



Welcome to CMP4103 Computer Systems and Network Security

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Data Centres

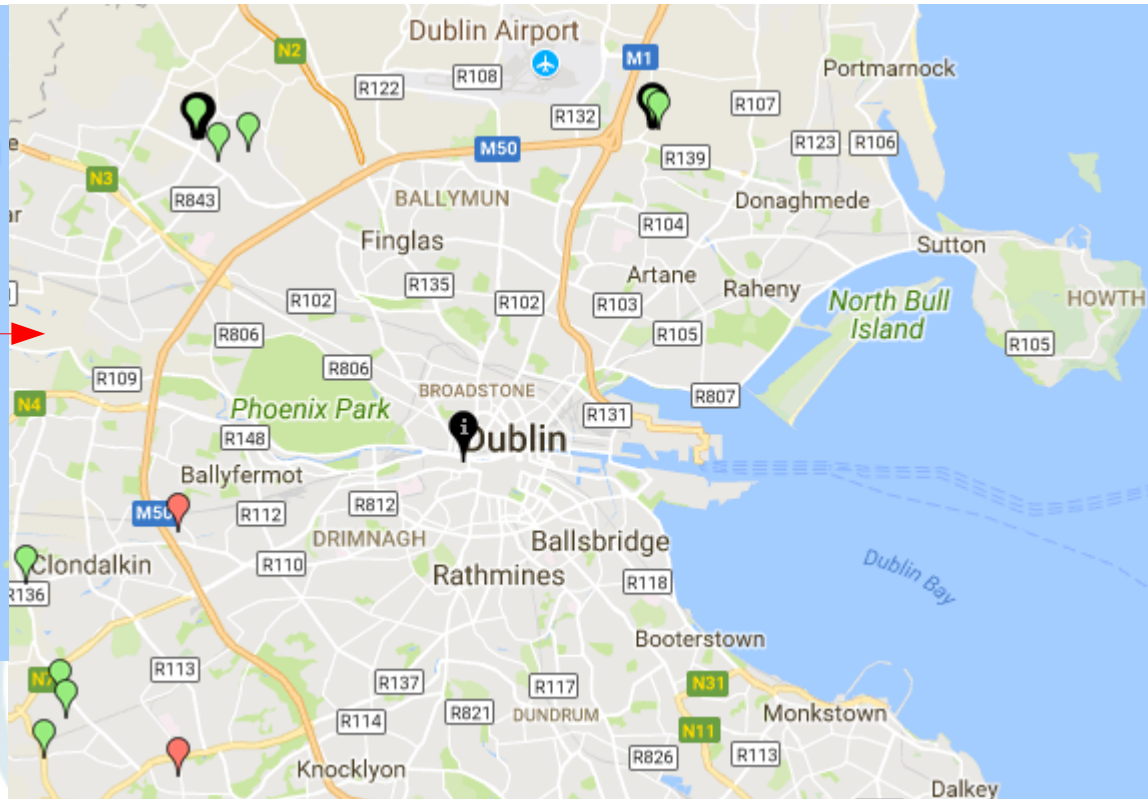
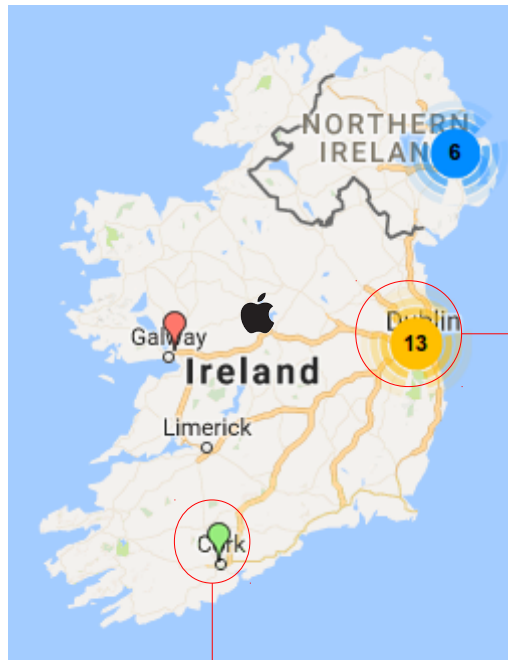
