

CAB432 Cloud Computing

Lecture 1 - Introduction

Faculty of Science





Cloud is many things, but think about *elasticity* and *scale*.

WHAT IS CLOUD?





XaaS, Public, Private,

THE BASICS

What is Cloud Computing?

Elastic Utility Computing at Scale:

Utility computing

- IT infrastructure and services 'piped in'
- We turn on the tap as needed.
- Pay only for what we consume

Elastic provisioning

- Scale the services as we need them
- Automatically adjusted with load

Modern cloud computing operates globally and at massive scale.



The Origins of Cloud

- Amazon had an online bookstore... and they were better than most at large scale distributed computing
- Moving large scale IT from CAPEX to OPEX
- AWS was launched in 2002 and offered initial Compute (EC2) and Storage (S3) services in 2006
- Microsoft and Google followed soon afterwards
- They were good at distributed computing too...

The Business Case for Cloud

- The simple premise is that we only pay for what we use
- We don't spend a fortune on servers and machine rooms
- We manage capacity through elastic provisioning
- The major vendors promise capacity limited only by the size of your credit card...

Public, Private and Hybrid Clouds

PUBLIC CLOUD

- Services offered by the major vendors
- Available globally on a commercial basis
- 'Limited only by the size of the credit card'

PRIVATE CLOUD

- Services hosted and managed by large companies or government
- Same elastic service model, but smaller scale
- Usually more limited service offerings

HYBRID CLOUD

- Services based on a mix of public and private clouds
- Often used to manage regulatory requirements and client concerns over location of sensitive data sets.
- Government services, Major corporates

Pre-Requisites for Cloud Usage

- Anyone can use and combine a basic cloud service
 - Phone client and gmail, Flickr, Outlook, Facebook, Twitter
- Business migration requires a fat, bi-directional pipe
 - IT departments have been happy to allow a fat, if constrained, outward pipe for customers to access company sites
 - But the inward pipe has been a trickle, tightly guarded and limited to the barest essentials.
 - But with cloud, *all* the corporate data lies elsewhere, so the network changes fundamentally

Pre-Requisites for Cloud

VIRTUALISATION

- **Costly to maintain lots of small machines**
- **Better to maintain lots of Virtual Machines in the one place**

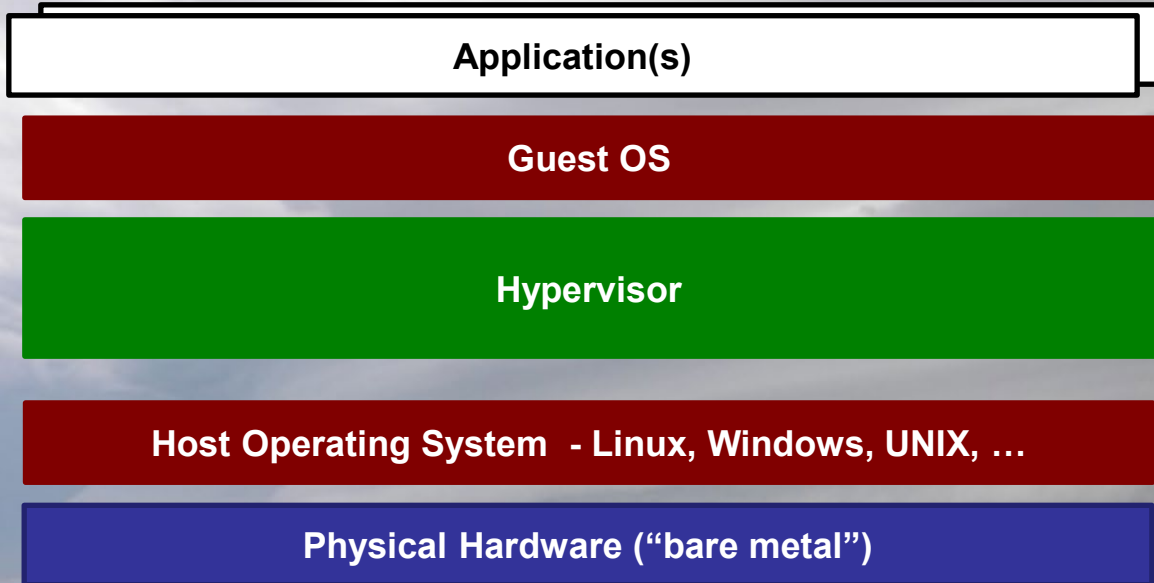
ELASTICITY

- Measure load and automatically scale as needed
- Scale **out** when people are waiting. Scale **in** when we have too many machines

SCALE

- Cloud data centres are huge
- Major vendors have nodes around the world and their own undersea cables.

