism in X-Road system. This chapter represents the research methodology that contains brief description of data exchange method particularly concerning security and transparency on X-Road system.

Chapter three analyzes of the data foxing on regulations of X-Road and explaining in detail the requirements of X-Road system. Chapter four also explains Afghanistan e-government strategy and some of the e-services pilot projects that are ongoing in Afghanistan. It also explains the advantages and disadvantages of adopting X-Road system in Afghanistan government agencies.

Final and fourth chapter provides the recommendations with a brief discussion on the study and summarization of the thesis paper.

CHAPTER 2

2.1 Literature Review

A lot of studies have been conducted in both developed and developing countries to assess the parameters leading to good governance. The chapter presents a review of the literature on e-Governance structure i.e. x-road system for good governance through service delivery where by some of the theoretical and empirical debates are presented and discussed. This chapter extensively illustrates the research studies already conducted that are related to the x-road system for the purpose of good governance. This chapter also explains the e-Government initiatives taken by the Government of Afghanistan with purpose of improving efficiency and effectiveness of the services delivery.

A frequent confusion about the purpose of X-Road stems from the fact that this software is designed for State institutions and government agencies to use in the course of exercising their duties, not for individuals' home use (<https://www.ria.ee/en/introduction-to-xroad-part1.html>).

For a State to function, several conditions must be met such as:

- Persons have to be identified. Each person should have a unique numeric identity.
- A numeric identity must be assigned to land properties, vehicles, businesses and addresses.
- Since persons, addresses, land properties are in constantly changing relationships with one another a lot of data has to be gathered on relationships, deals and procedural interactions.

This sort of data is highly complex; a variety of variables must be recorded, for instance person's names and personal data, family data, addresses, business relationships, titles, property maps etc. Without systemized data of this kind we will not have a State but a pack of hunters-gatherers or an unorganized group of countrymen.

2.1.1 Concept of X-Road

the technology that we now a days call the X-Road grew out of Estonia's efforts to solve these thorny issues and deal with these trade-offs in the late 1990s and early 2000s. According to

Taavi Kotka a software engineer of ICT Ministry of Estonia in one of his lecture in UAE mentioned that population of Estonia is around 1.3 million and government of Estonia was worried and thinking of how to serve people nonetheless, government but, also private sector side too. In 1991 government and as well as private sector understood that the only way they can serve people is to digitalize the services. The key reason to digitalize the services and force the people to use internet force the people to use e-services was less population of Estonia government could not serve or deliver services to every corner of Estonia for instance, once the government closed one of government post office in Estonia city because, of less transaction only seven transaction per day (7/day). Estonia was experiencing such kind of problems for almost twenty (20) years when they apart from Southern Union in 1991. The second reason was lack of money after being apart from Southern Union the country was financially weak so, again atomization force people to serve themselves.

The X-Road project was initiated (at the Ministry of Economy and Communications) around 1998 in Estonia. The pilot was ready in 2000 and was shown at a public conference. Three databases were interconnected and their data was exchanged according to the XML-RPC standard. The main development was done by Tanel Tammet, Hanno Krosing and Vello Kadarpiik, all of whom are famous in Estonian IT. One of the biggest challenges facing these developers was whether to use the proprietary technology of a corporation or try to manage using the free software.

The project was managed by Niilo Saard and Aleksander Reitsakas. One of the subcontractors for Assert was AS Cybernetica. They had a huge influence on the X-Road via their programming of the logs chaining module (<https://www.ria.ee/en/introduction-to-xroad-part1.html>).

2.1.2 Introduction to X-Road

X-Road is the data exchange layer which is a technical and organizational environment that enables secure internet based data exchange between the state's information systems. The X-Road allows government agencies, organizations, and institutions/people to securely exchange data as well as to ensure people's access to the data maintained and processed in state databases.

Public and private sector enterprises and institutions can connect their information system with the X-Road. This enables them to use X-Road services in their own electronic environment or

offer their e-services via the X-Road. Joining the X-Road enables institutions to save resources, since a cooperative and secure data exchange layer already exist with all the other X-Road members. Data exchange between all the members of the X-Road ecosystem is significantly more efficient and secure.

2.1.3 Birth of X-Road

The platform of starting the X-Road was made in Estonia in 2000 when, on initiative of the advisor to the Prime Minister, Linnar Viik, the pilot project was initiated. Further, history of X-Road on web www.ria.ee/en/introduction-to-xroad-part1.html explains that Cybernetica has taken the lead role in the development of the X-Road. As aside, the initial name of this technology was not “X-Road” but “Crossroad(s)”.

One thing that is important to understand about the X-Road is that is not a fundamentally new invention. Estonia simply harnessed then existing technologies and applied them in a novel way in the state governance context. The outcome of this novel application of existing technologies was named the X-Road.

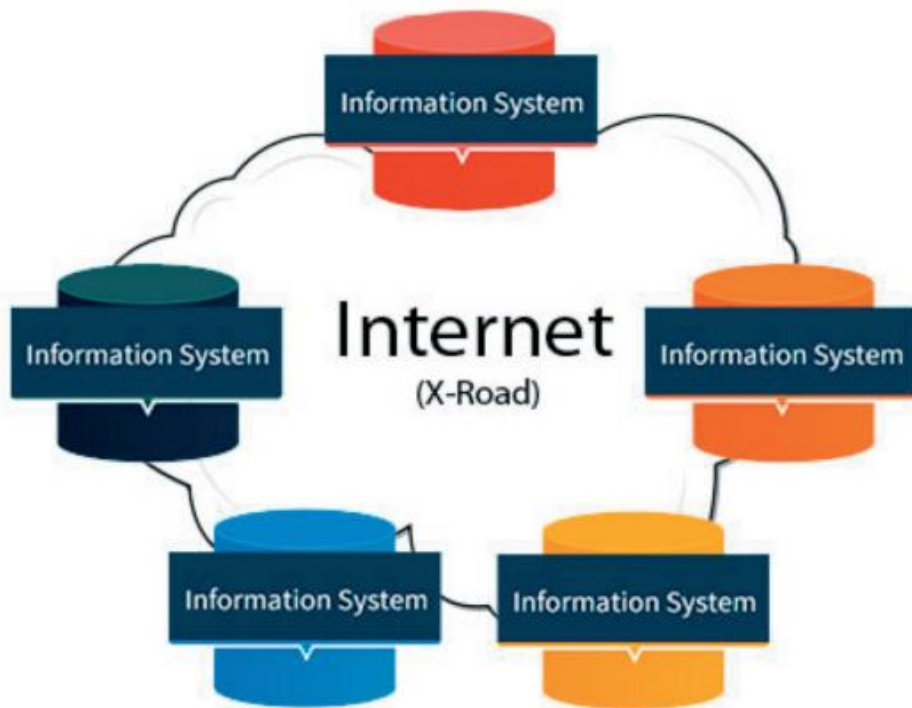


Figure 3 from X-Road fact sheet-2014

The X-Road relies on a platform that is **open, secure** and **simple**. As shown in above figure 1 Information system based on different platforms can successfully communicate with each other simultaneously and their individual characteristics do not hinder this. X-Road gives services providers and data owners free hands to design and implement new services while relying on the existing secure infrastructure (X-Road fact sheet-2014). This communication and data exchange between agencies can be possible when there is internet so; internet is the fundamental and essential factor for X-Road system to perform.

2.1.4 Purpose of X-Road

A frequent confusion about the purpose of X-Road stems from the fact that this software is designed for State institutions and organizations to use in the course of exercising their duties, not for individuals' home use (<https://www.ria.ee>.)

According to Professor *Ahto Kalja, head of the Chair of System Software, Department of Computer Engineering, Tallinn University of Technology* The State databases and information systems have undergone two major transformations. The first began in the early 1990s, when the paper based folder and register system came to an end, and DBMS (Database Management System) based development began. The second transformation began a decade later and is still continuing. The aim is to integrate databases which had been created independently of each other into common data resources that are accessible over the Internet.

It must be understood that no new information technology was invented by developing the X-Road but a new way of governance (e-governance technology) was created based on existing information technology.

Today X-Road has become a data exchange standard in Estonian public sector. It is the IT backbone of the state of Estonia. State databases are obliged to perform data exchange by using X-Road platform.