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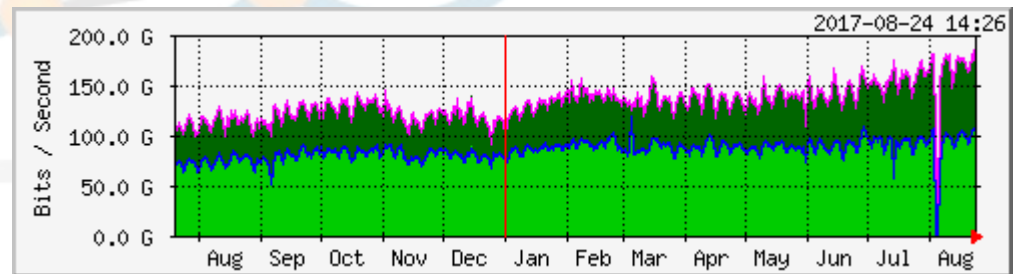
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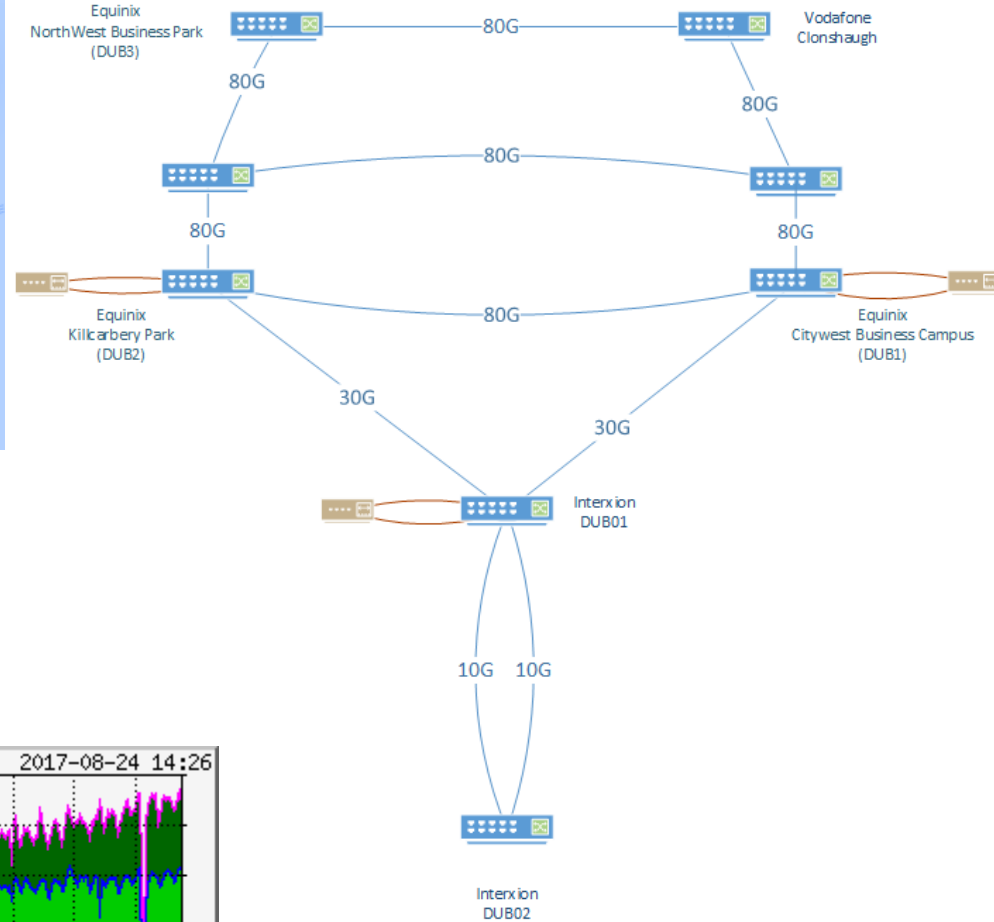
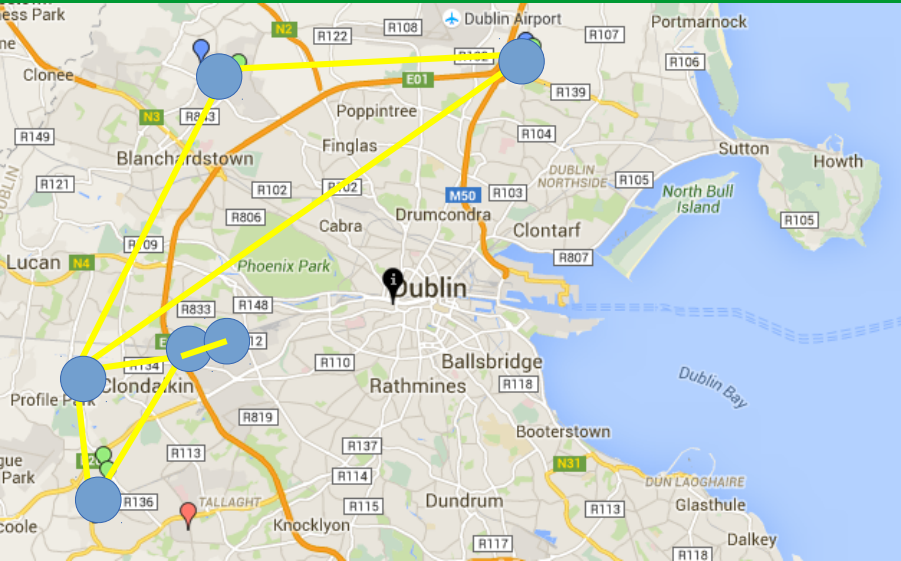
Ireland - 'data capital of Europe'



