

CLOUD COMPUTING-IT0530

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Introduction:

Introduction to Cloud Computing, Types of clouds and Risks, Cloud Architecture and SOA,

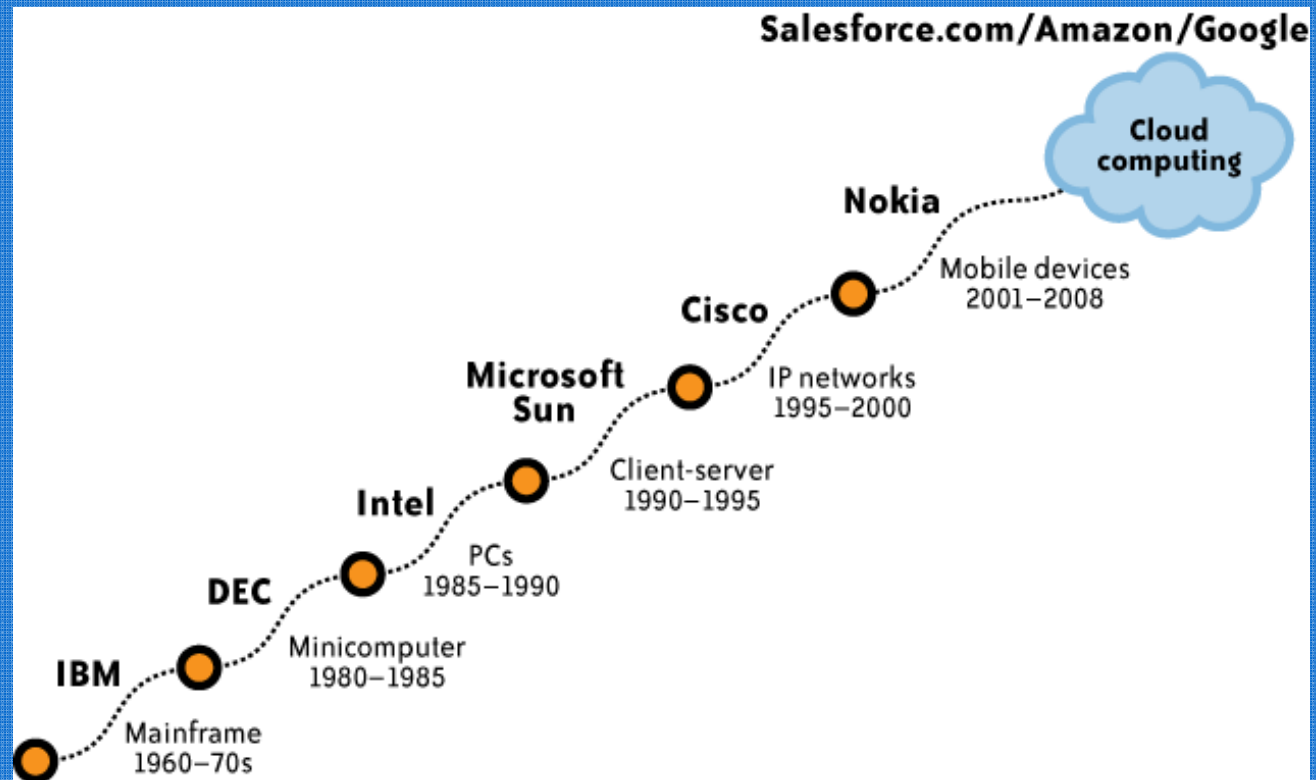
Modeling and Design:

Cloud Service Models for Software, Infrastructure and Platform, Cloud Service Providers

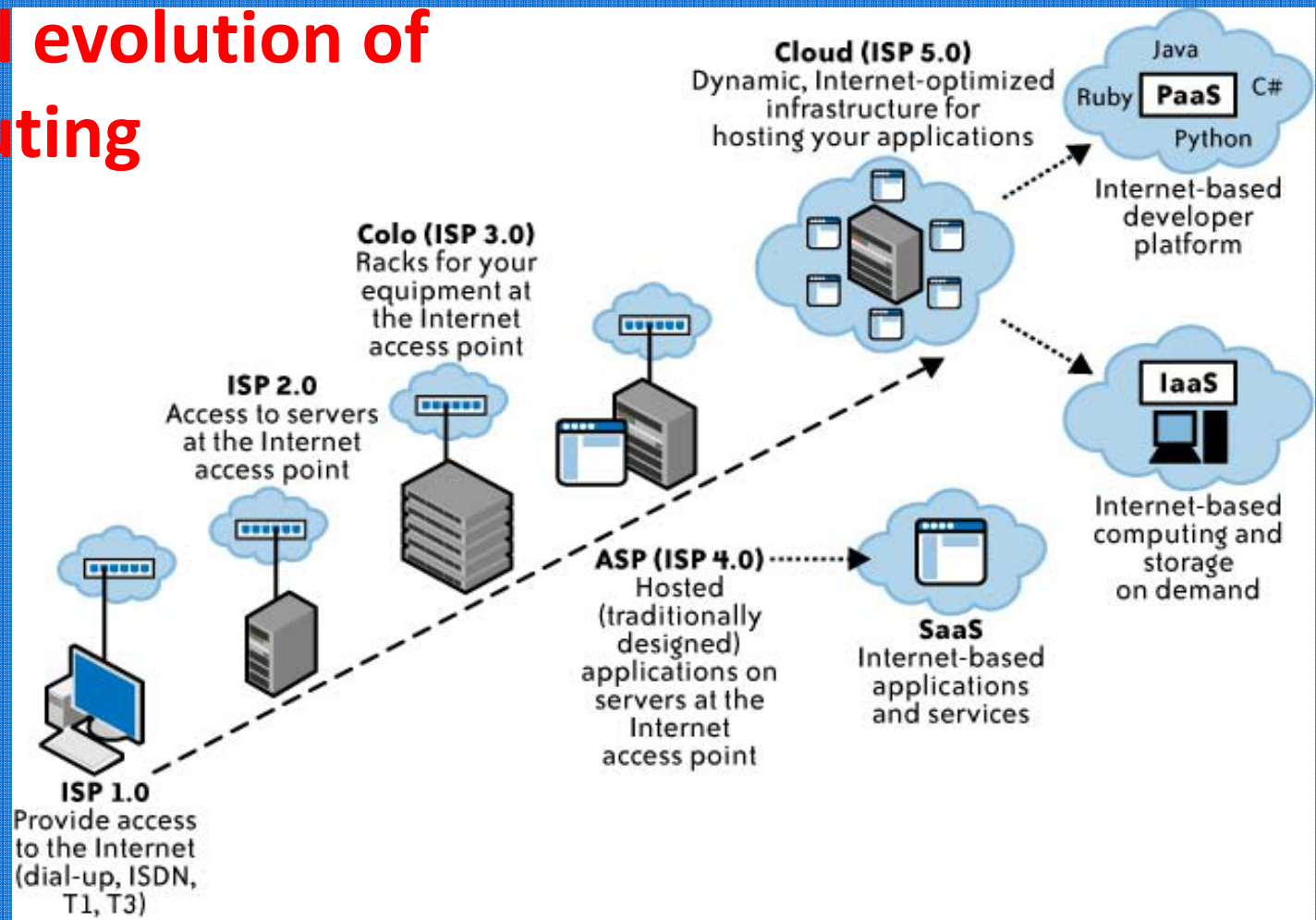
Introduction to Cloud Computing

- ✓ Evolution of model computing
- ✓ Logical evolution of computing
- ✓ Evolution of Sharing on the internet
- ✓ What is Cloud Computing?(Different views)
- ✓ Fundamental Elements of cloud Computing
- ✓ Five characteristics of cloud computing
- ✓ Pros and Cons of cloud computing

Evolution of model computing



Logical evolution of computing



Services Sharing Cloud Computing

- Everything as a service over the Web: SaaS, utility computing, IT services, ...
- everywhere, always available, scalable, ...

Resource Sharing Grid Computing

- Standards and software for sharing of remote resources and collaboration
- Mainly used for highly scalable HPC jobs

Information Sharing The World Wide Web

- HTML page format, HTTP protocol, and Mosaic browser for document exchange
- Initially in universities; worldwide adoption

Network Sharing Inter-Networking and the Internet

- Inter-Networking of regional networks with TCP/IP
- Began to replace regional alternatives
- Worldwide adoption – file transfer

Networking Networks

- Multiple regional networks linking computers
- Initially at universities and national labs