2.1.5 Design Decisions of the X-Road

The following list explains main design goals and design decisions of the X-Road system (<https://github.com/ria-ee/X-Road>).

- **Decentralized** – in X-Road system the data exchange happens directly between organizations. There are no intermediaries. If the two organizations have established secure connection, the continuous data exchange depends only on availability of the organizations and the network between them.
- **Ownership of data** – X-Road does not change ownership of data. The data owner service provider controls who can access particular services.
- **Availability** - it is a central concern the protocols are designed so that there is no single bottleneck in the system. Additionally, no component should become single point of failure.
- **Digital evidence** – all the messages and data processed by the X-Road are usable as digital evidence. The technical solution must comply with requirements for digital seals according to eIDAS (*electronic Identification, Authentication and trust Services*). This implies SSCDs (*Support for Secure Signature Devices*).
- **Service calls** - all the communication is implemented as service calls using the SOAP (*Simple Object Access Protocol*). The services are described using the WSDL (*Web Services Definition Language*).
- **Cross-border services** – it is possible for an organization to invoke services provided by an organization belonging to a different instance of X-Road.
- **Encapsulation the security protocol** – the security measures and the security protocol are encapsulated in standard components. The organizations are not required to implement security related functionality for data exchange.
- **Standardization** – X-Road aims to standardize the communication protocol between organizations. This enables the organizations to connect to any number of service providers without implementing additional protocols. X-Road core does not perform

protocol and data conversion. If necessary, these conversions can be performed by the organization’s information system.

- **No predetermined roles** – once an organization has joined the X-Road infrastructure, it can act as both service client and service provider without having to perform any additional registration.
- **Two level authentication** – X-Road core handles authentication and access control on the organization level. The End-user authentication is performed by information system of the service client.

2.2 X-Road System Components

The X-Road main components and interfaces are shown in figure (2). The components that are not part of the X-Road core are shown on grey background. The components and the interfaces are described in detail in the following sections (<https://github.com/ria-ee/X-Road>).

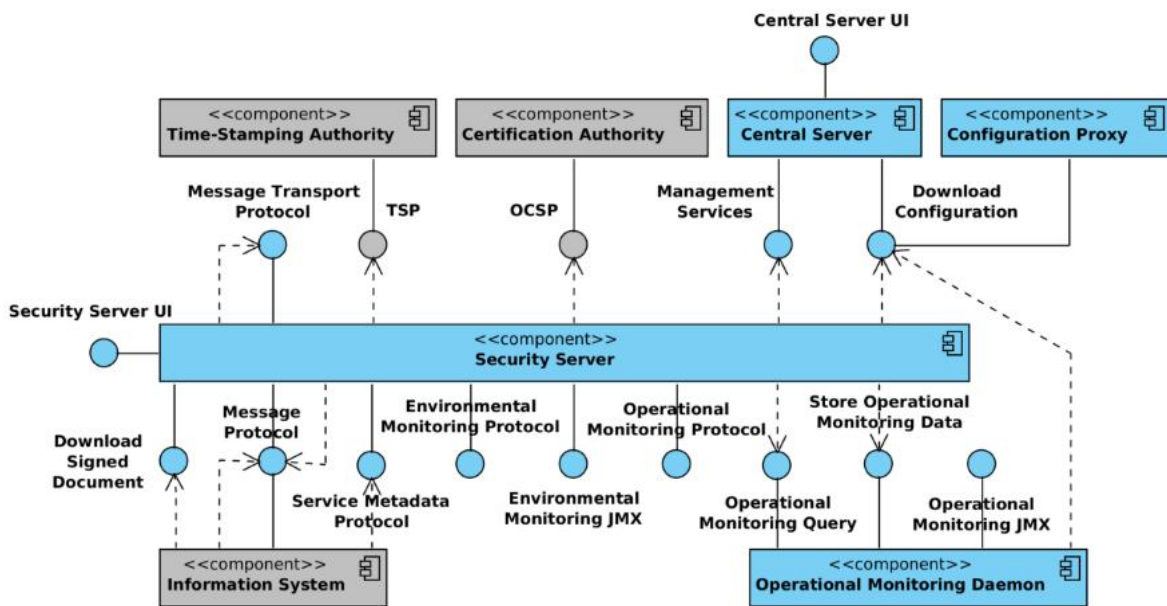


Figure 4 from (www.github.com/ria) Logical Structure of X-Road

2.2.1 Security issues

When speaking about security, we must first turn to the issue of confidentiality, i.e. who can access the information and on what conditions. To a certain extent, data integrity threats will also be considered - i.e. can some actor change the information without leaving a trail and can the data be protected and retained intact (<https://www.ria.ee/en/introduction-to-xroad-part1.html>).

Thus there was clear need to enhance standardization both from interoperability as well as security point of view. To achieve this goal in Estonia, a unified data exchange middleware called X-Road was launched in December 2001. During the next years it has evolved with addition of features and evolutionary changes to protocols and data formats, reaching version 5 in 2010 (Freudenthal and Willemson).

By the end of 2016, X-Road had 1789 connected services by 246 services providers. Altogether, 975 member organizations exchanged roughly 575 million transactions per year. The advance type or next generation of X-Road started in 2014. It was based on product prototype developed two years earlier by Cybernetica AS, the developer and maintainer of the original X-Road software. One of the goals for new version was better support for international deployment and cross-border electronic services. The new version i.e. was version 6 a fresh start and did not use the same technical solution and protocols as the previous versions 1 to 5.

Analysis has shown that X-Road is one of six core state information system that provides support to all state information systems. The organization responsible for the X-Road uses the administration system of the state information system RIHA (RIHA serves as a catalogue for the state's information system. At the same time, it is a procedural and administrative environment via which the comprehensive and balanced development of the state's information system is ensured. RIHA guarantees the transparency of the administration of the state's information system and helps to plan the state's information management) to help it administer the X-Road. RIHA is also one of the six supportive state information system is mandatory for all national and local state information systems (Käärman, 2006).

2.2.2 Central Server

The central server (see [ARC-CS] for details) manages the database of X-Road members and security servers. In addition, the central server contains the security policy of the X-Road instance. The security policy consists of the following items;

- List of trusted certification authorities,
- List of trusted time-stamping authorities,
- Tunable parameters such as maximum allowed lifetime of an OCSP (*Online Certificate Status Protocol is an Internet protocol used for obtaining the revocation status of an X.509 digital certificate. It is described in RFC 6960 and is on the Internet standards track*) response.

Both the member database and the security policy are made available to the security servers via HTTP (*Hypertext Transfer Protocol*). This distributed set of data forms the global configuration. To configure distribution, the central server provides interface for performing management tasks such as adding and removing security server clients. These tasks are invoked from the user interface of the security servers. The management services are implemented as standard X-Road services and offered via central security server.

2.2.3 Security Server

The security sever mediates service calls and service responses between information systems. The security server encapsulates the security aspects of the X-Road infrastructure: managing keys for signing and authentication, sending messages over secure channel, creating the proof value for messages with digital signatures, time-stamping (see section 2.2.1) and logging. For the service client and the service provider information system, the security server offers as SOAP-based protocol. This protocol is the same for both the client and the service provider, making the security server transparent to the applications.

The security server manages two types of keys;

- The authentication keys
- The signing keys

The authentication keys are assigned to a security server and used for establishing cryptographically secure communication channels with other security servers.

The signing keys are assigned to the security server's clients and used for signing the exchanged messages. The keys can be stored either on hard disk (software token) or on an SSCD (*Secure Signature Devices*). The security server downloads and cache up to date global configuration and certificate validity information. Caching allows the security server to operate even when the information sources are unavailable. The security server contains an optional monitoring component that keeps track of environmental properties such as running processes, available disk space, installed packages etc. The monitoring component publishes this data via environmental monitoring service and monitoring JMX (*Java Management extensions*) interfaces.

2.2.4 Information System

The information system uses or provides services via the X-Road. For the service client information system (IS), the security server acts as an entry point to all the X-Road services. The client IS is responsible for implementing a user authentication and access control mechanism that complies with the requirements of the particular X-Road instance. According to website www.gethub.com the identity of the end user is made available to the service provider by including it in the SOAP message. The client can discover the X-Road members and available services by using the X-Road metadata protocol.

The service provider information system implements a SOAP (*Simple Object Access Protocol*) service and makes it available over the X-Road. For this purpose, the service must conform to the X-Road message protocol. The service must be accompanied by the service description implemented in the WSDL language.