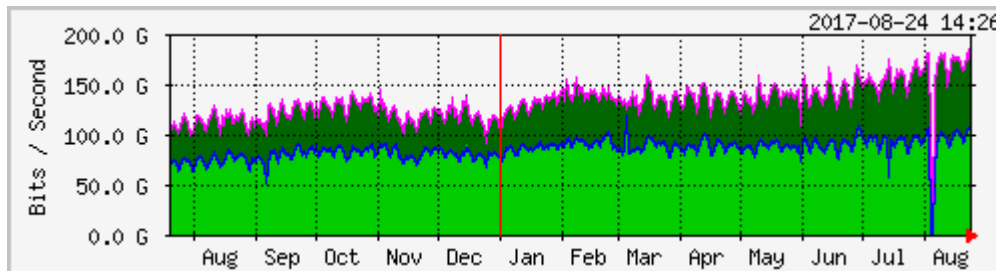
- Data Centres in Ireland



Irish iNternet EXchange



- INEX (Irish Internet eXchange)
 - 5 Data Centres in Dublin
 - Connection to CIX



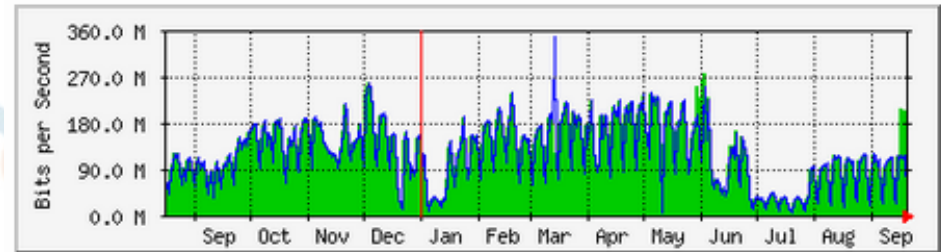
Uganda Internet eXchange Point



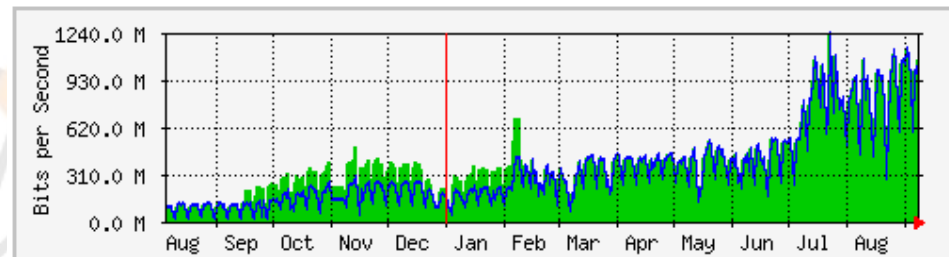
UIXP The Uganda Internet eXchange Point

- UIXP (Uganda Internet eXchange Point)
 - 3 x 19" racks (1 in 2015)
