

The Journey of e-Governance to Cloud: Hybrid Clouds as a Strategic Option

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Abstract — The cloud is no longer in future, it's here today. The cloud has fundamentally changed the landscape of computing. Governments are facing critical challenge of improving resource utilization, increase service responsiveness, distributed storage of data, availability of resources at lower cost. In order to fulfil this huge challenge, Governments are fast adopting the new paradigm of computing: Cloud Computing. Governments are moving into Cloud as its adoption presents numerous costs, agility, and operational advantages. In early days of cloud, much of the debate focused on the different merits of Public & Private cloud and the best scenarios, in which a particular model should be adopted. Now there's a growing realization that Hybrid Cloud is the best model for the government. The paper describes characteristics of each cloud computing deployment models and describes the best scenarios in which a particular model should be adopted based on certain parameters. However, the best scenario for cloud in government will be the hybrid cloud model. Thus Hybrid cloud is the final destination of the cloud journey. The Paper also discusses the common use cases for hybrid cloud adoption by the Governments.

Keywords— e-Governance, Cloud Computing, Cloud Deployment Models, Hybrid Cloud, Hybrid Cloud use cases.

I. INTRODUCTION

E-Governance is the application of Information and Communication Technologies (ICT) to exchange information between the government and the citizens, government and businesses and between government organizations [1]. Governments are moving into Cloud as its adoption presents numerous costs, agility, and operational advantages. A cloud based e-governance System has a lot of benefits like scalability, accountability, significant cost reduction apart from ensuring high availability, security and quality. Cloud computing or simply the Cloud is a new paradigm of computing, which has fundamentally changed the landscape of computing, storage, and information and communication (ICT) services. The ICT services are delivered as a service from inside or outside the organizations as such it allows to focus more on other business needs or customer interactions. The cloud is increasingly being adopted by organizations and governments as cloud computing can deliver a wide range of services like management of infrastructure, development platforms, software applications and complex business processes very efficiently and cost-effectively. Governments are adopting this cutting edge technology as e-Governance to improve resource utilization, increase service responsiveness, availability of resources at lower cost as well as for providing security, scalability,

accountability and modifiability. Analysts concur that cloud adoption is gathering pace and expect growth to continue over the next decade. Forrester forecasts that the global market for cloud computing will grow from \$40.7 billion in 2011 to more than \$241 billion in 2020[2]. In early days of cloud, much of the debate focused on the different merits of Public & Private cloud and the best scenarios, in which a particular model should be adopted. Now there's a growing realization that Hybrid Cloud is the best model for the government. The paper describes characteristics of each cloud computing deployment models, viz. private, public, hybrid and community clouds and explores the best scenarios in which a particular model should be adopted based on certain parameters. Governments should essentially view their move to the cloud as a journey. Different cloud models should be explored in great details for providing necessary functionality and flexibility efficiently and cost-effectively. However, the best scenario for cloud in government will be the hybrid cloud model as discussed later. Thus Hybrid cloud is the final destination of the cloud journey. The Paper also discusses the common use cases for hybrid cloud adoption by the Governments. The 2014 State of the Cloud Survey [3] shows that hybrid and multi-cloud implementations continue to be the end goal for the organizations: 74 % respondents have a multi-cloud strategy out of which 48 % are planning for hybrid clouds, 15 % expect to use multiple public clouds, and 11 % are planning for multiple private clouds (Figure 1)

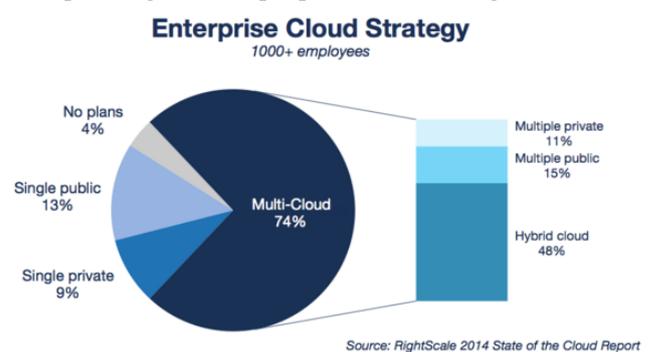


Fig. 1 The 2014 State of the Cloud Survey

The remainder of this paper is organized as follows. The following section defines Cloud Computing & Cloud Deployment Models in section II. The next section discusses the journey of e-Governance to Cloud in section III. In this section factors for weighing up the Cloud Deployment Models, advantages, disadvantages of each Cloud Deployment models and different scenarios in which a particular model will be most suited for the e-Governance

