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An Introduction to Cloud Computing:

Evolution or Revolution?

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Agenda

- A (very) Brief History of Computing
- The Anatomy of a Cloud
- What Are They Good For?
- Getting Started Today

In the beginning….

…was the mainframe

- The IBM S/360
- IBM created the first fully *virtualized* hardware machine in 1967
- and made it a standard feature of all the S/370 mainframes in 1972

Many *Virtual Machines* able to run on a single mainframe, sharing the CPUs, memory, storage and network

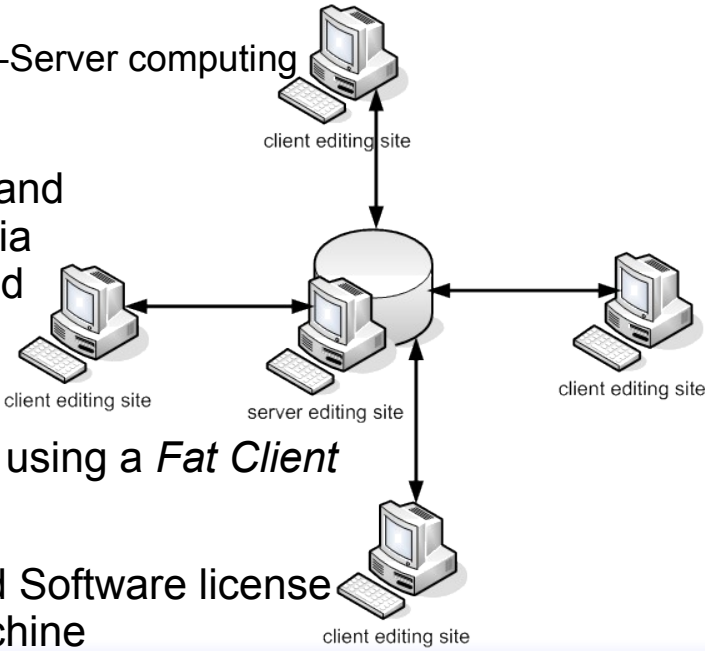
Users accessed the VMs from *thin clients* (“dumb terminals”)

The usage of the mainframe was broken down in detail to allow charge-back to the users’ departments

and then things got distributed…

- The ’80’s saw the shift to Personal Computing…
  - Democratization of computing, making it cheaper for more people to have access to computers
  - Initially a shift to “computers for all”, with each user having the whole machine dedicated just to them

- … the 90’s to Client-Server computing
  - Sharing data and applications via Client PCs and Server PCs
  - User typically using a *Fat Client*
  - Hardware and Software license costs per machine



Optimized for Agility

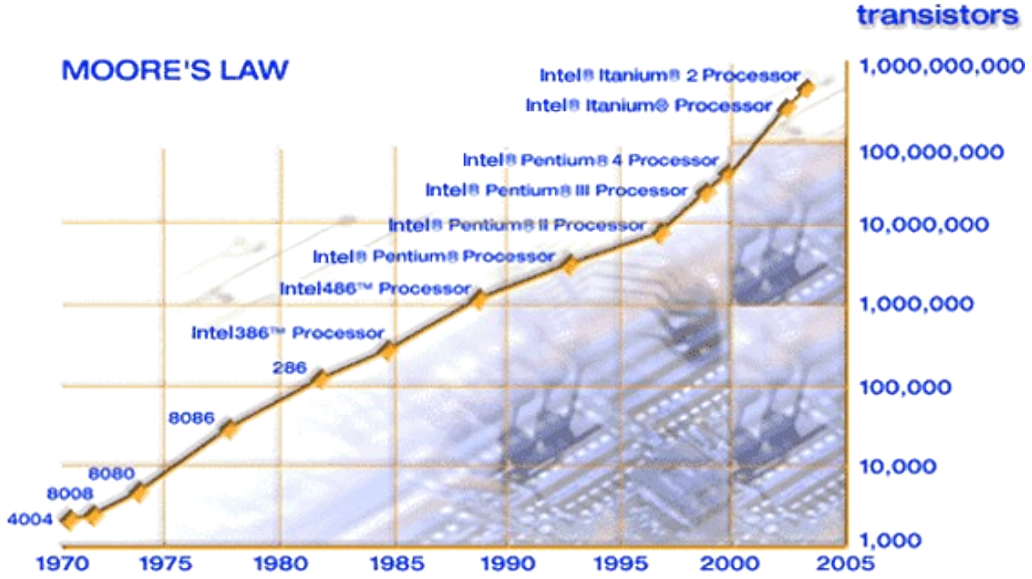
…and the web took this to the extreme

- The turn of the millennium saw further democratization of computing…
  - Now a shift to “sharing for all” and “content for all”
  - But also a shift back to *thin clients* (the web browser) to access the applications as services

- …and emergence of standards to re-connect the distribution
  - to try and help to join back up all the distributed computers
  - Grids, Web Services, and Utility Computing have visions of “Virtual Organizations”

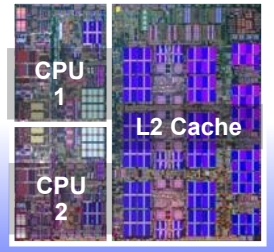
Meanwhile…the hardware "free lunch" runs out

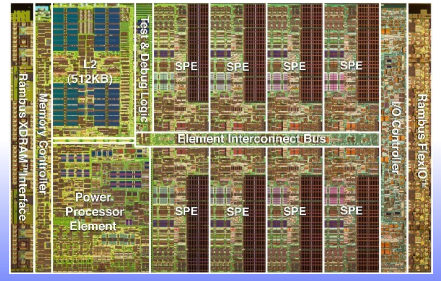
- Whilst processors had been getting faster and faster, individual PCs could handle the increasing workloads



- But although transistors continue to shrink, we could no longer make them run faster and faster*

- The solution was to *scale out* (with multi-cores and commodity hardware) rather than *scale up*

