Leveraging Cloud for mission critical and Enterprise-wide Applications

by:

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Cloud Computing

- Cloud computing is the delivery of **dynamically scalable** and often **virtualized computing** resources—everything from applications to data centres—'**as a service**' over the Internet or intranet on a **flexible pay-for-use basis.**

- From an IT perspective, cloud computing offers an infrastructure management and services delivery that leverages:
  - Virtualized resources
  - Ability to manage as a single large resource
  - Services delivered with elastic scaling

- According to NIST (National Institute of Science & Technology) US,: *"Cloud Computing is a model for enabling 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 CSP interaction."*

Cloud Computing

As per ITU-T Y.3500 – "Cloud computing is a paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand.

The **cloud computing** paradigm is composed of the following key characteristics –

- **cloud computing** roles and activities,
- **cloud capabilities types** and
- **cloud service categories**,
- **cloud deployment models**, and
- **cloud computing** cross cutting aspects**"**

Cloud Computing

- Cloud is a disruptive technology which influences across all aspects of a modern economy.

- Cloud's emergence, as a catalyst for continual innovation across both business and IT, offers a user experience and business model that provides:
  - Standardized, self-service offerings that enable efficiency
  - Rapidly provisioned services that create agility
  - Flexible pricing that can enable innovation

- Cloud can deliver **security-rich IT** with fewer boundaries. But more importantly, it can enable rapid delivery of product and service innovation.

Cloud Computing Characteristics

Essential Characteristics:

On Demand Self-Service

Broad Network Access

Rapid Elasticity & Scalability

Resource Pooling

Measured Service

Common Characteristics:

Multi-tenancy

Resilient Computing

Homogeneity

Geographic Distribution

Virtualization

Service Orientation

Low Cost Software

Advanced Security

Characteristics of the Cloud Computing

- **Shared Infrastructure** — Uses a virtualized software model, enabling the sharing of physical infrastructure, storage, and networking capabilities. The cloud infrastructure seeks to make the most of the available infrastructure across a number of users.

- **Multi-tenancy.** A feature where physical or virtual resources are allocated in such a way that multiple **tenants** and their computations and data are isolated from and inaccessible to one another.

- **Dynamic Provisioning** — Allows for the provision of services based on current demand requirements, which is done automatically using software automation, enabling the expansion and contraction of service capability, as & when needed. This dynamic scaling needs to be done while maintaining high levels of reliability and security.

- **Broad Network Access** — Needs to be accessed across the Internet from a broad range of devices such as PCs, laptops, and mobile devices, using standards-based APIs from anywhere. Deployments of services in the cloud include everything from using business applications to the latest application.

- **Managed Metering** — Uses metering for managing and optimizing the service and to provide reporting and billing information. Consumers are billed for services according to how much they have actually used during the billing period.

Cloud computing allows for the sharing and scalable deployment of services, as needed, from almost any location, and for which the customer can be billed based on actual usage

Service Models

Cloud Service Models

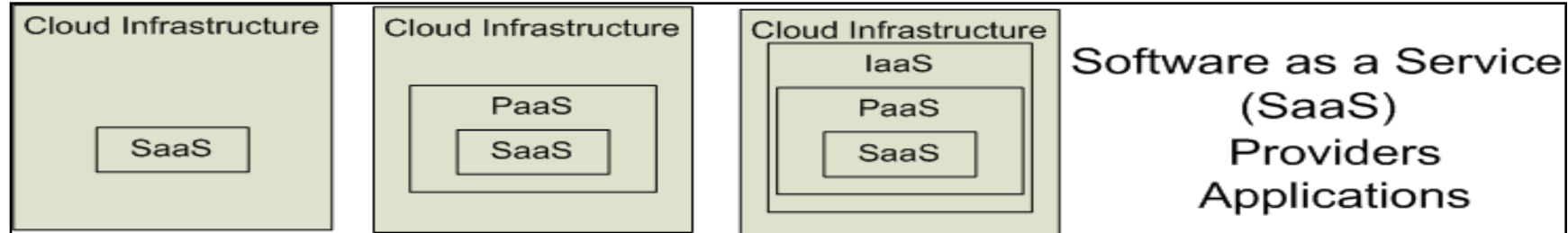|	
Software as a Service (SaaS)	End-user application is delivered as a service. Platform and infrastructure is abstracted, and can deployed and managed with less effort.
Platform as a Service (PaaS)	Application platform onto which custom applications and services can be deployed. Can be built and deployed more inexpensively, although services need to be supported and managed.
Infrastructure as a Service (IaaS)	Physical infrastructure is abstracted to provide computing, storage, and networking as a service, avoiding the expense and need for dedicated systems.