has been discussed in detail. The adoption of Hybrid Cloud as a Strategic option has been discussed in Section IV. In this section, drivers of Hybrid Cloud and use cases for the Hybrid Cloud adoption have been discussed. Finally conclusion and future scope of future work has been discussed in Section V.

II. OVERVIEW OF CLOUD COMPUTING

This section presents a general overview of cloud computing, including its definition and a comparison with related concepts.

A. Defining Cloud Computing

The definition that received industry-wide acceptance is given by National Institute of Standards and Technology (NIST) [4]: “Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models.”

B. Cloud Deployment Models:

A cloud delivery model represents a specific type of cloud environment describing how a cloud solution is used by an organization, where the data is located, and who operates the cloud solution. Mell and Grance define the four Cloud Deployment models [5]:

1) *Public cloud*: The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services

2) *Private cloud*: The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise.

3) *Hybrid cloud*: The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds).

4) *Community cloud*: The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premise or off premise.

III. THE JOURNEY OF E-GOVERNANCE TO THE CLOUD

Governments should essentially view their move to the cloud as a journey. Different cloud models should be explored in great details for providing necessary functionality and flexibility efficiently and cost-effectively. Public clouds allow organizations to necessary computing

power & all other resources on demand, which are totally flexible and elastic. Private Cloud provides the highest control over data and applications and best suited for business-critical applications. However it is very important to consider all such factors as mentioned below and select the appropriate model accordingly.

A. Factors for Weighing up the Cloud Deployment Models

Governments should consider following factors for the selection of appropriate Cloud Deployment model:

1) *Specific Needs of the Organization*: It is very important to first evaluate the nature of workload, existing infrastructure of the organisation and infrastructure required for running the applications. In a Public Cloud, infrastructure is typically based on commodity hardware, while in a Private Cloud; organizations can choose specialized hardware as well. Nature of data and data maturity level within the organization affects the choice between a public or private cloud. An evaluation should be done to examine how this data impacts the organization. If the data is compromised, what will be the ramifications? For low and medium impact data, public clouds offer lower cost/strong performance options. However, if the data is high-impact and sensitive, a private cloud offers a stronger solution - including data isolation and the ability to specify security.

2) *Security*: Governments keep lot of confidential and sensitive data of the citizen, so the security is one of the most critical parameter for deciding Cloud Deployment models. Until recently, many governments have adopted a private cloud model to run applications with stringent security requirements. However, public cloud security capabilities have advanced considerably over the last several years.

3) *Regulatory Concerns*: A Government Organisation has to comply with various regulatory requirements, such as PCI, HIPAA, and FISMA. Although many Public Service Providers also provide an environment fully complied with these regulatory requirements nowadays, still private cloud offer a more flexible and better choice for the compliance of mandatory regulations. It is difficult to implement various regulations, contradictory to each other sometimes, in a Public Cloud.

4) *Scalability Requirements*: The scalability of the workload is a very important factor for deciding a Cloud Deployment model. The Public Cloud environment is well suited for a Government for running an application which require high scalability and availability. If an application require a lot of computing resources then massive amount of infrastructure will be required, which could be provided only by Public Cloud. In case of a Private Cloud, scaling up often requires additional hardware which can both be time-consuming and expensive.

5) *Performance Requirements*: The Access to data is faster in a Private cloud, as the firewall is within the organisation. In case of a Public cloud, the data transfer rate is dependent on speed provided by the Internet Service

Provider. If the data transfer rate is slow and a large volume of data is to be accessed then Public cloud be a problem. In addition, a private cloud is often a lot more customizable in terms of hardware performance, storage performance and network performance as all the equipment is owned by the Organisation.