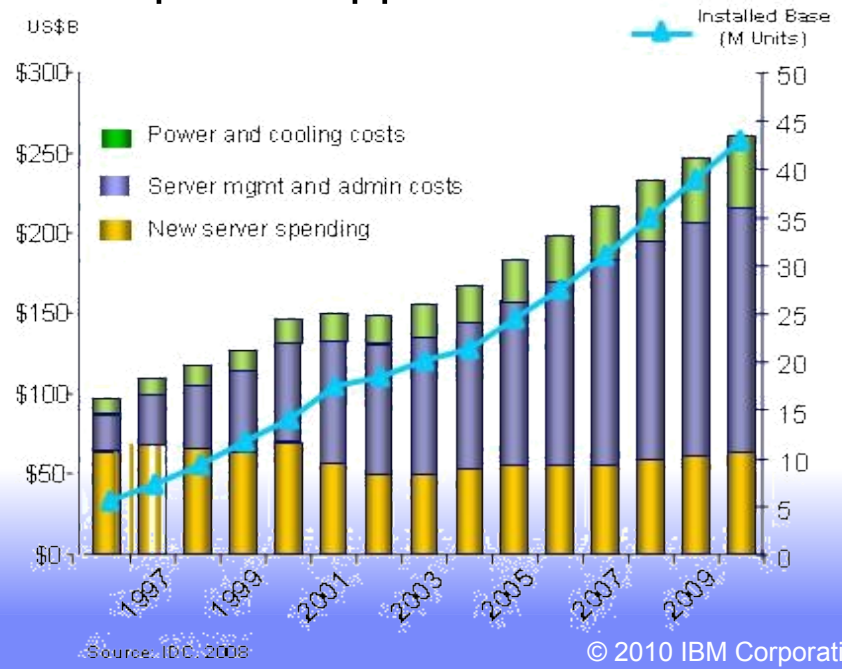




But what was wrong with this picture?

- The key values from the mainframe platform were lost
  - The management capabilities of a single platform
  - The high utilization
  - The redistribution of costs of the platform to it's users

- Server machines bought and installed for specific applications
  - Many different operating systems, software and middleware to manage
  - Very low utilization per server
  - All consuming power
  - All needing cooling



With the economic climate, and ecological issues, things had to change…

Doing more with less

Reduce capital expenditures and operational expenses

Reducing risk

Ensure the right levels of security and resiliency across all business data and processes

Higher quality services

Improve quality of services and deliver new services that help the business grow and reduce costs

Breakthrough agility

Increase ability to quickly deliver new services to capitalize on opportunities while containing costs and managing risk

So what is Cloud Computing?

> … a style of computing in which dynamically **scalable** and often **virtualized** resources are provided **as a service** over the Internet. Users need not have knowledge of, expertise in, or control over the technology infrastructure "in the cloud" that supports them.
>
> *Wikipedia*

- "The Cloud" is the infrastructure that a "service" runs on
  - A collection of *resources* pooled together, and ***virtualized***
  - ***Standardized*** service running on *virtual resources* in that pool
  - As demand increases, the service is *rapidly provisioned* through ***automation***, on more *virtual resources* from the pool – *elastic scaling*

- *Effectively, it's the value proposition of the mainframe, client-server, and web, all converging together*

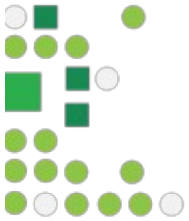
Cloud computing is an Evolution that helps deliver IT and business benefits

Virtualized

- Higher utilization
- Economy of scale benefits
- Lower capital expense

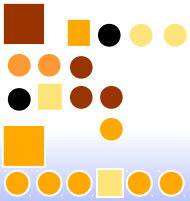
Standardized

- Easier access
- Flexible pricing
- Reuse and share
- Easier to integrate



Automated

- Faster cycle times
- Lower operating expense
- Optimized utilization
- Improved compliance
- Optimized security
- End user experience



Doing more with less

Higher quality services

Breakthrough agility and reducing risk

Anatomy of a Cloud

Cloud Computing Deployment Models

Flexible Deployment Models

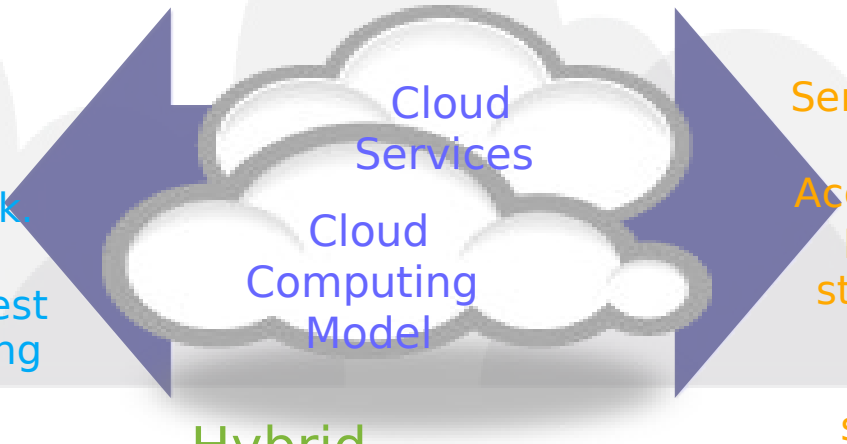
Private …

Privately owned and managed.

Access limited to client and its partner network.

Drives efficiency, standardization and best practices while retaining greater customization and control

Standardization, capital preservation, flexibility and time to deploy



Hybrid …

Access to client, partner network, and third party resources

Public …

Service provider owned and managed.