- Akamai joined as first ASP
 - Traffic jump over 1 Gb/s
- Google Global Cache (GGC)
 - On its way, Sept 2017

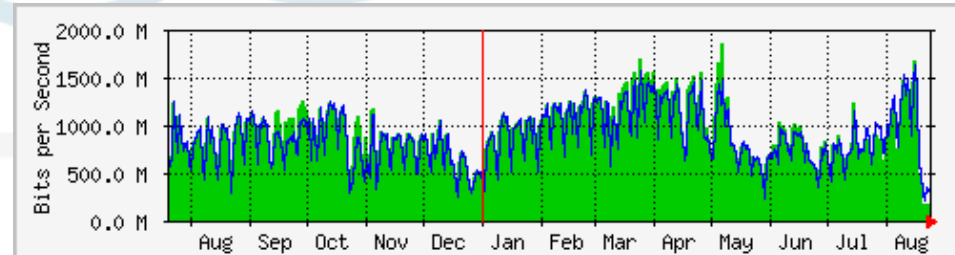
2015



2016



2017



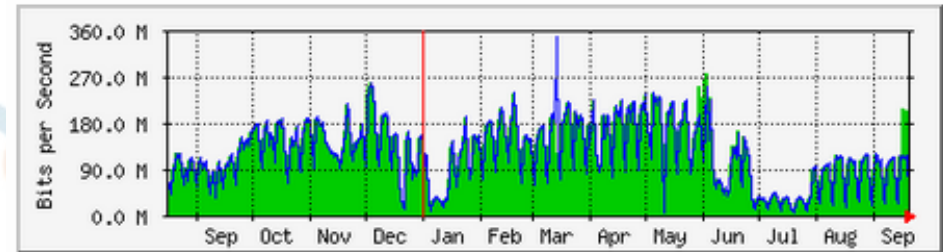
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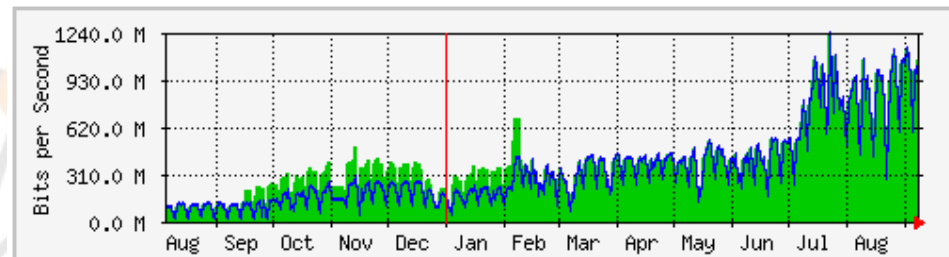
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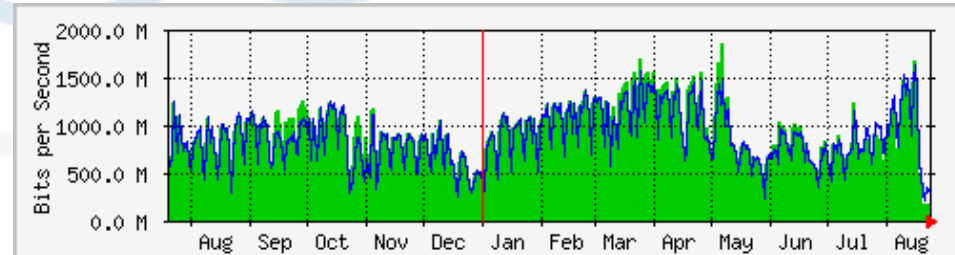
2015