Cloud Service Models
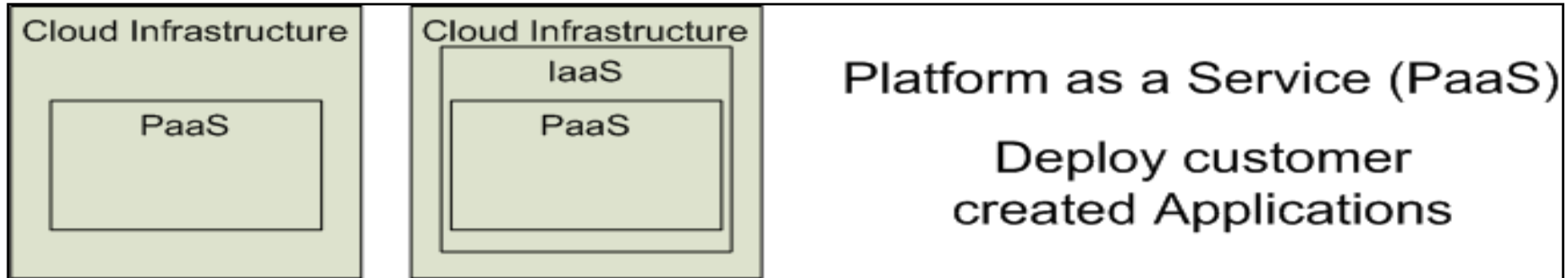
Software as a Service (SaaS)	Platform as a Service (PaaS)	Infrastructure as a Service (IaaS)

SalesForce CRM

LotusLive

Google App Engine

Windows Azure
The Future Made Familiar

amazon
web services™

rackspace
HOSTING

Cloud Service Models

Further there can be addition Service Models of Cloud Computing (Derivatives)

- *Communications as a Service (CaaS).* A **cloud service category** in which the capability provided to the **cloud service customer** is real time interaction and collaboration;

- *Compute as a Service (CompaaS).* A **cloud service category** in which the capabilities provided to the **cloud service customer** are the provision and use of processing resources needed to deploy and run software;

- *Data Storage as a Service (DSaaS).* A **cloud service category** in which the capability provided to the **cloud service customer** is the provision and use of data storage and related capabilities;

- *Network as a Service (NaaS).* A **cloud service category** in which the capability provided to the **cloud service customer** is transport connectivity and related network capabilities;

Deployment Models

Deployment Models

- ***Private Cloud:***

  - The cloud 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.

- ***Community Cloud:***

  - The cloud infrastructure is shared by several organizations and supports a specific community that has **shared concerns.**