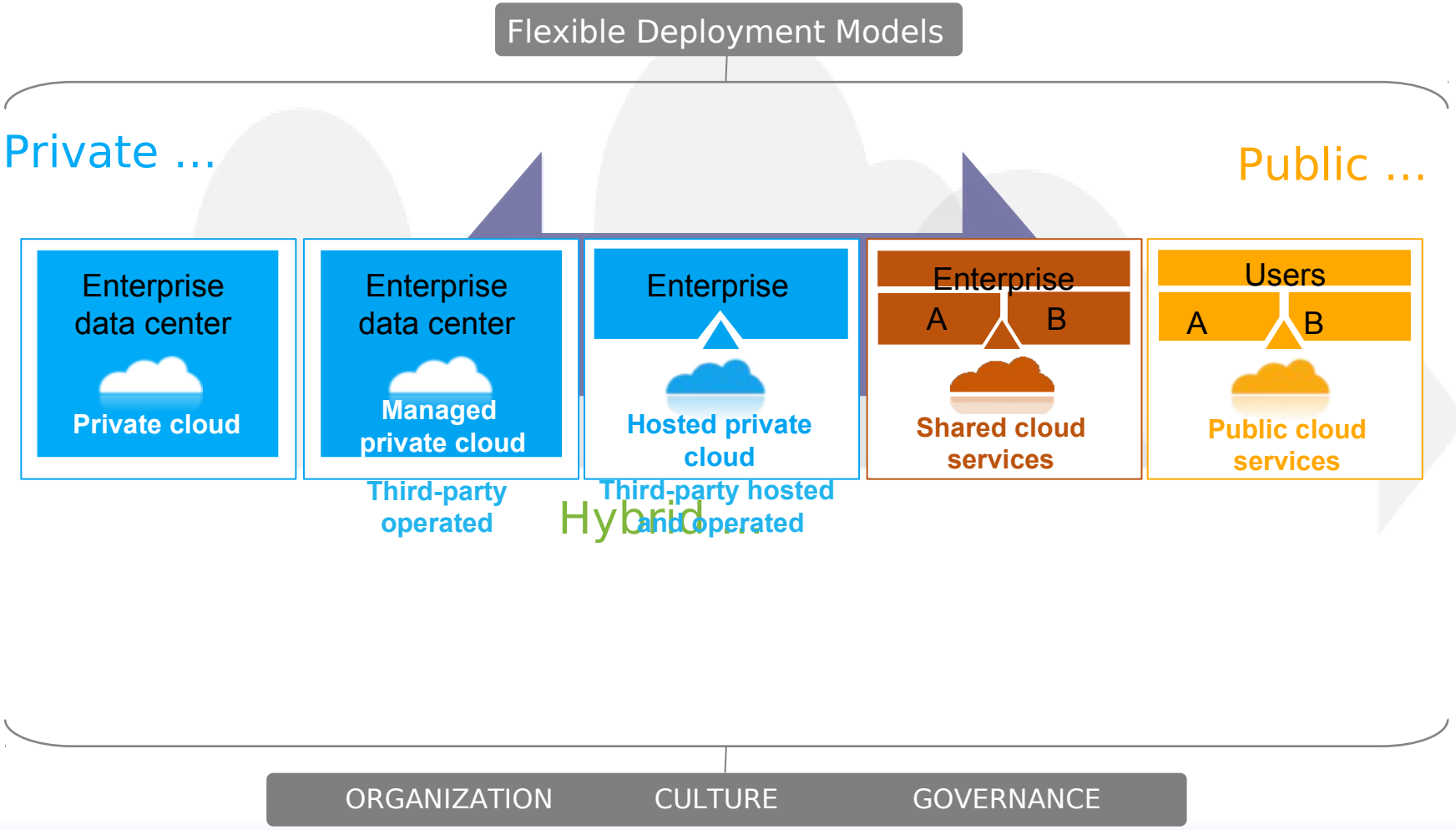
Access by subscription.

Delivers select set of standardized business process, application and/or infrastructure services on a flexible price per use basis.

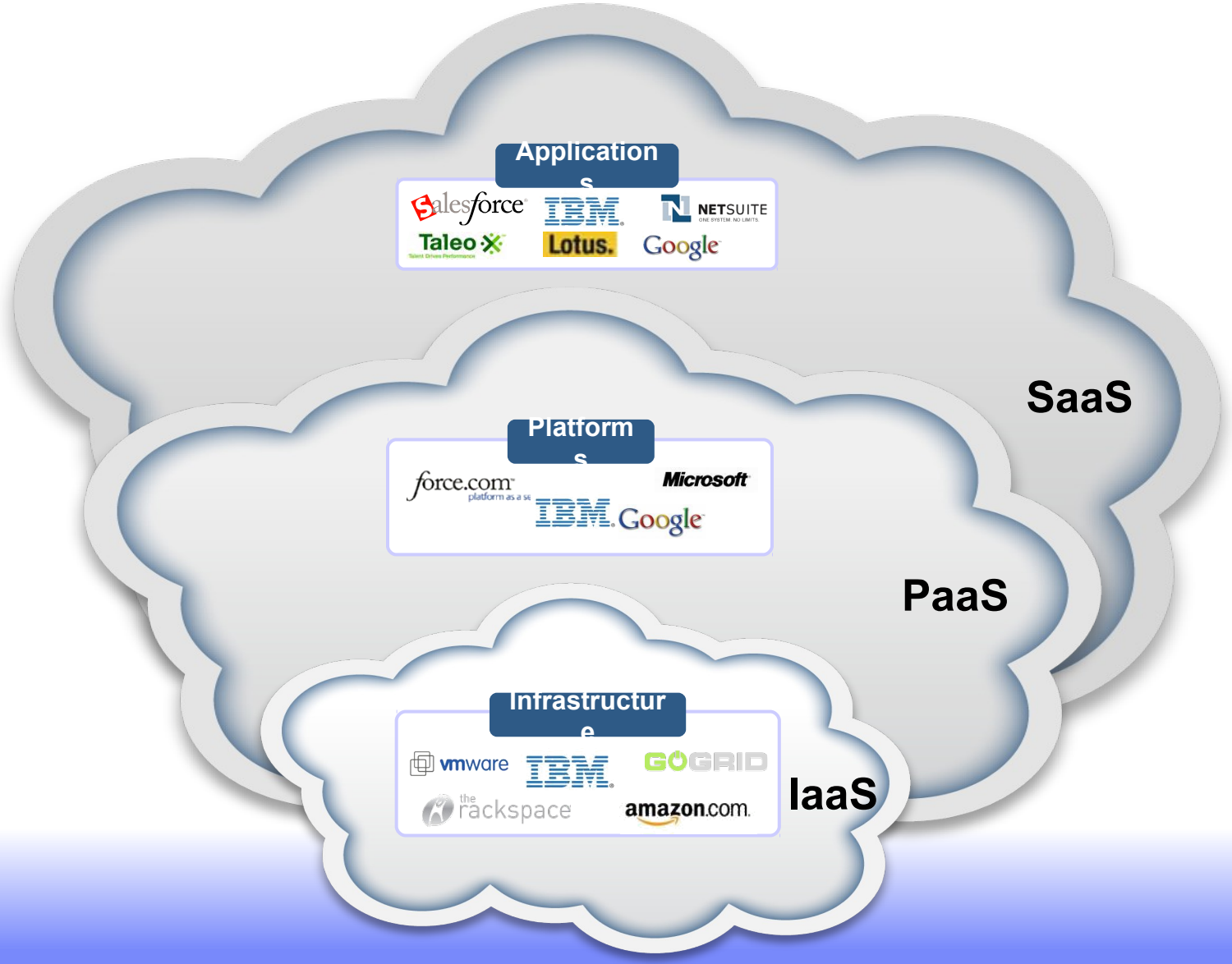
Customization, efficiency, availability, resiliency, security and privacy

