B.SC. CSIT
6th Semester
E-Governance CSC366
Unit 2
E-Governance Infrastructure Development 10 Hrs

Instructor

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Introduction

- Full stack of E-gov consists of UI for Users, Applications, data centers, networks, laws, organizations, human resources, budget, standards, various infrastructures such as network, computing and data.

- So, for the successful use of e-gov requires e-readiness of government.
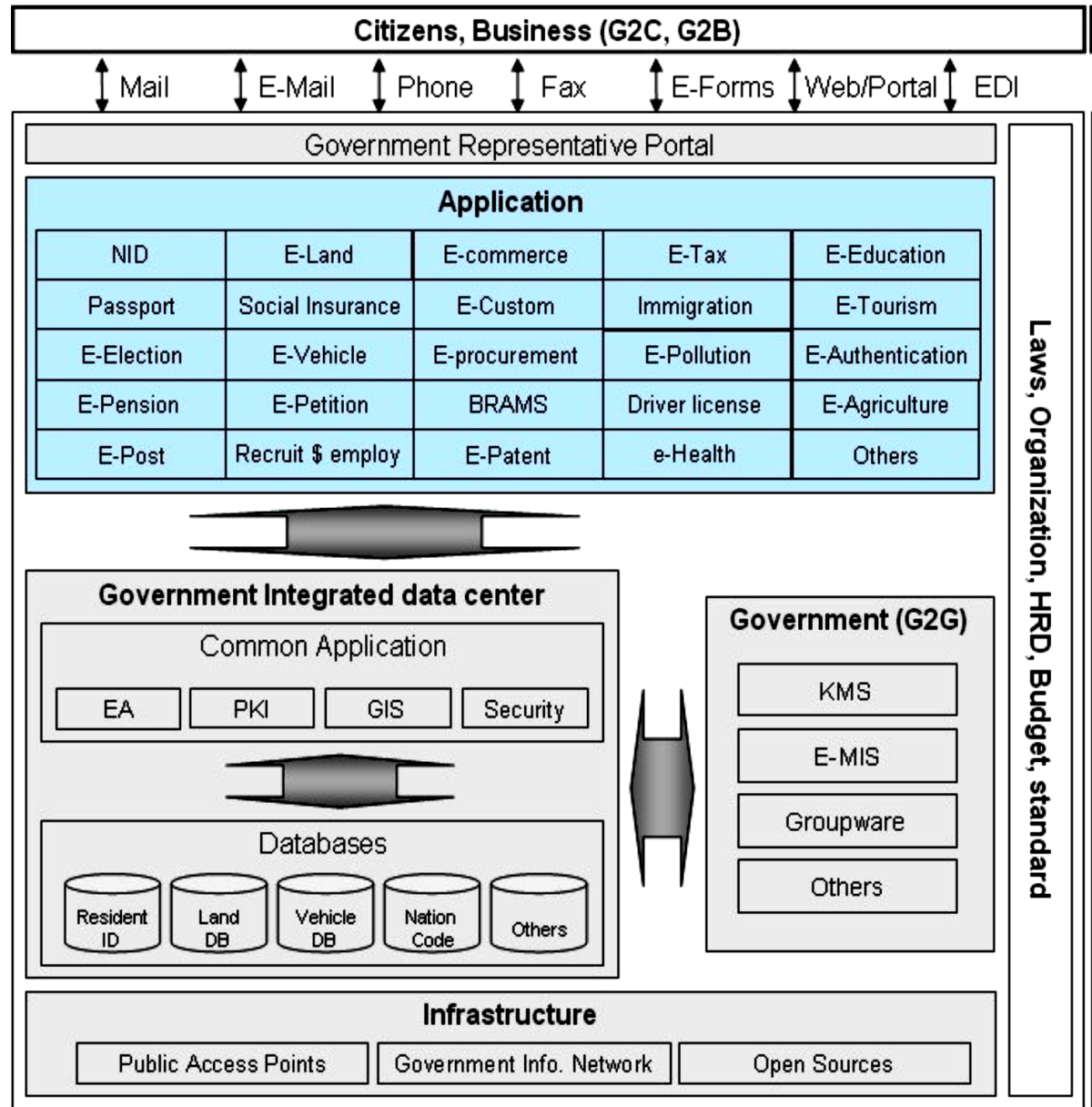
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- **E-readiness** essentials are a set of prerequisites that act as sound building blocks for implementing e-governance.

- Most of the e-governance initiatives in the past have either failed or could not commence because of lack of e-readiness.

- Following define the e-readiness of an organization

  – Data system infrastructure preparedness

  – Presence of strategic thinking, leadership and commitment among top-level decision makers.

  – Institutional infrastructure

  – ICT Infrastructure

  – Human Capacities

  – Legal Infrastructure

Contd…

- Presence of strategic thinking, leadership and commitment among top-level decision makers.

  – It is necessary to have visionaries at the top level who can put e-governance on the agenda of the organization and are able to carry it through to implement and effective utilization.

- Institutional infrastructure

  – There should also be institutions responsible for creating e-governance awareness among stakeholders and users, and coordinate the e-governance exercise.

- ICT Infrastructure

  – A sound computing and communication infrastructure is an essential requirement for effective operationalization of e-governance services.

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- **Human Capacities**

  - It is important to build human capacities in terms of necessary knowledge and skills to initiate, implement and sustain e-governance initiatives. It is equally important to generate right attitude that is receptive to ICT based administration and ICT based delivery of services. All require extensive and intensive training and ICT orientation programs at various levels of the staff and officers in the concerned government organization.

- **Legal Infrastructure**

  - `The Necessary laws and regulations should also be in place to support ICT as a tool for good governance.

- **Data system infrastructure**

  - MIS, records, databases and work processes should be in proper place to provide the quantity and quality of data to support the move to e-governance

E-Governance Infrastructure

- Infrastructure is the foundation needed to realize the e-government and to provide advanced services to the citizens.

- Without this foundation, all the e-governance services cannot be provided, and thus infrastructure needs to be laid out before anything else.

- National E-Governance Infrastructure should primarily involve, setting up following facilities:

  - Nationwide Network Infrastructure

  - Computing Infrastructure

  - Data Centres

  - E-Government Architecture

  - Interoperability Framework

# E-Governance Infrastructure--Network Infrastructure
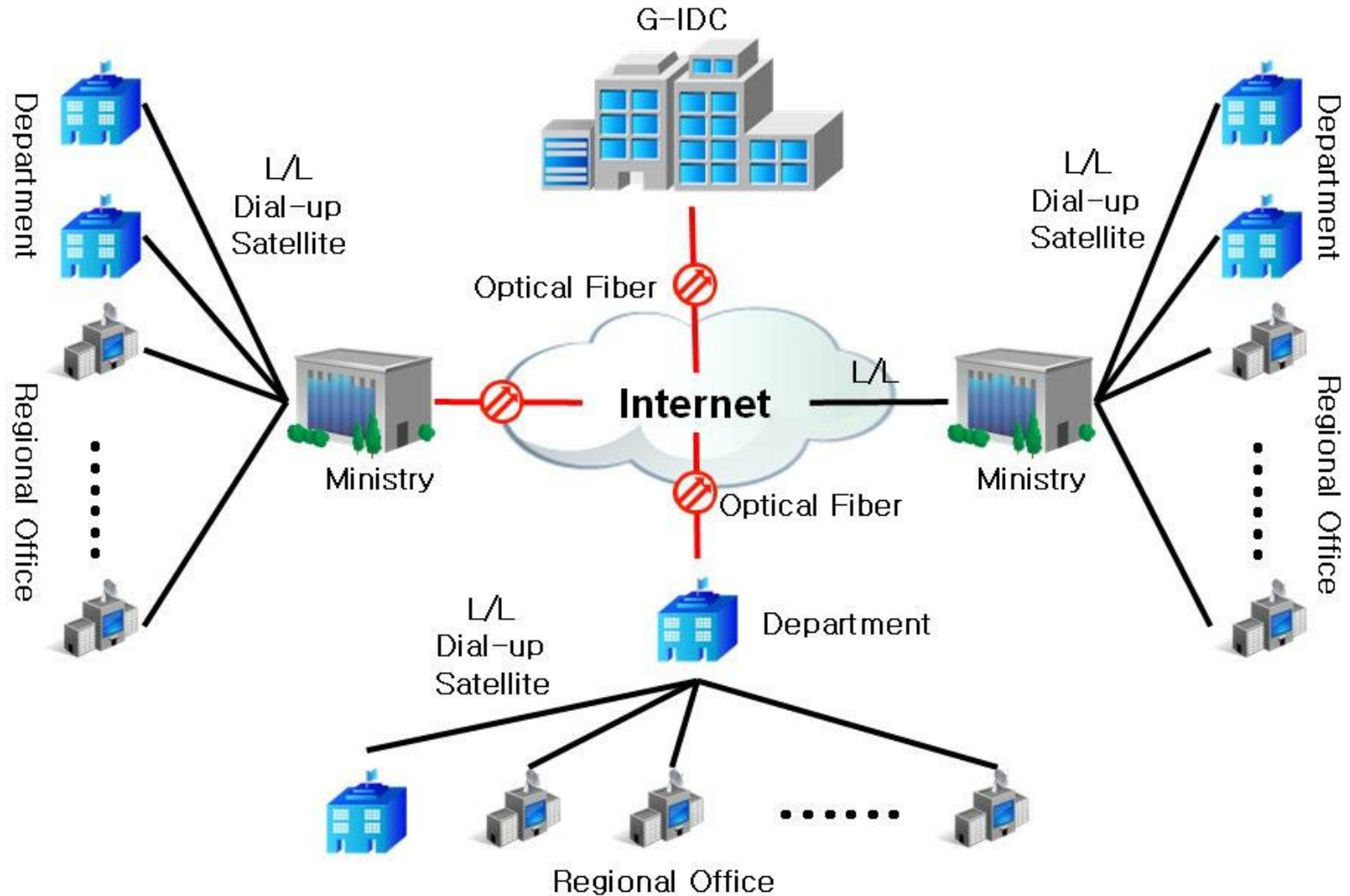
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- Network Infrastructure needs to be setup for government to deliver its services online, there is an equally important need for setting up nationwide communication network for citizens to easily access government services whether in the urban areas or in the rural parts of the country. Generally, urban parts of the country are already equipped with communication facilities. Therefore, Government needs to pay more attention to the rural and remote areas of the country to avoid occurrence of another digital divide.

- Various communication technologies have been successfully deployed in different countries. The popularly used communication technologies in various countries developed or developing, vary from Dial-up, ISDN, Leased Lines, Radio Frequency, Wimax, Fiber Optic, Satellite to Broadband.

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- Each of these has its own strengths & weaknesses. Based on the demographic, geographic and economic status of the country, one could choose among these technologies which are best suited for them. One could also consider deploying a combination of these technologies. Nationwide Communication Network, based on the geography & demography of the country, could be a daunting task. Government may, therefore, consider its execution in a phased manner. Strong and stable communication infrastructure is one of the critical success factors for delivery of government services online.