6) *Latency*: Network latency is an important factor in deciding Cloud Model. Network latency is dependent on the proximity of cloud infrastructure to the consumers of the resources and network infrastructure. In case of an on-premises private cloud, network latency is reduced significantly.

7) *Cost*: In case of Private cloud, the total cost include allocated data centre costs such as space, power, and cooling; hardware and software costs; and staff costs associated with provisioning and maintaining the environments. In case of Public Cloud, total cost include cost of resources provided by the service provider like computing, storage and network costs as well as costs of third-party software and cost of internal staff. The total cost has to be also calculated in terms of capital cost and operating cost for deciding cloud model. Some Governments may not have the total initial capital fund required and will prefer purchasing cloud resources as an operational expense. Other Governments may prefer to capitalize their hardware. A public cloud often works with a pay-as-you-go system, which ensures that payment is to be done for the equipment used, sometimes even charged on an hourly, or even shorter, basis.

B. Advantages of Public Cloud:

Public cloud computing services offers the Governments so many advantages. Some of the important advantages of Public Cloud are as following:

1) *Utility Model*: Public Clouds typically deliver as a pay-as-you-go model, where any organisation pays for the period of during which any service or resource has been used. No capital expenditure is required for any set up and required revenue expenditure is also low.

2) *High Scalability on demand*: One of the major benefits of Public Cloud is that the resources can be scaled up or down as per demand almost instantly. Governments have access to a huge pool of virtual resources which can be accessed in case of any unpredictable & sudden demand of peak load, in an efficient, flexible and cost effective way.

3) *Low cost*: The services of a Public Cloud are available at low cost as any organisation does not have to purchase physical hardware as Servers and other resources, which are provided by the Service Providers. No capital expenditure is required. In case of SaaS, the applications are also provided by the Service Provider.

4) *Geographical Reach*: With the adoption of Public cloud, any Government can have a global reach within no time and without any huge investments taking the advantage of Global presence of a Service Provider. Such a

global reach gives tremendous boost to business growth along with a big source of revenue generation. In case of e-government service also, such global reach makes the e-Government very effective as well as is also a very good source of revenue generation.

5) *Highly Reliable Services*: In a public Cloud, the services are provided by Cloud Service Providers. Most Cloud providers are extremely reliable in providing services, with many of the Cloud Service Providers are maintaining 99.99% uptime. So, with the adoption of Public Cloud, Government can provide a very reliable service and availability is also increased significantly.

6) *No Long term Contracts*: In Public Cloud, services are provided based on usage purchased for a specific time-period, there are no long-term commitments. Once the specific time period (monthly or yearly subscription) is over, the Government is under no obligation to continue with same public cloud service. It may choose any other Service Provider, if service provided by the current Service Provider is not satisfactory.

Thus different advantages of moving into Public Cloud have been mentioned above. As per IDC’s CloudTrack survey 2013 [6], most important drivers for moving to Public Cloud are as following (fig 2):

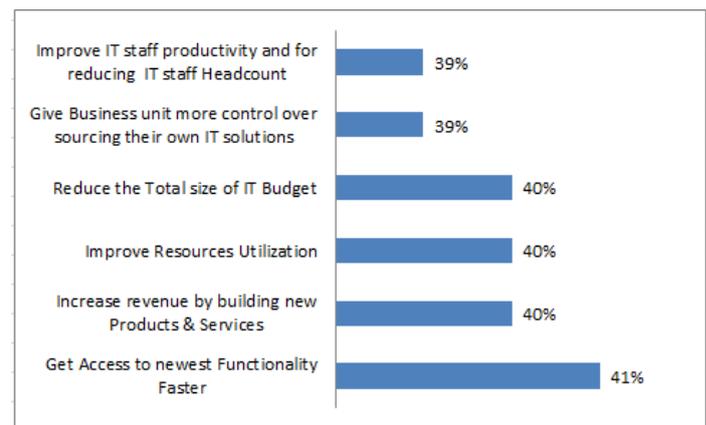


Fig. 2 Drivers of Moving to Public Cloud

C. Disadvantages of Public Cloud

Although there are so many advantages of using Public Cloud for an e-Governance, there are some disadvantages also. Some of the important disadvantages are following:

1) *Security Risks*: Security is one of the biggest obstacles in adoption of the Public Cloud. It should be not said that Public cloud does not have any security system; Public Cloud Providers have also excellent security systems in place, but the organisations with sensitive information are not at all comfortable in putting these in sensitive information in the control of a third party.