2.2.5 Time-Stamping Authority

The time-stamping authority issues time stamps that certify the existence of data items at a certain point of time. The time-stamping authority must implement the time-stamping protocol. Time-stamping protocol is a synchronous protocol that is provided by the time-stamp authority and used by security server to ensure long-term proof of the exchanged messages. However, the

security servers use the time-stamping protocol in an asynchronous manner. Security servers log all the messages that are exchanged with other security servers (www.github.com/rea-ee).

X-Road uses batch time-stamping. This reduces the load of the time-stamping service. The load does not depend on the number of messages exchanged over the X-Road; instead it depends on the number of security servers in the system.

2.2.6 Certification Authority

The certification authority (CA) issues certificates to security servers and to X-Road member organizations (signing certificates). All the certificates are stored in the security sever. The CA must distribute certificate validity information via OCSP protocol the OCSP (*Online Certificate Status Protocol*) protocol is used by the security servers to query the validity information about the signing and authentication certificates. OCSP protocol is synchronous protocol that is offered by the OCSP responder belonging to a certification authority. The security servers cache the OCSP responses to reduce the load in the load in the OCSP service and to increase availability. The load on the OCSP service depends on the number of certificates issued.

2.2.7 Configuration Proxy

The configuration proxy implements both the client part and the sever part of the configuration distribution protocol. The protocol is based on HTTP (*Hyper Text Transfer Protocol*) and MIME (*Multipurpose Internet Mail Extensions*) multipart messaging. The configuration is signed by the central server to protect it against modification. The protocol allows configuration clients to check whether the configuration has changed and only download the modified parts. The configuration proxy downloads the configuration, stores it, and makes it available for download. Thus, the configuration proxy can be used to increase system availability by creating an additional configuration source and reduce load on the central sever.

2.2.8 Operational Monitoring Daemon

The main functionality of the operational monitoring daemon is to collect and store operational data of the X-Road security and make it available for external monitoring system via corresponding interfaces.

2.3 How X-Road works

The security of X-Road is guaranteed by its architecture together with regulatory, organizational and technical measures data transactions between service providers and users occur directly between secure servers using encryption (<https://www.ria.ee>). In X-Road data is analyzed by Sharemind technology. Sharemind is a data analysis system for securely processing confidential information. Sharemind protects your data better than standard databases thanks to its use of secret sharing. Secret sharing allows you to share your records with your partners without losing control (<https://cyber.ee/en/security>).

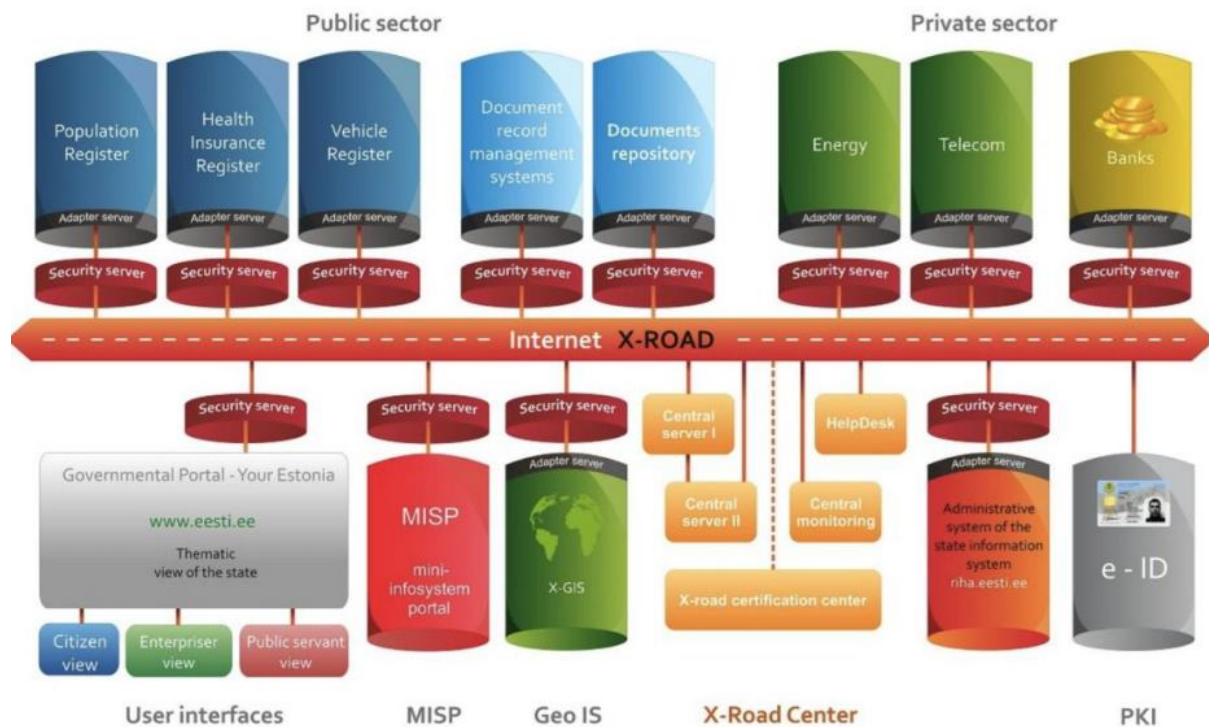


Figure 5 from Google scholar

In the X-Road environment, encrypted data are directly transferred through secure servers from one information system to another. Data does not pass through the X-Road center and cannot be viewed there. The center only has statistical information about data transfer.

The X-Road central server issues certificates to secure servers and provides a list of trusted certificates to systems connected to the X-Road. Additionally, the central server accepts log hashes from secure servers so that if needed, a chain of service usage can be constructed later. In this case, the service provider's log, the service user's log and the central server's hash are compared. This method allows for checking the integrity of secure servers' logs, as it is impossible to change a log without it being detectable later. Service users' groups are described in the central server, so that service providers could open services to groups as well as shown in figure 3.

2.3.1 X-Road platform

X-Road servers are built on GNU/Debian Linux, one of the most stable, free and best maintained Linux distributions. All the additional software is packaged as Debian packages that can be installed and maintained using standard Debian tools. To simplify X-Road server installation by participating organizations, a self-contained installation CD is provided that installs and configures a GNU/Debian Linux system and X-Road software with minimal user intervention.

X-Road servers have a simple and clean graphical user interface for maintenance and configuration tasks. There is also a built-in patching system that allows distributing and updating X-Road software in a secure way. All keys, including the top-level certification keys, can be changed on the fly without interruptions to the system operations and with minimal user intervention (Jan and Arne, 2005).

2.4 Data exchange in X-Road

To understand and determine the permission and rights to exchange data or information in X-Road system. The provider of data services determines and decides who are allowed to exchange

data with them through the specific data service. In order to use data services, an X-Road member needs to have:

- Technical readiness – a data service client application;
- Access right given by the provider of data service for using a data service.

The basis for giving access rights is an agreement between the provider and user of the data service. X-Road does not check the basis for giving access rights. X-Road ensures that:

- Only those members can use the services, who have received access rights from the provider of data services;
- Data exchanged via data services reach the relevant members without deviations and with evidential value.

Representing the above explanation/mechanism in diagram figure 4 as follow;



Figure 6 form www.roksnet.com

The numbers in diagram indicates;

1. Identifies the partner system
2. Creates a secure channel between your system
3. Encrypts the communication (End-to-End)

4. Digitally signs each data transactions
5. Creates the log files of data usages
6. Timestamps the log files

CHAPTER 3

Findings and analysis with respect to e-services in Afghanistan

In chapter two, X-Road was explained and identified. Chapter three explains that what are the needs or requirements and regulations to manage and organize X-Road system. This chapter also explains Afghanistan e-governance strategy.

3.1 Requirements and regulations for the X-Road management organization

The X-Road management organization directs X-Road administration and development in accordance with the regulations in the present document and existing act/laws. The management organization makes important decisions regarding the X-Road including planning development and coordinating budgets, determining who may join the X-Road, signing contracts with those that join the X-Road and supervising the activities of the X-Road center.

The management organization, in cooperation with other government institutions and X-Road developers, coordinates discussion forums and seminars in regards to future development activities (Käärman, 2006, p.18).