- E-government aims to bridge the gap or digital divide and provide equitable access of its services to all. Generally, network Infrastructure is readily available in major towns and cities while access is really poor in the remote villages or under-developed parts of the country. Depending on the existing state of infrastructure and geographic span/terrain of the country, it could at times become a daunting task and the government may find it difficult to carry it out alone. Participation of private sector should be sought in this area.

E-Governance Infrastructure--Computing Infrastructure
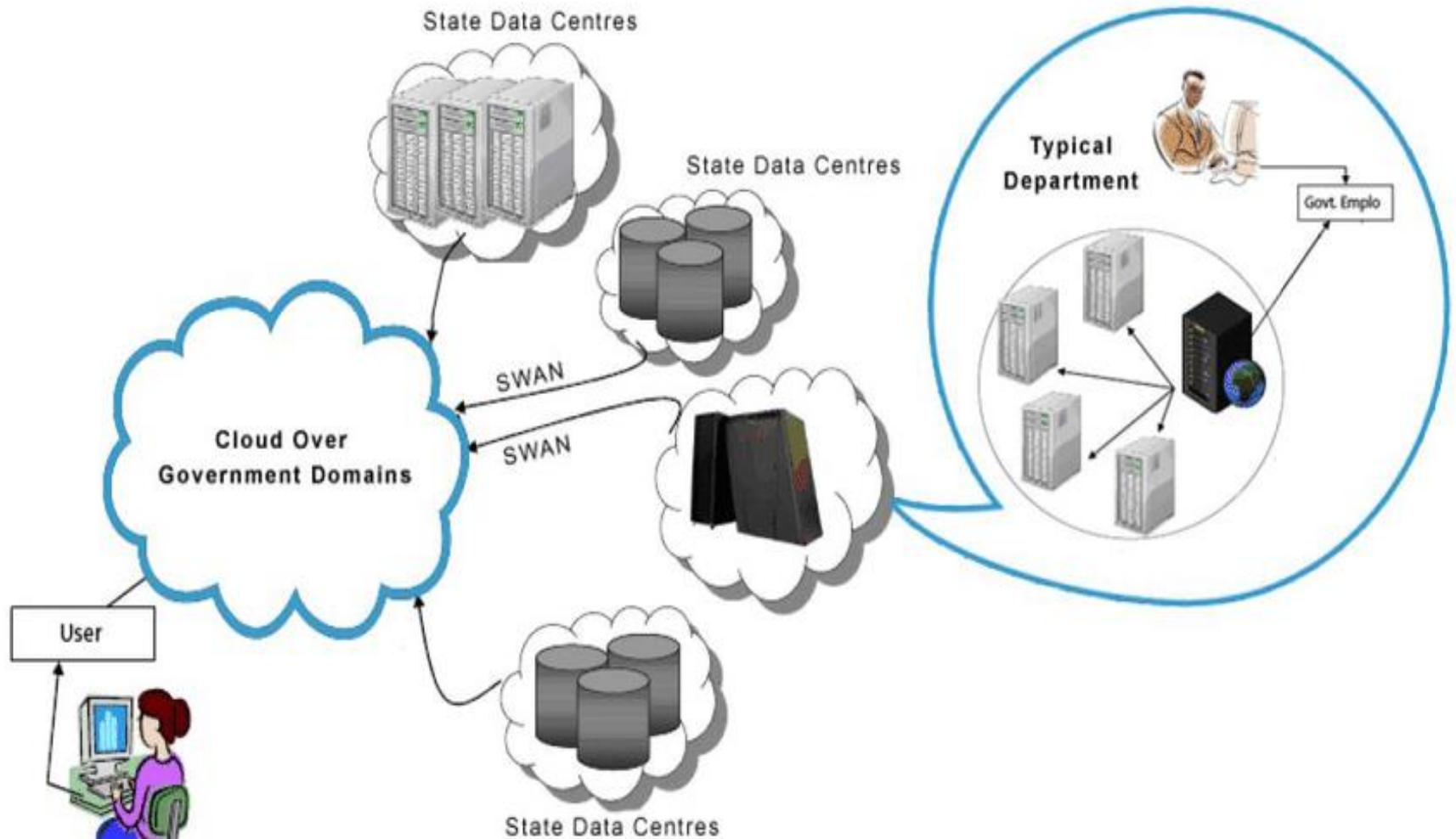
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- Computing Infrastructure is another important dimension of National e-Government Infrastructure. While on one end, government needs large computing infrastructure to develop and deliver e-government services on continuous basis, infrastructure is also needed at the end of citizens to derive the benefits of these services.

- Again, like network infrastructure, there is a high order of disparity in availability, affordability of computing devices in urban and rural areas, particularly in developing countries. Further, in rural areas, due to lack of basic infrastructure such as electricity, telephony, it may not be worthwhile for the people to have computers, even if they could afford it. To extend the reach of government services and address the wide range of citizens, governments world over are setting up shared infrastructure in the form of community information centres, Internet kiosks etc. Government should also consider, making their services accessible from various other media/devices such as basic telephones, mobiles, cable TV network, PDAs and many other hand held devices.
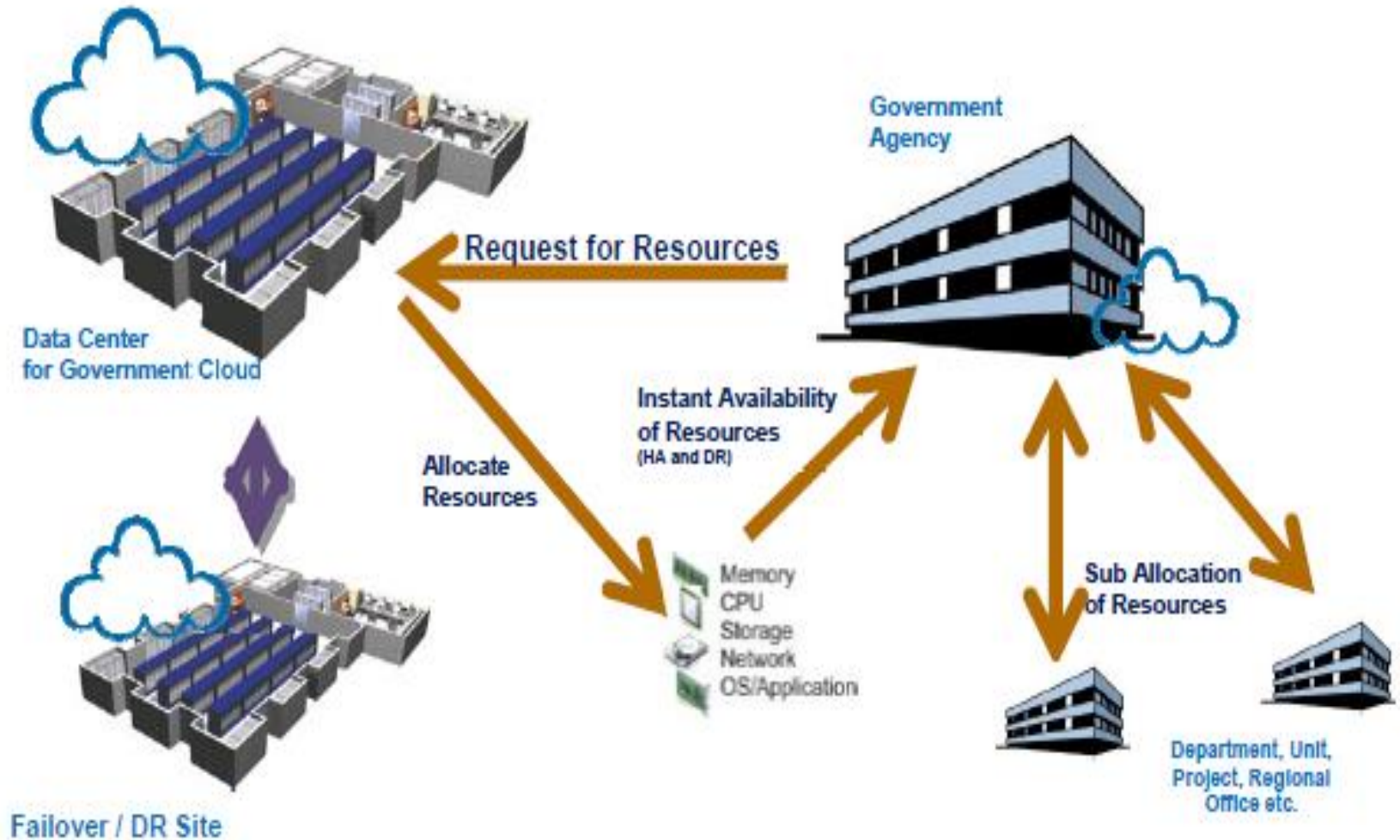
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- **Government should partner with state governments as well as local institutions to setup community information centres, computer centres and Internet Kiosks whereby people of the community can go and access the government services.** Such a concept has been tested in many countries and proved to be successful.

- Various models have been evolved in making these centres sustainable. Though initial funding has been made possible in many of the cases, the private sector/entrepreneurs should be asked to set up such centres, operate them to eventually make them self sustainable.

- The local institutions may also be asked to maintain and sustain such centres. Same centres can also be used for capacity building, conducting basic level ICT training programmes.

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- Behind the delivery of electronic services, a lot of automation and computerization of data and processes has to be handled at the backend. Large size software systems need to be developed to enable backend data processing, reporting Development, Testing and Tuning (Performance, Security) of these software need a lot of computing/storage resources. If the network connectivity is good between the Data Centre and the associated departments, the development and testing infrastructure (combination of hardware and software) could be set up inside the data centre but completely isolated from the Production Data Centre. Alternatively, the departments may have their own computing/development infrastructure. However, high end software testing infrastructure should be set up centrally at a Data Centre or in some shared facility of the government to make the proposition technically feasible and economically viable.

# E-Governance Infrastructure -- Data centers

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- In the era of e-governance, government is expected to deliver its services to the citizens on 24*7 basis. To achieve this, the government has to set up a sound and stable infrastructure operational round the clock.