A Quick Guide to Virtualisation



But there are important differences

- Cloud is neither mainframe nor simple virtualised hosting
- As always, the boundaries become somewhat blurred
- One person's small cloud is another's mainframe
 - Variations discussed: http://en.wikipedia.org/wiki/Mainframe_computer
 - But at one level the mainframe remains a single server
- But modern utility computing is fundamentally distinct
- Server farms based on thousands of commodity components, with distributed processing and redundancy
- Racks are being replaced by modular components

The Forecast is Cloudy

- Cloud used to mean *scalable* virtualisation
 - Mainly compute and storage services
 - IaaS and low-end PaaS
- And the on-demand provision of really bad puns
 - plus ça change: “You cannot be Cirrus” (The Economist)
- Cloud has changed fundamentally in recent years
 - Vastly richer offerings in the PaaS and SaaS space
 - Managed services have much higher margins, so no surprises
 - We will consider these in detail later

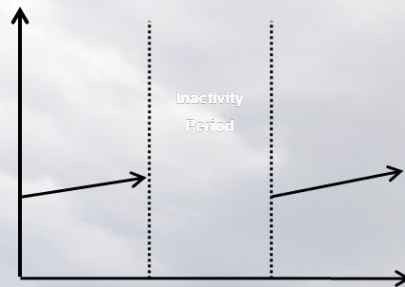
Utility Computing is a very old Idea

- IT offsite - share a big machine instead of maintaining lots of small ones
 - IT as a service – rent rather than buy
 - But modern Cloud is *very* different
- http://en.wikipedia.org/wiki/Electronic_Data_Systems
- https://en.wikipedia.org/wiki/IBM_System/370

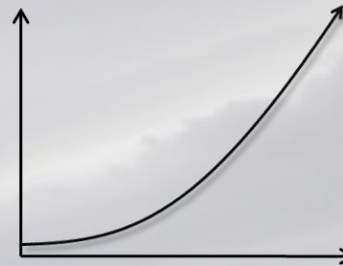


Elasticity and Cloud Workloads

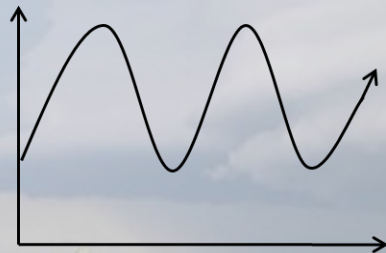
On and Off



Rapid Growth



Predictable Bursting



Unpredictable Bursting



Elasticity means that we can provide resources that match the workload at the time.

And we are able to scale automatically.

As long as we have credit available...