ORGANIZATION CULTURE GOVERNANCE

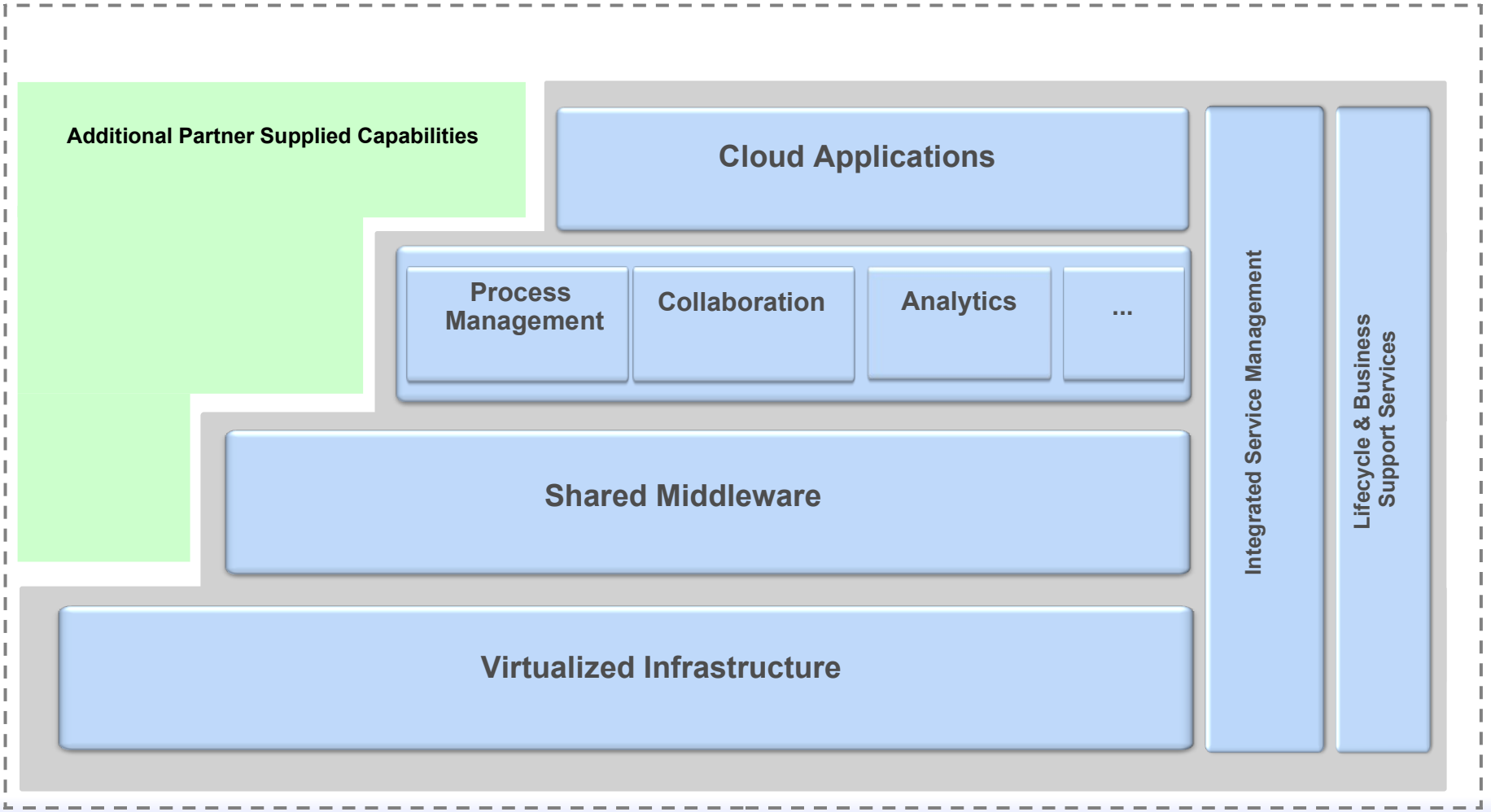
Cloud Computing Deployment Models



There are a range of layers to clouds



An IBM architectural view of cloud computing



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Cloud Workloads: What are they good for?

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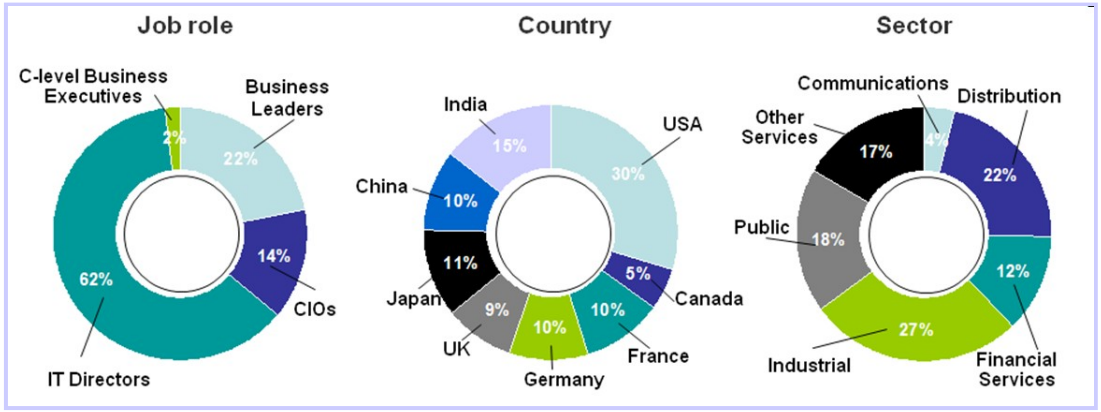
In July 2009, IBM interviewed 1090 IT and LoB decision makers to understand their current cloud adoption



- **Sourcing choices**
  - Cloud delivery models
  - Drivers behind adoption
  - Barriers to adoption
- **Workload adoption**
  - Public/private cloud preferences
  - Adoption rates
- **Delivering "services" in cloud**
  - Service management
  - Infrastructure readiness

Analytics

Collaboration

Development and Test

Desktop and Devices

Infrastructure

Business Services

Source: IBM Market Insights, *Cloud Computing Research*, July 2009.