  - It may be managed by the organizations or a third party and may exist on premise or off premise. This may help to limit CAPEX for its establishment as the costs are shared among the organizations.
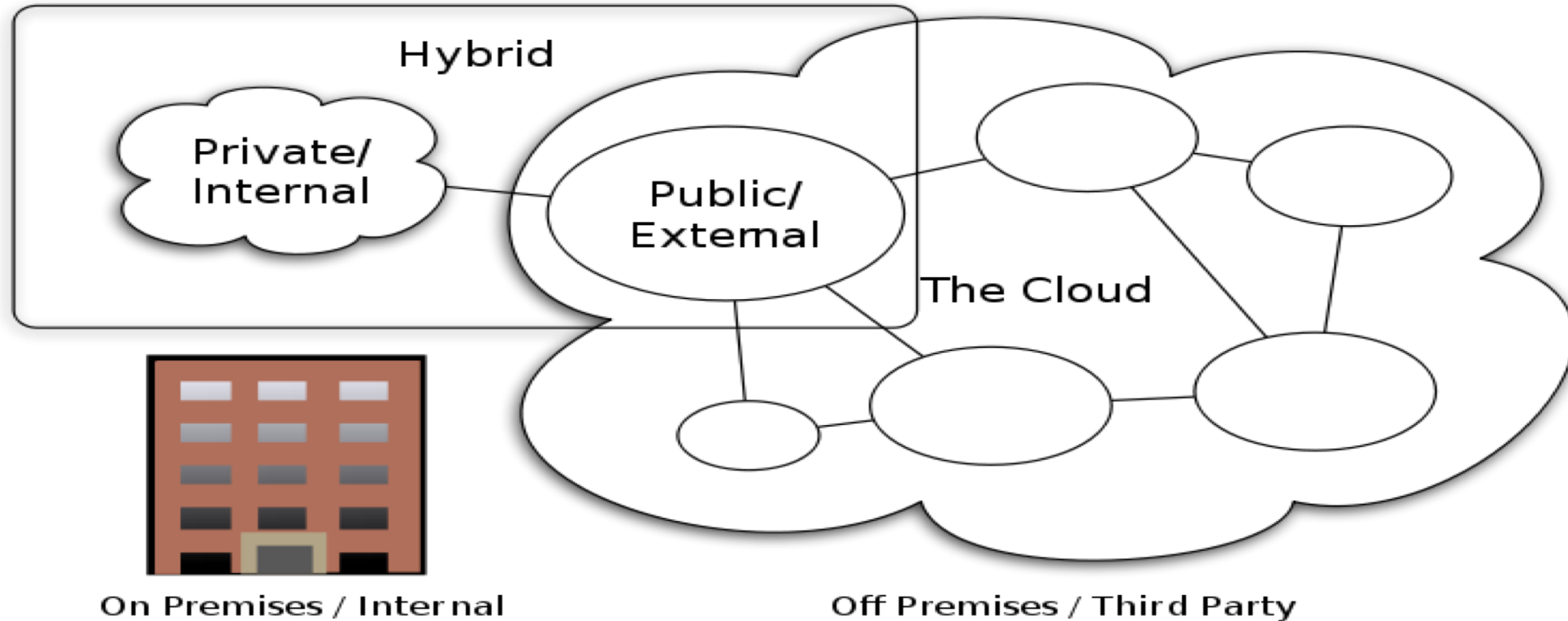
Deployment Models Contd.

- **Public Cloud:**

    - The cloud infrastructure is made available to the general public or a large industry group and it is owned by an organization selling cloud services on a commercial basis.

- **Hybrid cloud:**

    - The cloud infrastructure is a composition of two or more clouds (private, community, or public). The clouds have the ability through their interfaces to allow data and/or applications to be moved from one cloud to another.