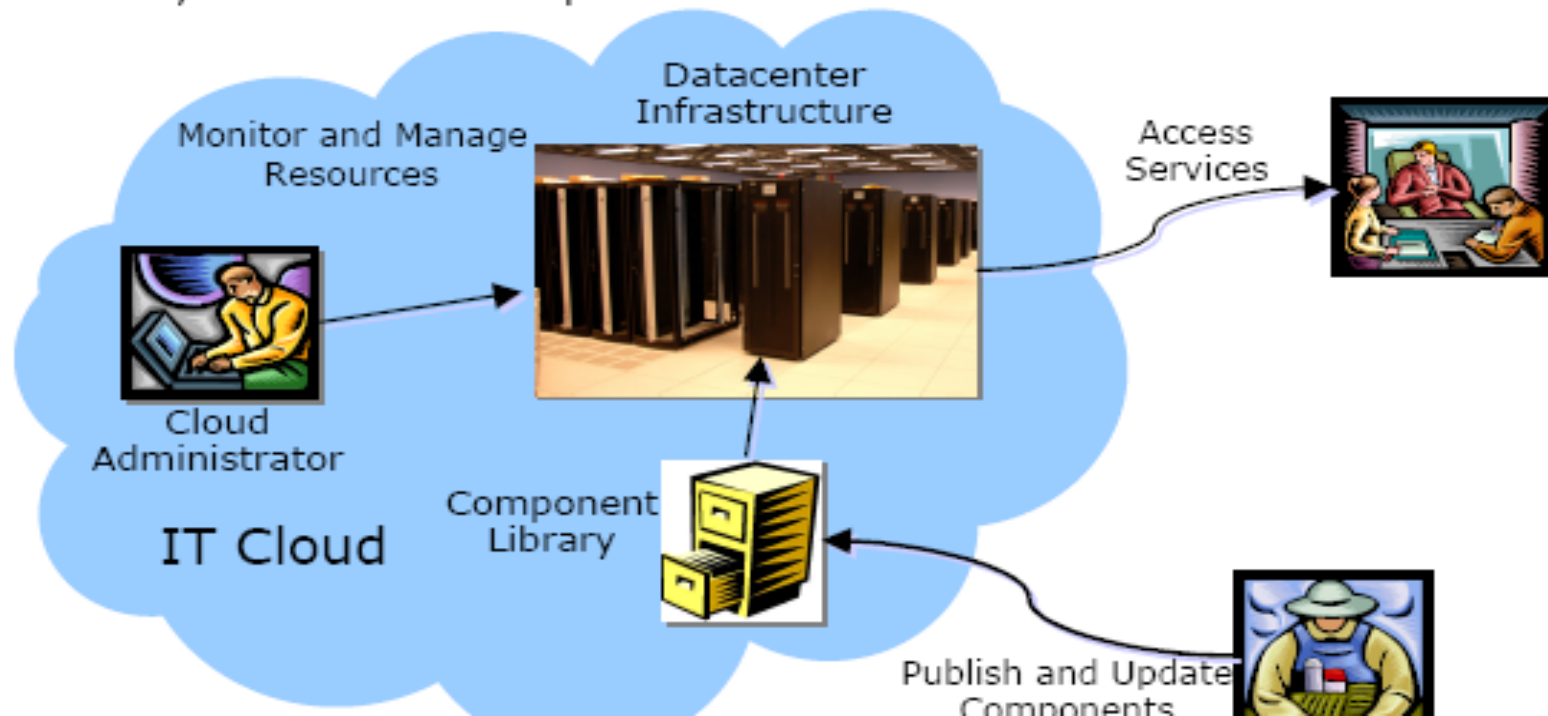
Evolution of Sharing on the Internet

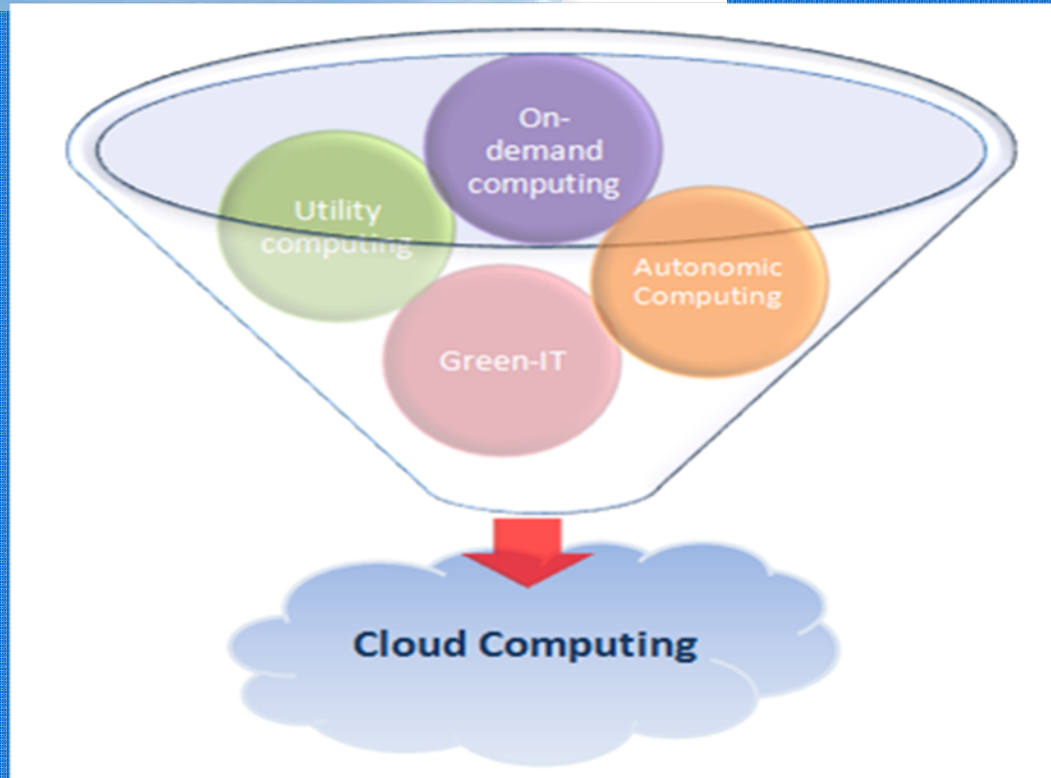
What is Cloud Computing?

Common,
Location-independent,
Online
Utility that is available on
Demand

Cloud Computing is an emerging style of computing in which **applications, data, and resources** are **provided as services** to users over the Web

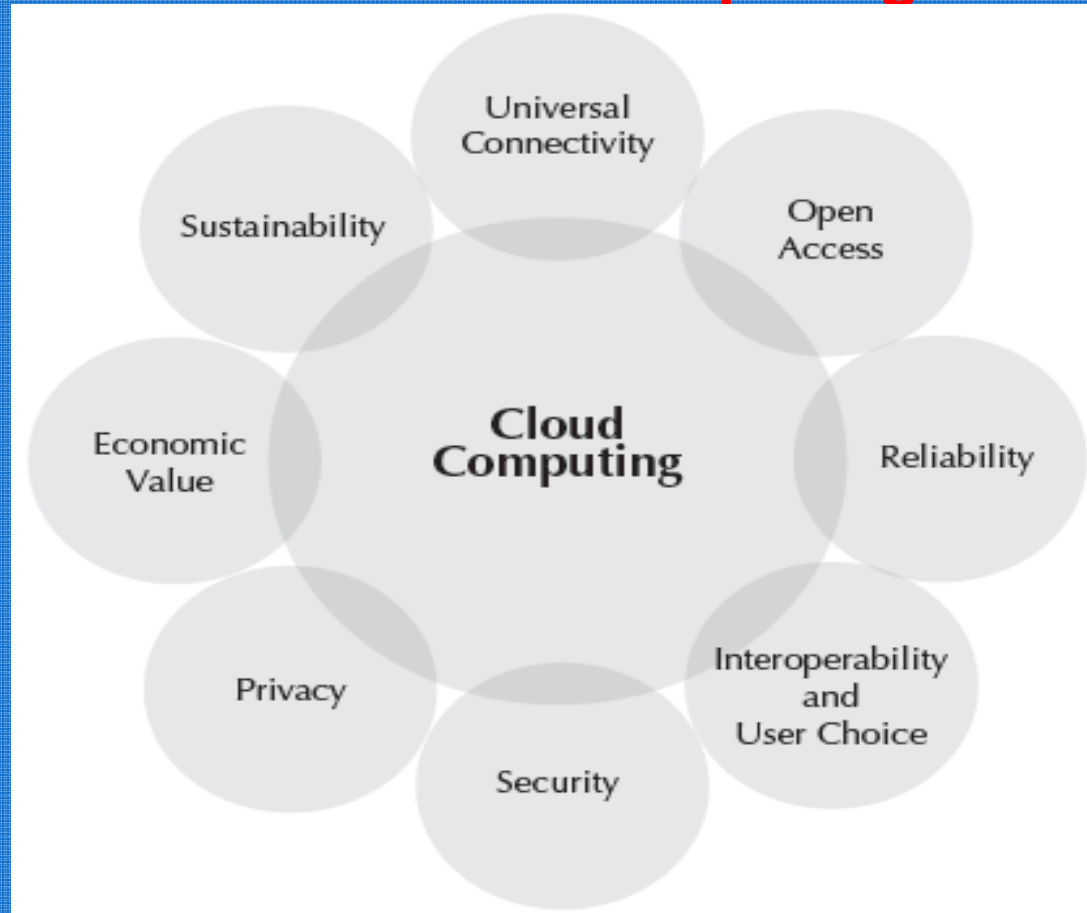
- Services provided may be available globally, always on, low in cost, “on demand”, massively scalable, “pay as you grow”, ...
- Consumers of the services need only care about *what* the service does for them, *not how* it is implemented





Cloud computing is an emerging business model that delivers computing services over the Internet in an elastic self-serviced, self-managed, cost-effective manner with guaranteed Quality of Service(QoS).

Fundamental Elements of cloud Computing



Five characteristics of cloud computing

Resource-Pooling
Scalable
On-Demand-Self-Service
Uses-Internet-Technologies
Metered-by-Use
Elastic

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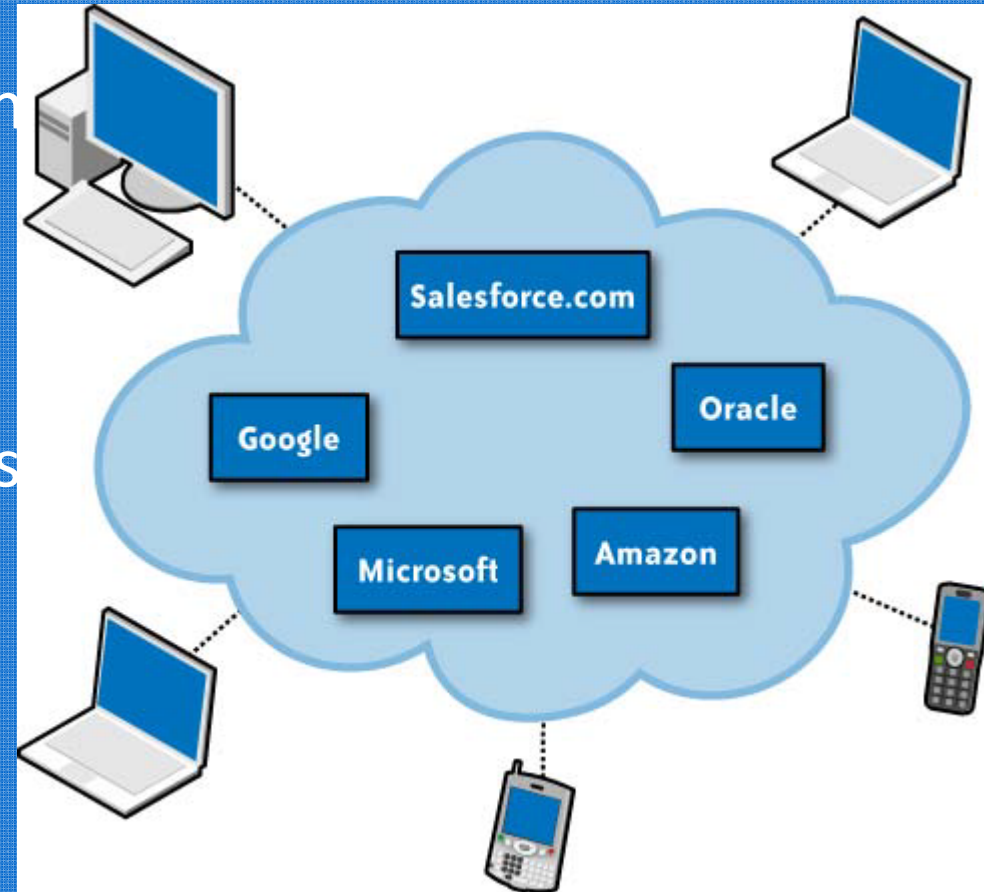
Pros and Cons of cloud computing



Types of clouds and Risks

- ✓ Public/External cloud
- ✓ Hybrid/ Integrated cloud
- ✓ Private/Internal cloud
- ✓ Community/Vertical Clouds
- ✓ Risks in cloud computing

→ A **public cloud** (also called External Cloud) is one based on the standard cloud computing model, in which a service provider makes resources, such as applications and storage, available to the general public over the Internet. Public cloud services may be free or offered on a pay-per-usage model.



- A public cloud is hosted, operated, and managed by a third-party vendor from one or more data centres
- In a public cloud, security management and day-to-day operations are relegated to the third party vendor, who is responsible for the public cloud service offering.
- Hence, the customer of the public cloud service offering has a low degree of control and oversight of the physical and logical security aspects of a private cloud

The main benefits of using a public cloud service are:

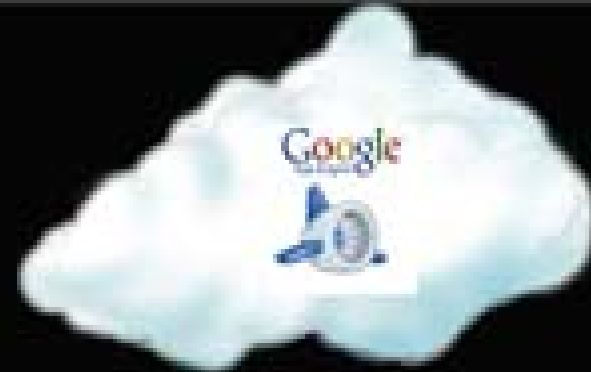
- Easy and inexpensive set-up because hardware, application and bandwidth costs are covered by the provider.
- Scalability to meet needs.
- No wasted resources because you pay for what you use.