Top workloads

Top public workloads

Audio/video/Web conferencing

Service help desk

Infrastructure for training and demonstration

WAN capacity and VoIP infrastructure

Desktop

Dev/Test environment infrastructure

Storage

Data center network capacity

Server

Infrastructure and collaboration workloads emerge as most appropriate

Top private workloads

Data mining, text mining, or other analytics

Security

Data warehouses or data marts

Business continuity and disaster recovery

Test environment infrastructure

Long-term data archiving/preservation

Transactional databases

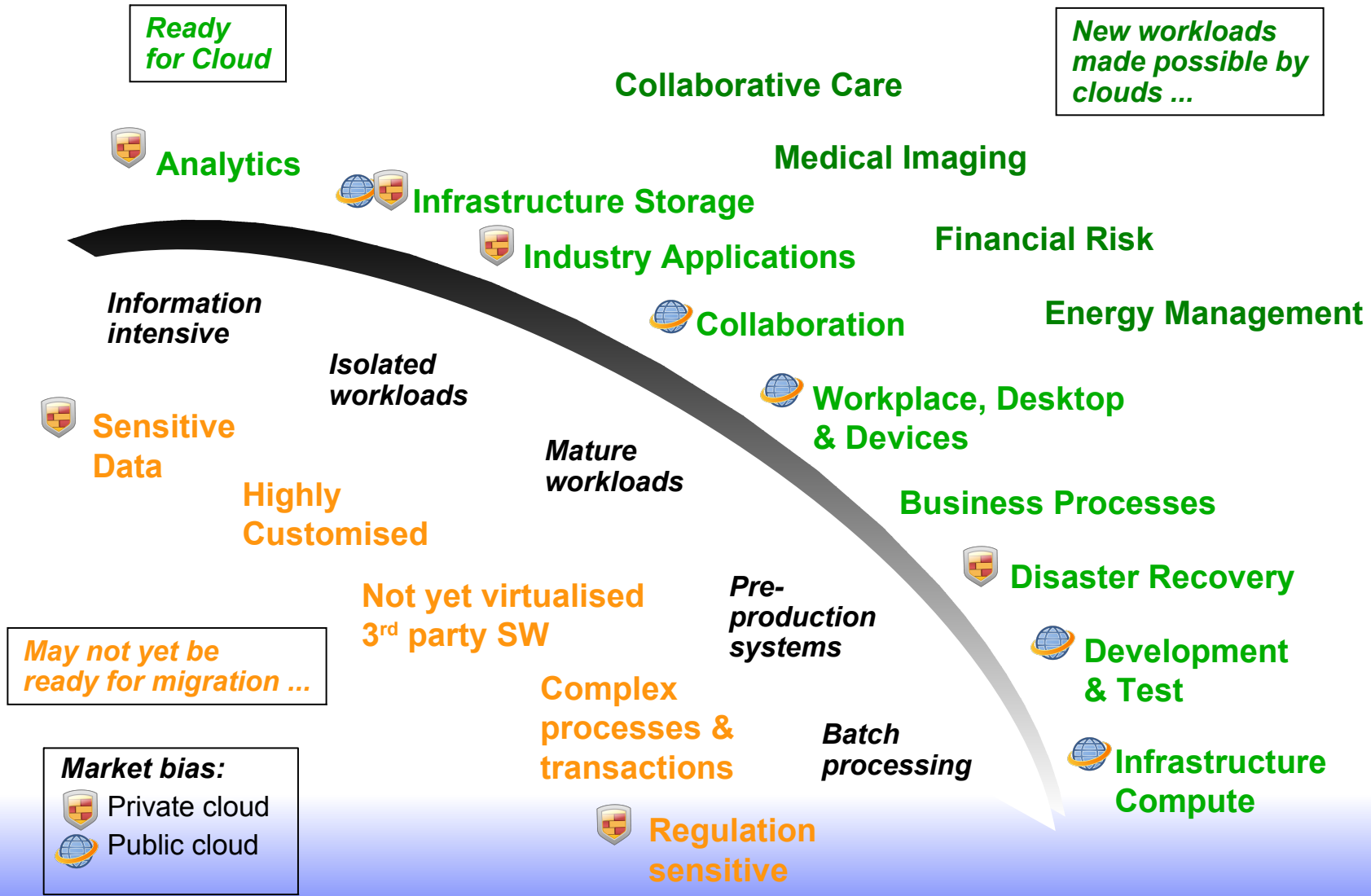
Industry-specific applications

ERP applications

Database, application and infrastructure workloads emerge as most appropriate

Source: IBM Market Insights, *Cloud Computing Research*, July 2009. n=1,090

Identifying workloads with affinity for Cloud



Smart Business Development & Test on the IBM Cloud

An online collaborative environment for the development and testing of applications

Features:

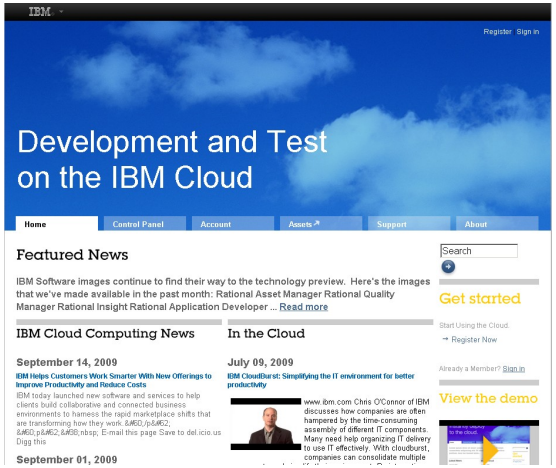
• Instant self-service provisioning of development and test environments

• Dynamic/ elastic computing for tests and builds with virtualized environments

• Flexible deployment pricing options
  • Private hosted – fixed price, time and materials, or pay as you go
  • Multi-tenant shared and shared – utility/ metered billing based consumption

Environment:

• System x – Linux and Windows with local storage and SAN option, p and z to follow
• Eclipse and Rational Tools
• IBM Middleware images