2016



2017



Cork Internet eXchange



CIX - Dimensions



	Hollyhill Facility
Data Centre Floor	CIX 1A - 281m ² CIX 1B - 281m ² CIX 1C - 562m ²
Raised Floor Height	CIX 1A - 800mm CIX 1B - 800mm CIX 1C - No Raised Floor
Customer Racks	CIX 1A - 100 CIX 1B - 100 CIX 1C - 240
Services Area	918m ² (10,000ft ²)
Total Facility Size	3,000m ² (32,291ft ²)

CIX - Power



	Current	Planned
Maximum Import Capacity	1MW	4MW
Transformer	1 x 10kV, 1MW	1 x 10kV, 1MW 1 x 10kV, 4MW
Diesel Generation	2 x 900kVA	2 x 900kVA 3 x 2MW DRUPS
Minimum Diesel Storage	96 Hours	
UPS	2 x 500kW GE Purepulse	2 x 500kW GE Purepulse 4 x 1MW DRUPS

CIX – Connectivity - Fibre



CIX - Connectivity



	Current	Planned
Telecoms Mast	30m	30m
Fiber Entry Ducts	2 x eNet 2 x Eircom 2 x BT 1 x Virgin Media	2 x eNet 2 x Eircom 2 x BT 2 x Virgin Media 2 x Aurora
Duct entry separation	35m minimum	
Providers	BT, COLT, Eircom, eNet, Atrato/Hibernia, ESBT, Virgin Media etc.	
Mesh Network	Juniper Powered 40Gbps Backbone: <ul style="list-style-type: none">• Border - 1 x MX480, 2 x MX80• Core - Dual EX9208 (both have redundant switch fabric & routing engine)• Aggregation - 40Gbps QFX5100 / EX4550 (40Gbps uplink)• Access 10Gbps - QFX5100 / EX4500 (40Gbps uplink)• Access 1Gbps - EX4200 (10Gbps uplink)	



CIX – Connectivity - Wireless



CIX – Security, Air Conditioning & Supply Chain



Security

	Current	Planned
Fire Detection	Honeywell	
Fire Suppression	Nitrogen Gas	
Camera Recording	24 Cameras x 90 Days	48 Cameras x 90 Days
Manned Presence	24 x 7 x 365	

Air Conditioning

	Current	Planned
Chillers	2 x 300kW Free-cooling Climaveneta	2 x 300kW Free-cooling Climaveneta Adiabatic Fresh Air cooling
CRAHs	7 x 120kW Edpac	
Design	Chilled water x two circuits, cold aisle containment and dynamic set point chillers	

Supply Chain

CIX 1A/1B	CIX 1C
800mm Raised floor	Concrete floor
Racks must be built in situ.	Racks (upto 1,500 kg) can be rolled into place.
Pallet truck and fork truck available.	Pallet truck and fork truck available.

Network Operations Centre (NOC)



- Occupied 24 x 365 to provide:
 - Proactive monitoring
 - Incident handling
 - Remote hands assistance and alerting
 - ISO9001:2008 standard