Amazon Web Services



Microsoft Windows Azure



Google App Engine



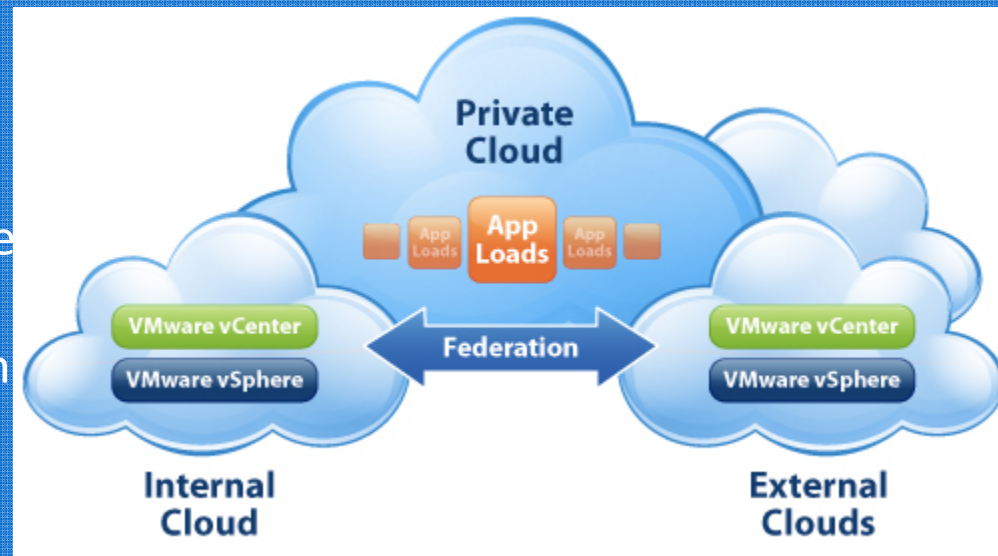
Examples of public clouds include:

- ✓ Amazon Elastic Compute Cloud (EC2),
- ✓ IBM's Blue Cloud,
- ✓ Sun Cloud,
- ✓ Google AppEngine and
- ✓ Windows Azure Services Platform

→ **Private cloud** (also called internal cloud or corporate cloud) is a marketing term for a proprietary computing architecture that provides hosted services to a limited number of people behind a firewall.

→ Advances in virtualization and distributed computing have allowed corporate network and datacenter administrators to effectively become service providers that meet the needs of their "customers" within the corporation.

→ Marketing media that uses the words "private cloud" is designed to appeal to an organization that needs or wants more control over their data than they can get by using a third-party hosted service such as Amazon's Elastic Compute Cloud (EC2) or Simple Storage Service (S3)



→ A variety of private cloud patterns have emerged:

Dedicated

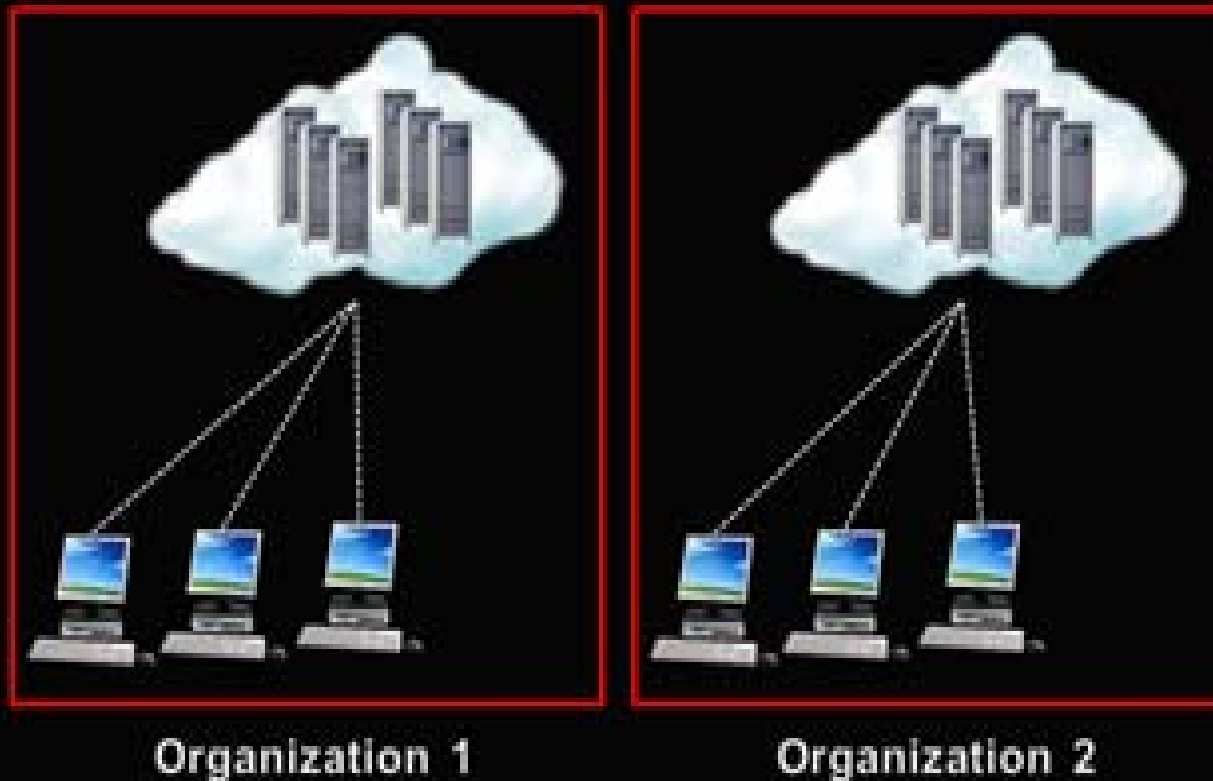
Private clouds hosted within a customer-owned data centre or at a collocation facility, and operated by internal IT departments

Community

Private clouds located at the premises of a third party; owned, managed, and operated by a vendor who is bound by custom SLAs and contractual clauses with security and compliance requirements

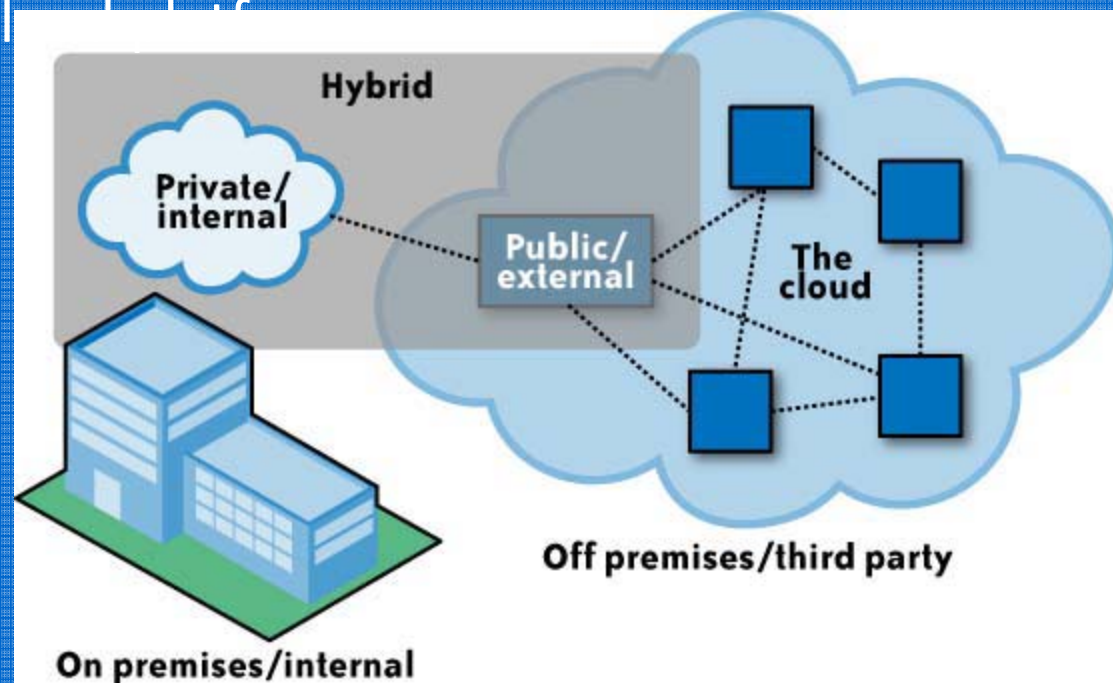
Managed

Private cloud infrastructure owned by a customer and managed by a vendor



→ **A hybrid cloud** is a composition of at least one private cloud and at least one public cloud. A hybrid cloud is typically offered in one of two ways: a vendor has a private cloud and forms a partnership with a public cloud provider, or a public cloud provider forms a partnership with a vendor that provides private cloud infrastructure.

→ A hybrid cloud is a cloud computing environment in which an organization provides and manages some resources in-house and has others provided externally.



- For example, an organization might use a public cloud service, such as Amazon Simple Storage Service (Amazon S3) for archived data but continue to maintain in-house storage for operational customer data.
- Ideally, the hybrid approach allows a business to take advantage of the scalability and cost-effectiveness that a public cloud computing environment offers without exposing mission-critical applications and data to third-party vulnerabilities.
- This type of hybrid cloud is also referred to as **hybrid IT**.