2) *Lack of control*: In Public cloud the data leaves the physical boundary of the Organization and reaches within the control of Service Provider, so this lack of control of the Governments over the data is a big concern. They may not

know about data storage location or how the data is being backed up.

3) *Slow speed:* In Public cloud, the speed of Services provided by the Service Provider is limited to the speed of data transfer of the Internet Service Provider. In case of transfer of large amount of data this may be a big concern.

D. Public Cloud as a e-Governance model

A public cloud is the obvious choice for any Government in following scenarios:

1) *High-performance Computing:* The Public Cloud is well suited for an Government for running an application which require high performance, scalability and availability. If an application require a lot of computing resources then massive amount of infrastructure will be required, which could be provided only by the Public Cloud.

2) *Web-based Application Hosting:* If a web Application is being run for e-Governance, where there is a lot of variance in peak demand because of some popular schemes, Public Cloud is the ideal choice. The cost of physical infrastructure required to handle such an abnormal demand for a small period will be very high as well as will require much more time in setting up such infrastructure. In case of Public cloud, servers can be dynamically added and removed depending on load, while payment is to be done only for the time period the resources have been actually run.

3) *Limited Resources:* Now a days, whole range of SaaS applications is available to cater different services to be provided by the Government. Due to limited budget or limited IT resources, it is not possible to develop such applications and set up & run Data Centre for running such applications. In this scenario, adoption of Public Cloud with different SaaS applications is the only choice to cater such demand. Public Cloud is also obvious choice when workload is standardized; Applications being used by lots of people, such as e-mail.

4) *Small Government Organizations:* Small Government Organisations with low budget can take advantage of a highly flexible and scalable infrastructure of a Public Cloud, as Public Cloud require very small set up and running cost. Government organisation can easily manage with low capital expenditure and low revenue budget.

5) *Testing and Quality Assurance:* Public Cloud is suited for testing a new application with unknown demand or high demand. In case of a Private cloud, the available resources may not be able to cater to sudden demand for some additional resources. Adoption of Public cloud will cater to such unknown and high demand of resources. In addition to this, other applications running at the centre will not be adversely affected due to such testing and will continue to run smoothly.

E. Advantages of Private Cloud

Private Cloud is a model where the hardware, storage and network are dedicated to a single organisation. Some of the important advantages of using Private Cloud are:

1) *Greater control:* In a Private Cloud, an organisation has more control over data, as the data does not leave the physical boundary of the Organisation. The infrastructure like hardware, network and storage can be customized as per specific requirement of the Organisation as the private cloud is owned by the organisation.

2) *More security:* Security is considered to be higher in a Private Cloud than in Public Cloud. In a Private cloud, services are dedicated to a single organization, the infrastructure like hardware, data storage and network can be designed to assure high levels of security in view of any specific security need of the organisation.

3) *Higher Regulatory Compliance:* In a Private cloud, services are dedicated to a single Organisation, so compliance with various regulations can be done easily. Some standard regulatory compliance like HIPAA, PCI DSS can be implemented in Public Cloud also, but sometimes it is difficult to implement any particular mandatory regulation.

4) *Customizable:* In Private Cloud, as the Hardware, network and storage are owned by the Organization, it can be customized as per specific requirement of the organisation.

5) *Saves Cost:* A private cloud saves cost, in case it utilizes otherwise un-used or under-utilized infrastructure in an already existing data center. The virtualized services maximizes hardware usage, as a result cost is reduced substantially.