Apple, new Irish Data Centre

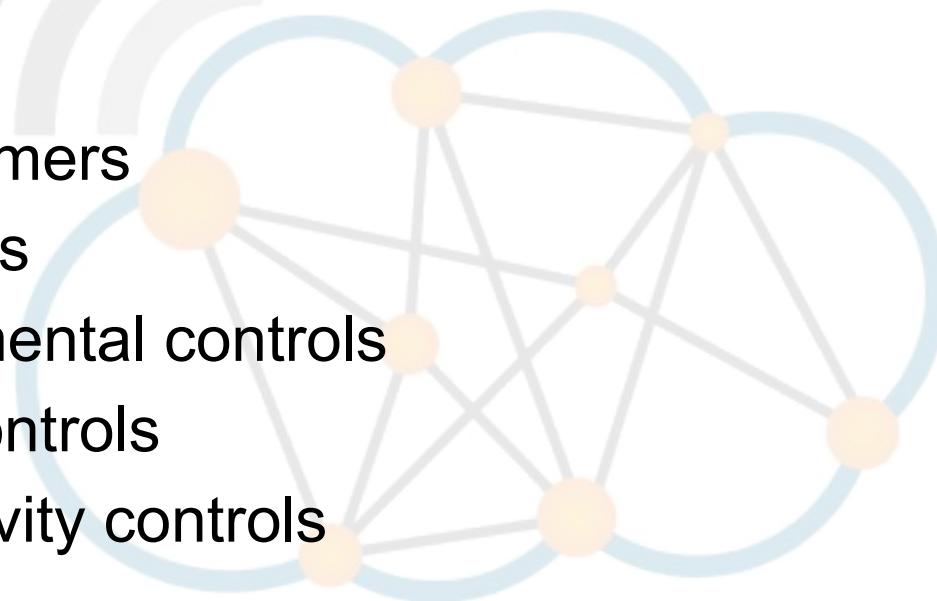


- €185 Million (UGX 754 Trillion)
- 166,000 m²
- Power with 100% renewable energy
- 20 megawatts of energy per hour





- Considering the Data Centre at CIX
 - Outline the physical security measures you would use
 - Access Controls for:
 - Staff
 - Customers
 - Visitors
 - Environmental controls
 - Power controls
 - Connectivity controls



A large, fluffy white cloud dominates the center of the frame, set against a clear, vibrant blue sky. The cloud has soft, billowing edges and a bright, sunlit top. The overall scene is bright and airy.

Application

Cloud computing ?

What is Cloud Computing



- Definition

- Cloud computing is the practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server.

Google Code e.g. "templates" or "datastore" Search

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Run your web apps on Google's infrastructure. Easy to build, easy to maintain, easy to scale.

An Early Look at Java™ Language Support ^{New!}

App Engine is unveiling its second language, Java. This release includes an early look at our Java runtime, integration with Google Web Toolkit, and a Google Plugin for Eclipse, giving you an end-to-end Java solution for AJAX web applications. Our support for the Java language is still under development and we're eager to get your help and input. For now, access will be limited to the first 10,000 developers who [sign up](#), but we'll be including more as soon as possible. Give it a try and send us your feedback.

- Get the full scoop in our [blog post](#)
- Click over to YouTube to watch our [Campfire One announcements](#)
- See our docs for other new features like [cron support](#), [database import](#), and [access to firewalled data](#).

Get an overview of App Engine's new Java runtime and see a demo of a sample app from creation to deployment. [Watch Now](#)

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Explore Products

- ▾ Infrastructure Services
 - Amazon Elastic Compute Cloud (Amazon EC2)
 - Amazon SimpleDB
 - Amazon Simple Storage Service (Amazon S3)
 - Amazon CloudFront
 - Amazon Simple Queue Service (Amazon SQS)
 - Amazon Elastic MapReduce
 - AWS Premium Support
- ▾ Payments & Billing
- ▾ On-Demand Workforce
- ▾ Alexa Web Services

News & Events

What's New?	Media Coverage	Events
May 07, 2009	Amazon CloudFront Adds Access Logging Capability	
Apr 29, 2009	AWS Goes To School With Programs For Educators, Researchers, and Students	
Apr 22, 2009	Amazon EC2 Running IBM Now Available	
Apr 15, 2009	Amazon EC2 Reserved Instances Now Available in Europe	
Apr 09, 2009	Announcing Amazon SQS WSDL Version 2009-02-01 and Amazon SQS in Europe	

Cloud Computing Service Offerings



- Software as a service (SaaS)
- Platform as a service (PaaS)
- Infrastructure as a service (IaaS)
- Storage as a service (StaaS)
- Security as a service (SECaaS)
- Data as a service (DaaS)
- Test environment as a service (TeaaS)
- Desktop as a service (DaaS)
- API as a service (APIaaS)
- Back-end as a service (BaaS)