3.2 Requirements for the X-Road center

The X-Road center carries out its tasks according to the present regulations document and other respective laws/acts which include, collecting materials to enable management organization decisions, day to day activities related to the operation of the X-Road, processing and resolving complaints and arguments, as well as required cooperation with individuals and institutions.

The X-Road center creates the following documents to support the operations of the X-Road:

- Archival procedures which include the archival of X-Road logs;
- Archival plans which include management organization approved archival frequency and location etcetera;
- Backup guidelines which include procedures necessary for recovering X-Road related components (explained in chapter 2);
- Backup plans which include the frequency and location of backups;
- Internal guidelines which correspond to the state public information act in regards to information distribution policies and complaint resolution;
- Precise guidelines which are communicated to all X-Road center employees in regards to crisis resolution. The guidelines must include contact information for those individuals that are responsible for reacting to and resolving crisis situations;
- Security procedures corresponding to ISKE (*Intelligent System and Knowledge Engineering*) requirements as well as determining ISKE security grades for service provided by the X-Road.

Moreover, description of physical, organizational and technical security requirements for X-Road partners it can be;

- Service providers;
- Services consumers;
- Application service providers;
- Authentication service providers;

Upon joining to the X-Road, **service providers** must install at least one security server and at least one adapter server. The security server is a PC type computer which has specially installed

software and no other applications installed. The adapter server can be a standalone computer or a module installed on the database server.

All the service providers that have joined the X-Road must also join the Test-road and provide test data to the Test-road. If the Test-road servers use the same hardware as the X-Road servers then the Test-road environment can be quickly switched to the X-Road environment it required.

The security of data is concern for both parties' service providers and service consumers the level and extent of security procedures depends on the following:

- i. What are the security grades of their consumed services;
- ii. How important and or expensive are the decisions made on the basis of data;
- iii. The service provider takes into account the importance of decisions made on the basis of the information they provide via the service.

Service consumers who only read data must apply security procedures corresponding to the highest security grade of the services they consume. If the service consumer uses the X-Road to change data then their security level must the same as the service provider.

The security grade of the **application service provider** must be at least as high as the highest security grade of the services it mediates. All application service providers must join the Test-road.

Application service provider system administrators must be authorized to perform the following activities:

- i. Installation of servers;
- ii. Installation of security patches;
- iii. Archival of logs;
- iv. Backup configuration;
- v. Restoration of servers from backups;
- vi. Changing of server parameters;
- vii. Changing of security server keys;
- viii. Administration of individuals to contact in case of service disruption;
- ix. Administration of user rights.

Authentication service providers offer authentication to users of the citizen's portal. The X-Road does not regulate the method of authentication used by an authentication service provider. Authentication service provider agreements must define the following:

- i. How individuals seeking authentication identify themselves (upon signing up for the service individual must present a piece of photo identification);
- ii. How individuals seeking authentication authenticate their identity (at least with a password or open key encryption system);
- iii. What is the level of service provided (the agreement should specify what is the maximum allowed down time for the service).

3.2.1 Archiving

According to *Käärman* archiving is a procedure that saves information to a differing media for long term storage. The X-Road center must have an approved archival procedure including a list of information to be archived and archival frequency. An archival plan must exist which outlines what, where and when archiving takes place. The archives must enable the X-Road center to retrieve query contents.

3.2.2 Backup

Backup procedures ensure that the central servers and certification servers can be recovered following a disaster event. The X-Road center must have backup and restoration procedures in place. The procedures must include events that must be preceded by a backup, for instance the installation of a security patch. The X-Road center must have a backup plan that describes who, how and when backups are taken.

3.2.3 Recovery from backups

The X-Road system supervisor is responsible for and has the right to restore X-Road service by restoring central servers from backups. The X-Road center manager must be notified when restoration from backups has occurred. In the event of a security breach the system supervisor must remove the central server where the breach occurred, replace it with a backup server (Käärman, 2006, p.23).

3.2.4 X-Road security patches

The X-Road center system supervisor is responsible for the timely installation of X-Road security patches. They also must ensure that the operation of the X-Road is uninterrupted. Non-critical patches should be installed during a period of low X-Road use. Critical patches should be installed as quickly as deemed possible by the system supervisor. Backup and archival procedures should be carried out before and after installation of the security patch (Käärman, 2006, p.22).

3.3 Changing of central server parameters

The X-Road center system supervisor has the right to change the parameters of the central servers such as, changing their IP, adding or removing secondary central servers, changing of time servers' etcetera. In case if the IP address of the central server is to be changed the system supervisor must inform all the security server administrators by e-mail.

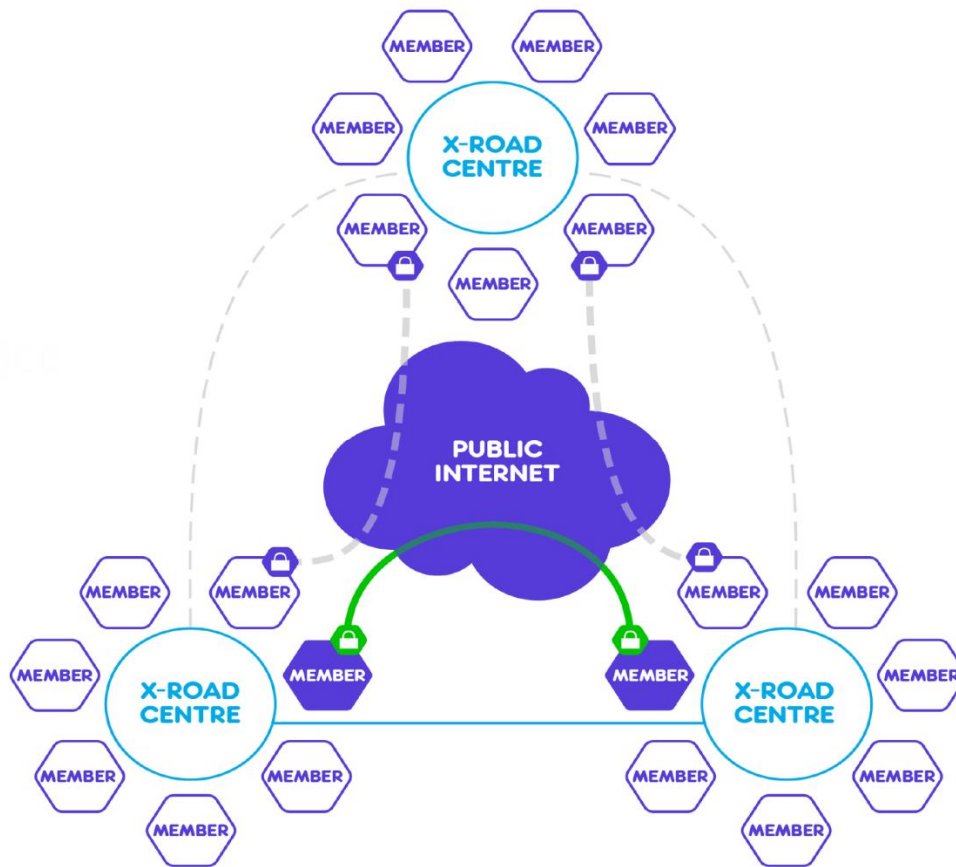


Figure 7 X-Road center server architecture form Google scholar

3.3.1 Central server key change

Supervisor of X-Road system is required to periodically change the keys of the central server and certification server. According to *Käärmann* the suggested interval is one year. Immediate key change can be necessary if for example, an existing key and all backup copies have been destroyed or corrupted, or if the existing key has been compromised. To overcome such miserable conditions the security server system administrators must be informed in advance via e-mail of scheduled key changes. The e-mail will also contain the authenticity and activation date of the new key figure 5 shows a simple interaction among X-Road center server and members.

In the case of a non-scheduled key changes security server administrators must be informed by previously agreed upon method.

Electronic government in Afghanistan aims to enable government transformation towards realization of benefits to citizens, businesses, the government and other stakeholders of governance. It is ultimately about technology enabled change in government and governance to support national development objectives and vision.

Such change in government and governance is often brought about by execution of programs and projects with clearly defines outcomes and benefits (Mohamed Shareef *et al*, 2011, p.7).

3.4 Afghanistan e-government strategy

The aim of AeGP (*Afghanistan electronic government program*) is to implement EGOV (*electronic governance*) initiatives towards the realization of strategic goals of Afghanistan EGOV Strategy and ultimately, achieving its vision.