- Data Centre is a facility which provides extremely reliable and secure infrastructure for running online operations on a 24*7 basis. It shall not at all be cost effective if each department starts setting up its own data centre as running a high class Data Centre needs a lot of recurring resources. It is, therefore, suggested that the government may set up a high grade Data Centre at a National level to be used by all entities of the government. All departments should, in turn, establish high speed connectivity with the data centre so that they can manage their applications from their own premises in a secured manner.
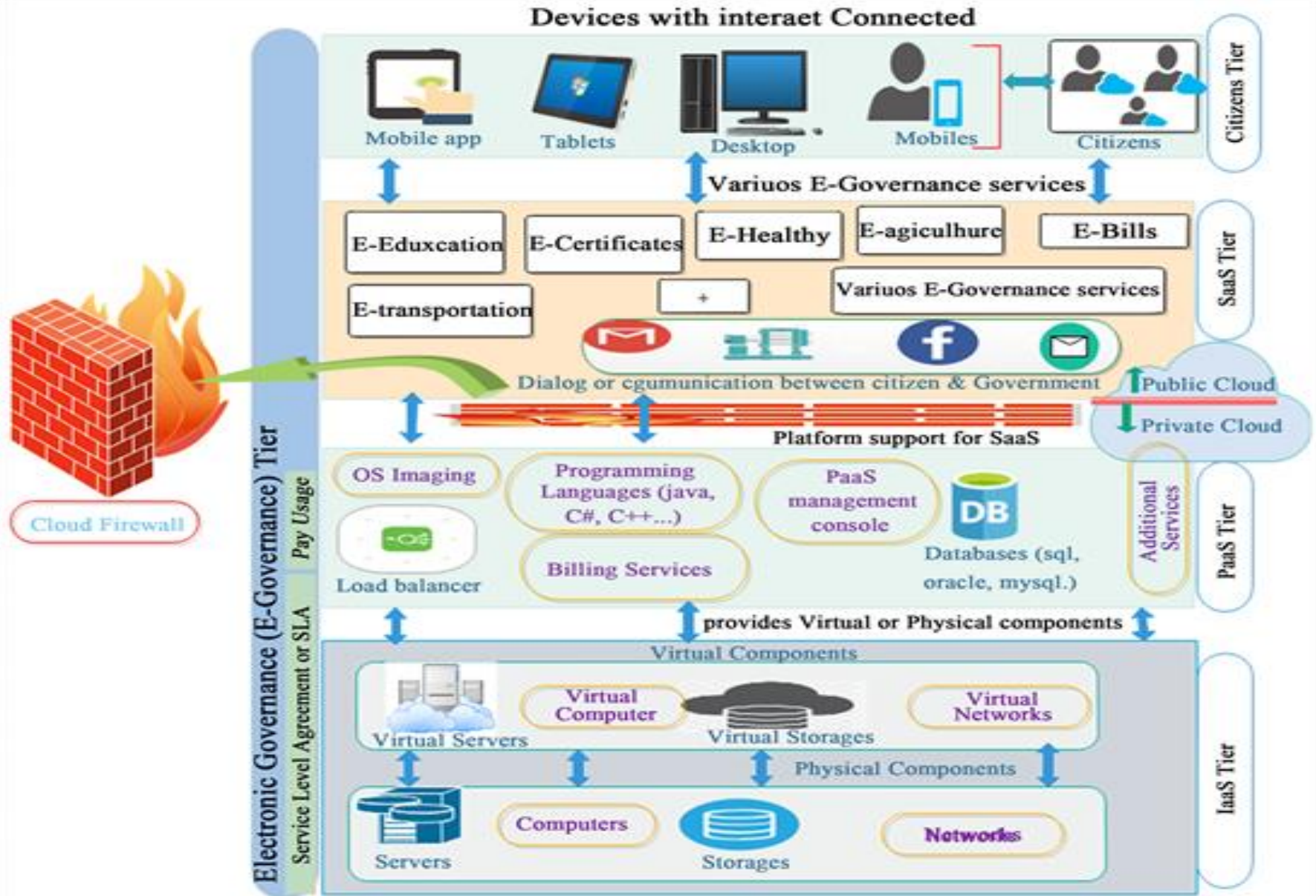
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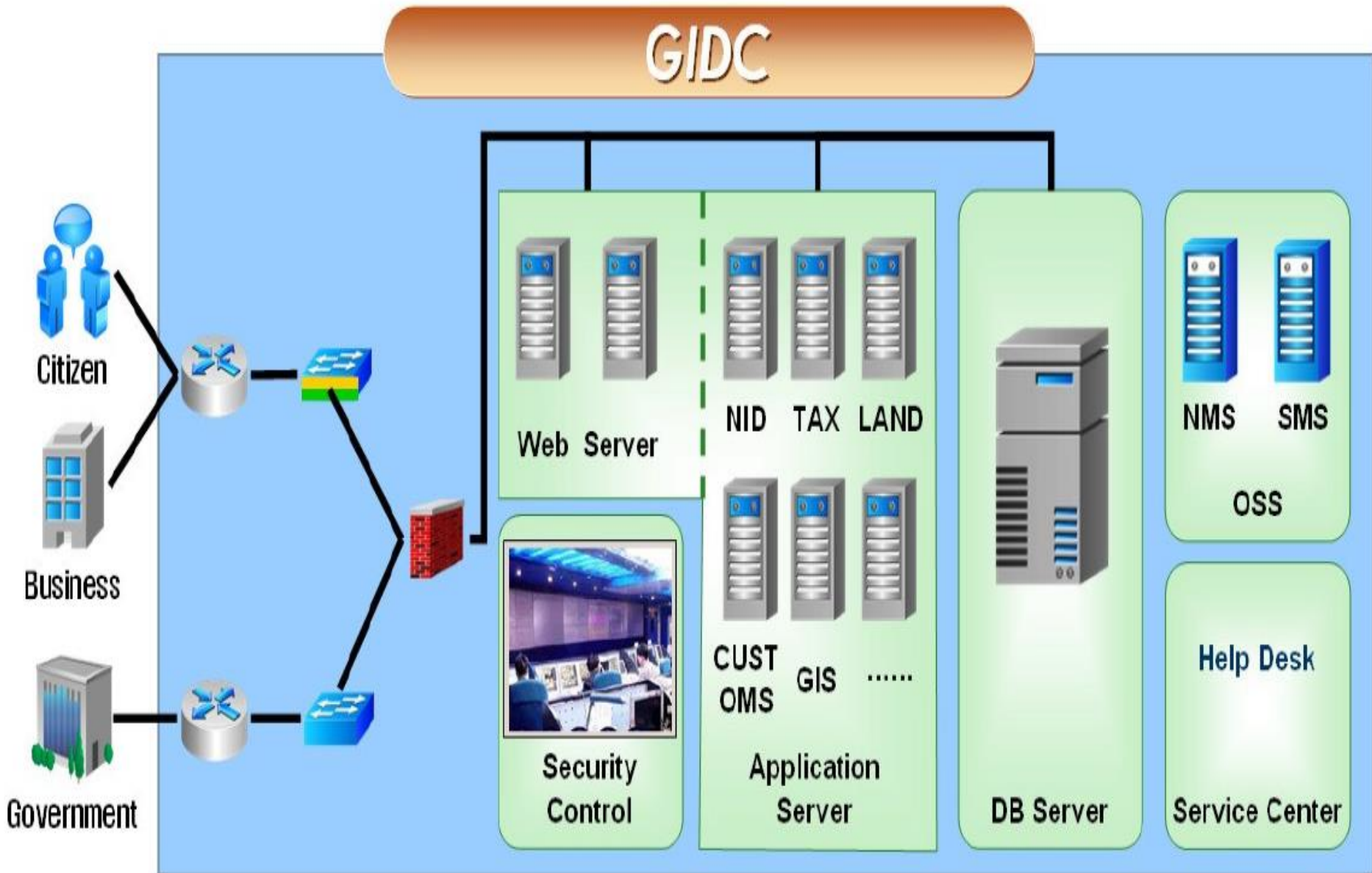
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- **An Data Centre should essentially have the following features:**
  - **High End Computing Infrastructure**
  - **Storage Networks (SAN/ NAS)**
  - **High Speed Local Area Network**
  - **Multi-Tier Security**
  - **High Speed Internet Connectivity**
  - **24*7*52 Help Desk**
  - **Multi level Redundant power back-up**
  - **Air Conditioning Management**
  - **Fire Detection & Control System**

- Besides providing computing and storage resources on demand, another important aspect/role of Data Centre is to provide **data protection.** Therefore, Data Centres need to have strong **state-of-the-art backup and recovery and vaulting solutions** in place.

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- The data digitized and gathered by the government in the process of governance is very valuable and the government can not afford to lose this data at any cost, even due to natural disasters.

- Hence, the government has to consider setting up a Disaster Recovery Centre in a geographically different location, preferably in a different seismic zone.

- In case a government has multiple data centres, they can be connected to act as a back-up for each other.

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E-Governance Infrastructure--E-Government Architecture

- E-government Architecture consists of three components :

  - Services Architecture

  - Process Architecture

  - Data Architecture

  - Application architecture

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- Services Architecture :