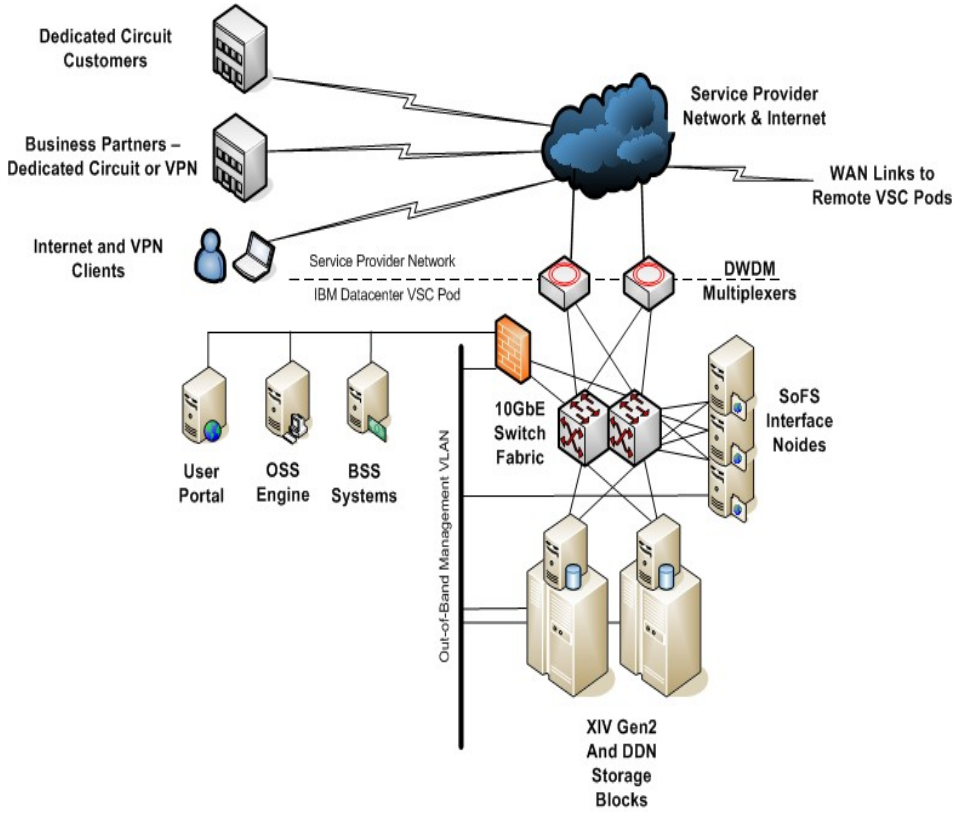
Client Benefits:

•Reduced high cost and deployment time of software development and test environment
• Limit capital investment and significant software license savings
• Reduce development and test provisioning cycle times from weeks to minutes
• Improve quality with reduced defects due to faulty configurations
• Improve governance and reduce risk of large software deployments

Smart Business Storage Cloud

A remote file based storage solution

What is a storage cloud? It is a multi-tenant pool of data storage resources that is delivered over a network to local and remote compute resources. The business model supports a service catalog front-end and utility/metered billing based on consumption.



Features:

- Multi-tenant solution can leverage economies of scale
- Dedicated bandwidth for increased performance
- Geographical distribution to service global customers
- Cross site replication for data consistency
- Standards based solution (CIFS, NFS, FTP, HTTP)
- Unique security model, very high degree of isolation
- 24x7 monitoring and management
- Strong customer service

Use Cases:

- Collaboration Data and General File Storage
- Digital Media
- Web Content Store
- High Performance Analytics
- Medical Records (future)

IBM Smart Business Desktop Cloud

Characterized by thin clients, with higher levels of security and resilience, improved backup and recovery…and reduced cost and complexity associated with managing the desktop/laptop environment

Integrating hardware, software and services in an innovative solution

- Allows clients to create a private cloud that enables internet-based PCs and other devices to access applications and data through a centrally managed computing environment
- Maintains highest levels of quality and security in accessing critical information remotely, from any device, anywhere
- Helps clients quickly scale their IT infrastructures to address business demands, while reducing cost and complexity
- Helps clients use up to 73 percent less power than traditional desktops and laptops

Client Benefits:

- **Reduce deskside support costs by 85-90%**
- **Reduce help desk calls by 20-40%**
- **Reduce OS and application update costs**
- **Easily ensure desktop security and resiliency**
- **Use up to 73% less power over traditional fat client deployments**

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The Value of Application Aware Cloud Computing

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What is Shared Middleware?

Infrastructure View (aka IaaS)

Central Abstraction: **Virtual Machine**

Cloud provides:

- CPUs
- Memory
- Storage
- Networking

IaaS does not understand, or care, about the software running inside the virtual machine

Shared Middleware (aka PaaS)

Central Abstraction: **Application**

Cloud provides:

- Middleware runtimes
  - Databases, Connectivity, Queues
- Security
- Caching
- Routing
- Storage

PaaS has a **viewpoint** on application, supporting a particular set of programming models and **understanding** the execution of the application deeply

Running Your Application - Native Hardware

Running Your Application – Infrastructure Cloud

Tune/Admin/Maintain Environments
(Performance, Security, Patches, etc)

Install Application and Connect Tiers
(Different Procedures, lots of config)

Configure Middleware Topology
(Clusters, Active/Standby, Capacity, etc)

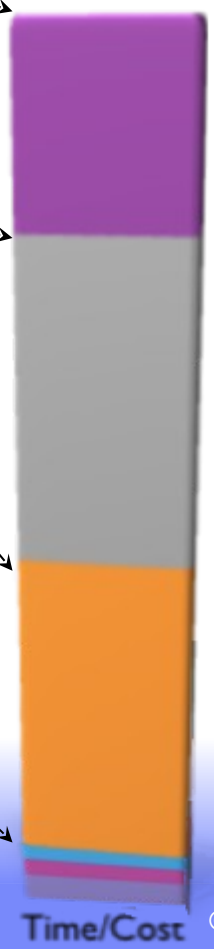
Select Middleware from Catalog
(Includes OS and Installation)

WebSphere. software

DB2 software

Run an Instance
(Select instance size)

AIX®



Running Your Application – Middleware-aware Cloud

Tune/Admin/Maintain Environments
(Performance, Security, Patches, etc)

Script Application onto Pattern
(Standardized Patterns, Automation)

