Introduction to Cloud Computing

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Introduction

- This is all about DataCentres

    And scaling DataCentres

    And scaling the enterprise's use of DataCentres

    And scaling the consumer's interaction with on-line data/content

- Cloud Computing is not:

    A new type of computer

    A new type of networking device

    An abstract computer

    Using your laptop in an aeroplane

Data Centres

- Internet is about content

  Users see websites and e-mail = Internet

- Traditional model

  ISP provides email services:

  POP3, IMAP, Webmail

  ISP provides hosting services:

  Customers host content on ISPs servers (either sharing web server, using dedicated webserver, or using dedicated hardware)

- But how to scale these services?

  And provide redundancy as these services scale?

Scaling Data Centres

- ISPs can duplicate data centres:

  To provide redundancy

  - One live, the other hot standby
  - Both operating live at the same time – customer uses nearest

  To provide scalability

  - Operating all sites at the same time ensures that one site is not overloaded
  - Load-balancers used as front end to content

- Where does all this lead to?

Where does this lead?

- **Service Providers operating multiple datacentres with multiple servers**
  - All redundant
  - Customers get access to different classes of server
    - Shared address – virtual hosting, by context   **small**
    - Unique address – virtual machine   **medium**
    - Unique hardware – dedicated machine   **large**

- **Content providers developing services based around these concepts**
  - The end-user no longer has visibility of the individual pieces which make up their content

Cloud Computing

- From wikipedia:

  Cloud computing is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, like the electricity grid.

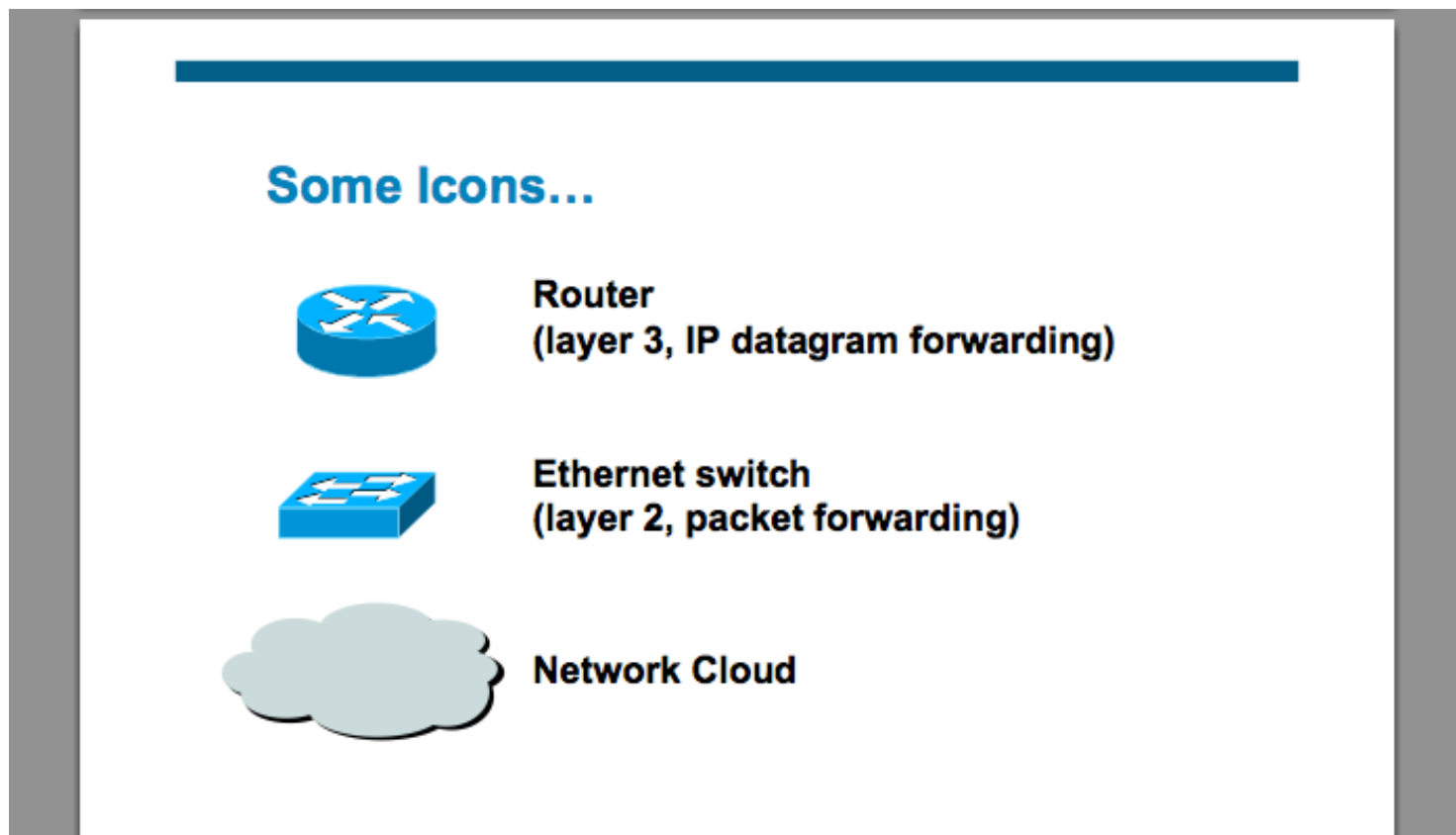- Or put another way, "The Cloud" is a simple reference to the Internet itself