    – Describes the whole lot of services offered by the Government, processes to be followed for each service, Concerned Department(s), relation/dependence on other services etc. Services could be like Vehicle Registration, Passport Issuance, Caste Certificate, Payment of Tax, etc.
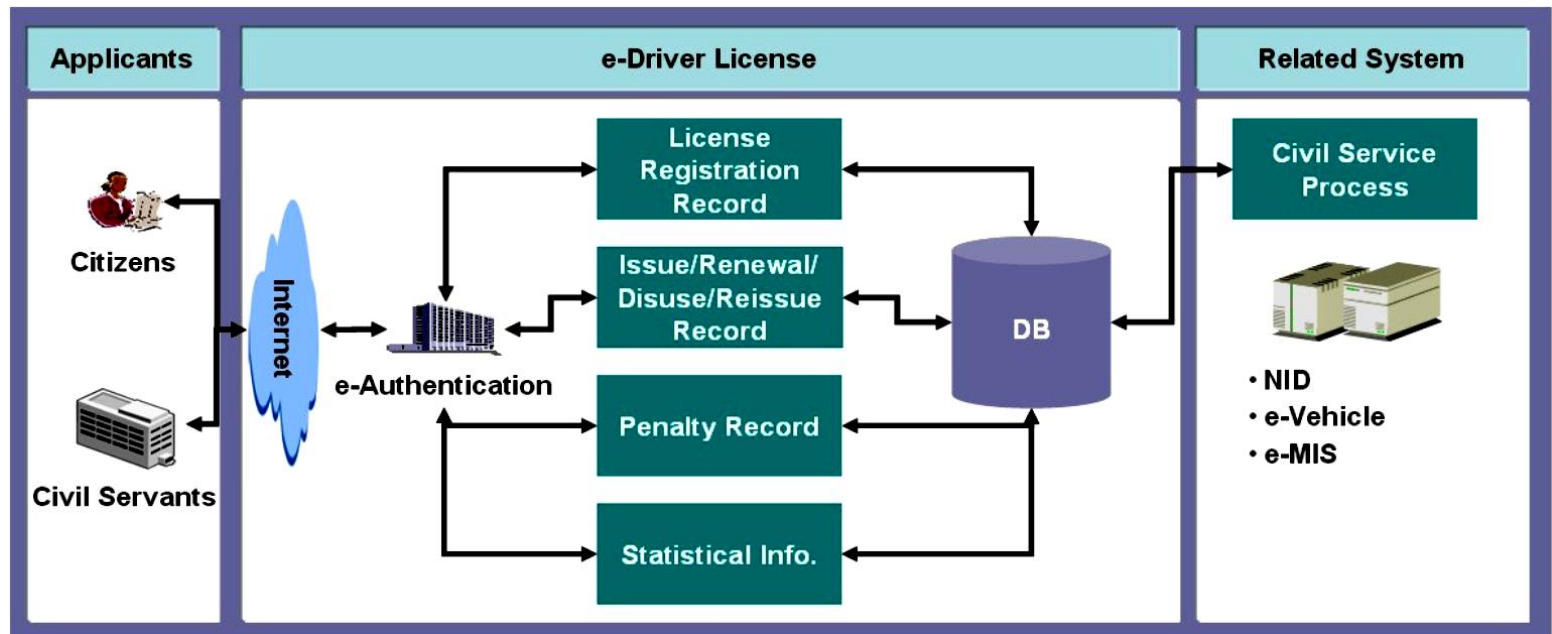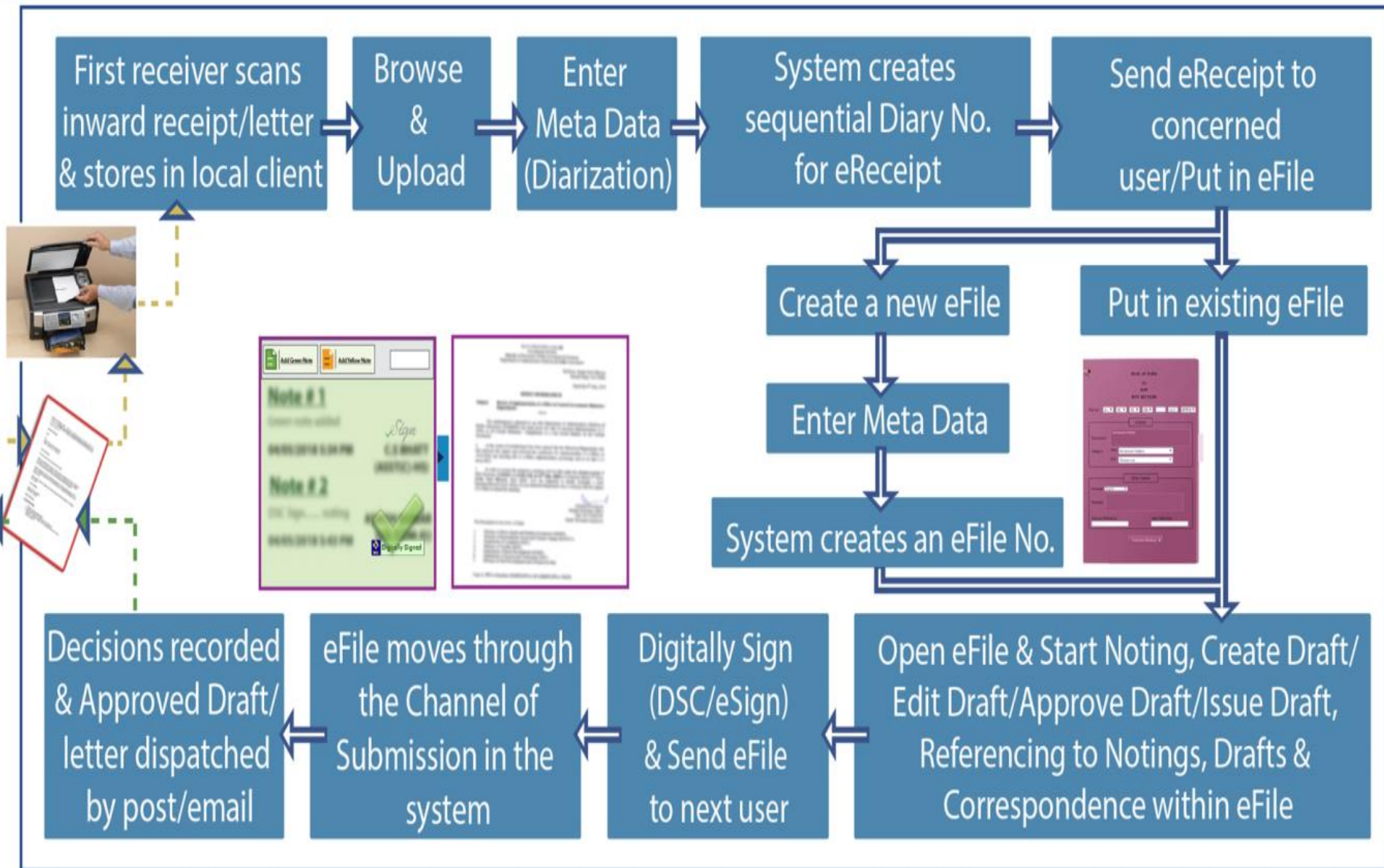
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- **Process Architecture :**

  - Lists the various processes to be followed for rendering different services, independent of their association with one or more services.

  - These processes are then further grouped in various categories and detailed rules/procedures are defined for executing each of the processes.

  - This brings a lot of standardization across services and promotes interoperability as well as reuse of process components.

  - Processes could be Content Management, Citizen Registration, Personalization, Online Form Submission, Electronic Payment etc.
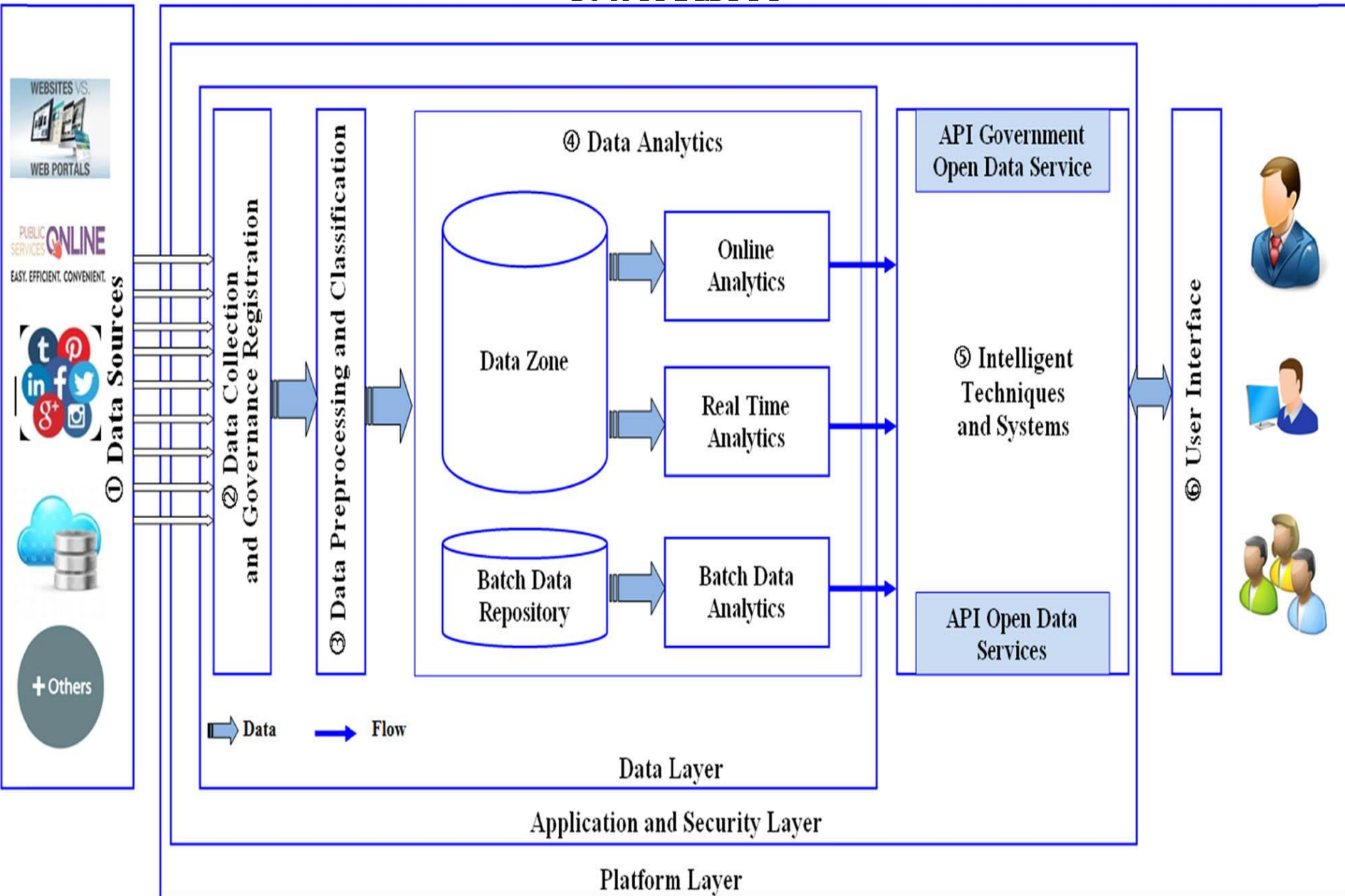
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- **Data Architecture :**

  – Deals with the data associated with various Government Services, as described in service architecture.

  – In Data Architecture, we enlist all the data elements needed/associated with above service and then define metadata about each data element.

  – This metadata information includes the standard Nomenclature for each data elements, their type, size, format, default value, valid value range, owner etc.

  – Use of such a standard definition by all government applications shall facilitate interoperability among various applications as well their integration which shall go long way in delivery of integrated/ one stop services to the citizens and businesses.

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- **Application architecture:**

  - It primarily defines the various tiers of an ICT application such as Data Layer, Business Logic, Presentation Layer, technologies to be used in each layer and interaction between these layers.

  - Guiding principle is that each layer should be separated or made independent from each other, layers as afar as possible. E-government applications are generally about automation of government operations at the back end and delivery of services at the front.

  - These applications involve a lot of data and logic based on government rules, procedures, regulations etc. In a real life situation these entities undergo change from time to time.

  - Effort should be to separate different layers of application so that change in any one of them should not effect the whole application.

  - Principles of n-tier architecture and Web Services based Architecture should be used while defining Application Architecture.