Select and Customize Topology Pattern

Includes OS & Middleware, Clustering, HA and other characteristics

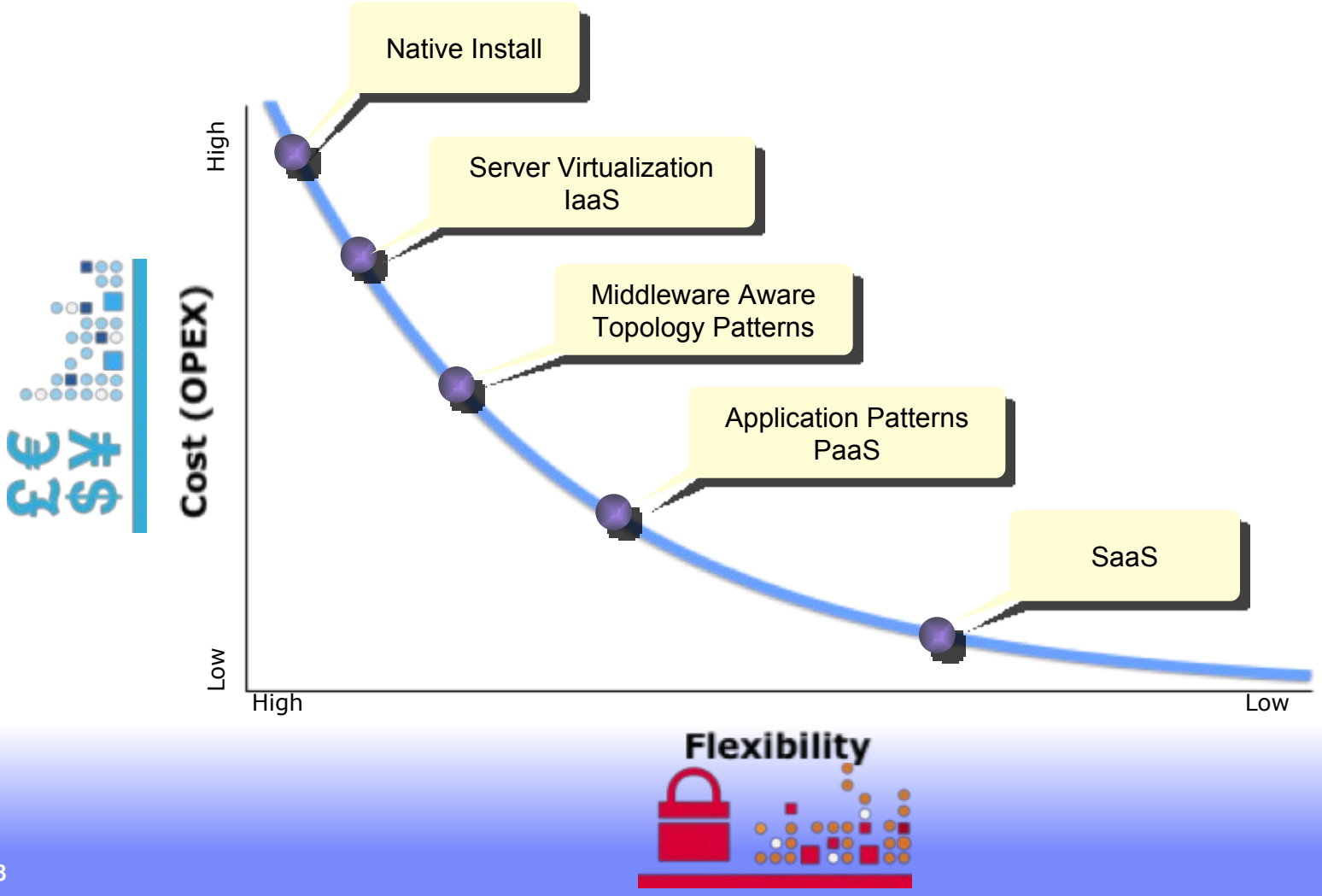
WebSphere. software

AIX

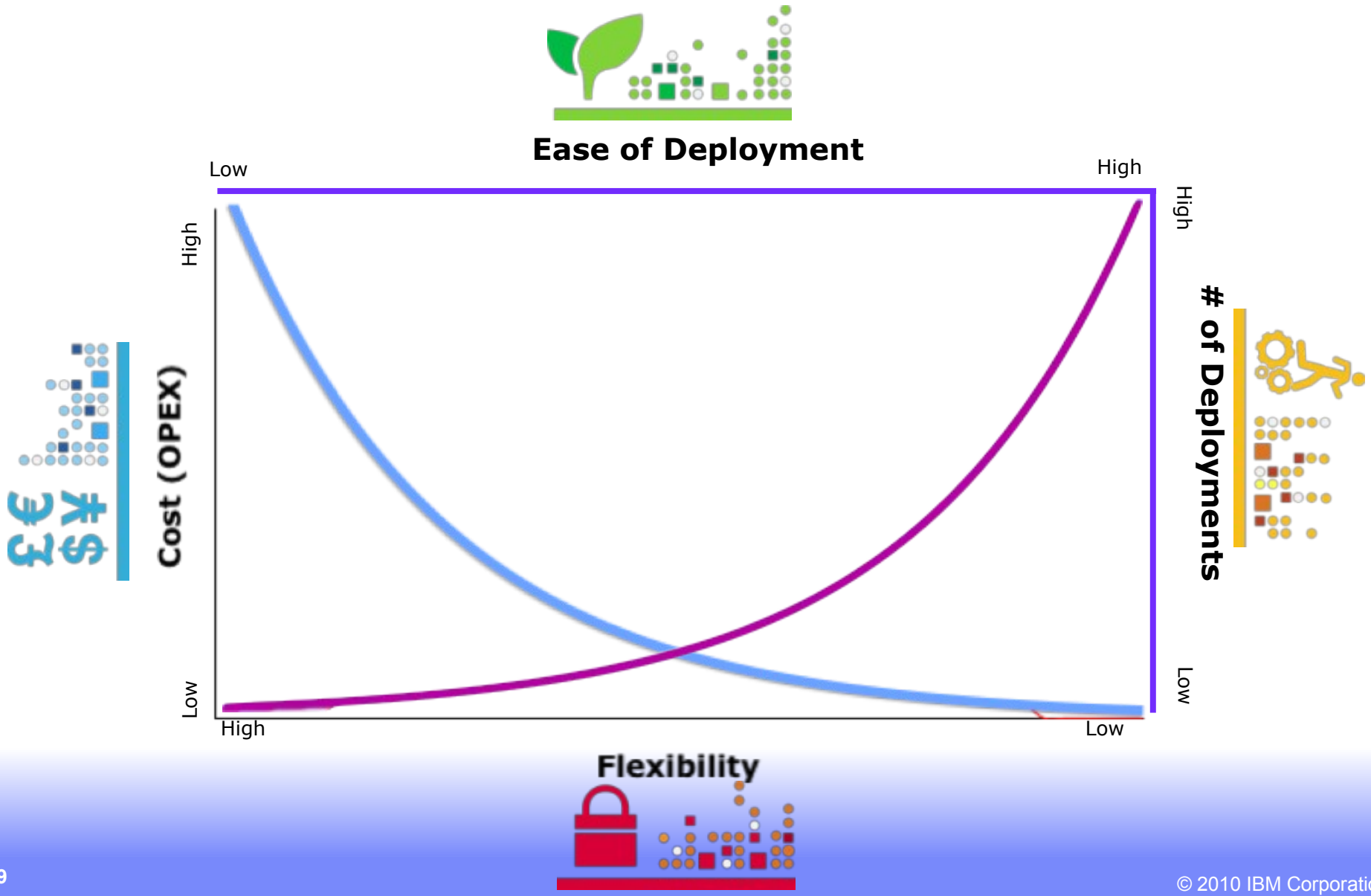
DB2 software

Time/Cost

Nothing is Free...