  The Internet being the service that users see, rather than the individual components that make it up

- Some describe this as a paradigm shift

  In reality it is more like that the Internet has grown up and is now the ubiquitous content and communications infrastructure in the way that the telephony network was "The Cloud" in the past

By the Way: Network Cloud

- For decades we've referred to network topologies and devices that make up the network as a Cloud:

Some Icons…

Router
(layer 3, IP datagram forwarding)

Ethernet switch
(layer 2, packet forwarding)

Network Cloud

The Cloud – Examples

- Typical Examples of components of "The Cloud" might include:

Facebook	Social Networking
Yahoo!/Google/Microsoft	Email, Search, News, Content
Amazon	Commerce
Salesforce.com	Customer relationship management

- In fact any globally distributed content provision operation

- These are public examples – there are also private clouds where businesses use "The Cloud" for their internal IT needs

Cloud Computing – Services

- Cloud Computing (Cloud) offers IT/Network infrastructures, platforms, software or applications as utility like services

- It is identified by three major services

  Infrastructure as a Service (IaaS)

  Compute, Storage and Network resources as service

  Users: Enterprise/End-user Admins, Consumers

  Platform as a Service (PaaS)

  Software middleware services and development and testing platforms as service

  Users: Software Developers

  Software as a Service (SaaS)

  Software applications as service

  Users: Enterprise/End-user Admins, Consumers. Software Developers

Infrastructure as a Service

- An enterprise uses a "cloud infrastructure" as their IT service

- In reality this would be:

    Servers

    Storage

    CPU power/processing – aka computing

- Outsourced to, hosted at and administered by a hosting provider

    Who takes care of administration & management

    Who takes care of backups & redundancy

    Who takes care of security

- Releasing the enterprise IT to concentrate on more strategic operational issues

Platform as a Service

- Rather than providing a whole datacentre service, PaaS provides software platforms

    - Targeted at software developers primarily

    - They don't have to buy expensive software development platforms, rather lease time on the "Cloud" service

- Developers use SDK (software development kits) provided by the PaaS

- Examples of PaaS might include:

    - Google AppEngine

    - Microsoft Azure

    - Amazon SimpleDB

Software as a Service

- Fully finished software products are offered as a service

- Rather than buying a software product outright, an enterprise would buy into the SaaS organisation's "Cloud" offering

    Outsourced, accessing their software & function via the Internet

- Examples of SaaS might include:

    SalesForce.com

        Provide customer relationship management software (used by an enterprises sales teams) for account management

    WebEx

        Video/Audio Conferencing system and collaboration tool

    Google

Categories of Clouds (1)

- Public Cloud

    A service owned an operated by an ISP or Content provider, available and accessed over the Internet, for use by the general public

    Sometimes called an "external cloud"

- Private Cloud

    A service owned and operated by an enterprise IT department, for that enterprise's internal users (departments, staff, etc)

    (Benefit is not clear as the enterprise still has to build, own and operate the environment)

    Sometimes called an "internal cloud"

- Virtual Private Cloud

    A private cloud operated by a service provider and provided for enterprise use over the public network (compare with VPN)

Categories of Clouds (2)

- Hybrid Cloud

  A cloud infrastructure providing a mix of the features of private and public clouds

  Usually this is a cloud delivered by internal and external service providers (common situation for most enterprises)

- Community Cloud

  A cloud infrastructure which is used by a small group of organisations all having similar requirements

  More secure than public cloud without the restriction of private cloud – and easier to spread the costs across participating organisations

- Inter-Cloud

  Any interaction between any of the above types of cloud

Major features & characteristics

- Cloud customers are offered abstracted and virtualised services:

    Offload IT operations

    CAPEX and OPEX savings

    Cost-effective use of resources

    Built-in business continuity and disaster recovery

    Pay per use model

    Service and Resource CRUD is immediate and fast

        (CRUD = Create Read Update Delete)

    Flexibility

        Services and resources scale according to requirements

Being a Cloud Provider

- The next step for the DataCentre operator

- Considerations:

    Multiple sites

    Hardware (switches/routers/servers)

    Software (virtual machines, IPv4/IPv6)

    Server virtualisation

    Server and site redundancy

    Service offerings

    Security (Virtual Private Clouds versus Public Clouds)

Being a Cloud Provider

- **Consumer/User Trust**

    Where is my data and who else can see it?

    Can I get my data at all times and all places?

- **Enterprise IT**

    Availability – this has to be better than running my IT department internally

    Security – critical if using VPCs or any non-private cloud

    Performance – the Internet is underlying transport

Summary

- Cloud Computing

    Scaling Datacentres

    Virtualised Datacentres

    The next big "marketing" concept for the Internet to describe the ongoing scaling and distribution of content provision and services around the world