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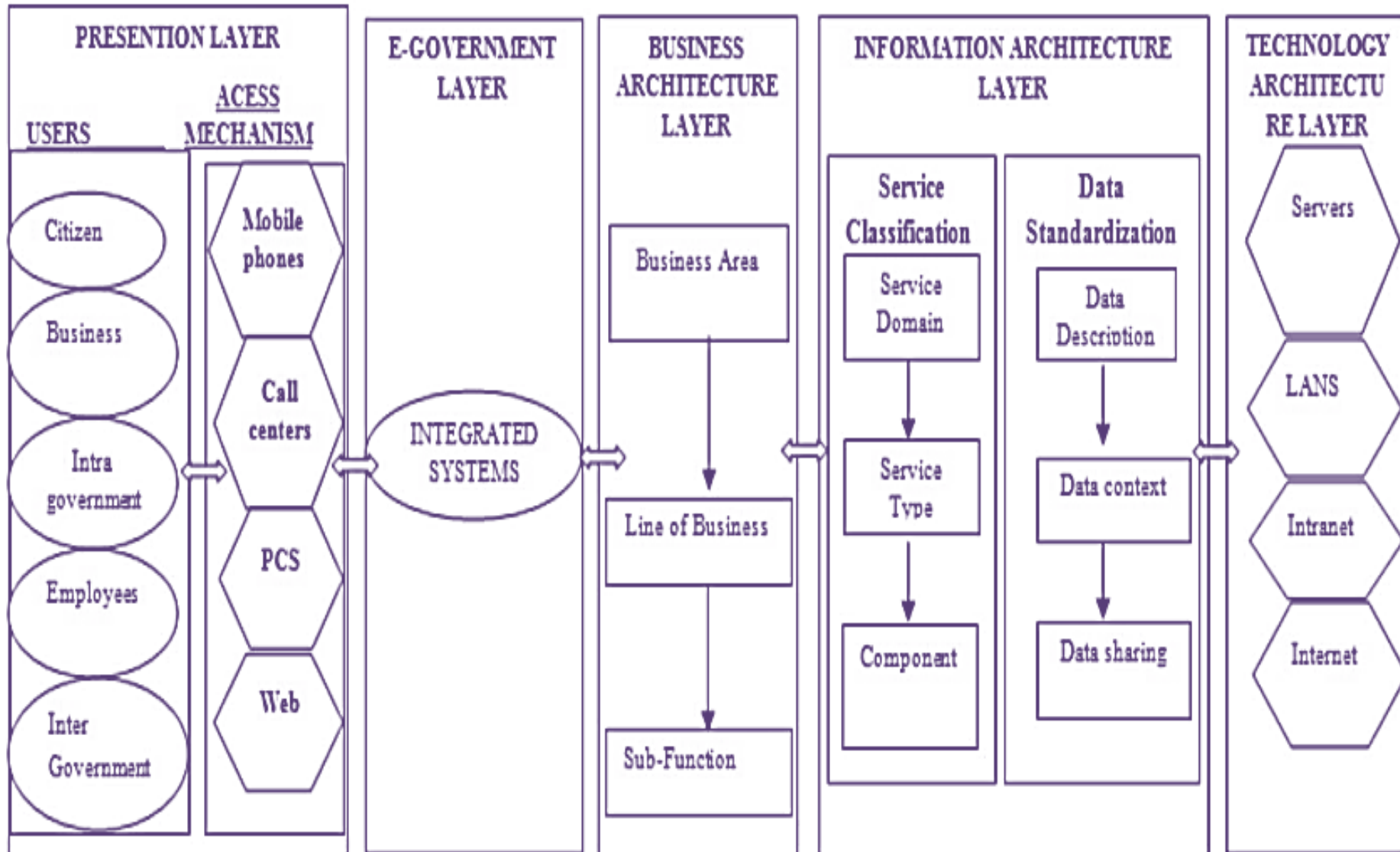
E-Governance Infrastructure—Enterprise Architecture

- EA provides a unified information standard at the government level by defining services and work procedures of each agency and the relationship between current conditions of ICT and future tasks.

- It also ensures information sharing within the administration, standardizes processes, and establishes ICT Governance by developing link information among architectures and by building EAMS which manages ICT resource information.

- Enterprise Architecture provides Performance Reference Model, Business Reference Model, Data Reference Model, Service Component Reference Model, Technical Reference Model.

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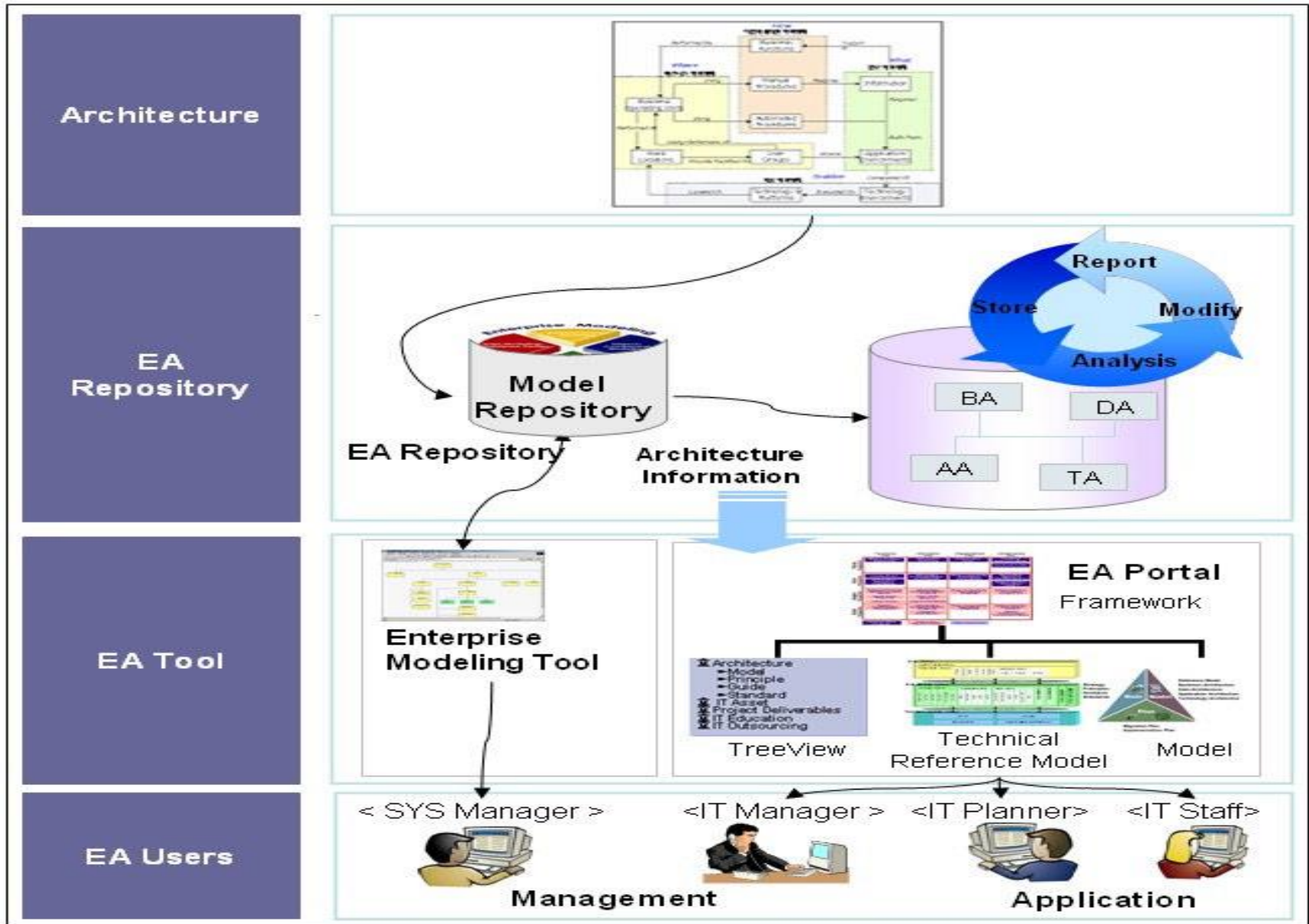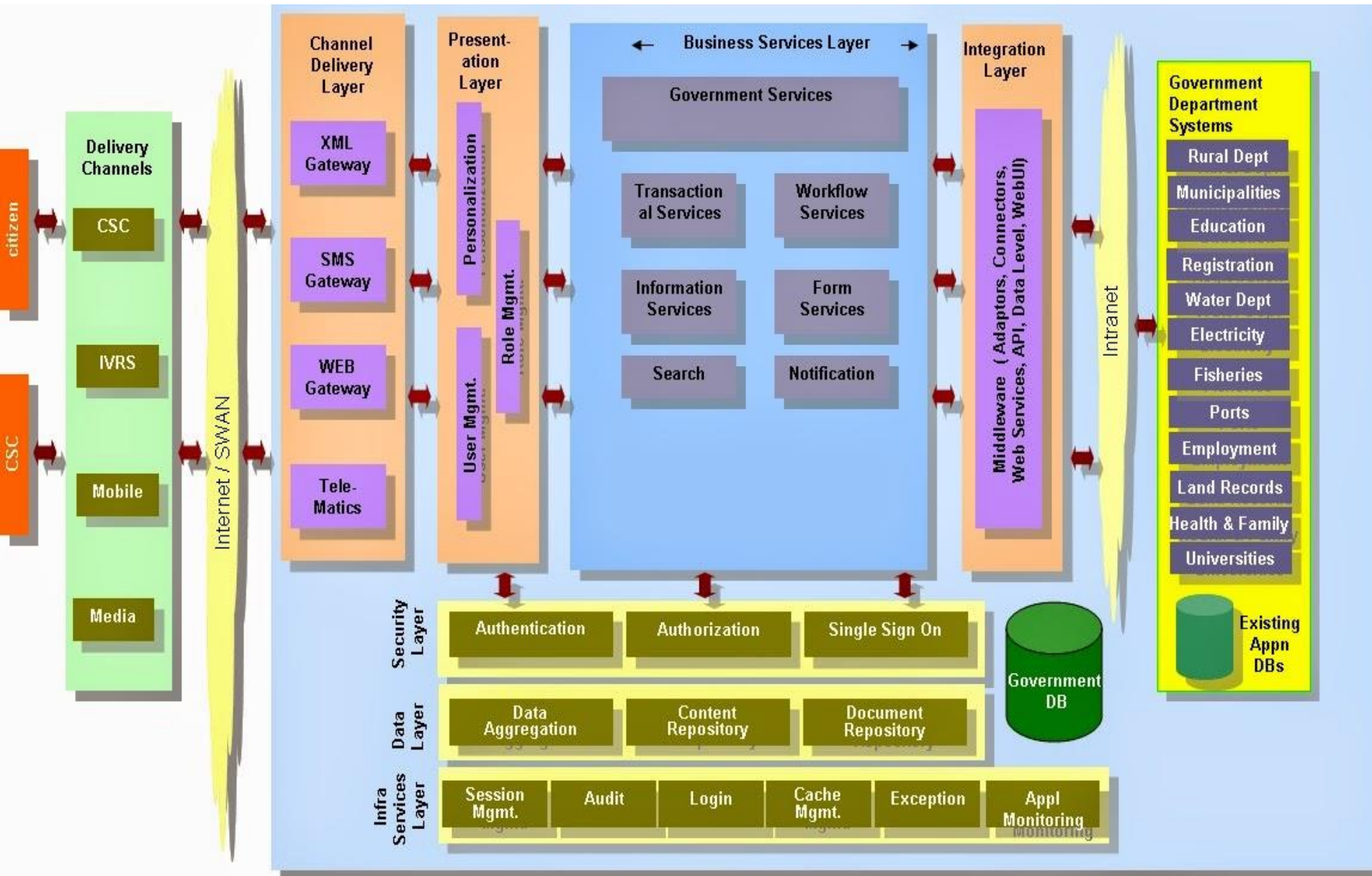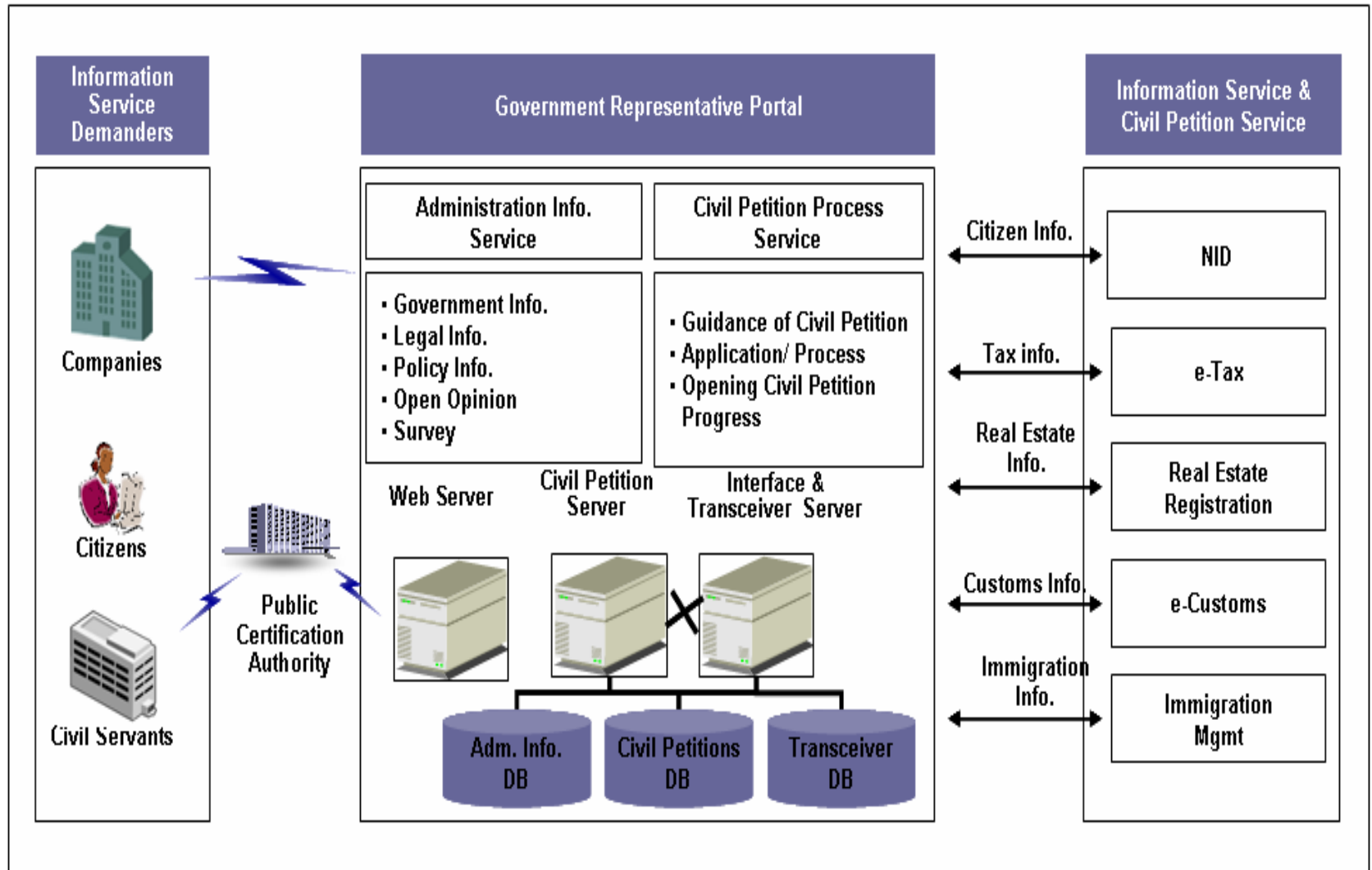
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- Enterprise Architecture provides the following benefits to the government:

  - Creation of communication tool between work processing organization and ICT organization

  - Formulation of the basis for cooperative utilization of public information by establishing interoperation system and standardization

  - Clearance of redundant projects and fair estimation of project cost

  - Decision-making to introduce information technology based on technologies, principles, and guidelines

E-Governance Infrastructure--Interoperability Framework

- One of the main objectives of most E-Government initiatives is to provide one stop integrated, client-centric government services to the citizens as well as businesses.

- In order to attain this objective, the Government needs to be perceived as a single entity, with seamless flow of information across individual ministries and departments as necessary.

- An Interoperability Framework is essential to support the flow of information and to improve the coherence of information systems maintained by individual ministries and departments.

- The Interoperability Framework aims to define the set of specifications to facilitate Government systems to communicate and interoperate with other systems, both within Government and external to it, efficiently and effectively.

- Interoperability Framework provide the government the ability to share information and integrate information and business processes by use of common standards.

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- By bringing together the relevant specifications under an overall framework, ICT management and software developers have a single point of reference whenever a need arises to locate the required interoperability specifications that should be followed for a specific project. By adopting these interoperability specifications, system designers can ensure interoperability between systems while at the same time have the flexibility to select different hardware, systems and application software to implement solutions.

- Compliance with the Interoperability Framework can be made mandatory for any system in the Government. Suitable mechanisms must be adopted by existing and legacy systems to conform to the framework.

- Framing of policies and specifications for Interoperability Framework should be followed up with provision of support, guidance on best practices, toolkits and agreed schemas. The entire strategy to implement good e-government should be viewed in long-term perspective and hence must be supported by vigorous processes. The development of Interoperability Framework must therefore be reviewed and updated on a continuous basis.

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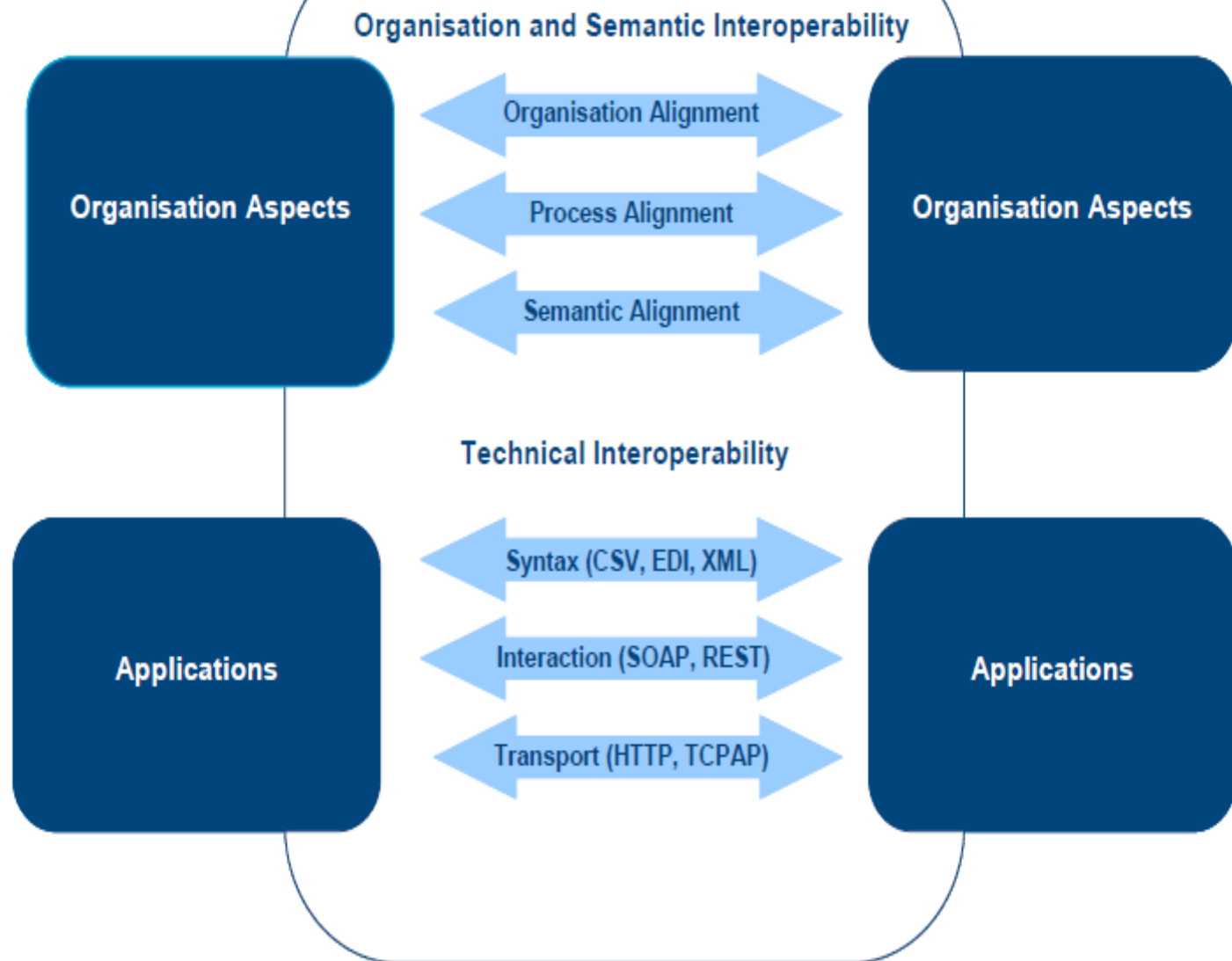
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- *Interoperability Framework is a* framework to the government to share, collaborate and integrate information and organisation processes by use of common standards.

- **Dimensions of interoperability standards:** Business process or organizational interoperability, information or semantic interoperability, and technical interoperability.

- Recommended standards for the success of interoperability is Open Standards.

- **Advantages:** Interoperability among government agencies, Share, Re-Use and Collaborate, Scalability, Adherence to open standards.

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Agency C
(Affiliated Agency of Ministry A)

User 1   User 2   User N

Sharing of Organization Chart
- Necessary when interoperability with related agencies is high
- Used for appointing the e-Approval line

e-Document Exchanges

No Sharing of Organization Chart
- When defining standard of e-Document exchange
- When two agencies exchange document as defined

User 1   User 2   User N
Ministry A

User 1   User 2   User N
Ministry B

E-Governance Infrastructure- Public Key Infrastructure(PKI)

- The Public Key Infrastructure uses public key to enhance confidentiality and authentication in an open network environments that requires high security. Therefore, confidentiality and authentication are critical to prevent adverse effects of digitalization.