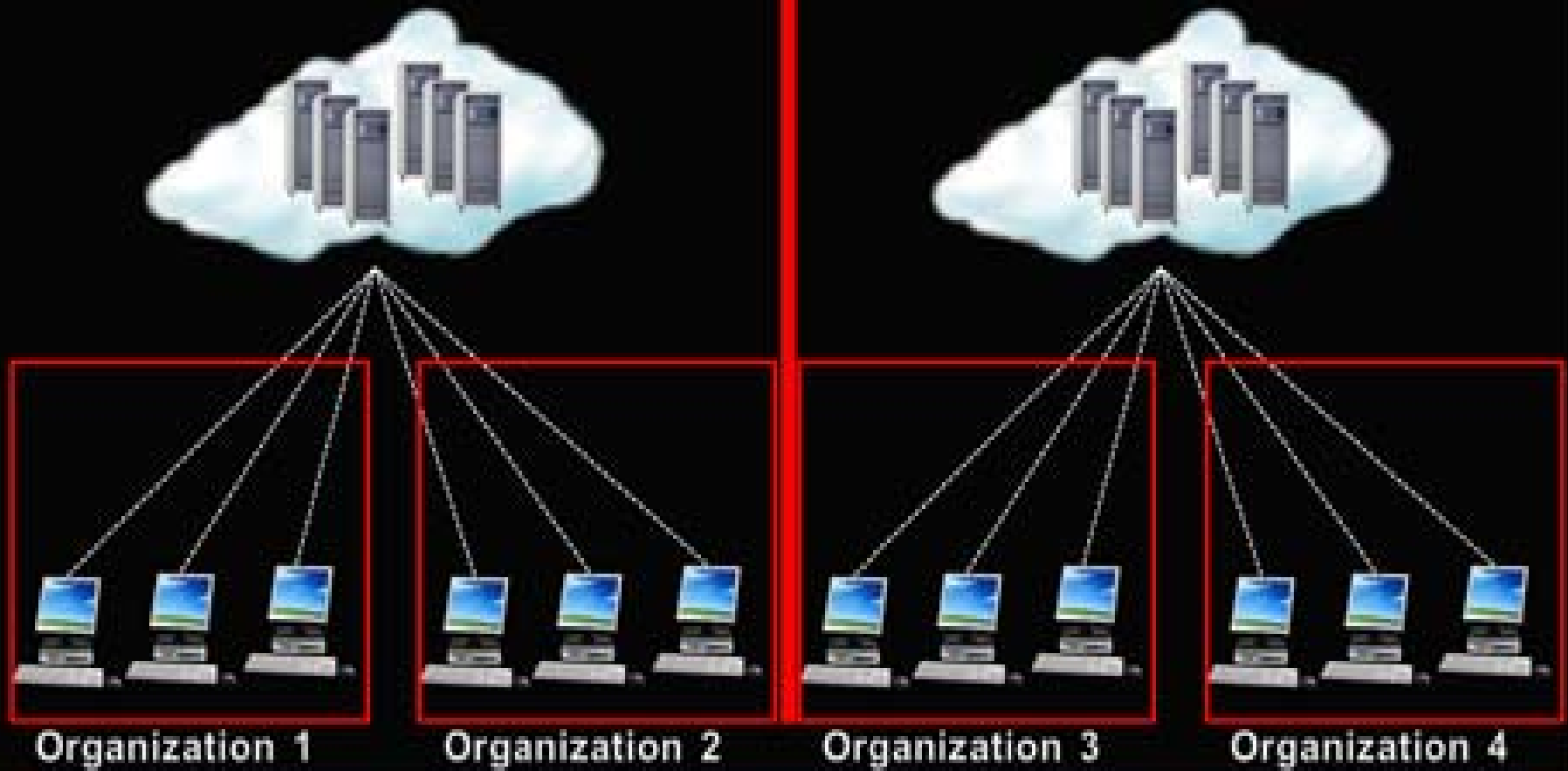


Organization 1



Public Cloud

- **Community clouds** are a deployment pattern suggested by **NIST**, where semi-private clouds will be formed to meet the needs of a set of related stakeholders or constituents that have common requirements or interests.
- Communities of Interest (COI) constructs typical of the federal government may be enabled by community clouds to augment their wiki-centric collaboration processes with cloud enabled capabilities as well.
- A community cloud may be private for its stakeholders, or may be a hybrid that integrates the respective private clouds of the members, yet enables them to share and collaborate across their clouds by exposing data or resources into the community cloud.



Risks in cloud computing

- ❖ Security
- ❖ Compatibility
- ❖ Availability
- ❖ Compliance
- ❖ Monitoring
- ❖ Lock – In
- ❖ Standardization

SOA and Cloud:

→ **Service oriented architecture (SOA)** is defined by The Open Group to be “*an architectural style that supports service orientation. Service orientation is a way of thinking in terms of services and service-based development and the outcomes of services.*”

→ According to NIST “**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 promotes availability and is composed of five essential characteristics, three service models, and four deployment models.”

→ Cloud services, according to The Open Group definition, are SOA services. However, not all SOA services are Cloud service because they require automated deployment and management as well as offering support in order to support the Cloud characteristics.

SOA standards in The Open Group that can be applied to Cloud include:

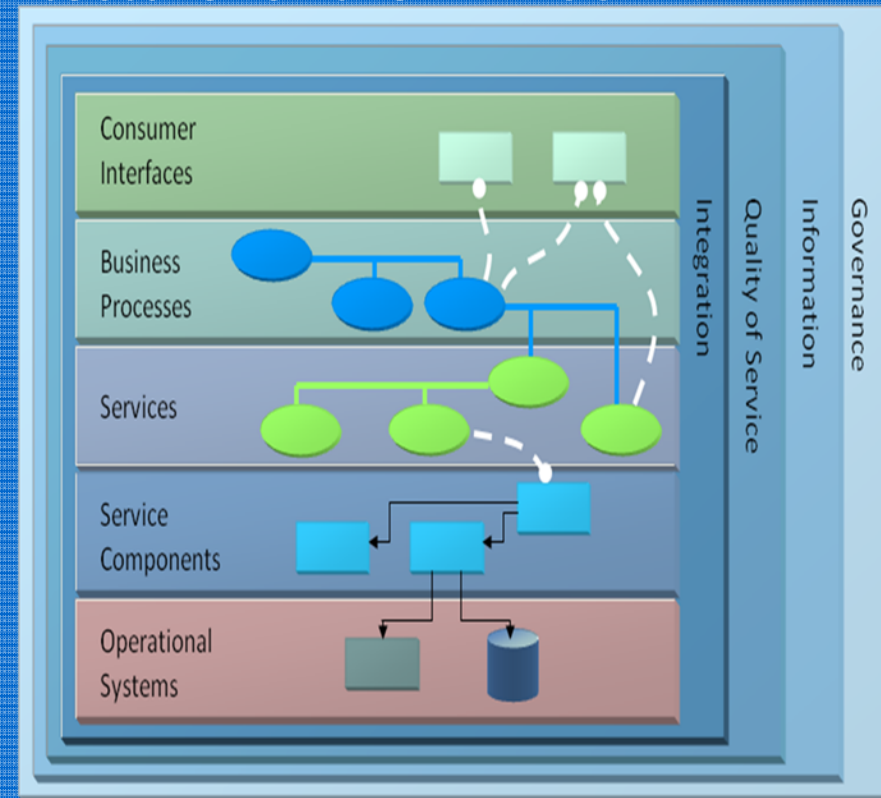
- The Open Service Integration Maturity Model – this model helps determine the level of service use in an organization, these levels apply to the use of cloud services. Cloud computing can be seen as the “Virtualized” and “Dynamically reconfigurable” levels.
- The SOA Ontology defines service and SOA concepts which can be used as a basis for describing cloud services, though extension Ontologies should be developed for cloud..

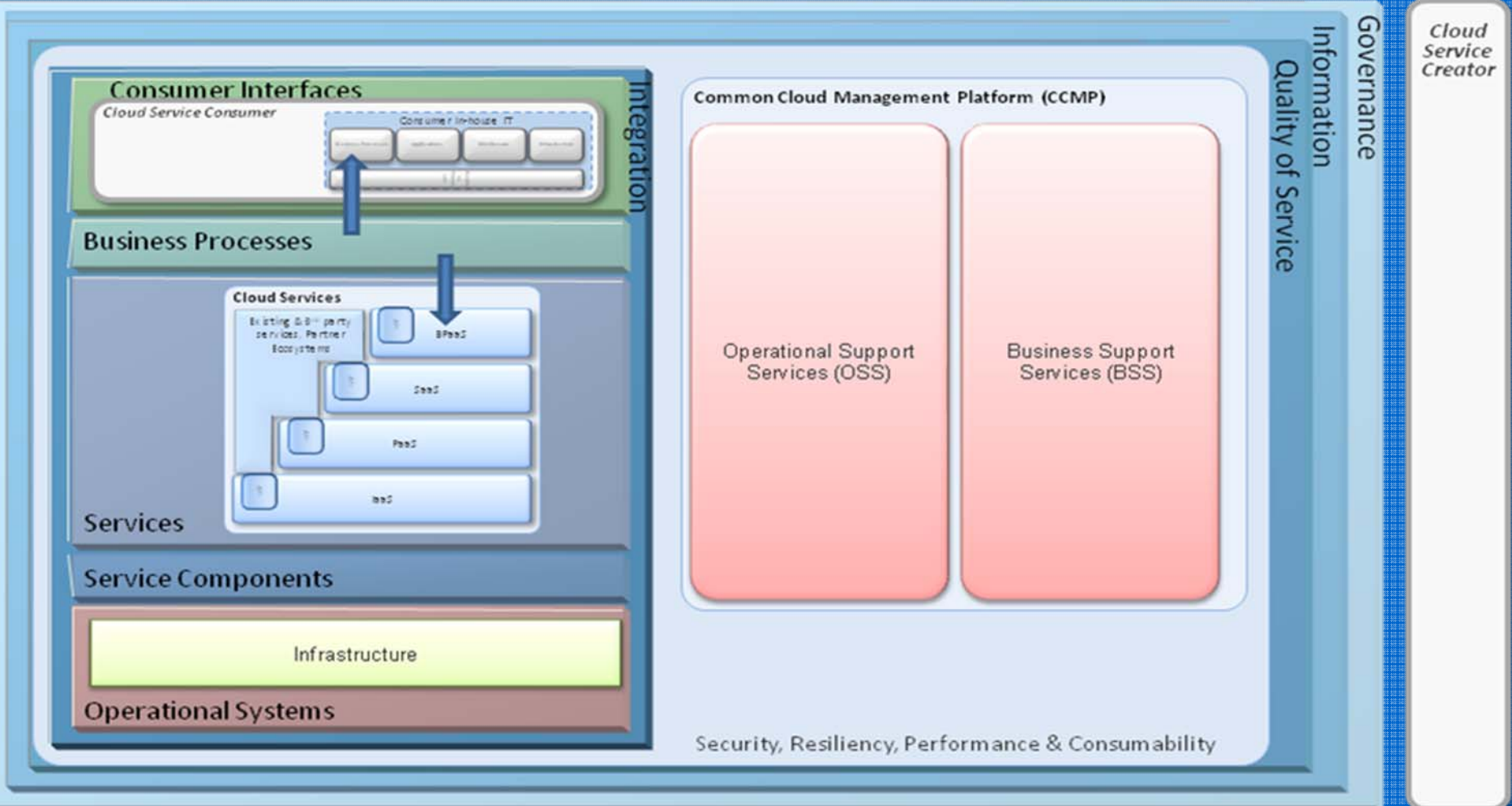
- The SOA Reference Architecture defines the functional and cross cutting concerns and ABBs for SOA, which also applies to Cloud. This standard has been used as a basis for the IBM CCRA.
 - The SOA Governance Framework defines a governance reference model and method that applies to the development of cloud services and solution portfolio and lifecycle management. Best practices for governance of Cloud solutions will need to be developed in addition to this standard.
 - Security for Cloud and SOA, a joint workgroup between SOA and Cloud Workgroups in The Open Group, defines security considerations and ABBs for both Cloud and SOA.
- SOCCL, another joint SOA and Cloud Workgroup in The Open Group defines the architecture for exposing infrastructure as a service for both SOA and Cloud solutions.

The SOA RA as being standardized by The Open Group, applies to Cloud architectures and is the underlying architecture for the IBM CCRA.