The key objectives of AeGP are;

- To provide an efficient, professional and modern institutional environment and management framework for AeGP implementation.
- To organize, plan and manage EGOV related projects in Afghanistan implemented by various government agencies and stakeholders in coordinated, collaborative and effective way
- To deliver the outcomes associated with the AeGP strategic goals with the expected professional capabilities through relevant organizational changes in public sector management.
- To ensure realization of benefits of the technology enabled transformations in public administration and service delivery to Afghan citizens and stakeholders.
- To raise the Afghan government capacity for EGOV development, coordination, and implementation based on partnership and collaboration.

The AeGP derives its mandate directly from the AeGPS (*Afghanistan electronic government program strategy*), which supports ANDS (*Afghan national development strategy*) and GPARS (*Governance and public administrative reform strategy*).

The strategy responds to high demand from the public and within government to tackle corruption in public administration and public service delivery, increase transparency and

administrative efficiency and effectiveness. The strategic context for AeGP is shown in figure 6(Mohamed Shareef *et al*, 2011, p.8).

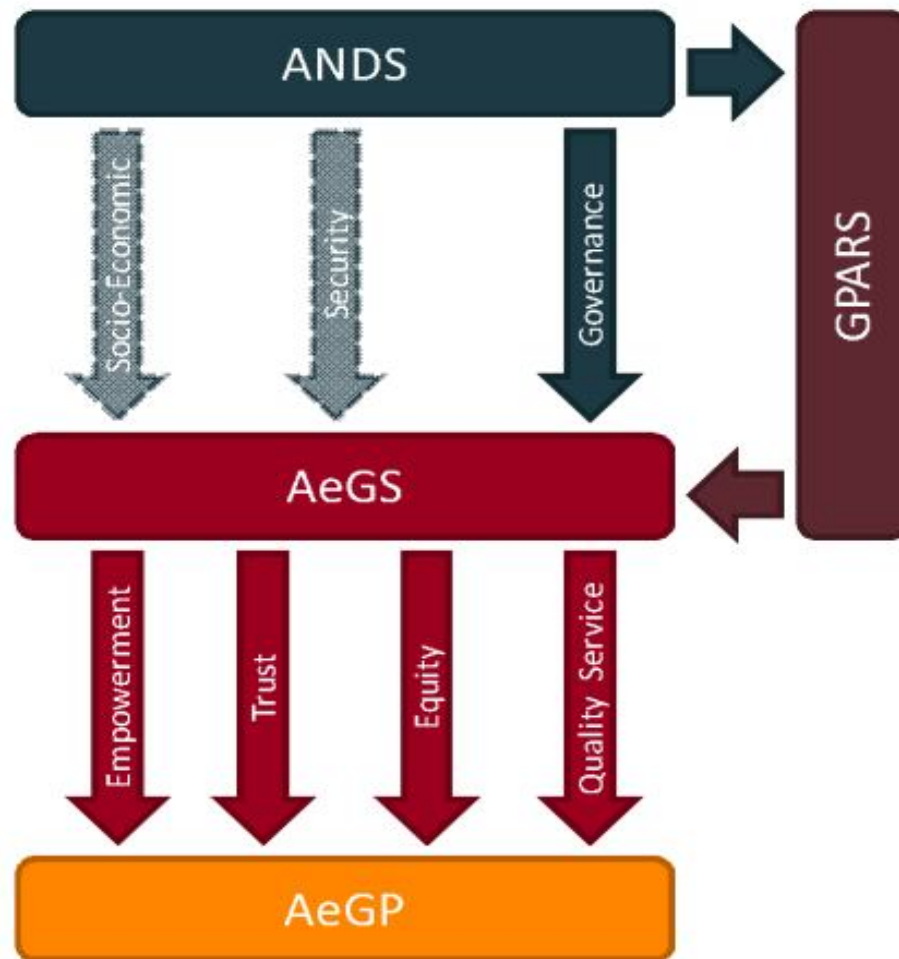


Figure 8 Strategic context for AeGP from Electronic Government Program Draft for Afghanistan available on www.mcit.gov.af

The AeGP envisions technology enabled transformation leading to various direct and indirect benefits to the stakeholders including Afghan citizens, its government and the private sector. It lays out a three prong strategy towards achieving its vision based on three perspectives (Mohamed Shareef *et al*, 2011, p.8):

- 1) Quality Equity Public Services;
- 2) Modernization of Public Sector Management ;
- 3) Public Participation in Government.

3.4.1 Strategic goals and directions

The strategic goals for EGOV in Afghanistan are defined by AeGS (*Afghanistan electronic governance strategy*) towards achieving EGOV vision within the strategic framework as shown in figure 7.

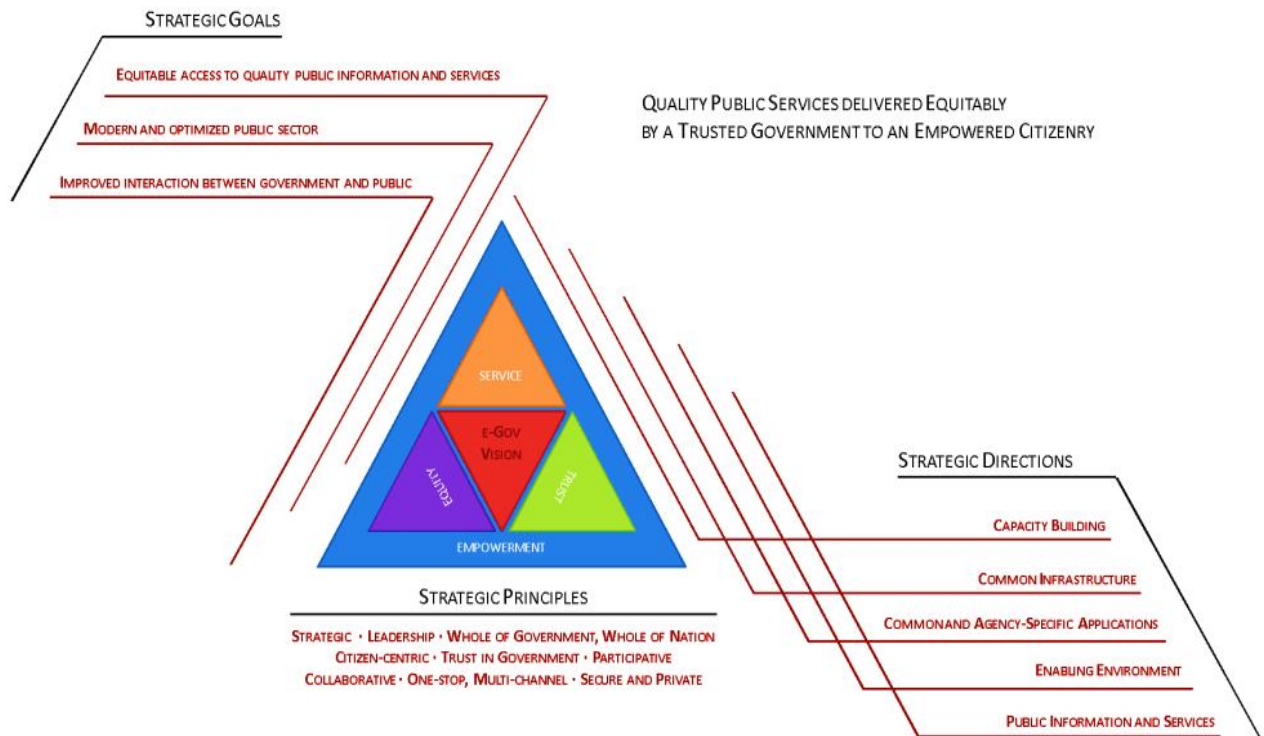


Figure 9 Strategic implementation www.mcit.gov.af

They organized in three major perspectives such as **Public Information and Services**, **Modernizing Public Sector**, and **Public Participation in Government**. They are formulated by key stakeholders as follows;

Goal 1: Equitable and balance access to access to high priority public services, particularly in health, education and agriculture and services for businesses and others.

Goal 2: A modern and optimized public sector through innovation, collaboration and technology.

Goal 3: Improved interaction between the government and public in governance.