Deployment Models Contd.
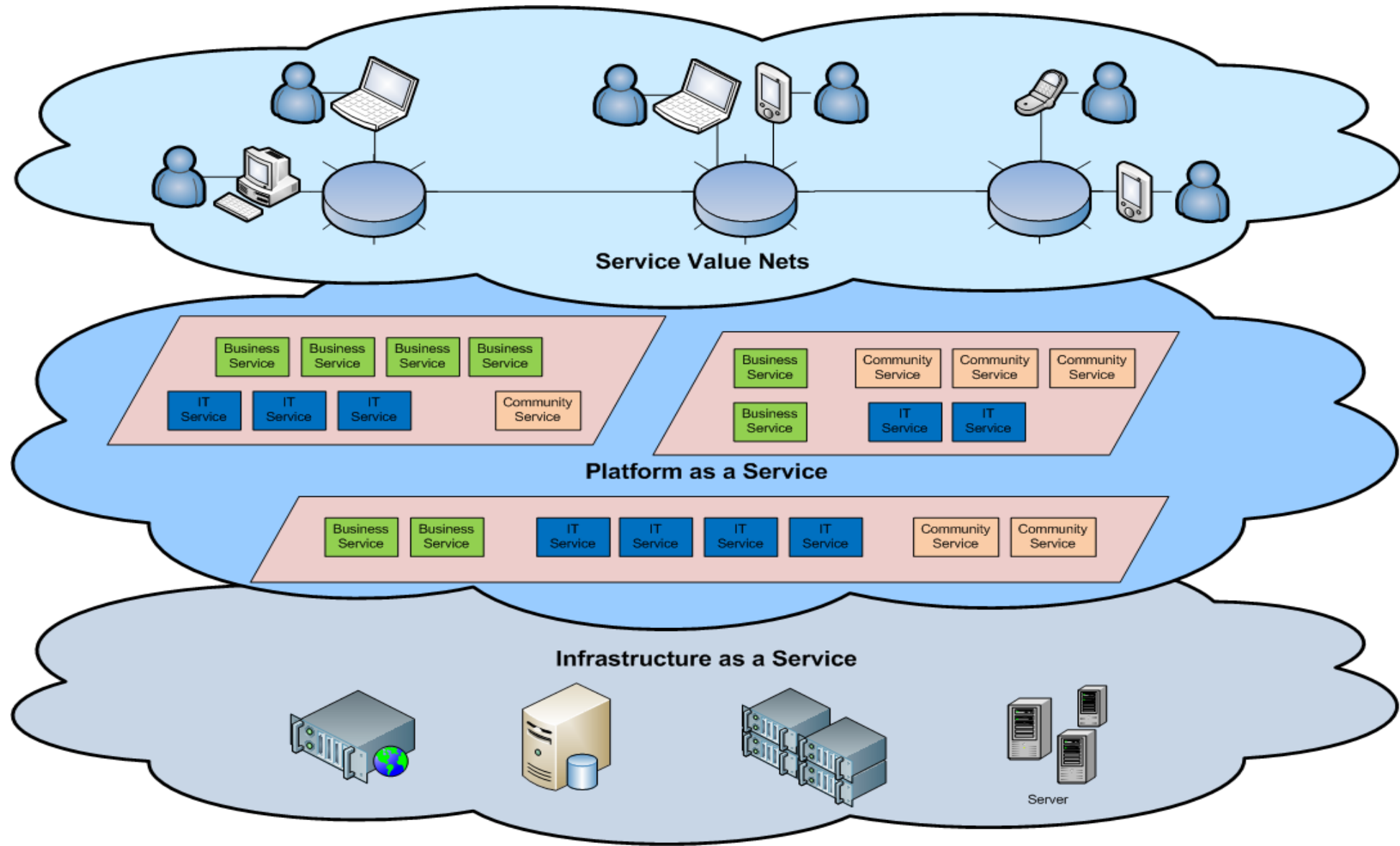

Hybrid

Private/Internal

Public/External

The Cloud

On Premises / Internal

Off Premises / Third Party

Cloud Computing Types

Cloud Architecture

Service Value Nets

Platform as a Service

Infrastructure as a Service

Server

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Benefits of Cloud Services

- **Cost Savings** — Companies can reduce their capital expenditures and use operational expenditures for increasing their computing capabilities. This is a lower entry barrier and also requires fewer in-house IT resources to provide system support.

- **Scalability/Flexibility** — Companies can start with a small deployment and grow to a large deployment fairly rapidly, and scale back if necessary. Also, the flexibility of cloud computing allows companies to use extra resources at peak times dynamically, enabling them to satisfy consumer demands.

- **Reliability** — Services using multiple redundant sites can support business continuity and disaster recovery.

- **Maintenance** — Cloud service providers do the system maintenance, and access is through APIs that do not require application installations onto PCs, thus further reducing maintenance requirements.

- **Mobile Accessible** — Mobile workers have increased productivity due to systems accessible in an infrastructure available from anywhere.

- **Big Data:** The new computing ecosystem world is by essence creating a huge amount of data. While some see this deluge of data as a challenge in terms of storage and management, the reality lies in the opportunity that resides in this data if one could mine it and transform it into sources of information and intelligence.

Benefits of Cloud Services (Contd..)

- Cloud Computing makes any **smartphone "Smarter"**. These smart devices with some small storage and small computing power act as front ends to large scale data centers which provide all sorts of services in real time may it be Voice, "Apps", language translators, personal assistants, etc.

- Cloud Computing will help to address some of the pressing human challenges such as energy or environmental issues and new generations of drugs testing or genomic research in an accelerated manner.

- The combination of mobility, connectivity, smarter search, social computing etc., allowed by Cloud innovators will come up with new ideas to help any company digitally transform, innovate and bring new unprecedented work scenarios to their employees and services to their clients.

- Cloud Computing will help governments become more flexible and agile by delivering new services quickly at very low cost, reducing the risk of failure.

Benefits of Cloud Services (Contd..)

- More than ever, governments and businesses are expected to deliver services to their clients the way the client want to consume them – on their preferred device, anywhere any time.

- Businesses must innovate, differentiate from competitors, bring new products and services to market faster, and connect to their clients in new ways.

- Governments are expected to meet their constituencies' needs and expectations, while at the same time controlling budgets and cutting costs.

- Governments must make smart decisions, based on real insight from their constituencies, act fast, and become agile and flexible to efficiently serve.