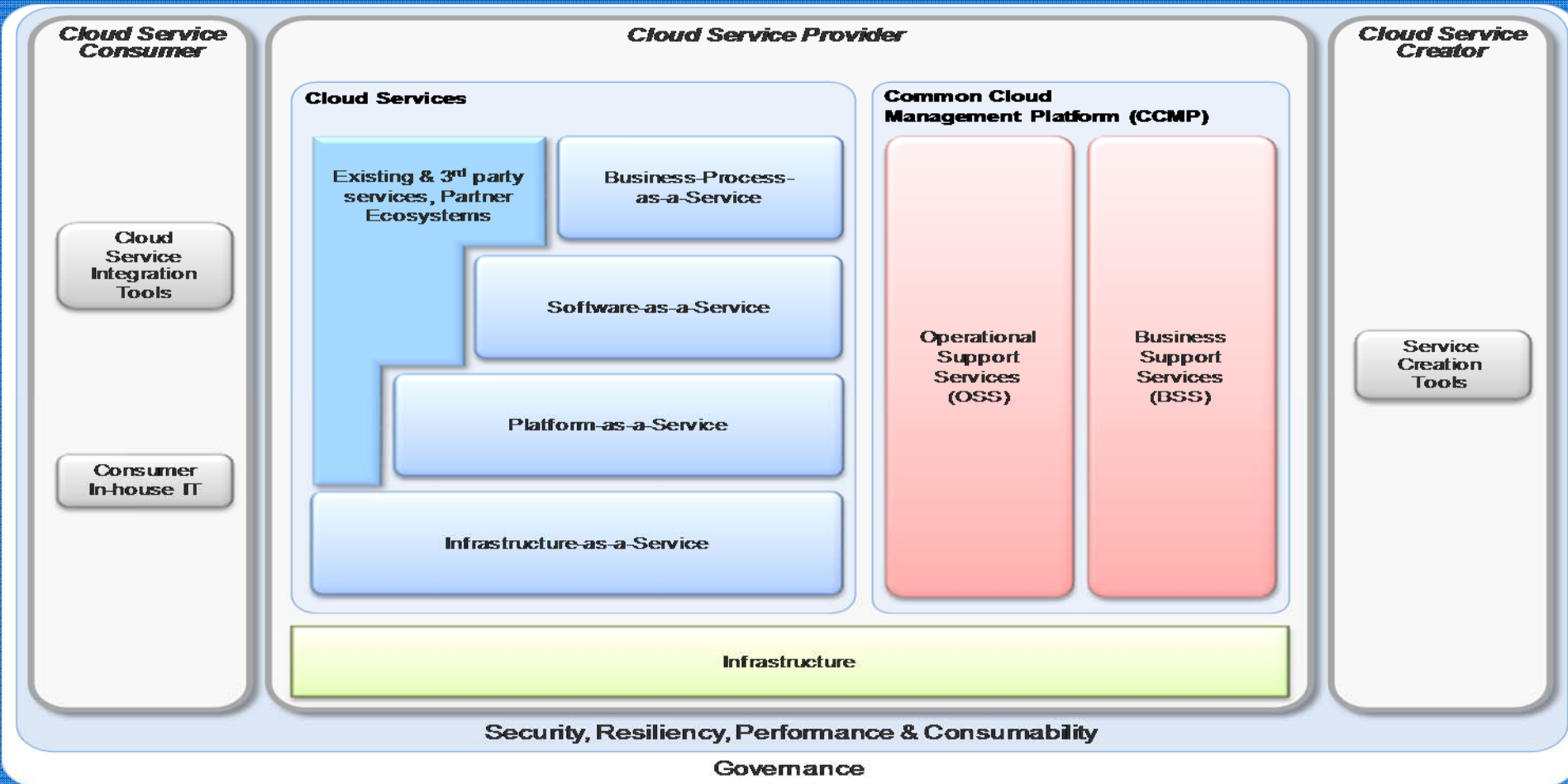
The functional concerns:

- ✓ operational systems
- ✓ service components
- ✓ Services
- ✓ business processes and consumer interfaces; all exist in and are relevant to functional concerns for cloud architecture's





Cloud Computing Reference Architecture(IBM)



Roles

→ The IBM Cloud Computing Reference Architecture defines three main roles:

- Cloud Service Consumer,
- Cloud Service Provider and
- Cloud Service Creator.

→ Each role can be fulfilled by a single person or can be fulfilled by a group of people or an organization.

→ The roles defined here intend to capture the common set of roles typically encountered in any cloud computing environment.

→ Therefore it is important to note that depending on a particular cloud computing scenario or specific cloud implementation, there may be project-specific sub-roles defined.

Cloud Service Consumer

→ A cloud service consumer is an organization, a human being or an IT system that consumes (i.e., requests, uses and manages, e.g. changes quotas for users, changes CPU capacity assigned to a VM, increases maximum number of seats for a web conferencing cloud service) service instances delivered by a particular cloud service.

→ The service consumer may be billed for all (or a subset of) its interactions with cloud service and the provisioned service instance(s).

Cloud Service Provider

→ The Cloud Service Provider has the responsibility of providing cloud services to Cloud Service Consumers.

→ A cloud service provider is defined by the ownership of a common cloud management platform (CCMP).

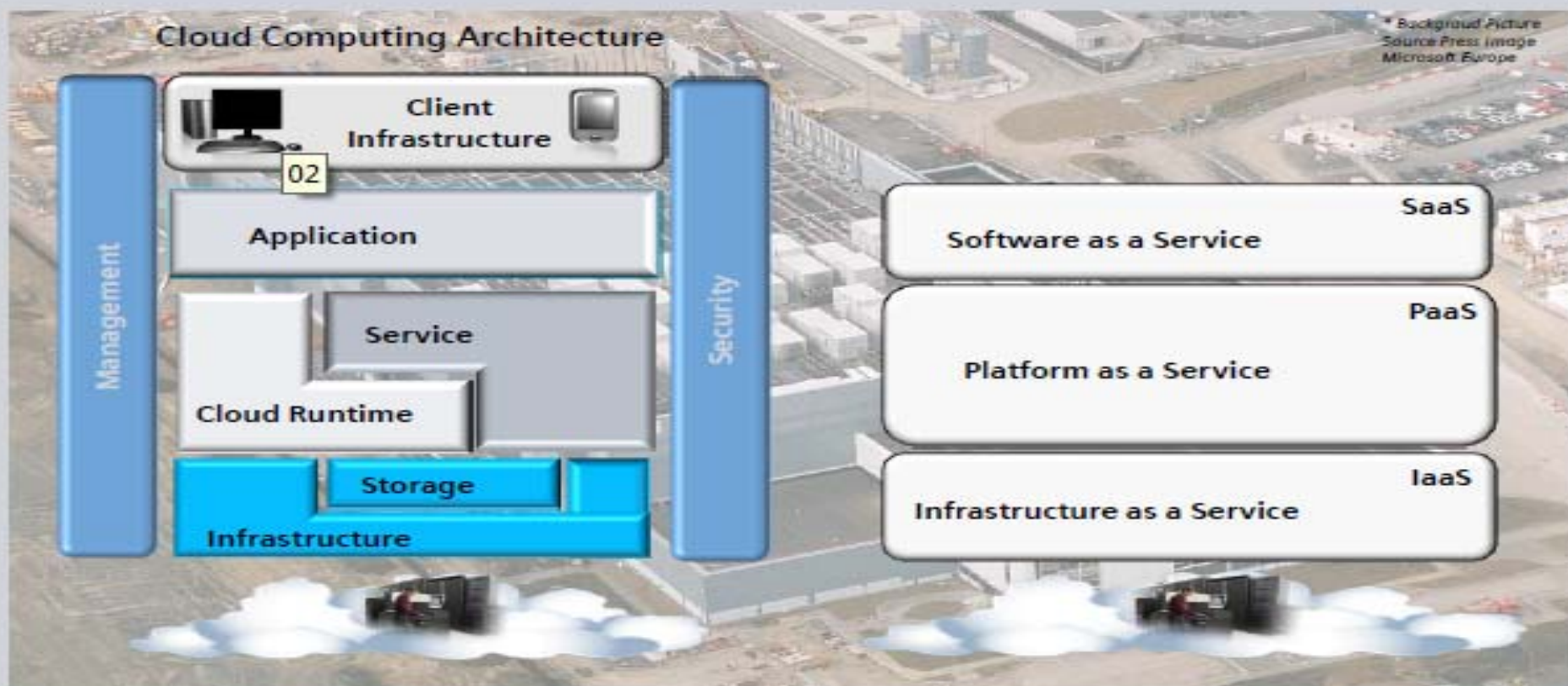
→ This ownership can either be realized by truly running a CCMP by himself or consuming one as a service.

Cloud Service Creator

- The Cloud Service Creator is responsible for creating a cloud service, which can be run by a Cloud Service Provider and by that exposed to Cloud Service Consumers.
- Typically, Cloud Service Creators build their cloud services by leveraging functionality which is exposed by a Cloud Service Provider.
- Management functionality which is commonly needed by Cloud Service Creators is defined by the CCMP architecture.
- A Cloud Service Creator designs, implements and maintains runtime and management artifacts specific to a cloud service.

Cloud Computing Architecture vs. “XaaS”

... allows comparisons, maps to common dictionary

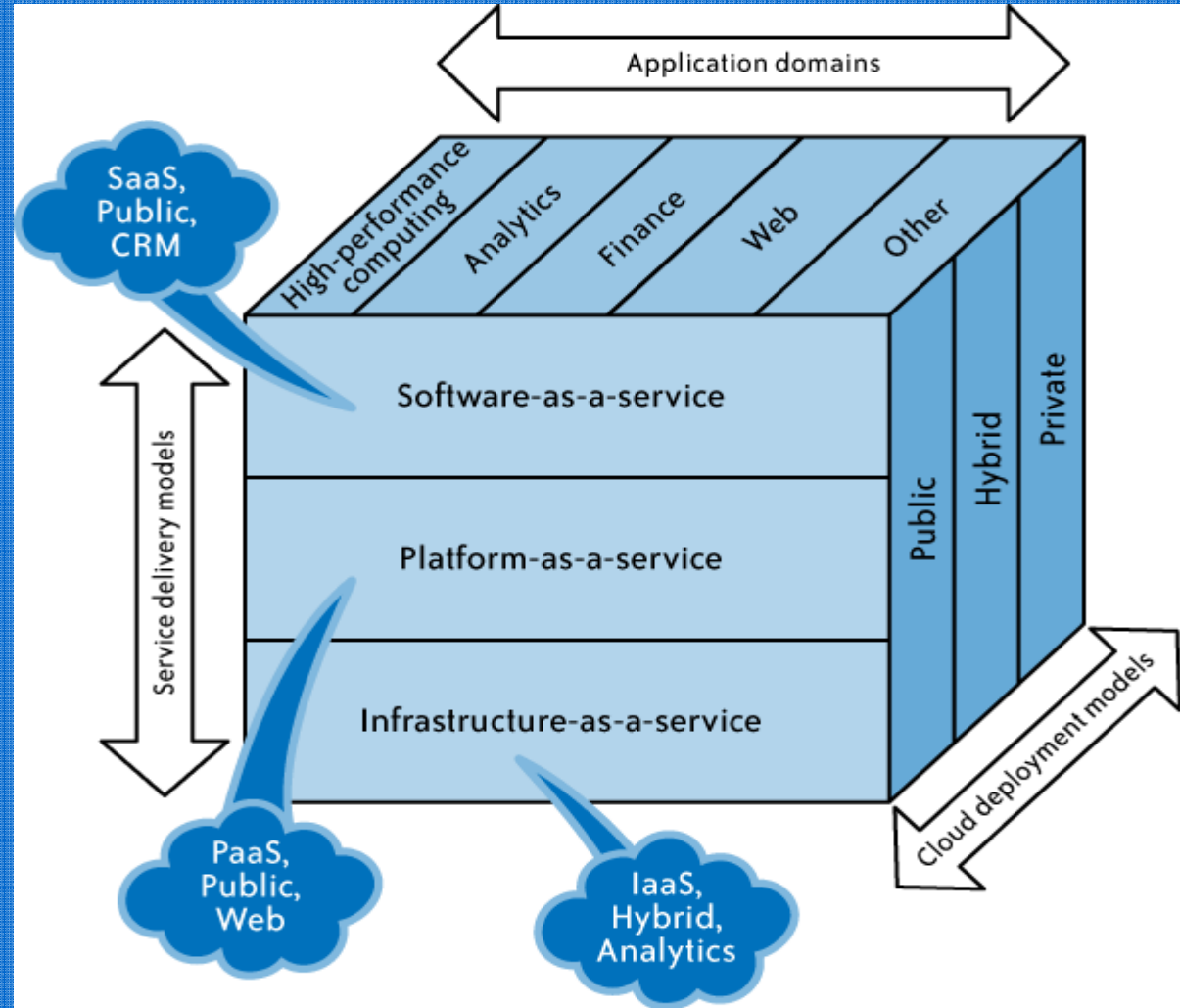


Cloud Service Models :