The Scale Speaks for Itself



Source: AWS web pages

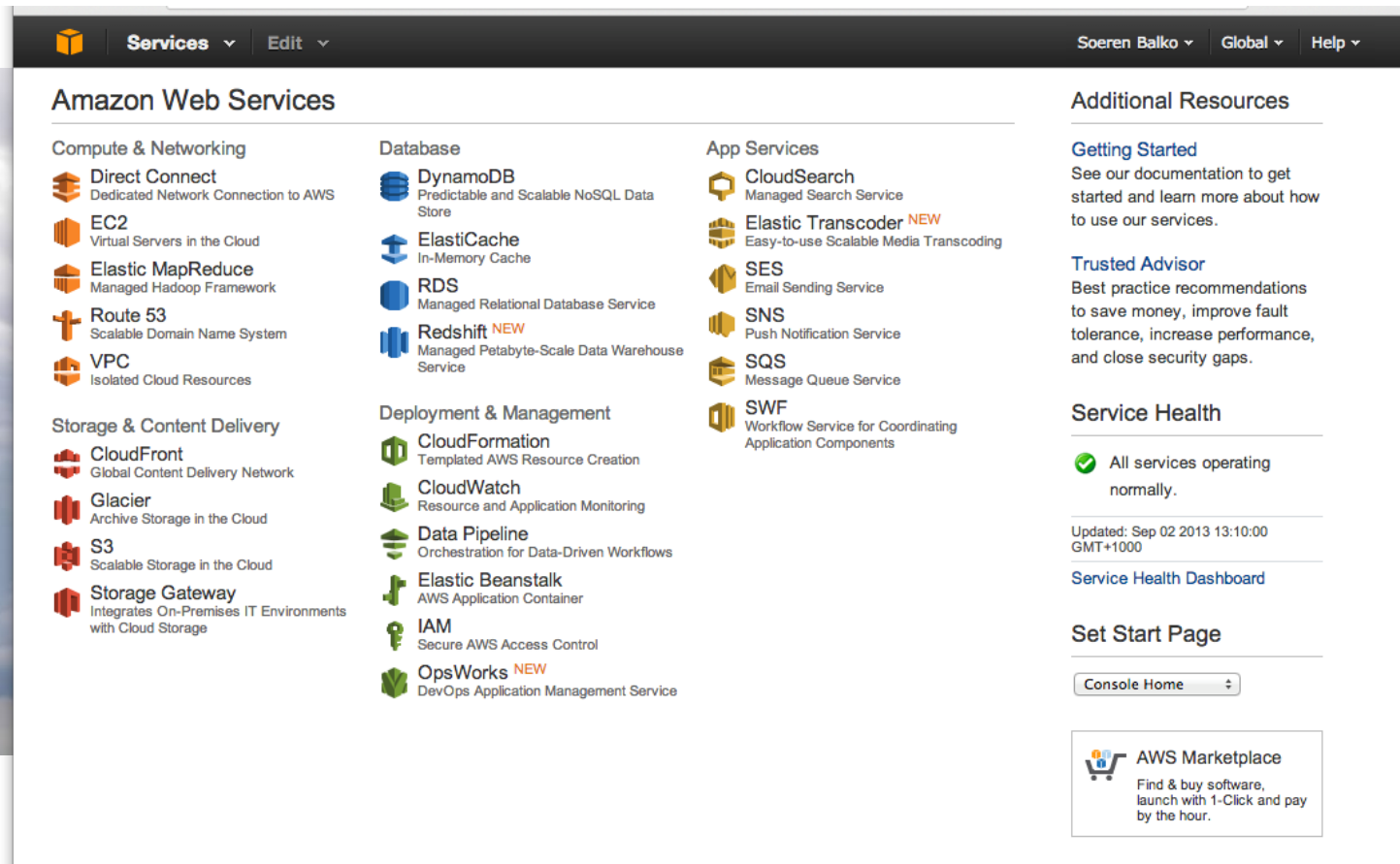
Types of Cloud Services

- The earliest cloud services were ‘close to the metal’
- Service offerings have become far richer and varied
- We will consider three standard service categories:
 - IaaS – Infrastructure as a Service
 - PaaS – Platform as a Service
 - SaaS – Software as a Service
- Later we will talk about containers and CaaS

XaaS – the Cloud Service Hierarchy

Infrastructure as a Service	Platform as a Service	Software as a Service
<ul style="list-style-type: none">• Virtual Machine + (Linux) OS• Pick your size• Storage – entity storage, SQL, NoSQL, archive• Pick your favourite DB	<ul style="list-style-type: none">• Not just the OS• Pre-configured software stack on each VM• Managed provisioning and scaling	<ul style="list-style-type: none">• Application hosting in the Cloud• Subscription-based• All hosting and management is done for you – for a fee• Salesforce is the usual example here

Services: AWS 2014



The screenshot shows the AWS Services page from 2014. The top navigation bar includes the AWS logo, 'Services' with a dropdown arrow, 'Edit' with a dropdown arrow, and user information 'Soeren Balko', 'Global', and 'Help' with a dropdown arrow. The main content area is titled 'Amazon Web Services' and is organized into several categories:

- Compute & Networking**
 - Direct Connect**: Dedicated Network Connection to AWS
 - EC2**: Virtual Servers in the Cloud
 - Elastic MapReduce**: Managed Hadoop Framework
 - Route 53**: Scalable Domain Name System
 - VPC**: Isolated Cloud Resources
- Storage & Content Delivery**
 - CloudFront**: Global Content Delivery Network
 - Glacier**: Archive Storage in the Cloud
 - S3**: Scalable Storage in the Cloud
 - Storage Gateway**: Integrates On-Premises IT Environments with Cloud Storage
- Database**
 - DynamoDB**: Predictable and Scalable NoSQL Data Store
 - ElastiCache**: In-Memory Cache
 - RDS**: Managed Relational Database Service
 - Redshift** **NEW**: Managed Petabyte-Scale Data Warehouse Service
- Deployment & Management**
 - CloudFormation**: Templated AWS Resource Creation
 - CloudWatch**: Resource and Application Monitoring
 - Data Pipeline**: Orchestration for Data-Driven Workflows
 - Elastic Beanstalk**: AWS Application Container
 - IAM**: Secure AWS Access Control
 - OpsWorks** **NEW**: DevOps Application Management Service
- App Services**
 - CloudSearch**: Managed Search Service
 - Elastic Transcoder** **NEW**: Easy-to-use Scalable Media Transcoding
 - SES**: Email Sending Service
 - SNS**: Push Notification Service
 - SQS**: Message Queue Service
 - SWF**: Workflow Service for Coordinating Application Components