- Cloud Computing enables cost reduction, flexflibility, agility, scale, and innovation.

Challenges of Cloud

- **Security and Privacy** — The most **CRITICAL** issues which generally attributed to slowing the deployment of cloud services are relate to storing and securing data, and monitoring the use of the cloud by the service providers. These challenges can be addressee, by storing the information internal to the organization, but allowing it to be used in the cloud. The security mechanisms between organization and the cloud need to be robust and a Hybrid cloud could support such a deployment.

- **Lack of Standards** — Clouds have documented interfaces; however, no standards are associated with these, and thus it is **unlikely that most clouds will be interoperable**. The Open Grid Forum is developing an Open Cloud Computing Interface to resolve this issue and the Open Cloud Consortium is working on cloud computing standards and practices. DoT / TRAI has mandated TSDSI to develop the Cloud Interoperability & Portability Standards for India.

- **Continuously Evolving** — User requirements are continuously evolving, as are the **requirements** for interfaces, networking, and storage. This means that a "cloud," especially a public one, does not remain static and is also continuously evolving.

- **Government Regulatory Compliance Concerns** — The SOX Law in the US and Data Protection directives in the EU are just two among many compliance issues affecting cloud computing, based on the type of data and application for which the cloud is being used. In India, TRAI / DoT is in the process of framing the policy on Cloud Computing.

Cloud Interoperability and Portability

- ***Interoperability*** can be defined as a measure of the degree to which diverse systems or components can work together successfully. More formally, IEEE and ISO define interoperability as the ability for two or more systems / applications to exchange information and mutually use the information that has been exchanged.

  Interoperability aspects of a cloud service mainly relate to the three interfaces between the customer systems and the cloud service – the **functional**, **admin** and **business interfaces**.

- ***Portability*** is about the ability of a customer to move and suitably adapt their applications and data between **their own systems and cloud services**, and between **cloud services of different cloud service providers** and **potentially different cloud deployment models**. Portability is differentiated into two separate areas: **cloud data portability** and **cloud application portability**:
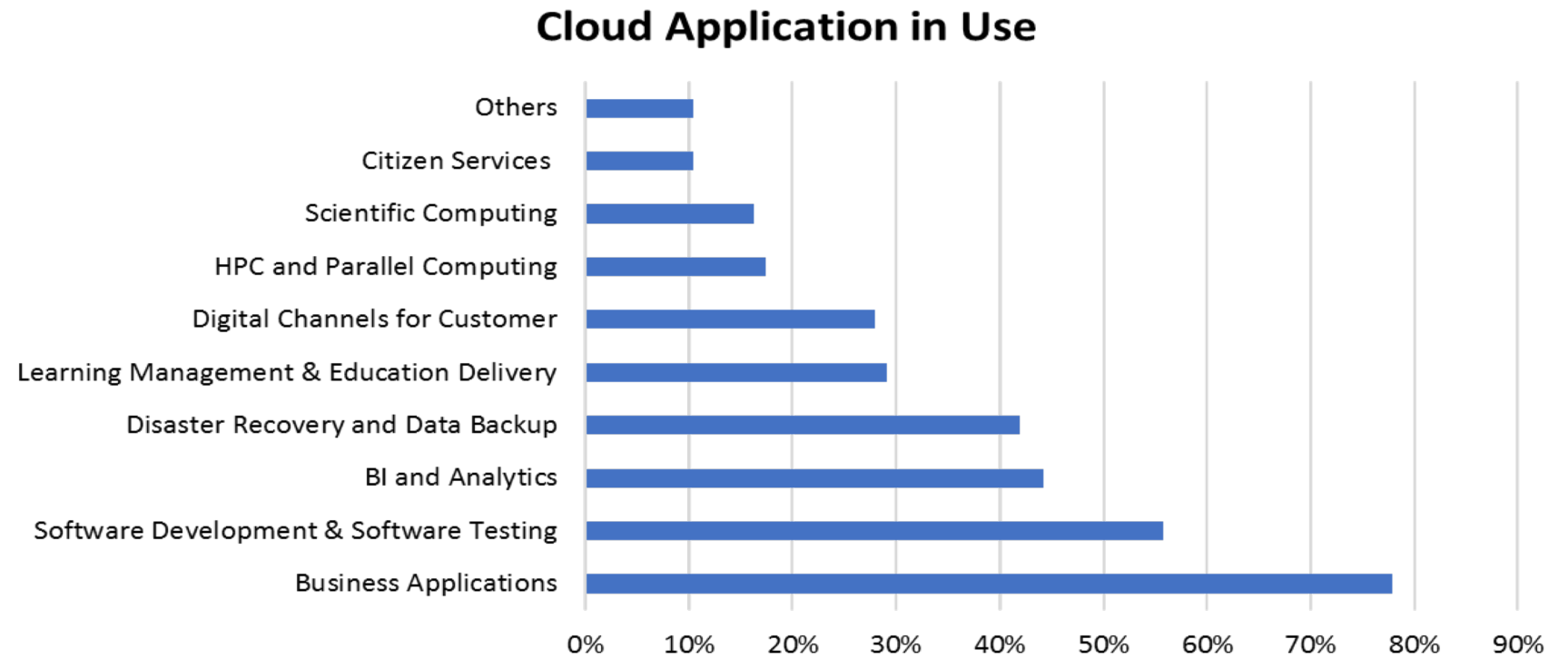
- ## Interoperability and Portability Challenges