Thus different advantages of moving into Private Cloud have been mentioned above. As per IDC’s CloudTrack survey 2013[6], most important drivers for moving to Private Cloud are as following (fig 3):

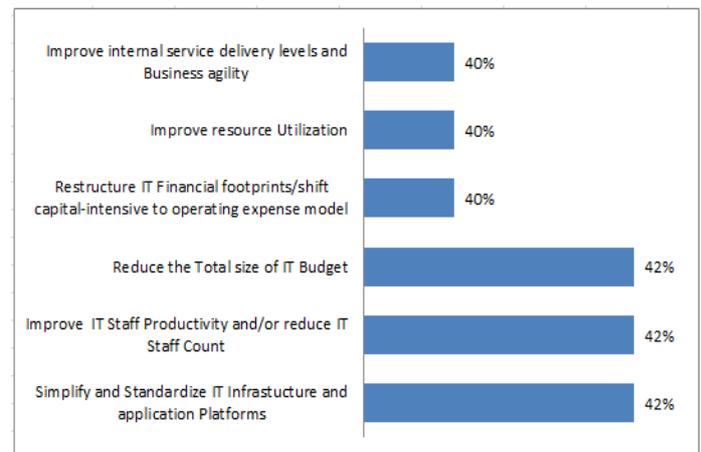


Fig 3 : Drivers of Moving to Private Cloud

F. Disadvantages of Private Cloud

Although there are so many advantages of using a Private Cloud, there some disadvantages of using Private cloud. Some of the important disadvantages are as following:

1) *Higher cost:* Private cloud services are more expensive than public Cloud as they are made primarily for a particular organization. The cost of purchasing necessary Hardware, software and hiring staff often results in higher costs to an organization having their own private cloud.

2) *On-site Maintenance:* In case of Public cloud, apart from initial set up cost, on-site maintenance costs is also required to be borne by the organisation. The cost includes power supply, cooling and general maintenance of the server.

3) *Limited Capacity:* The resources available in a public Cloud is limited as the physical resources of a Private Cloud are limited, leading a limited scalability or flexibility.

G. Private Cloud as a e-Governance model

A Private cloud is the obvious choice for any Government in following scenarios:

1) *Highest level of Security:* If the data being kept for the Government is highly confidential, the Private cloud is obvious choice to ensure highest level of security.

2) *Highly Customized environment:* A private cloud provide a highly Customized environment, which is not available in Public Cloud. If a highly customized environment is required, Governments should adopt a Private Cloud.

3) *Higher Regulatory Compliance:* In a Private cloud, services are dedicated to a single Organisation, so compliance with various regulations can be done easily. Some standard regulatory compliance like HIPAA, PCI DSS can be implemented in Public Cloud also, but sometimes it is difficult to implement any particular mandatory regulation.

4) *Large Organisation:* Private cloud is ideal for large Governments organizations that have underutilized infrastructure. Adoption of Cloud model enhances utilization of infrastructure.

5) *Specialized Environment:* If any specialized hardware, Operating System, or software is required, Governments have to go for a Private Cloud, as these specific environments are not possible in a Public Cloud.

H. Advantages of Hybrid Cloud

Nowadays, Organizations are finding out that off-premises cloud vs. on-premises data center is not an either/or option. In a Hybrid cloud, organizations can plan and manage ICT resources across their on-site data center and a compatible public cloud. Some of the important advantages of using a Hybrid Cloud are as following:

1) *The Ability to leverage both Public and Private Cloud:* The Hybrid Cloud model leverage the best of both

models by intermixing private and public cloud models. The hybrid model allows public cloud for non-sensitive operations and private cloud for sensitive operations. In addition to this, It also allows to run existing applications already running in the data center.

2) *Holistic approach to IT:* Hybrid Cloud provides a holistic approach to the consumption of ICT resources. In this model, Public cloud, private cloud and existing data center work together seamlessly as one platform and each job is matched to right platform. As a result, the agility is also enhanced.

3) *Improved Performance:* In a Hybrid Cloud, Performance is improved through optimization of available infrastructure. Public clouds can be used for development and testing phase while private clouds can be used for production phase.