Key implementation strategies are defined for EGOV development in Afghanistan to better address the current needs and challenges and take advantages from opportunities and strengths.

They are organized within following five (5) strategic directions:

- Public information and services
- Enabling environment
- Capacity building
- Common infrastructure
- Common and agency specific applications

Quality **public information and services** of high priority, particularly in the areas of health, education and agriculture and also services targeted towards businesses, will be:

- i. Delivered through multiple channels, with particular emphasis on mobile telephony,
- ii. Prioritized based on positive impact on the daily lives in terms of socio-economic benefits and there positive impact on the daily lives in terms of socio-economic benefits and there positive impact on inclusiveness in terms of reaching to minorities and disadvantaged parts of the society.

Creating **enabling environment** for developing e-Government, delivering electronic/mobile services, electronic documents, applications, forms and interacting with citizens via electronic/mobile channels by:

- i. Ensuring ownership on EGOV strategy and implementation program,
- ii. Leadership at all levels (top, middle, bottom or operation),
- iii. Raising awareness among government employees and citizens,
- iv. Adopting legislation, rules and regulations and
- v. Establishing sustainable financial mechanisms and

- vi. Organizational culture.

Building capacity of

- i. Central EGOV coordination agency in implementing, supporting and promoting e-Government;
- ii. Government employees in delivering public information and services and interacting with public via electronic and mobile channels, and
- iii. Citizens in utilizing electronic and mobile services and interacting with government.

Building common infrastructure in the Government that can be utilized by many or all ministries and agencies such as National Data Center, National ID system etc.

Developing common and agency specific applications such that

- i. Common applications can be used by many or all ministries and agencies such Human Resource Management, Planning and Management, Procurement, Project Management and Monitoring and Evaluation, Document/Record Management, Correspondence, Collaboration and Internal Communication , etc. and
- ii. Sectorial or agency specific applications such as healthcare, agriculture, education, social welfare etc.

3.5 E-services in Afghanistan

3.5.1 E-post

International Telecommunications Union (ITU), Universal Postal Union (UPU), Government of India and Government of Afghanistan have built modernize post offices in 11 provincial towns. The project aims to set up MCTs (*Multipurpose community tele-center*) in post offices to provide a variety of services such as community access to ICTs, e-post, e-mail, money transfer and salary payments.

The MCTs (*multipurpose community tele-center*) at 11 provincial towns are being used for providing training, salary payments to the families of defense personnel, printing, e-mail and

scanning. E-post has become very popular particularly when there have been disruptions in road communications. Messages are scanned, e-mailed, printed by the recipient post master and delivered.

3.5.2 eNID (National identification) card

The two major affairs necessary to control the fundamentals of a nation are residential affair and land affair. Especially, residential affair is the first priority to manage a nation. Number, name, activities of residents, and moving residence can be a basis of various national administration such as taxation, crime control, health management, passport and immigration (*Mohmand et al, 2009*).

Afghanistan resident identification module is to develop infrastructure which includes hardware, network, ID card issuance system, and application software to process resident data registration, resident management such as notice of birth, death and change of residence, and voter's list management.



Figure 10(A) sample of e-ID card

Figure 8 is the front side of Afghanistan National e-ID card which contains name, father name, grand father name/family name, date/place of birth, and residential permanent and temporary

3.5.3 Driver license (DL) system

Driver license is a computer application that will be implemented for driver license registration, revision, cancellation, recovery and renewal. This system will be fully integrated with the resident management system through interconnections. The goal of driver license system is to advance business and service of driver license through improved administration efficiency, information consistency, and reliability on driver license (www.gtr.com).

3.5.4 Vehicle registration (VR)

Vehicle Registration according to www.gtr.com is a computer application which will be delivered to Afghan government for the purpose of centralized management of vehicle registration, ease government regulation, law enforcement modernization of the current system and taxation of motorists. By adopting of international standards and best practices of vehicle registration system, the mentioned system will cover:

- Vehicle Registration ·
- Alteration registration ·
- Ownership Transfer Registration ·
- Revocation Registration and ·
- Investigation Registration ·
- Collateral Registration ·
- Model Registration and, ·
- Legal Entity Registration with certain statistics and tax reports

3.6 Outcomes and analysis

X-Road is explained in chapter two and three and also reviewed Afghanistan e-governance strategy and some of e-services in Afghanistan, now having a broad knowledge about X-Road system and e-services of Afghanistan in this section the combination or introduction of X-Road

system to Afghanistan e-services for secure and transparent data transformation among government agencies comparing to Estonia e-services.

Considering figure 9 it is the overall structure of Afghanistan e-government by applying the X-Road system to this structure it will ensure more protection and more transparency among government agencies. So far, explaining the X-Road system it is a very secure and protected data transformation system. It uses the digital signature technology to ensure transparency and protect data from third eye and third party.

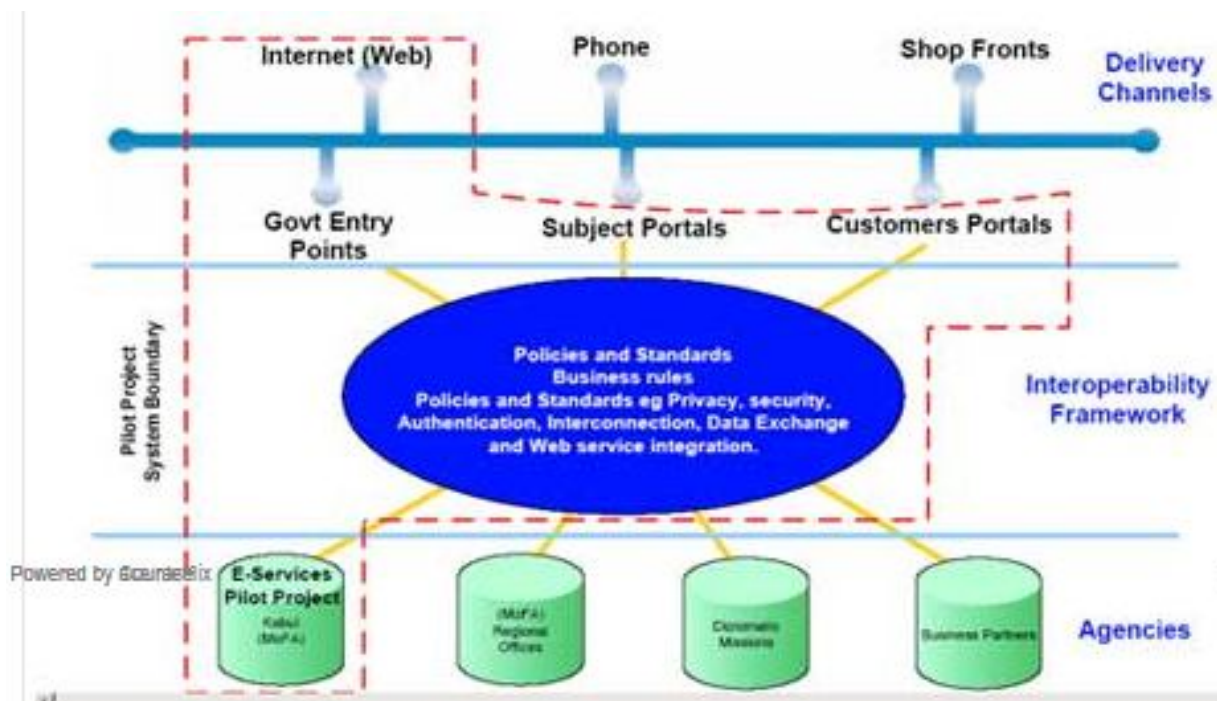


Figure 11 Afghanistan EGOV structure www.mcit.gov.af

Figure 10 is the overall structure of Estonia e-governance.