- PKI Provides facility for

  - Issue/renew/revoke certificates

  - Encoding information(confidentiality)

  - Preventing forgery of information(integrity)

  - Checking user identity(authenticity)

  - Enhancing user reliability through electronic signature(non-repudiation)

- PKI helps

  - Promotion of reliable on-line commercial transactions

  - Replacement of face-to-face, paperwork-oriented transactions

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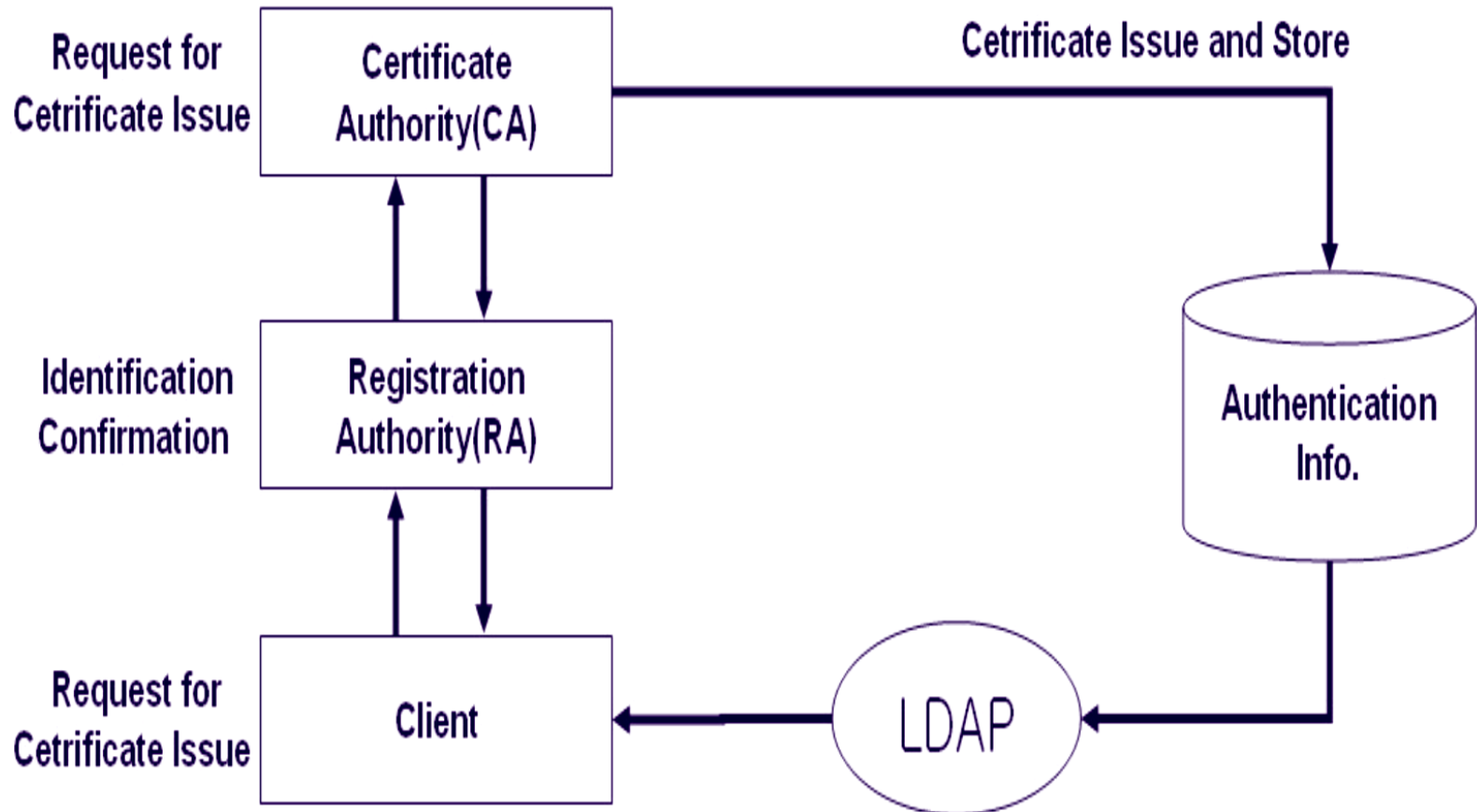
E-Readiness

- Degree of preparedness of a country for implementing e- governance.

- E-Readiness is the ability to use information and communication technologies (ICT) to develop one's economy and to foster one's welfare.

- Is the ability to pursue value creation opportunities facilitated by the use of the Internet.

- Is a measure of e-business environment, a collection of factors that indicate how amenable (willing) a market is to Internet-based opportunities.

- Is not simply a matter of the number of computer servers, websites and mobile phones in the country, but also things such as its citizen's ability to utilize technology skill fully, the transparency of its business and legal systems, and the extent to which governments encourage the use of digital technologies.

E-Readiness

E-readiness: Domains and Clusters	
Domains	Clusters
1. Access	(a) Infrastructure
	(b) Services
2. Capacity	(a) Social Factors
	(b) Economic Factors
	(c) Policy Factors
3. Opportunities	(a) Opportunity penetration
	(b) Specific Applications

E-Readiness


```
E-services
├── Access
│   ├── Infrastructure : Wireless density, #ISP, etc
│   └── Services: telephone, prices postal services, etc.
├── Capacity
│   ├── Social: literacy rate, poverty index, etc.
│   ├── Economic: GDP per Capita, #credit card accounts, etc.
│   └── Political: telecom competition, Openness of trade, etc.
└── Opportunities: E-banking, B2B, B2C, B2G, C2C procurement, Marketing/information search, Comparison of alternatives, Payment, Delivery of goods, Logistics, Interface with public administration, etc.
```

E-Readiness -- Data System Infrastructure

- The core of e-governance is e-MIS and holds the entire database of any organization .

- The data that were managed manually need to be computerized or brought into electronic form which means that the preparedness of computerized database or data warehouse is required.

- Data quality and data security are of prime concern here as most of the government infrastructures are not up to the mark in developing countries.

- The major question that arises here is " Are all the requisite management information systems, records, databases and work processes in proper place so as to provide the quantity and quality of data to support the move to e-governance?"

- This is the core computerization activity of any government process which may take several years to reach this stage.

E-Readiness -- Legal Infrastructural Preparedness

• The manual processes in government are usually obsolete, inefficient and bureaucratic.

• Though they have transformed to computerization practices, they continue to have poor and inefficient performance and this is due to lack of administrative reforms and lack of business process reengineering.

• They lack requisite legislation and legal infrastructure to enable such reforms or reengineering of the existing business practices, rules and regulations within the government at various levels.

• This seems to be accentuated in developing countries while developed countries have been significantly successful in administrative reforms and business reengineering.

• The fundamental question that arises here is " Are the laws and regulations required to permit and support the move towards e- governance initiatives in place?

• E.g., ETA, Digital Signature Act, Legal acceptance of computer printed docs

E-Readiness --Institutional Infrastructural Preparedness

- For any government to implement a successful e-governance project, the required institutional infrastructure must be in place which most of the government lack.

- The government body has to establish a separate IT department which basically coordinates with facilitators for e-government projects within the nation.

- The IT department works out for the hardware selection and procurement, network or software development and implementation and also the training of staff at various levels of the government.

- Many countries still lack the institutional infrastructure.

E-Readiness -- Human Infrastructural Preparedness

- Human resource development by training is an essential requirement which comes from well trained manpower both technical and non-technical.

- The technical manpower resources are essential for all the phases of e- governance and related information system life cycle comprising systems analysis, design, programming, implementation, operation and documentation.

- Both private and government institutions should play a major role in this regard.

- Apart from technical human infrastructure, there is a need for the crucial training and orientation of user personnel i.e. government staff in e- governance project.

- The government employees and staff who are the stake-holders in all e-government projects as the end users are to be appropriately trained and oriented for change management from a manual government environment to e-governance environment.

- Such training will make them competent and capable of handling e- governance projects at operational level

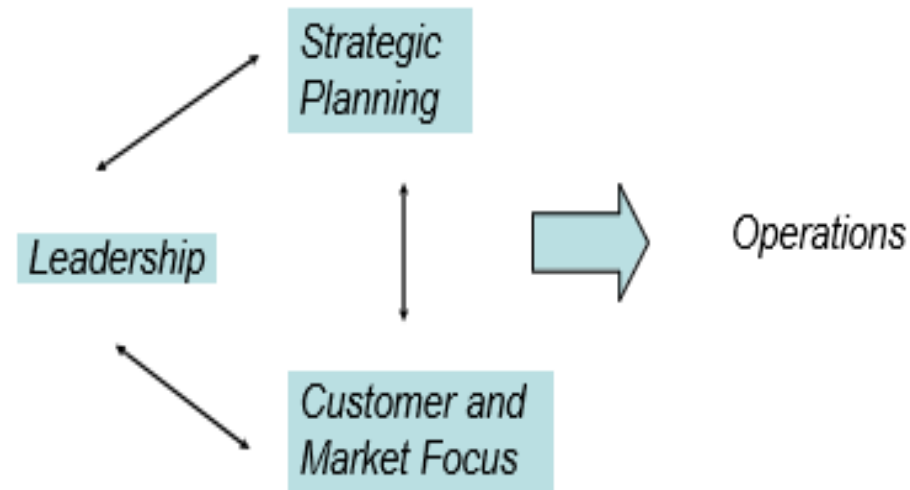# E-Readiness --Technological Infrastructural Preparedness

- Technology is fast changing in ICT domain and there is a rapid obsolescence of software as well as hardware which require great financial support time and again.

- Government organizations encounter this situation especially as their procedures to procure hardware or software are very inefficient and slow.

- The latest technological infrastructure in developing countries including computing and telecommunication is absent. As a result software and hardware may not be compatible.

- The major reasons are

  - cost of technology

  - Adaptability

  - Obsolescence

- This is a serious limitation to e-governance implementation.

- Innovative solution for funding needed to be explored.
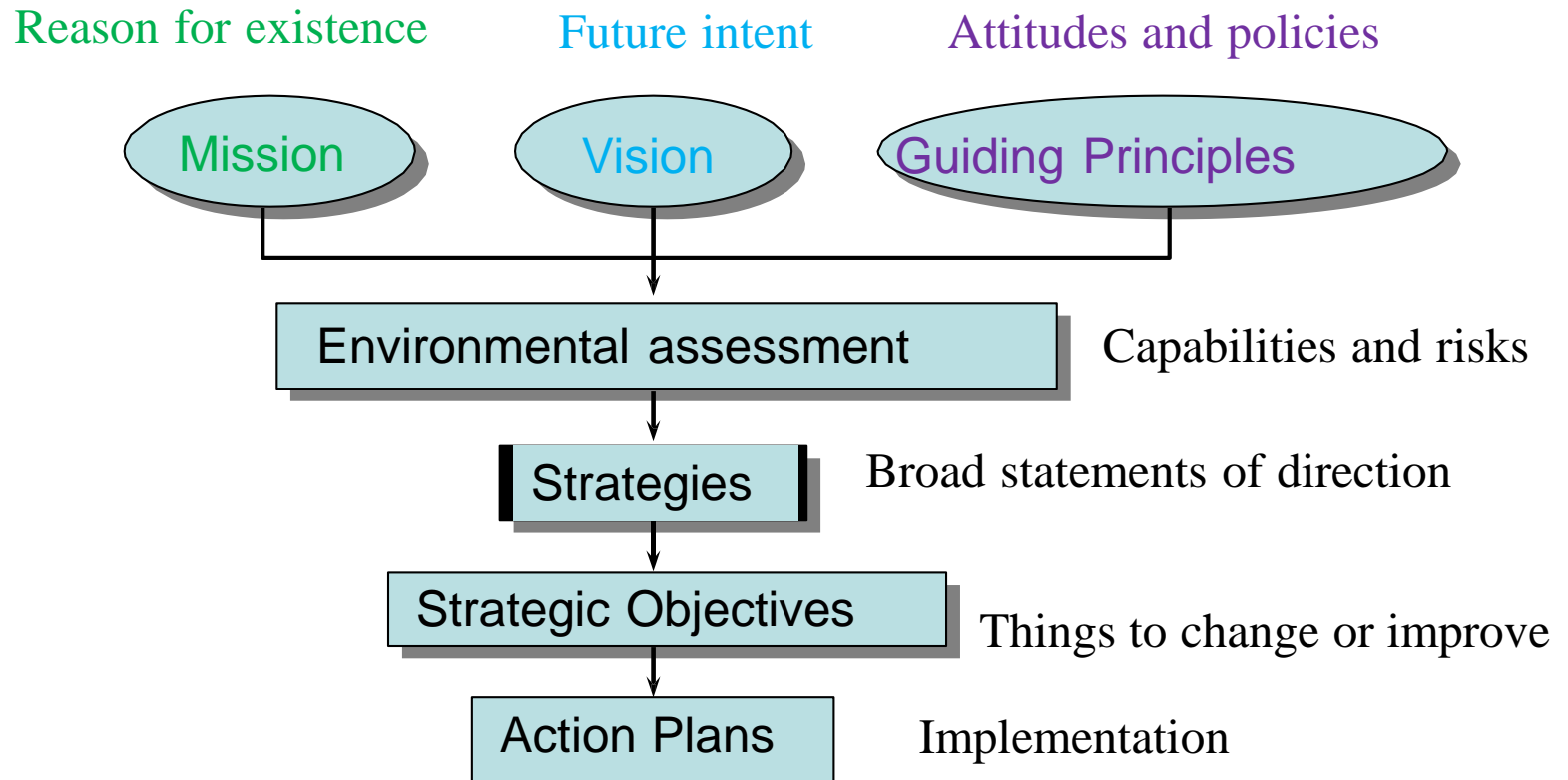
E-Readiness: Leadership and Strategic Planning