Cloud Computing can be broadly classified into three *aaS, i.e., three layers of Cloud Stack, also known as **Cloud Service Models** or **SPI Service Model**:

- Infrastructure-as-a-Service (**IaaS**)
- Platform-as-a-Service (**PaaS**)
- Software-as-a-Service (**SaaS**)

Diagram for :
Relationship
between services,
uses, and types of
clouds



In general terms, Internet and Cloud can mean the same thing. They are shown here as two layers because the Internet is quite broader than the cloud.

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Infrastructure-as-a-Service (IaaS)

- This is the base layer of the cloud stack.
- It serves as a foundation for the other two layers, for their execution.
- The keyword behind this stack is *Virtualization*.
- Amazon EC2 is a good example of an IaaS. In [Amazon EC2 \(Elastic Compute Cloud\)](#) our application will be executed on a virtual computer (also known as an instance).
- we have our choice of virtual computer, meaning that we can select a configuration of CPU, memory and storage that is optimal for our application.

- The IaaS provider supplies the whole cloud infrastructure viz. servers, routers, hardware based load-balancing, firewalls, storage and other network equipment.
- The customer buys these resources as a service on an as needed basis.
- A few of us may claim that this sounds somewhat similar to what the customers were doing even 10 years back with traditional hosting

Why should companies opt for IaaS ?

- The billing is on hourly or monthly basis
- Cloud is elastic in nature(IaaS provider can respond quickly to *scale up or down*, Amazon EC2 calls it **Auto Scaling**)

→One more feature about Amazon EC2, which is perhaps provided by other IaaS providers as well, is **Elastic Load Balancing**

→The Amazon EC2 **SLA** (Service Level Agreement) guarantees 99.95% availability of the service within a region over a trailing 365 day period.

GoGrid has the most generous **SLA** with a guarantee of **100%**

Uptime and **24/7 Support**

Platform-as-a-Service (PaaS):-

- the middle layer of Cloud Stack, i.e., PaaS (Platform as a Service).
- This middle layer of cloud is consumed mainly by developers or tech savvy individuals.
- The PaaS provider will deliver the platform on the web, and in most cases we can consume the platform using our browser.
- There is no need to download any software.
- This combination of simplicity and cost efficiency empowers small and mid-size companies, or even individual developers, to launch their own **Cloud SaaS**.
- Without any initial investment, they can leverage the power of these platform providers.

PaaS Layers:-

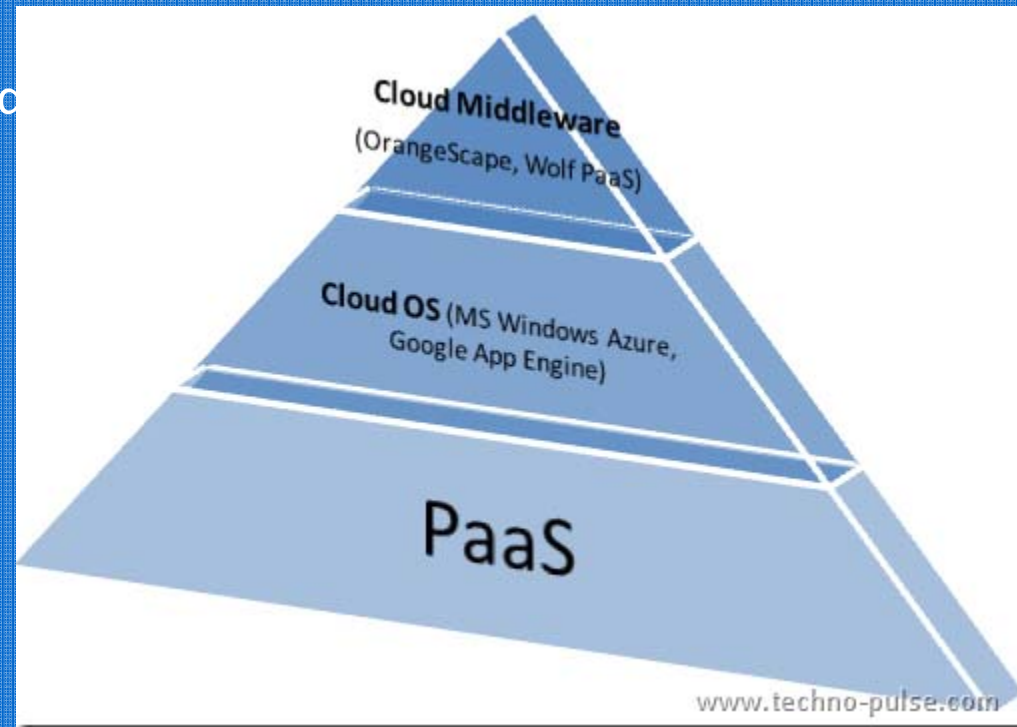
- Cloud OS
- Cloud Middleware

→ Google App Engine and Windows Azure are examples of Cloud Operating Systems (OS).

→ Orangescape and Wolf PaaS are cloud

Examples: Best PaaS Providers

- Microsoft Windows Azure
- Google App Engine
- Force.com (SalesForce)
- OrangeScape
- Wolf PaaS



Different components of a typical PaaS offering:-

Client capabilities	Browser-based development tools: Google Web Toolkit, Google Gears, Mashup Editor, Google Gadgets, etc.
Cloud computing services	Cloud-based runtime: EC2, Google App Engine, etc.
General purpose support services	Web services tools: Simple Storage Service, Simple DB, MTurk, GAE Datastore, GDate, Google Accounts, Social Graph API, etc.

Software-as-a-Service (SaaS)

→ Software as a Service (SaaS) is a cloud computing model, which hosts various software applications and makes them available to customers over the Internet or other network.

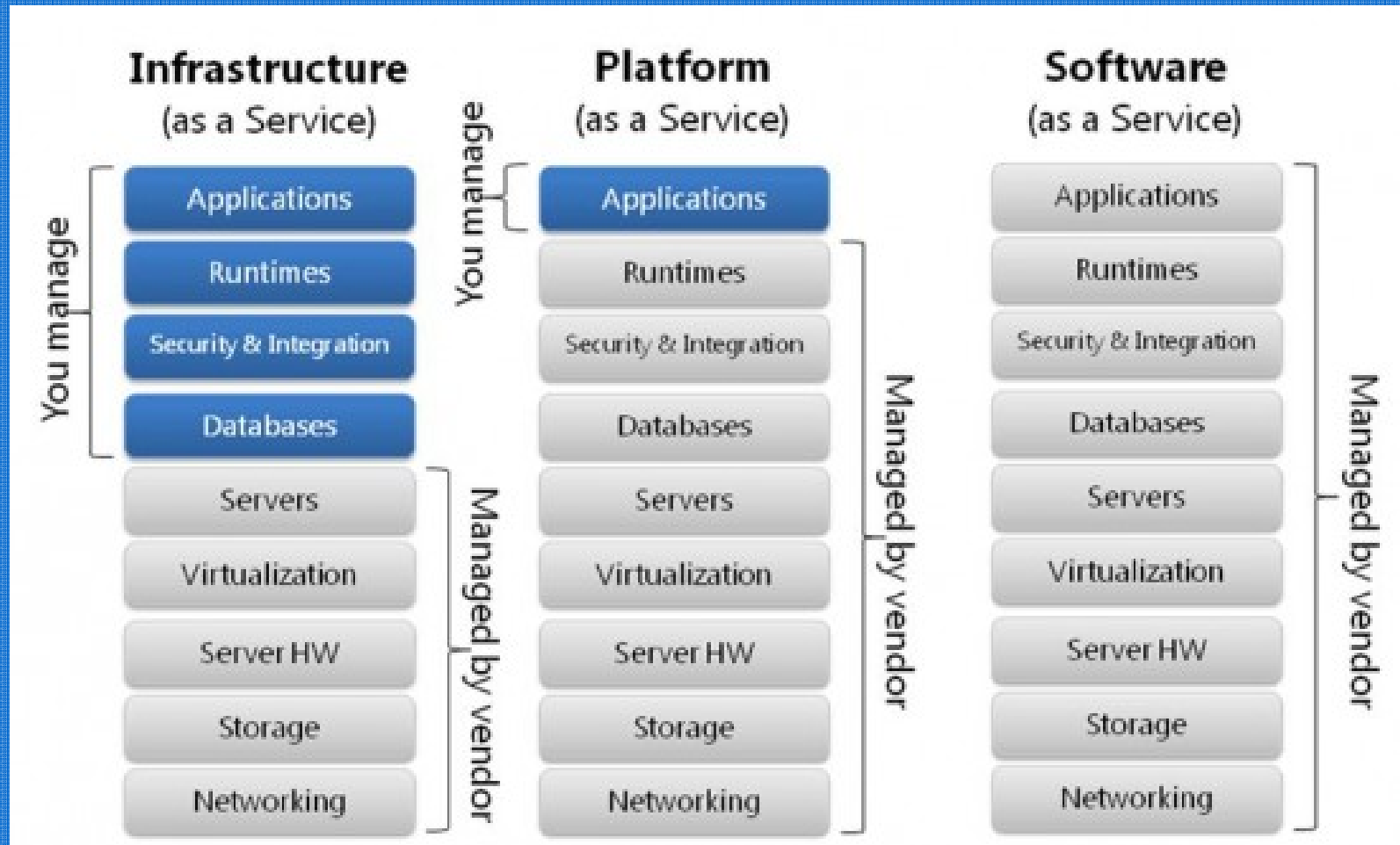
→ There are two main software delivery models for SaaS:

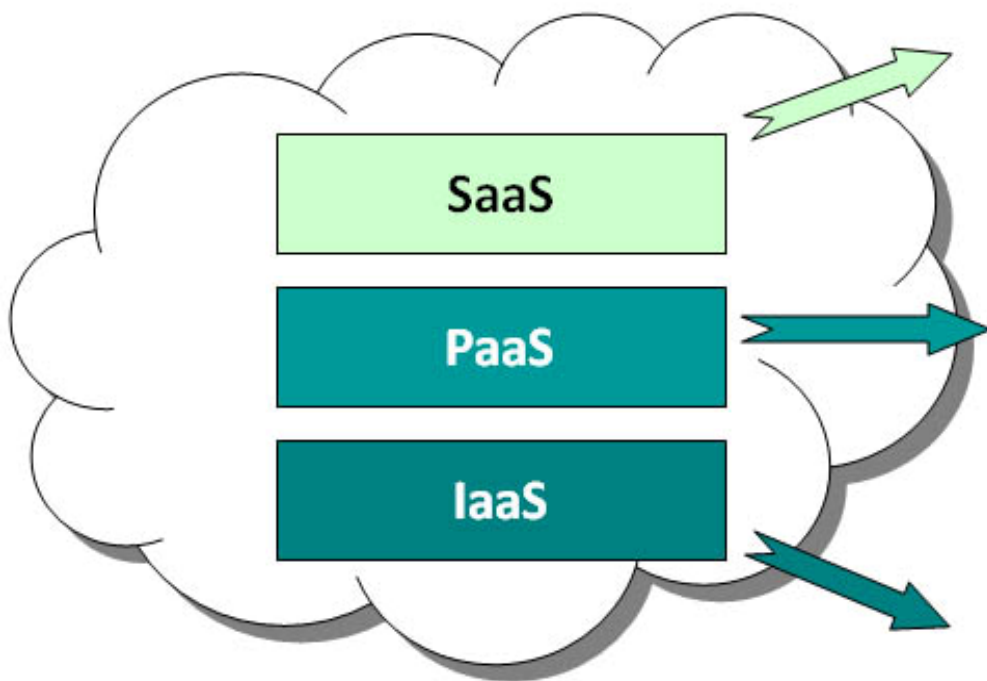
- ✓ to give an online access to a single copy of an application,
- ✓ to host commercially available software and deliver it over Internet.

→ The last opportunity is very similar to one, which is used for other on demand computing software delivery models, for example **ASP (application service provider)**.



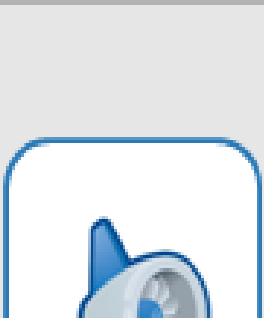


→ However due to its global accessibility and main technologies that support service-oriented architecture (SOA), Web services and even new developmental approaches, SaaS is becoming more and more popular amongst other software delivery models.

- The main advantages of SaaS model are:
no concerns about software buying (licenses),
installing and maintaining,
- automatic updates and patch management,
 - automation of administrative tasks,
 - easier collaboration with other users – everyone has the same version of software,
 - world-wide access.





Who Uses It	What Services are available	Why use it?
Business Users	EMail, Office Automation, CRM, Website Testing, Wiki, Blog, Virtual Desktop ...	To complete business tasks
Developers and Deployers	Service and application test, development, integration and deployment	Create or deploy applications and services for users
System Managers	Virtual machines, operating systems, message queues, networks, storage, CPU, memory, backup services	Create platforms for service and application test, development, integration and deployment

	Amazon	Google	Salesforce	Customer Implications
Software as Service				<ul style="list-style-type: none"> + Application logic, platform and infrastructure abstracted + Significant reduction in effort to deploy, run and manage - Apps can be configured but may not meet highly customized requirements
Platform as Service				<ul style="list-style-type: none"> + Platform & infrastructure abstracted + Custom apps can be built order of magnitude more quickly and cheaply - Custom apps still need to be supported and managed
Infrastructure as Service				<ul style="list-style-type: none"> + Physical infrastructure abstracted + Can be scaled up and down as needed - Needs to be provisioned/managed - Higher levels of stack still need to be managed, maintained and supported

Cloud Service Providers in India:

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Sl No	Company	Service	Location
1	AppPoint	AppsOnAzure -PaaS	Bangalore
2	Clogeny	Cloud Enabler	Pune
3	CtrlS	CtrlS Cloud -IaaS	Hyderabad
4	EazeWork	EazeHR - SaaS	Noida
		EazePayroll -SaaS	
		EazeSales -SaaS	
5	NetMagic Solutions	Cloud 2.0	Mumbai
		CloudNet	
		CloudServe	
		PrivateCloud	
6	OrangeScape	OrangeScape Studio - PaaS	Chennai
7	Ozonetel Systems	KooKoo – PaaS	Hyderabad
		CTS - SaaS	

Sl No	Company	Service	Location
8	PK4 Software	Impel CRM -SaaS	Bangalore
9	Ramco	Ramco OnDemand -SaaS	Chennai
10	Remindo	Remindo - SaaS	Mumbai
11	Synage	DeskAway -SaaS	Mumbai
12	Tata Communications	InstaCompute - IaaS	Mumbai
		InstaOffice -SaaS	
13	TCS	iON - ITaaS	Mumbai
14	Wolf Frameworks	Wolf PaaS	Bangalore

2011 Top 10 : Cloud Service Providers

#1: Amazon

→ For the second year in a row, the king of cloud is still Amazon Web Services. No other company has come close to the cloud-based innovation AWS provides.

→ Amazon has stepped up its support and now offers a premium "white glove" service that routes your call to the nearest engineering specialist.



The screenshot shows the AWS website homepage with the following elements:

- Header:** Amazon Web Services logo, navigation menu (AWS, Products, Developers, Community, Support, Account), and a search bar.
- Main Banner:** "Premium Support for Your Cloud" with a graphic of support plans (Basic, Developer, Business, Enterprise) and a "Sign up for a free Amazon Web Services Account" button.
- News & Events:** A section with tabs for "What's New?", "Media Coverage", and "Upcoming Events". It lists several updates from early 2011, such as "New Edge Location for Amazon CloudFront and Amazon Route 53" and "Introducing Amazon Simple Email Service (Beta)".
- Products & Services:** A section listing services like Amazon Elastic Compute Cloud (EC2), Amazon Route 53, and Amazon Virtual Private Cloud (VPC).
- Get Started:** A sidebar with links for "Business Managers", "Solutions & Use Cases", "Security Center", "Economics Center", "Case Studies", "Service Health Dashboard", "Solution Providers", "Videos & Webinars", and "AWS Blog".

#2: Verizon/Terremark

→ Charging into the number two position on our list is Verizon.

→ The telco giant had previously built its own cloud; high-quality stuff but with a commensurate price.

→ Verizon then bought Terremark, much as you or I would buy a coffee and a bagel. Not only is Terremark one of the premier Tier 1 hosters in the world, it's also a cloud supplier to the coveted enterprise market, effectively moving Verizon into the top ranks.



#3: IBM

→ New to the list is IBM with its Smart Business Test and Development Cloud.

→ While Big Blue might be lugging a hundred years of IT baggage, it has finally launched **Infrastructure as a Service**, although initially just for test and development purposes.



The screenshot shows the IBM Smart Business website. The main heading is "Cloud Computing" with sub-points: "Reduce costs.", "Improve service delivery.", and "Enable business innovation." Below this is a navigation bar with tabs for "Overview", "Business leaders", "Tech professionals", "Developers & systems", and "Community". The main content area features a section titled "IBM Cloud - Plan, Build & Deliver" with a sub-heading "Cloud computing helps enterprises transform business and technology. With IBM's enterprise class cloud computing capabilities, you have the trusted partner to help you assess cloud readiness, develop adoption strategies and identify business entry points." Below this are several promotional tiles: "IBM Smart Business Development and Test" (Get a competitive edge with your application development and testing), "Lifted live" (Don't pay 30 day, no charge trial for collaboration, web conferencing in email solutions), and "IBM Information Protection Services - Integrated solution" (Cloud-based managed data backup - 99.999% uptime). On the right side, there is a "News & announcements" section with a list of recent news items and a "Cloud Solutions by" section listing "Business Leaders", "Technology Professionals", and "Developers and Architects". At the bottom, there is a "Our cloud: An IBM conversation series" section with a video thumbnail and text about the challenges, achievements, and opportunities of cloud computing.

#4: Salesforce.com

- Salesforce.com maintains a spot in the top five
- The company singlehandedly forced its way into the Platform as a Service market with this buy, and it will give them legs to hit customers not interested in the patented "Salesforce.com maximum lock-in" feature offered on Force.com and their CRM platform.
- The Software as a Service market is rapidly coalescing into a mature, well-defined space; props to Salesforce.com for grabbing on to something that keeps it relevant going forward.



The screenshot shows the Salesforce.com homepage. At the top, there is a navigation bar with the Salesforce logo, a search bar, and links for "Customer Login" and "Free Trial". Below the navigation bar, there are several menu items: "Products", "Solutions", "Services", "Customers", "Events", "Resources", and "About Us". The main content area features a large banner for "Cloudforce 2011" in New York City, with a "Register for free" button. To the right of the banner, there are three promotional boxes: "contact manager \$3 per month", "free trial Salesforce CRM for WebEx", and "view demo". Below the banner, there is a section titled "The leader in customer relationship management (CRM) & cloud computing" with two sub-sections: "CRM and collaboration" featuring "Sales Cloud" and "IT and development" featuring "Force.com cloud platform". At the bottom, there is a "Share this page" section with social media icons and a "Connect" button.

#5: CSC

- Our second new entrant on the list is CSC.
- The IT integrator and service provider has cooked up an interesting **private cloud** service called BizCloud.
- The company will wheel VCE -- the giant cloud-in-a-box system from VMware, Cisco and EMC -- into your IT shop.
- CSC then manages your hardware; for extra capacity, you can hook into a **public cloud** service, also running on VCE.
- CSC points to the trend of enterprises looking for practical ways to use (and get to) cloud computing; the company also performs massive-scale integrations with Google Apps and other **Software as a Service** players.