As explained in section 3.5 the Afghanistan eNID (electronic national identification card) is an integrated project of e-vehicle registration, e-driving license, and resident data registration. X-Road is the preferred way to use for integration of e-services and is accomplished by taking the following steps (Willemson *et al*, 2007) ;

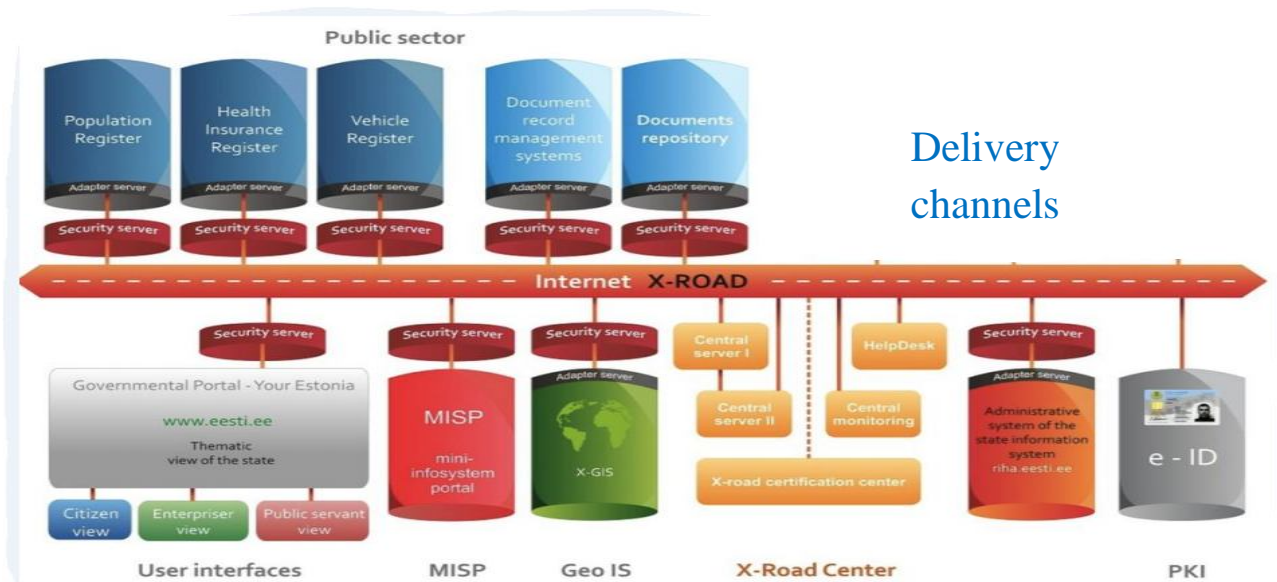


Figure 12 from www.raii.ee

- A separated X-Road server is installed in the organization’s premises and configured.
- The information system of the organization is modified to use X-Road services proxied by the X-Road server.
- Finally after making the contract with service provider, the user access rights are set up according to the contract.

By applying X-Road system to this pilot project of Afghanistan e-services as shown the overall structure of Afghanistan e-government in figure 9 or in other words transforming the structure shown in figure 9 to structure shown in figure 10 will ensure data protection and data transforming transparency.

X-Road system will **protect data** from transmitting to receiving or in other words it will protect the information from sender to receivers. The security of X-Road is guaranteed by its design and architecture together with regulatory, organizational and technical measures, data transactions between sender and receiver or between service provider and users occur directly between secure servers using encryption. The question is; how authority can securely exchange important data?

First, the data must be easily accessible by the authorities that are authorized to use.

Second, the integrity of the data must be maintained no third party should be able to make any changes to data while it is in transit.

Third, the data must remain confidential during its journey it must be protected from the eyes of unauthorized parties.

The X-Road system ensures **data transformation transparency** by assigning PKI (public key infrastructure) and digital sign to data and information. PKI requires the provider to use a mathematical algorithm to generate two long numbers, called keys. ... When a signer electronically signs a document, the signature is created using the signer's private key, which is always securely kept by the signer as shown in figure 11.

The X-Road makes life simple for both state and citizens for instance, when a child is born information about the birth is send it directly from the hospital to the population register from there it is send automatically to the health insurance fund, so that the child go health insurance and a family physician, this prevents the creation of excessive paper work and saves time.

PKI and Digital signature mechanism

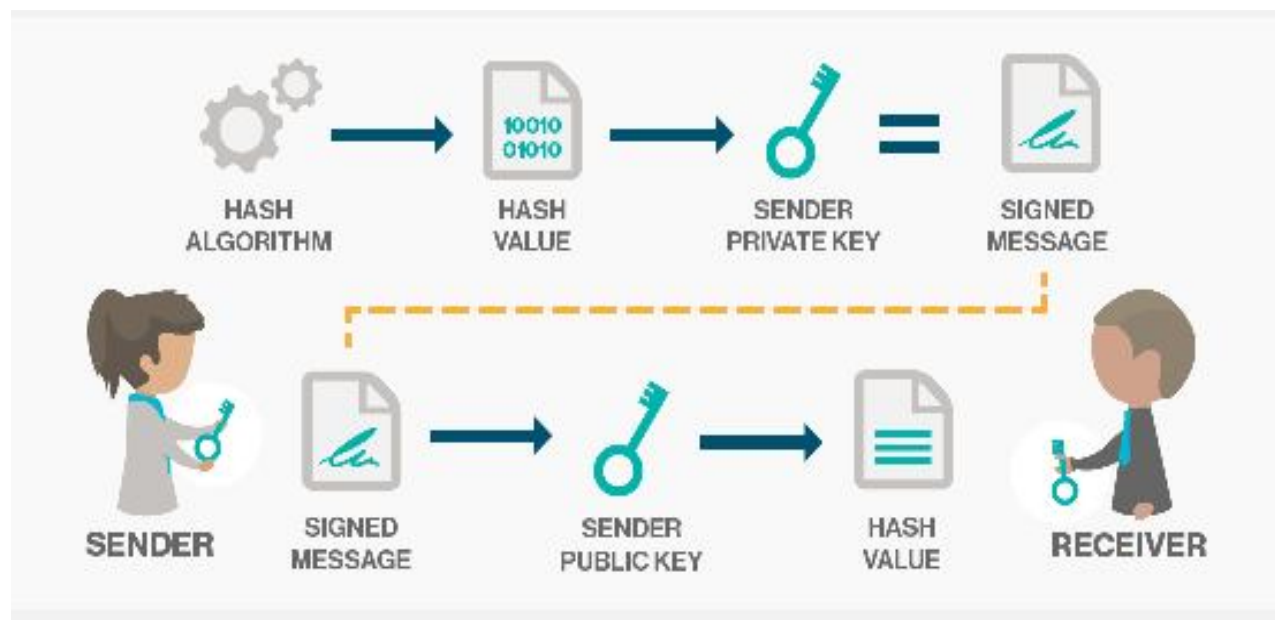


Figure 13 from www.google.com

Sensitive information move securely and the system itself is so resilient that cannot be easily breakdown by those with malicious intensions. The X-Road helps the state see a big picture of how different authorities are connected to one another in addition, the X-Road makes it possible

to exchange data not only within the country but also across national borders i.e. if databases and information systems are working properly.

3.7 Benefits of the X-Road system

Automation has proven to bring significant savings and raise the efficiency of government work. When processes are automated, users can be freed from tedious and routine tasks. For instance, when a governmental organization needs data from another organization, its information system can automatically request the necessary data from the IT system of the other governmental organization.

3.7.1 Offer services to people in a unified way

X-Road consolidates the services offered by different governmental organizations and provides users (citizens, entrepreneurs, government officials, local municipalities' officials, etc) with a unified user interface for interacting with the state. X-Road achieves this minimal impact on the existing structure of the governmental organizations that is, without changing the responsibilities of particular governmental agencies or shifting functions from one agency to another. The creation of new services is easy and affordable. To provide unified services to people, the system uses service portals, which are managed by specially appointed organizations for example figure 12.