  The interfaces and APIs of cloud services are not standardized and different providers use different APIs for what are otherwise comparable cloud services.

CLOUD & Mission Critical Applications

- According to the survey by Harvard Business Review Analytic Services – "the Cloud must also support mission-critical operations, those ones which are essential in disaster planning, maintaining high availability and scalability. However, the same report states that "the greatest barrier for mission-critical applications is **security**".

Cloud Application in Use*

Cloud Application in Use

Chart showing "Cloud Application in Use" with horizontal bars:
- Business Applications: ~78%
- Software Development & Software Testing: ~55%
- BI and Analytics: ~44%
- Disaster Recovery and Data Backup: ~42%
- Learning Management & Education Delivery: ~29%
- Digital Channels for Customer: ~28%
- HPC and Parallel Computing: ~17%
- Scientific Computing: ~16%
- Citizen Services: ~11%
- Others: ~11%

Business applications are by far the most popular for cloud migration.

Software development and testing is more popular compared to Business Intelligence and Analytics.

Learning Management and Education Delivery is applications has been migrated to cloud by more respondents than either Scientific Computing or HPC & Parallel Computing.

Standardization Work done by ITU

Recommendation **ITU-T X.1601 (2014**) - *Security framework for cloud computing*

Recommendation **ITU-T Y.3300 (2014) -** *Framework of software-defined networking*

Recommendation ITU-T Y.3500 (2014) - *Cloud computing – Overview and Vocabulary*

Recommendation **ITU-T Y.3501 (2013) -** *Cloud computing framework and high-level requirements*

Recommendation **ITU-T Y.3502 (2014) -** *Cloud computing – Reference Architecture*

Recommendation **ITU-T Y.3510 (2013) -** *Cloud computing infrastructure requirements*

Recommendation **ITU-T Y.3511 (2014) -** *Framework of inter-cloud computing*

Recommendation **ITU-T Y.3512 (2014) -** *Cloud computing - Functional requirements of*
Network as a Service

Recommendation **ITU-T Y.3513 (2014) -** *Cloud computing - Functional requirements of*
Infrastructure as a Service

Cloud Services - Regulatory Frameworks in India

- TRAI issued a Consultation Paper on "Cloud Computing" on 10th June 2016 https://main.trai.gov.in/consultation-paper-cloud-com.... CCICI submitted its inputs to TRAI in response to this consultation paper along with other organisations.

- Subsequently, TRAI issued its recommendations on "Cloud Services" on 16th August, 2017 and send it to DoT. [available on https://main.trai.gov.in/sites/default/files/Recommendations_cloud_computing_16082017.pdf]

  TRAI Recommendations on **"Cloud Services"** includes recommendations on :
    - Legal and regulatory framework for Cloud Services,
    - Overarching and comprehensive legal framework for data protection,
    - Interoperability and portability,
    - Legal framework for Cloud Service Providers (CSPs) operating in multiple jurisdictions,
    - cost-benefits analysis, incentives for conceptualisation and implementation of cloud based services in India, especially in government networks.

- Under legal and regulatory framework for Cloud Services, **TRAI recommended to adopt 'light touch regulatory approach to regulate CSPs through their industry bodies'**. Accordingly, TRAI recommended that DoT may prescribe a framework for registration of CSPs' industry body(s), which are not for profit.