On the right side, there are three sections:

- Additional Resources**
 - Getting Started**: See our documentation to get started and learn more about how to use our services.
 - Trusted Advisor**: Best practice recommendations to save money, improve fault tolerance, increase performance, and close security gaps.
- Service Health**
 - A green checkmark icon and the text 'All services operating normally.'
 - Updated: Sep 02 2013 13:10:00 GMT+1000
 - [Service Health Dashboard](#)
- Set Start Page**
 - A dropdown menu showing 'Console Home' with a dropdown arrow.
- AWS Marketplace**
 - An icon of a shopping cart.
 - Text: 'Find & buy software, launch with 1-Click and pay by the hour.'

Services: AWS 2021

Networking & Content Delivery

VPC

CloudFront

Route 53

API Gateway

Direct Connect

AWS App Mesh

AWS Cloud Map

Global Accelerator



Editor

Amazon Grafana

Amazon Prometheus

AWS Proton

Incident Manager

Media Services

Kinesis Video Streams

MediaConnect

MediaConvert

MediaLive

MediaPackage

MediaStore

MediaTailor

Elemental Appliances & Software

Amazon Interactive Video Service

Elastic Transcoder

Nimble Studio

GuardDuty

Inspector

Amazon Macie

AWS Single Sign-On

Certificate Manager

Key Management Service

CloudHSM