- **Leadership**

  - The ability to positively influence people and systems to have a meaningful impact and achieve results.

  - **Strategic Planning:** The process of envisioning an organization's future and developing the necessary procedures and operations to achieve that future.

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- **Strategic Planning Process**

Reason for existence   Future intent   Attitudes and policies

```
   ( Mission )        ( Vision )        ( Guiding Principles )
        |                  |                      |
        +------------------+----------------------+
                           |
                           v
        [ Environmental assessment ]        Capabilities and risks
                           |
                           v
               [ Strategies ]               Broad statements of direction
                           |
                           v
          [ Strategic Objectives ]          Things to change or improve
                           |
                           v
              [ Action Plans ]              Implementation
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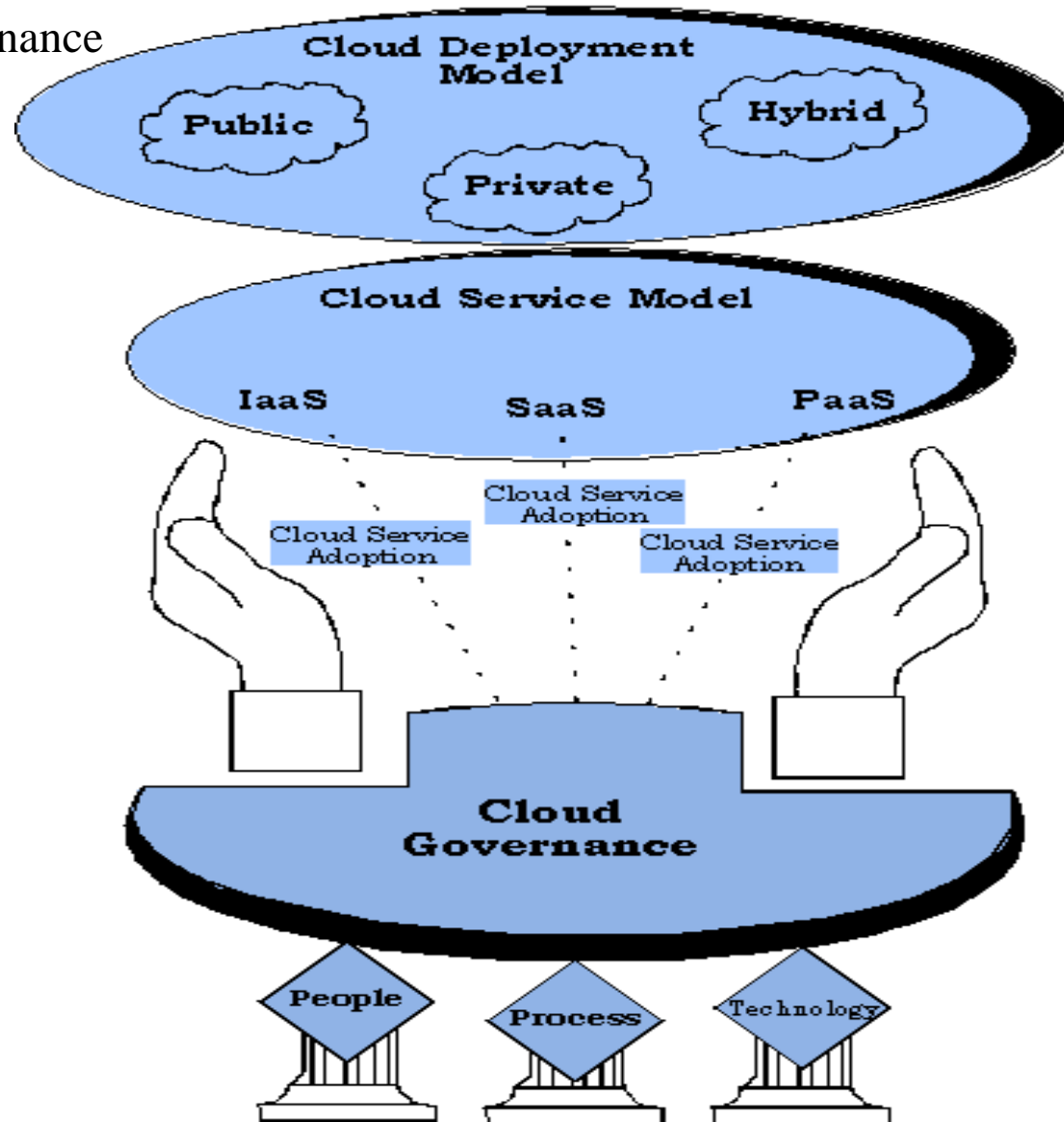
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- **Leading Practices - Strategic Planning**

    – Active participation of top management, employees, customers, suppliers

    – Systematic planning systems for strategy development and deployment, including measurement, feedback, and review

    – Use of a variety of external and internal data

    – Align short-term action plans with long-term strategic objectives, communicate them, and track progress

Cloud Governance

- Cloud Governance

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- Designing and implementing a best-in-class cloud governance framework takes time and effort. It's not something that can be pulled together in an afternoon, and you'll need to collaborate across teams to ensure that the final product is complete and actionable. But it's worth it. When developed properly, your cloud governance framework will return immediate and long-term benefits.

    - Controlled Access

    - Reduced Security Risks

    - Enhanced Compliance Readiness

Contd…

- **Controlled Access:**

  - By designating who owns each area of asset and software management, your cloud governance plan will build necessary limits on who can access and impact your cloud ecosystem.

  - As mentioned earlier, this is especially important considering how easy it is to implement new assets to the cloud.

  - The last thing you want is rogue IT applications and initiatives tampering with your sensitive architecture.

  - Controlling access to critical assets is vital and will enhance the reliability of your cloud processes.

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- **Reduced Security Risks:**

  - Once an organization has committed to moving their data to the cloud, it's imperative that they develop the security measures to protect that data.

  - While housing data on the cloud is certainly more convenient than hosting that data on-premise, it also brings increased risk for data breaches and unauthorized attempts to access data.

  - Your cloud governance plan will help you identify vulnerabilities in your system, enact plans to mitigate risk, and establish metrics to gauge the impact of security measures.

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- **Enhanced Compliance Readiness**

  - No matter your specific industry, it's likely that you need to pass regular audits and compliance assessments. Whether you're working with HIPAA, PCI, or SOC 2 requirements, your cloud governance program will streamline your compliance preparation and make it easier to demonstrate that compliance.

  - The benefits are two-fold.

  - First, developing a cloud governance program with your particular compliance requirements in mind allows you to build compliance review and standards into your processes and architecture.

  - Second, when it comes time to document your compliance, you'll have a thorough archive of your system's history, its current status, and your plans to enhance compliance.

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- **Cloud governance** is a framework to govern the use of cloud services, not block them from using these services. A cloud governance framework encompasses people, processes, and technology while ensuring security, cost management, and deployment acceleration. It helps in regulating and controlling the use of cloud services by defining process, standards, and policies to be followed in planning, on-boarding, operating and managing cloud services.

- Cloud governance is a carefully designed set of rules and protocols put in place by businesses that operate in a cloud environment to enhance data security, manage risks, and keep things running smoothly. Cloud governance ensures that everything from asset deployment to systems interactions to data security is properly considered, examined, and managed. The shift from on-premise IT infrastructures to a cloud environment adds layers of complexity to your system architecture[19]. It also means that more people across your organization have the potential to impact that architecture. This is why it's critical to develop and maintain a comprehensive cloud governance model.

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- **Lowered Costs**

  - Cloud governance shifts workflows from analog to automated. Instead of relying on time-consuming manual processes (like crafting complicated spreadsheets to track various accounts and system activity), cloud governance programs allow you to build in guardrails that automate the management of everything from budgets to policies.

  - These guardrails can also trigger automated responses to cloud activity, which reduces the manpower needed to enforce your cloud governance. And reduced manpower means reduced costs.

Contd…

- **Establishing Cloud Governance**

Plan	Build	Operate and Manage
Define vision and scope	Define reference architecture	Monitor
Define service catalog	Setup/configure tool	Measure KPI
Define government framework & tool	Build governance organization	Optimize
Define KPIs to measure the effectiveness of cloud governance	Define standards, templates, policies and procedures	

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- **Elements of Cloud Governance:** Cloud Governance is comprised of the following key components.

  - Cloud Business Office (CBO) ensures alignment of cloud vision with business vision and ensures that governance is enforced across the enterprise. CBO is also responsible for demand management, cost optimization, and prioritization.

  - Cloud Center of Excellence(CCoB) , which is a cross-functional team that defines processes, regulates and standardize cloud adoption, migration and operation across the enterprise.

  - Cloud governance organization structure and roles and responsibilities

  - Cloud governance processes around the cloud service lifecycle

  - Cloud foundational components like cloud reference architecture, standards, templates, guidelines, best practices and policies

Contd…

- **Risk of Poor Cloud Governance**

  - Cloud Security Risks

  - Cloud Proliferation and Sprawl

  - Cloud Integration (post proliferation)

  - Cloud Portability & Interoperability

  - Cloud Vendor Lock-In

  - Cloud Applications Governance – designing and migrating applications to appropriate Cloud pattern(s)

  - Lack of Incentives for Consumers to Onboard/Consume Cloud resources

  - Shadow IT and Hidden Clouds

Thank You !

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