Cloud Services - Regulatory Frameworks in India

- **Authority further recommended that:**
  - ➤ A threshold value (based on previous financial year) may be notified by the Government from time to time, above which all CSPs have to become member of one of the registered Industry body for cloud services and accept the code of conduct prescribed by such body. Such threshold may be based on either volume of business, revenue, number of customers, etc. or combination of all these. Registered Industry body, not for profit, may charge fee from its members, which is fair, reasonable and non-discriminatory.
  - ➤ Industry body for Cloud Services would prescribe the code of conduct of their functioning which shall include provisions for Adoption of a constitution towards its members, Membership, Creation of working groups, Mandatory codes of conduct, standards or guidelines that specifically include, Definitions, QoS parameters, Billing models, Data security, Dispute resolution framework, Model SLA, Disclosure framework, Compliance to its codes and standards, Compliance to guidelines, directions or orders issued by DoT, requisite information in stipulated time-lines as and when sought by DoT/TRAI.
  - ➤ **No restrictions on number of such industry bodies may be imposed**
  - ➤ DoT may issue directions, from time to time, to such registered industry body (ies).
  - ➤ A **Cloud Service Advisory Group (CSAG)** to be created to function as **oversight body** to periodically review the progress of Cloud services and suggest the Government actions required to be taken. This Advisory Group may consist of representatives of state IT departments, MSME associations, Consumer advocacy groups, Industry experts and representatives of Law Enforcement agencies.

Cloud Services - Regulatory Frameworks

- On 27th September 2018, DoT sought additional recommendations from TRAI on "terms and condition of registration of industry body, eligibility, entry fee, period of registration, and governance structure etc".

- TRAI reached out to CCICI formally on Jan 1, 2019 to seek our opinion on the topic of establishing recognized Industry body for Cloud Services in India. On our request, TRAI have sent a questionnaire so we can respond appropriately with the information they are seeking. The TRAI questionnaire is available at https://drive.google.com/open?id=0B8jA8yuC-TIUS19rNy11ZnFpLWpmS1Bub0dBb3hPVkpjdU9F,.

Questionnaire

Inputs about their own association and its practices

- What is the internal governance structure and organisational framework of your association, which may include Governance Board, Executive Committee and Secretariat etc? If yes, please provide the details about its composition, types of members, selection process for members and their power, rights (like voting right on any decision), roles and responsibilities.

- Whether you provide platforms for interactions among members. If yes, how members participate in meeting conducted by your association. What rights different types of members have in such meetings?

- How dispute amongst members are being dealt. What is the general practice? Whether you have observed any trend on such disputes and their resolutions. Who generally dominate in such meetings and outcome of dispute resolution, big size enterprises or small & medium enterprises?

- Whether you have any rules, regulations, code and guidelines, which guide conducts of your members. How is your association ensuring compliance of members? What Transparency and Documentation obligations are on your members? Whether it is different for different type of members?

- Whether your association has monitoring bodies for observation of practices of your members? If yes, what are the appointment procedure and functions of such monitoring bodies? Tell about the Transparency and documentation obligations of Monitoring body, if any.

- Policy of Membership followed by you, which may include, membership options, benefits and responsibilities, membership fee and their rights such as voting right in meeting & dispute resolutions etc.

- How you handle complaints from Members against the outcome of dispute resolutions, decision of Monitoring bodies and other decision of supervisory body? Tell about the Complaint Handling and procedures followed by your association, if any.

- How you handle complaints from consumers of cloud services (enterprises/individuals) against any CSP and its compliance with your guidelines, code or rules? Tell about the Complaint Handling and procedures followed by your association, if any.

- How your organisation manage cost of Secretariat, Monitoring Bodies and Complaint Handling System.

Questionnaire

- **Inputs regarding International practices**
    - How cloud service providers are managed in other countries. What is the role of Government/ Regulator and cloud services providers body in this regard.
    - What are the best codes of practices followed by Cloud services providers in other countries? How Cloud service providers' industry bodies can ensures compliance from members. Please cite your comments based on international practices.
    - What are the benefits/harms for any cloud service provider to join or not to join a cloud service industry body? Please provide your inputs for both big size enterprises and small and medium size intermediaries who provide cloud services to consumers.

Present Status

- The matter is being perused on continuous basis with TRAI
- As learnt, TRAI is in the process of preparing the consultation paper for public / industry consultation and expected to be released soon.