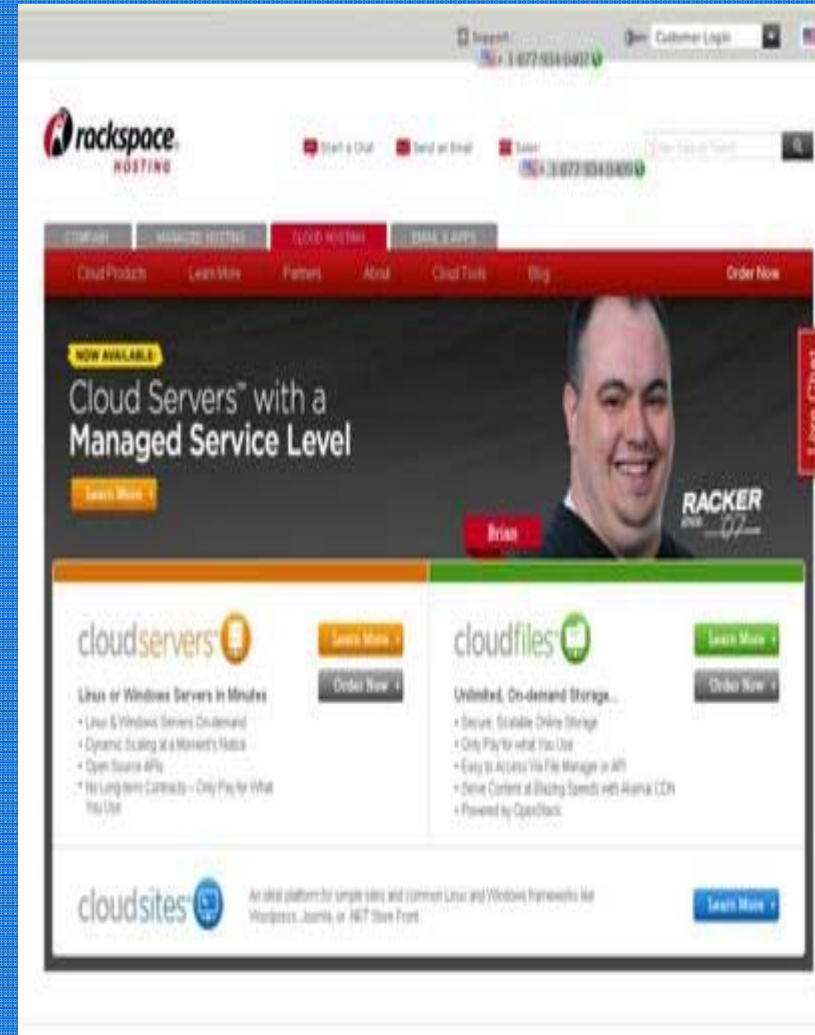


The screenshot shows the CSC website homepage. At the top, there is a navigation bar with 'Home', 'Services', 'Case Studies', 'Blog', 'Contact Us', and 'Partners'. The main headline reads 'RIGHT CLOUD RIGHT WAY' in large, bold letters, with a red 3D arrow pointing upwards and to the right, and a maze graphic. Below the headline, a sub-headline says 'Become more agile and cost-effective with CSC Trusted Cloud Services. Learn more.' The page is divided into several sections:

- Cloud Computing Services:** A vertical list of services including 'What is Cloud Computing?', 'Doing Business in the Cloud', 'Cloud Access', 'Cloud Services', 'Plan and Design', 'Implement and Integrate', 'Deliver and Manage', 'News and Events', and 'Trusted Cloud Services Blog'.
- Business First Approach:** A section with a photo of two people, listing benefits: 'Cloud enable business workflows from the top down' and 'Transform business processes into agile, innovative and cost-efficient workflows'.
- Security and Compliance Excellence:** A section with a photo of a server rack, listing benefits: 'Partnered by the world's most security-conscious enterprises' and 'Able to adapt to dynamic regulatory climate'.
- Service Drives Business Model:** A section with a photo of a person, listing benefits: 'Service delivery excellence backed by customer-centric SLAs' and 'Proven, scalable and accountability'.
- Innovative and Technology Excellence:** A section with a photo of a person, listing benefits: 'Future-proof implementations built to scale' and 'Decoupled and integrated solutions'.
- Take the next step:** A call to action: 'Visit our cloud website and applications'.
- News and Events:** A list of recent news items, including 'CSC selected as Johnson's Cloud IT Partner of the Year', 'Building a Culture Ready to the Cloud', 'The Cloud: A Tale of Two IT Futures', 'CSC Launches CSC BizCloud', 'CSC Steps to Cloud 2.0: New Promises', 'CSC Launches BizCloud, the One-Click, Private Cloud Offer as a Service', and 'The Disruptive Data Center?'

#6: Rackspace

- Even though Rackspace fell in the ranks from last year's list, it's still the number two cloud provider after Amazon in terms of revenue.
- It might even be coming close in terms of its user base, a remarkable feat.
- But aside from the feel-good soft launch of OpenStack last year, it's still business as usual.
- The company hasn't made any major renovations to the service, something that may change as Rackspace absorbs cloud management technology firm Cloudkick.



The screenshot shows the Rackspace Hosting website. At the top, there is a navigation bar with the Rackspace logo and links for 'Start a Deal', 'Send us Email', and 'Sales'. Below this is a red navigation bar with categories like 'Cloud Products', 'Managed Systems', 'Cloud Hosting', and 'Email & Apps'. The main content area features a large banner for 'Cloud Servers™ with a Managed Service Level' featuring a man named Brian. Below the banner are three product tiles: 'cloudservers' (Linux or Windows Servers in Minutes), 'cloudfiles' (Unlimited, On-demand Storage...), and 'cloudsites' (An ideal platform for single sales and content Linux and Windows frameworks like Wordpress, Joomla, or NET Store Front). Each tile includes a 'Learn More' button and an 'Order Now' button.

#7: Google

→ Google App Engine has won lots of business among Web, gaming and mobile companies -- much like Microsoft Azure -- but similarly has yet to make any impact among enterprise developers.

→ The company is also reportedly hiring 6,000 warm bodies in 2011, most likely to supply that crucial enterprise support Google has so notably lacked. Can't win the cloud with foosball and beanbags, kids; put your big-boy clothes on and get ready for real customers. The race is on with Microsoft!



The screenshot shows the Google App Engine website. At the top, there is a search bar with the text "Google code" and a "Search" button. Below the search bar, the text "v.2. 'Application' or 'Library'" is visible. The main heading is "Google App Engine" with navigation links for "Home", "Docs", "FAQ", "Articles", "Blog", "Community", "Terms", and "Download".

The main content area features a large blue speech bubble icon with the text "Run your web apps on Google's infrastructure. Easy to build, easy to maintain, easy to scale." Below this, a paragraph describes the benefits of Google App Engine, including fast development and deployment, simple administration, and effortless scalability. A link "Discover why developers are choosing App Engine" is provided.

A section titled "Google App Engine for Business ^{New!}" is also visible, with a sub-heading "Run your enterprise applications on Google's infrastructure". It lists several key features:

- Centralized administration:** A new, company-focused administration console lets you manage all the applications in your domain.
- Reliability and support:** 99.9% uptime service level agreement, with premium developer support available.
- Secure by default:** Only users from your Google Apps domain can access applications by default.
- Pricing that makes sense:** Each application costs just \$1 per user, per month up to a maximum of \$1000 a month. Pay only for what you use.
- Enterprise features:** Coming later this year - hosted SQL databases, SSL on your company's domain for secure communications, and access to advanced Google services.

A link "Learn more about the preview of App Engine for Business" is located below the list.

On the right side, there is a "Getting Started" section with three steps: "1. [Sign up](#) for an App Engine account.", "2. [Download](#) the App Engine SDK.", and "3. [Read the Getting Started Guide](#)". Below this is a "Watch and Learn" section with a video thumbnail and the text "Developing and deploying on Google App Engine. [Watch Now](#)".

At the bottom right, there is a "links from AppEngine.reddit.com" section with several links and their respective scores and comments.

At the bottom of the page, there are two buttons: "Download" and "Dive Deeper".

#8: BlueLock

- first new entrant on the list, BlueLock is a small-scale provider that's been a key testbed for VMware's vCloud Express.
- It even pioneered a tool to help customers get out of their ESX bubbles and mix in vCloud resources, something VMware hadn't been able to do.
- BlueLock's Indiana facilities should soon become a major local employer, as it's now a key VMware/VCE provider and likely to see continued growth.



The screenshot shows the BlueLock website with a blue header and navigation menu. The main content area features a large blue banner with the text "GO CONFIDENTLY TO THE CLOUD. FIND THE SOLUTIONS YOU SEEK." and a photo of a man and a woman. Below this, there are several sections: "Act Quickly with BlueLock Virtual Datacenters" with a "LEARN MORE ABOUT THE POWER OF A VDC" button; "Case Studies" with a "GET STARTED" button; and a "BlueLock's Virtual Datacenters—A Pragmatic Approach to Cloud Hosting" section with a "We Start with Understanding What You Really Need in a Cloud." sub-header. The right sidebar contains "Related Articles" and "Related Tags" sections.

#9: Microsoft

→ Microsoft is on a bit of a downward spiral. While the software giant has made a song and dance about its **Azure cloud service**, claiming 31,000 companies are customers, we've yet to see any significant traction among enterprise IT developers.

→ Web companies, mobile companies, tech and social networking firms use it, sure, but so far there's no standout among traditional enterprises.



The screenshot shows the Microsoft Cloud Power website. At the top, there's a navigation bar with links for 'WINDOWS TO THE CLOUD', 'HIRE US', 'SEND TO A FRIEND', and 'SHARE'. A search bar is present with 'Cloud Power' entered. Below the search bar, there are navigation tabs for 'Home', 'Cloud Solutions', 'Tools & Resources', 'Cloud Conversations', and 'Find a Partner'. The main content area features a large blue banner with the text 'EXPLORE CLOUD POWER IN 3 QUICK QUESTIONS'. Below this, there are three numbered circles (1, 2, 3) and a 'Get your report' button. To the right of the banner is a circular diagram with segments labeled 'PLAN', 'EXPLORE', 'SECURE', 'BRIDGE', and 'REDEFINE'. Below the banner, there are three columns of content. The first column has a 'Productivity' header and 'Office 365' logo, followed by 'Application Development & Hosting' and 'Windows Azure' logo. The second column has a quote: 'I LAUGH IN THE FACE OF UNPREDICTABILITY' and a short paragraph. The third column has a quote: 'THE MOST COMPREHENSIVE SOLUTIONS FOR THE CLOUD. ON EARTH.' and another short paragraph.

#10: Joyent

→ Joyent, however, kept a spot in the top 10 by releasing its platform software and forming a partnership with Dell to sell pre-configured cloud infrastructure packages.

→ It's a nice way to push the model -- use the Joyent service, or build our own if we like the technology but not the public option.

→ This may be the direction the market is headed, as more and more businesses want to adopt cloud computing within their infrastructure.



The screenshot shows the Joyent website with the following content:

- Navigation: SOFTWARE, SERVICES, CUSTOMERS, PARTNERS, NEWS, ABOUT
- Section: Cloud Software for Service Providers
- Text: Increase growth and widen margins by operating public, private, and hybrid clouds and managing services on your existing networks.
- Section: Joyent SmartDataCenter 6.0: The Complete Cloud Solution
- Graphic: A stylized bar chart composed of small squares.
- Text: SmartDataCenter 6.0 is the next evolution of the same robust software that Joyent has used to successfully operate its public cloud business since 2004. Now it's available for you to run your own clouds and services.
- Text: SmartDataCenter's comprehensive software stack includes:
- Right sidebar: "Looking for Joyent Public Cloud?" with a "JOYENT" button.
- Quote: "with big players, IBM and HP, and a selection of new contenders led by Joyent, there is no doubt that the 'next generation data center' is going to have to support a radically different group of technologies, deployed, and using resources, in a equally radically different way from the client-server, or mainframe applications running today."
- Text: Aron Walilant, CTO at Capgemini
- Section: guardtime logo
- Text: Trust and Integrity in the Cloud. Read more.
- List of features:
 - Gartner Leader/Visionary
 - 6 Year Track Record
 - High Utilization & Efficiency
 - Dynamic Scalability
 - Complete Software Stack
 - Open Platform
 - Documented SOAs