4) *Reduced Cost:* In a hybrid Cloud, capital expenses are reduced, as Service Providers provides some of the infrastructure as per need of the organisation. Public cloud is used for non-sensitive operations, resulting in reduction of operating cost. In addition, it includes a pay-for-your-payment feature as part of its public cloud services.

5) *Enhances Security:* Security is enhanced as critical and sensitive data can be kept within the premises of the Organization, out of the public cloud.

6) *Global Reach:* The Operation can be global and remote taking the advantage of Public Cloud. In addition, World class technologies is available through public cloud at an affordable price.

7) *Regulatory Compliance:* In Hybrid Cloud, Data security, privacy, standards and regulations can be complied with, by using private cloud instances and non-critical application testing can be moved into public clouds.

I. Disadvantages of Hybrid Cloud

Although there are so many advantages of using a Hybrid Cloud, there are some disadvantages of using Hybrid cloud. Some of the important disadvantages are as following:

1) *Security Concerns:* In Hybrid Cloud, IT perimeter is extended outside the organizational boundaries. As a result, a larger surface area is opened for attacks, including some of the area under the control of the service provider. The security risks associated with the security policies spanning the hybrid cloud environment are increased.

2) *Privacy Concerns:* In Hybrid Cloud data flows from private environment to a public cloud, which is in the control of service Provider leading to serious concern for the Privacy of data.

3) *Complex Compliance:* In a Hybrid Cloud, compliance is more complex. It needs to be ensured that not only the private and public providers are compliant but the means of coordination is also compliant as well.

4) *Challenging SLA's:* In Hybrid cloud, it is very challenging to achieve consistent SLA's for both cloud

models. SLA is based on what is achievable of the lesser of the two clouds.

J. Hybrid Cloud as a e-Governance model

A public cloud is the obvious choice for any Government in following scenarios:

1) *Large organizations with considerable infrastructure:* Any large organisation having necessary infrastructure to a considerable extent to fulfill the needs within their own private clouds and having certain short-term/occasional additional infrastructure needs, which can be handled in a public cloud.

2) *Mission-critical applications:* Government has some mission-critical applications, which can be deployed in Private Cloud. Rest of the applications, which are non-critical can be deployed in Public Cloud.

3) *Organisation with Sensitive data:* Governments offers services which are having sensitive data, then Hybrid Cloud option should be selected. Public cloud can be used to interact with the citizens, but sensitive data can be kept secured within the private cloud.

4) *Compliance of Regulations/Security requirements :* Governments have standards, regulations, data privacy and security requirements to comply with.

5) *Future QA infrastructure demands cannot be managed:* Government cannot completely manage the future Quality Assurance infrastructure demands with their available hardware assets.

6) *Old existing legacy system :* If the old existing legacy system like ERP solution cannot be discontinued in spite of moving into the cloud, Hybrid Cloud is the only model feasible in this scenarios.

IV HYBRID CLOUDS AS A STRATEGIC OPTION

As the governments are adopting the cloud to improve utilization of resources, increase service response time, elasticity and flexibility and availability of resources at lower cost, they are evaluating different cloud models for right balance of functionality along with investment protection. Although Private cloud allow governments to maintain control and visibility of the critical applications, it does not provide all the resources required by the government in the short timeframe. The flexibility and the elasticity is also very limited in a Private cloud. Public cloud allows governments to gain capacity and scale on demand, Security is one of the biggest obstacles in adoption of Public Cloud. But now it is being discovered that Public cloud vs. Private cloud is not an either/ or option. In many cases the best scenario for cloud in government will be one in which agencies have the best of both worlds, with the ability to use either model as per need. Hybrid cloud models provide the best of the both worlds: security, on

demand availability of ICT resources with the elasticity to move workloads onsite or off-site as per specific needs.