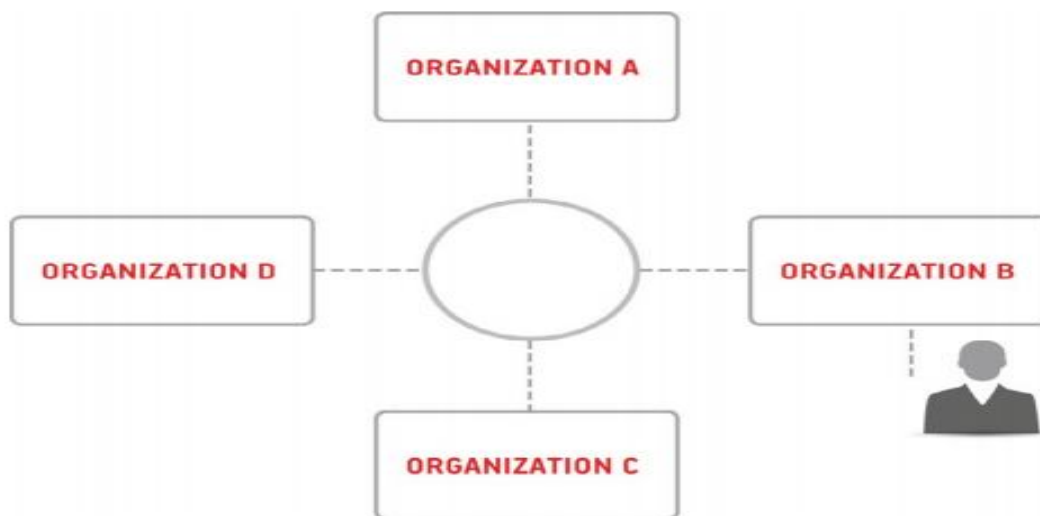


Figure 14 general view of the system www.cybernetica.ee

The figure 12 depicts a general view of the system. Example organizations A, B, C, and D offer services to each other and also use each other's services. The organization is seen as a black box, with services implementation details hidden. There is most probably an information system that provides and consumes the services. The services may be used because of the request executed by human user or because some automated process needs some data from other organization.

3.7.2 Replace paper documents completely

Most procedures demand the usage of paper documents for exchanging the information between persons. The security properties of paper documents are well understood and there are widely accepted and time proven solutions for archiving documents, For example, a single parent can apply for alimony without making a trip to the court house using document in court, determining the authenticity of documents, and so on. X-Road aims to build such kind of trust in electronic data or e-data by ensuring the long-term validity of electronic data exchanged using the system.

3.7.3 X-Road openness

X-Road is developed in the spirit of openness as in www.cybernetica.ee ;

- X-Road is developed from freeware components.
- A common protocol and the independence of development platform enables the X-Road system to secure interface with information system developed on any development platform.
- Data exchange on the public internet – X-Road does not require a separate network or a VPN (*virtual private network*). All data exchange is conducted over the public internet and is encrypted with SSL (*secure sockets Layer*).

3.8 Issues in e-services

3.8.1 Technical issues

Following are some of the main challenges that government should consider;

- **Interoperability** : The interoperation of various state governments, the various ministries with in a state government is a critical issue. Integration of data is main problem, how to capture the data in web based form and how to transfer it in common format for processing and sharing the information.
- **Privacy** : Privacy of any transaction or information provided by the citizen to the government agency must be ensured. Otherwise, the information can be misuse by the private sector or competitors and the users may be reluctant to access the services provided.
- **Security** : Transaction security is another major problem in e-governance. The tax, fine, and bill payment must be secured and the system design should be full proof. X-Road system can overcome this problem but it is expensive.
- **Authentication** : The authentication of citizens requesting services, needs to be verified before they access or use the services. The digital signature as explain in section 3.6 plays an important role in providing the authenticaticity but this is expensive and requires frequent maintenance.

3.8.2 Economic issues

- **Cost** : Implementation, operations and maintenance cost of service provided should be low enough for high cost benefit ratio.
- **Maintainability** : IT has been continuously evolving and software are frequently upgraded. Thus, the system must be compatible and maintainable for easily fulfillment of emerging needs.

- **Reusability** : E-governance should be considered as nationwide plan and the implemented modules must be reusable by other administrations.
- **Portability** : The primary requisite for portable applications is independence of components from hardware or software platforms, to help in possible reuse by other administrations.

3.8.3 Social issues

- **Accessibility** : E-governance service should be accessible for anybody from anywhere at any time. Even if internet population is growing exponentially, there is a very big portion of the population who may not be able to access e-governance for various reasons.
- **Usability** : All the users may not be expert of ICT transactions or the technology used for e-governance. Therefore the service provided must be usable or user friendly. To make the system usable, the guidance of operation may be provided to the users.
- **Acceptance** : E-governance requires reconfiguration of internal and external structure of public sectors. The main aim is to improve the system efficiently and to provide high quality services to the citizens. E-governance is for citizens convenience, instead of convenience of government. The power conflicts over the departmental and functional boundaries become more prominent in integration process.
- **Use of local languages** : The access of information must be permitted in the local languages for user comfort. There should be language software or some other technologies to translate the information from English to local languages.
- **Awareness in rural areas** : In Afghanistan there are very high percentage of villages where awareness of e-governance is required since large portion of rural populations are not aware of new technology and computer educations.

3.8.4 Political issues

Political willingness play an important role in the development and sustainability of e-government, but as far as Afghanistan is concern it is near to impossible to convince or to find out willingness of each political party. Some politically opposition organizations may take

advantage of the internet to spread propaganda on their ideologies and to create social disorder. It may be a big issue for Afghan government because, loose control of the government on political parties.

3.9 Challenges of e-governance/e-services in Afghanistan

Considering the current status and situation of Afghanistan the following e-governance/e-services challenges are comparison study with India e-governance challenges.

- **Lack of IT literacy and awareness regarding benefits of e-governance** : There is general lack of awareness regarding benefits of e-governance as well as process involved in implementing successful e-governance projects (G2G, G2C, G2B). The administrative structure is not geared for maintaining, storing and retrieving the governance information electronically (Athalye, 2013, p. 5).
- **Urbanization of existing ICT infrastructure** : To larger extent, in Afghanistan the computers in the department are used for the purpose of word processing only. This is resulting in the underutilization of computers in terms of their use in data mining for supporting management decisions. The time gap between the procurement of the hardware and development of custom applications is so large that by the time application is ready for use, the hardware becomes obsolete (Athalye, 2013, p. 5).
- **Unstability of government for sustaining e-governance projects at national level** : Direct and indirect interference of neighbour countries in Afghanistan create unstable situation or barriers for e-governance projects and its implementation for instance, the eNID (*electronic national ID card*) project since 2015 this project is ready but still to date it is not implemented or ID cards are not distributed to citizens.
- **Lack of coordination between government agencies and solution developers** : Designing of any application requires a very close interaction between the government agencies and the agency developing the solutions. Consequently the solution developed and implemented does not address the requirements of an e-governance project and hence does not get implemented (Athalye, 2013, p. 5).

CHAPTER 4

Conclusion and Recommendations

4.1 Conclusions

Running a modern state is data center in diver ensuring the functioning of the state requires administrating very large quantities of data or master database. Data is stored where it is created each agency administer its own data separately and the data is not duplicated at the same time. State authorities and agencies need data outside their previous in order to function.

The question is; how authority can securely exchange important data?

First, the data must be easily accessible by the authorities that are authorized to use. Second, the integrity of the data must be maintained no third party should be able to make any changes to data while it is in transit. Third, the data must remain confidential during its journey it must be protected from the eyes of unauthorized parties.

The X-Road makes life simple for both state and citizens for instance, when a child is born information about the birth is send it directly from the hospital to the population register from there it is send automatically to the health insurance fund, so that the child go health insurance and a family physician, this prevents the creation of excessive paper work and saves time.

The state functioning in the background the X-Road helps authorities make work process more convenient moreover, many activities can be automated which frees employee to deal with matters that requires human involvement. Authorities also do not have to worry about authenticity of data they can be confident that the data received from the population register office is

definitely originated from the actual office. Additionally the X-Road can be used regardless of what technology authority used it. For the state the X-Road above all makes it possible for authorities to efficiently exchange data among their selves.

Sensitive information move securely and the system itself is so resilient that cannot be easily breakdown by those with malicious intensions. The X-Road helps the state see a big picture of how different authorities are connected to one another in addition, the X-Road makes it possible to exchange data not only with in the country but also access national boarders i.e. if databases and information system are working properly.

The biggest beneficiaries of the X-Road are off course the citizens. They enjoy the benefits and better functioning of state and save all of that time they would otherwise submitting papers and forms.

4 Recommendations

The research study has certain limitations that could provide opportunities for further research. The methodology could look to expand by using primary data such as conducting focus groups involving citizen users, apart from using only secondary data. This paper has looked at the role of government taking initiatives toward e-services for ensuring data transparency among government agencies for instance eNID project in improving service delivery and the impact of that has on customer satisfaction. Further research in e-services should discover for effective utilization of e-services toward the searching of not only good governance but for better governance. This effective utilization will ensure and guarantee sustainable development of country and it will also ensure equilibrium in overall society.

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