Unexpected Effects...



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Getting Started Today

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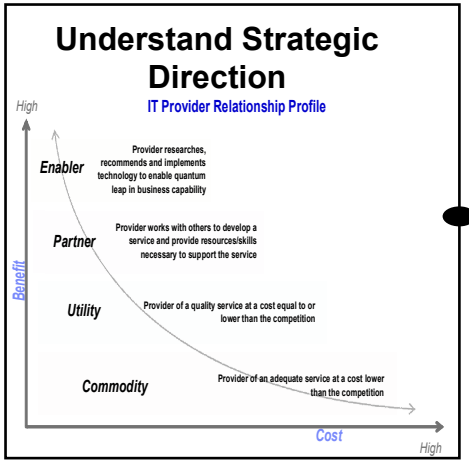
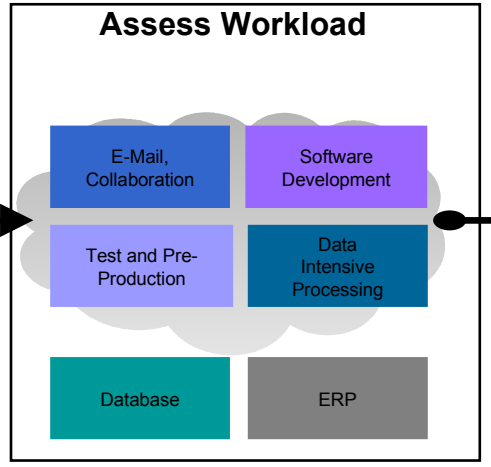
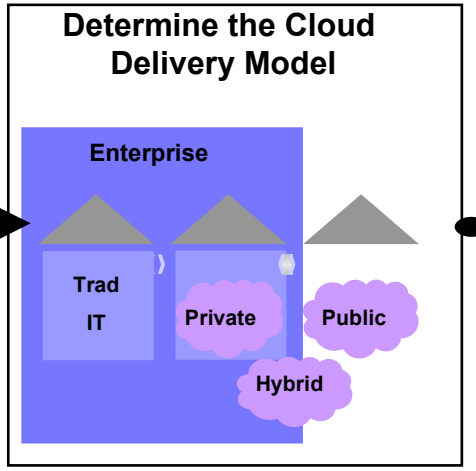
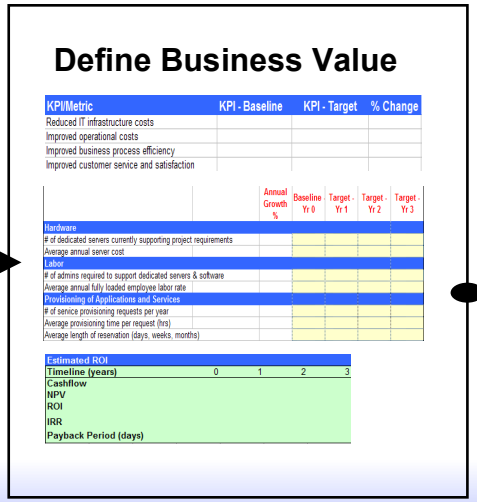
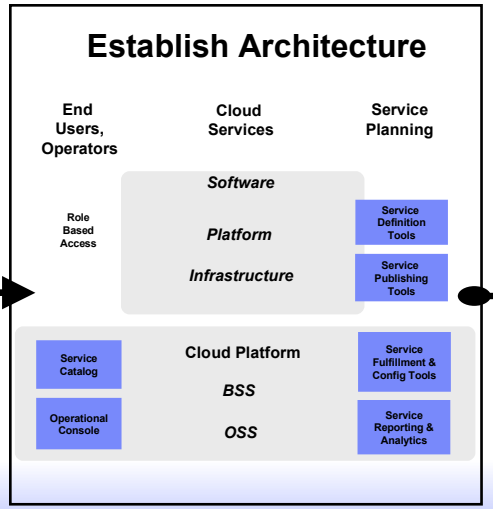
How to get started

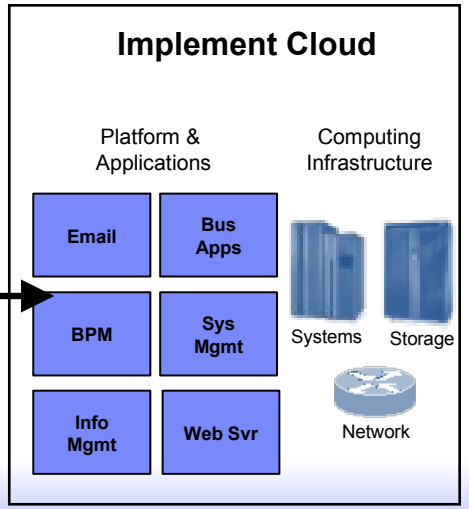












IBM offerings

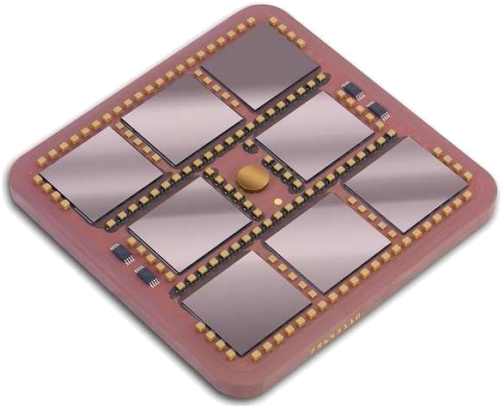
Public Cloud Services

Private Cloud Platform

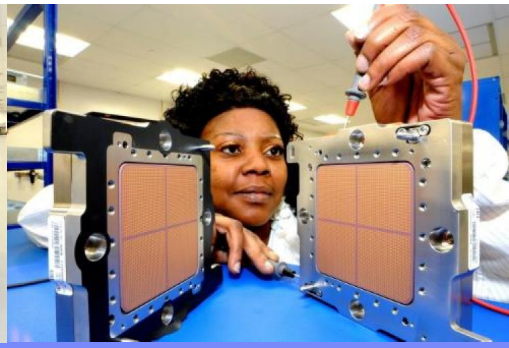
Private Cloud Systems

Back To The Future…

- IBM zEnterprise System
  - 96 5.2GHz cores
  - 3TB of RAM
  - Mixed workloads and architectures
  - 60% better performance
  - 80% more efficient



zEnterprise Multi Chip Module (MCM)



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