A. Drivers for Embracing a hybrid approach.

Hybrid cloud lets government organizations to plan and manage ICT resources across their on-site data center and a compatible public cloud. A new Market Pulse survey [7] by IDG Research Services indicates that more than 50 percent of organizations are currently using hybrid cloud or in the process of moving workloads to hybrid cloud, and another 15 percent are in the planning stages. “Hybrid cloud is where public cloud was five years ago— on the verge of significant growth,” said Mathew Lodge, vice president, Cloud Services Product Management and Marketing, VMware[7]. “Many organizations realize that they can get the infrastructure automation benefits of public cloud without sacrificing their existing investments in applications, operations and management. They are getting started by targeting specific projects, such as development and testing, and running them in hybrid cloud.”[7] Some of the important factors which are driving organization to move workload to hybrid cloud is shown below in fig 4 [7] :

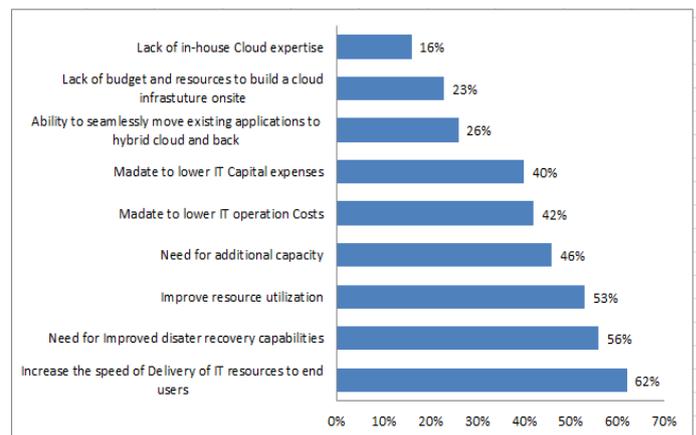


Fig. 4 Factors that are Driving Organisations to Hybrid Cloud

B. Top Use Cases for Hybrid Cloud.

This section presents some of the top use cases for hybrid cloud by any organization including any Government.[8]

1) Use Case: Best venue of Operation:

The best venue of operation is one of the key driver for the governments to adopt a hybrid cloud model, as in this model each application is placed in a public or private cloud based on its specific requirements considering following factors:

- Performance
- Cost
- Security
- Compliance
- Geo-location
- Vendors
- Existing Data centers

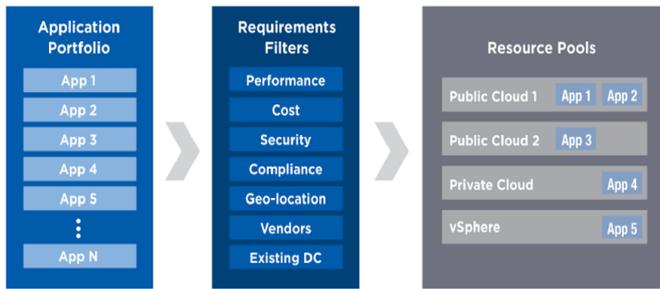


Fig 5 Factors for choosing Best Cloud [8]

2) Use Case : Lifecycle-Based Deployment

Apart from best venue of operation approach, another approached based on life cycle based approach can also be adopted for placing an application in a Private or Public Cloud. Different scenario for placing an application by governments could be as following :

TABLE I. LIFECYCLE –BASED DEPLOYMENT

Life cycle phase	Use case
Development /Testing in Public Cloud, Production in Private Cloud	When flexibility of the Development is critical but production data is highly sensitive/ confidential.
Development /Testing in Private Cloud, Production in Public Cloud	when existing private cloud resources is sufficient for development needs, but production phase need the higher elasticity or it requires greater geographic reach than the on-premises cloud can offer
New Applications in Public Cloud, Steady-State Apps in Private Cloud	Applications have very different demands over their lifespan. For example, a new mobile application having unpredictable demand initially and runs in the public cloud. It moves to Private cloud once the application reaches steady state.

3) Use Case: Disaster Recovery

Governments can use Public cloud for disaster recovery at much lower cost than traditional disaster recovery architectures that span multiple data centers. The hybrid cloud also offer an affordable disaster recovery solution with adequate capacity and lower cost. Although these Data Recovery solutions are much more complex due to security, latency, and cost of the cross-cloud database communication, but they can be managed well by Service Providers. A typical Hybrid Cloud Disaster Recovery Scenario is given below in figure 6.