Directory Service

WAF & Shield

AWS Firewall Manager

Artifact

Security Hub

Detective

AWS Audit Manager

AWS Signer

AWS Network Firewall

IoT Events

IoT Greengrass

IoT SiteWise

IoT Things Graph

Game Development

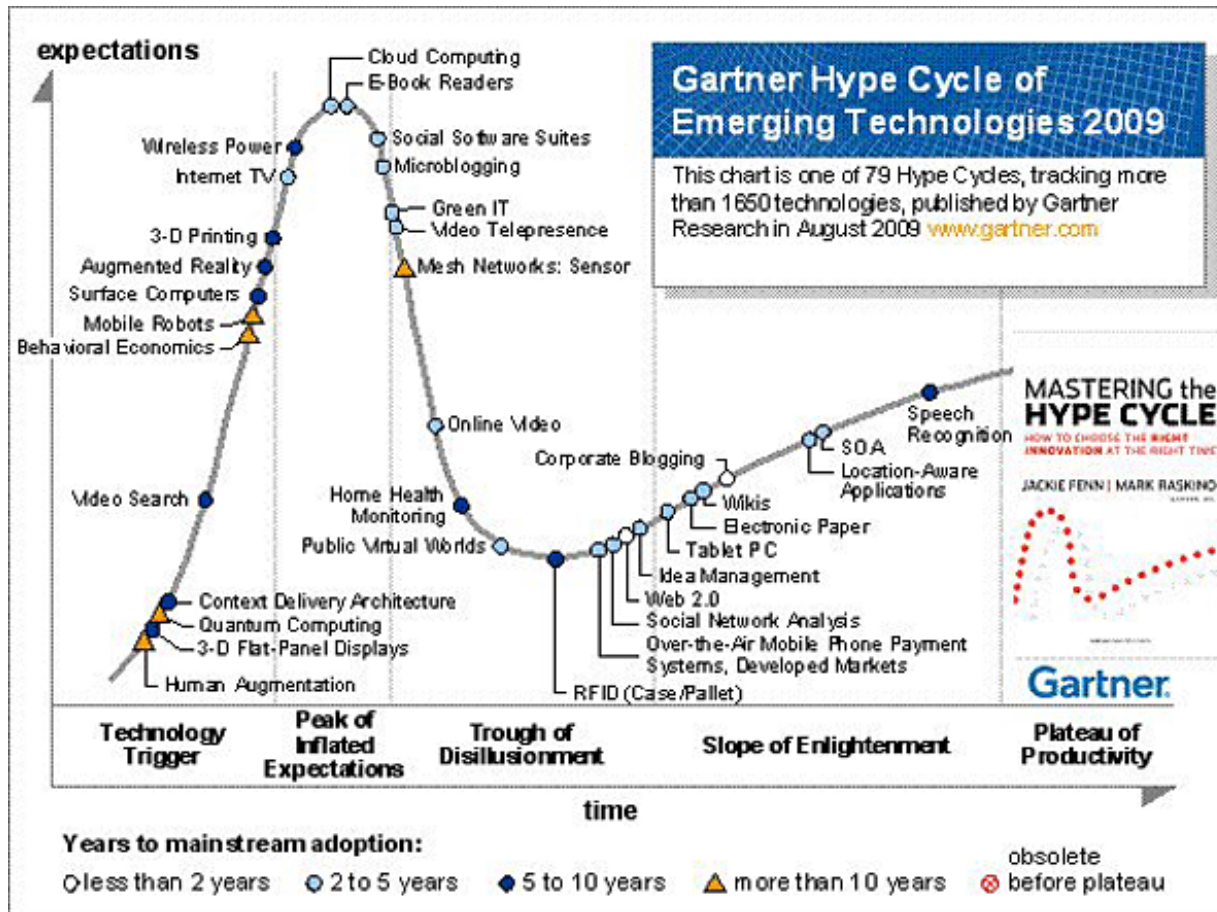
Amazon GameLift



There might have been some hype

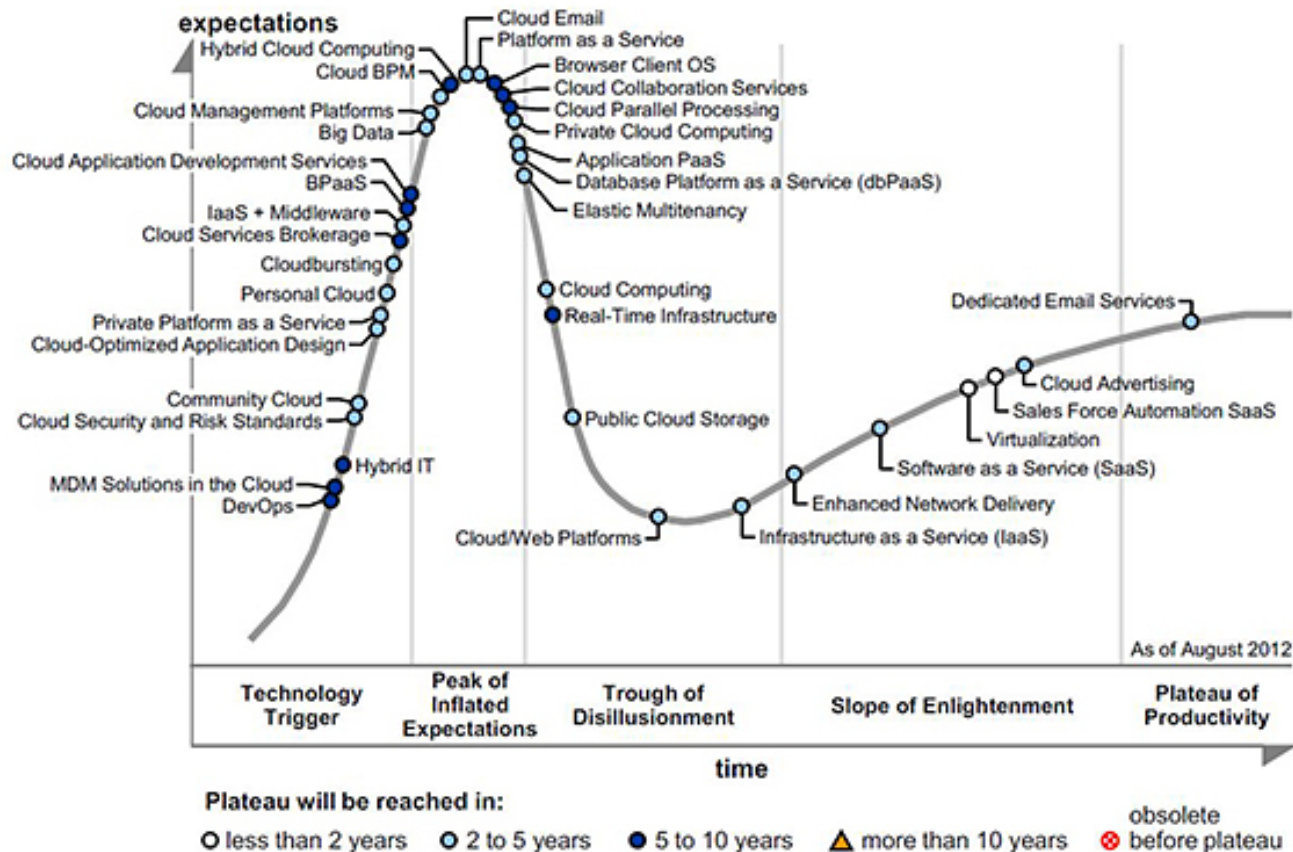
HOW IT BECAME CLOUDY

Cloud in 2009



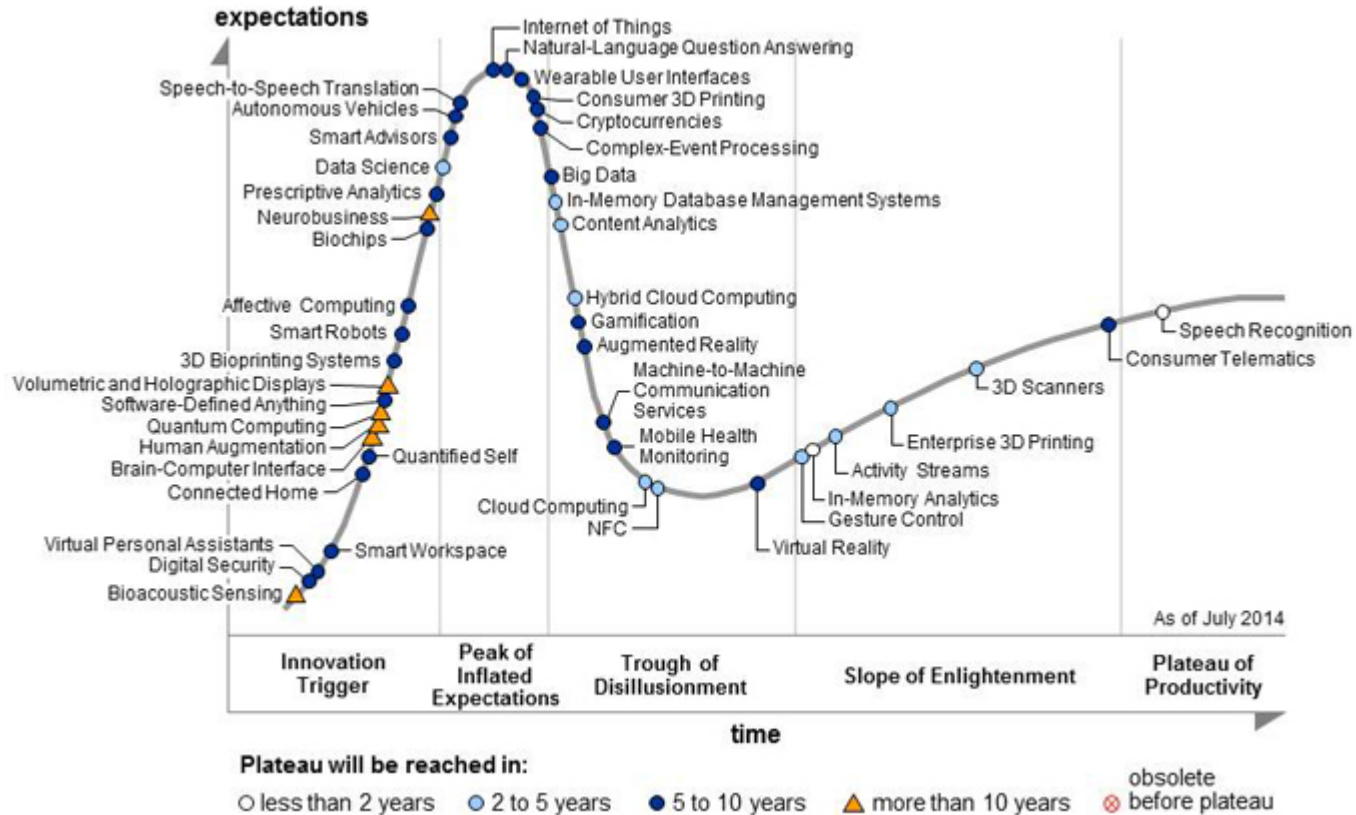
The Progress of Cloud

Figure 1. Hype Cycle for Cloud Computing, 2012



Source: Gartner (August 2012)

And more (2014)



Probably the last year for which it is worth looking at Cloud as such