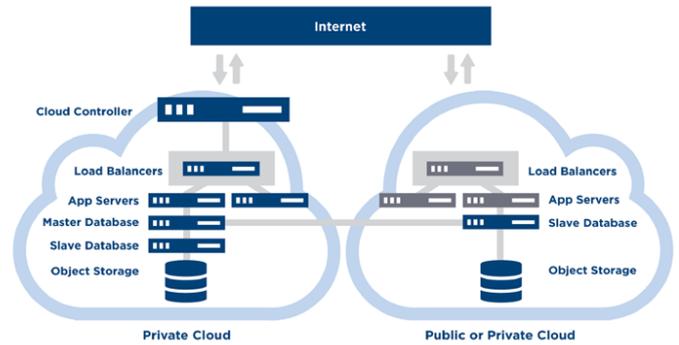


Fig. 6 Hybrid Cloud Disaster Recovery Scenario[8]

4) Use Case: Cloudbursting

With hybrid cloud , governments can extend current standard applications to the cloud to meet the need for additional capacity or to free onsite resources for more critical applications. Apart from this hybrid cloud provide “Cloud bursting” facility as per a typical architecture shown below in figure 7.

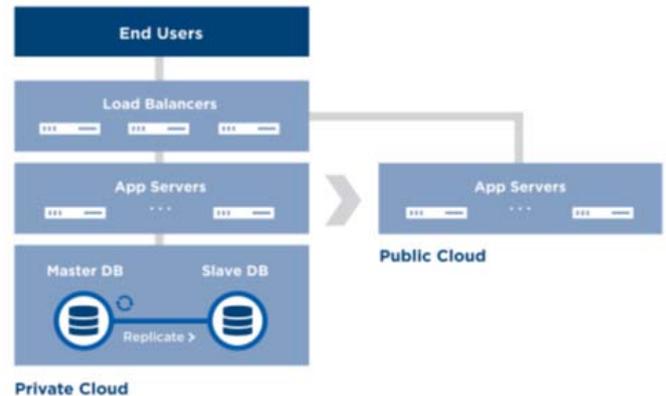


Fig 7 Cloud Bursting Architecture[8]

Thus some of the important use cases for Hybrid Cloud have been presented above. As per IDG Research Services, Feb 2014, different applications/workloads being used in Hybrid Cloud is as following: (fig. 8)

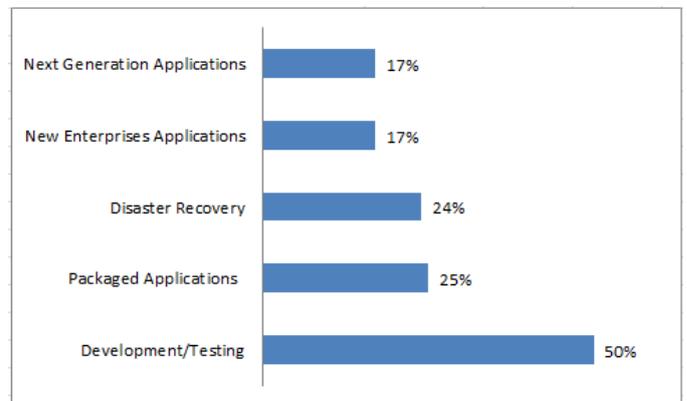


Fig. 8 Applications /workloads being used in Hybrid Cloud

V CONCLUSION AND FUTURE SCOPE

Hybrid cloud is the future model for e-Governance, as the adoption of Hybrid Model gives benefits from both cloud worlds. The 2014 State of the Cloud Survey shows that hybrid and multi-cloud implementations continue to be the end goal for the organizations: 74 % respondents have a multi-cloud strategy out of which 48 % are planning for hybrid clouds. Hybrid cloud being a new and complex architecture comes with its own set of challenges. In Hybrid Cloud, IT perimeter is extended outside the organizational boundaries. As a result, a larger surface area is opened for attacks, including some of the area under the control of the service provider. Therefore it is very important to work on these new set of challenges as a future work. In this regard, the author has presented a security framework for Cloud based e-governance system in his Paper [10].

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