SaaS
Software as a Service

PaaS
Platform as a Service

IaaS
Infrastructure as a Service



SaaS

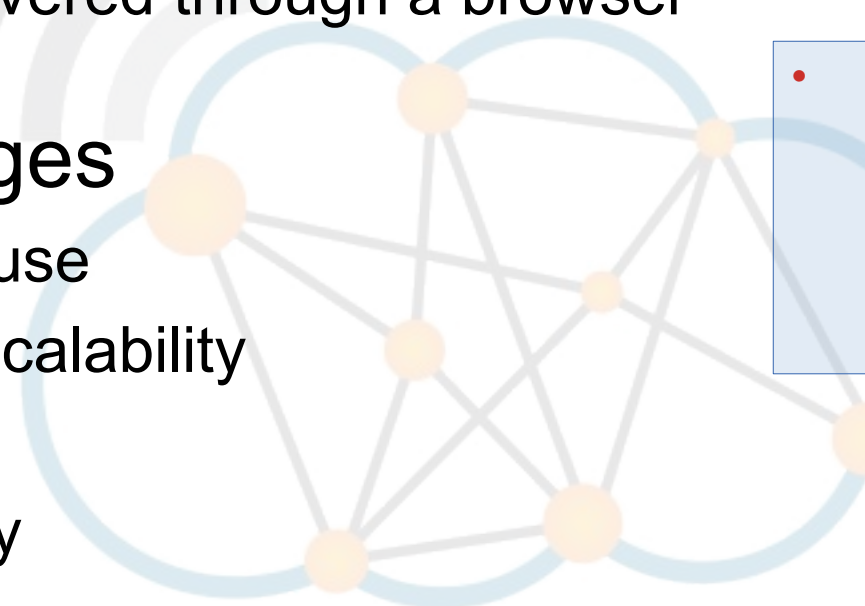
- Increasingly popular with SMEs
- No hardware or software to manage
- Service delivered through a browser

- **Advantages**

- Pay per use
- Instant Scalability
- Security
- Reliability
- APIs

- **Examples**

- CRM
- Financial Planning
- Human Resources
- Word processing





PaaS

- Platforms are built upon Infrastructure, which is expensive
- Estimating demand is not a science
- Platform management can be difficult
- Popular services
 - Storage
 - Database
 - Scalability
- Advantages
 - Pay per use
 - Instant Scalability
 - Security
 - Reliability
 - APIs

- Examples
 - AWS: S3
 - Google App Engine



Amazon Simple Storage Service (Amazon S3)

Amazon S3 is storage for the Internet. It is designed to make web-scale computing easier for developers.

Amazon S3 provides a simple web services interface that can be used to store and retrieve any amount of data, at any time, from anywhere on the web. It gives any developer access to the same highly scalable, reliable, secure, fast, inexpensive infrastructure that Amazon uses to run its own global network of web sites. The service aims to maximize benefits of scale and to pass those benefits on to developers.



- Access to infrastructure stack:
- Full OS access
- Firewalls
- Routers
- Load balancing

- Examples
 - AWS: EC2
 - CloudCIX

IaaS



Amazon Elastic Compute Cloud (Amazon EC2)

AWS EC2 is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers.

Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment. Amazon EC2 reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing requirements change. Amazon EC2 changes the economics of computing by allowing you to pay only for capacity that you actually use. Amazon EC2 provides developers the tools to build failure resilient applications and isolate themselves from common failure scenarios.

• Advantages

- Pay per use
- Instant Scalability
- Security
- Reliability
- APIs

Common factors



SaaS

- Pay per use
- Instant Scalability
- Security
- Reliability
- APIs

PaaS

- Advantages
 - Lower cost of ownership
 - Reduce infrastructure management responsibility
 - Allow for unexpected resource loads
 - Faster application rollout

IaaS

- Cloud Economics
 - Multi-tenanted
 - Virtualisation lowers costs by increasing utilisation
 - Economies of scale afforded by technology
 - Automated update policy



- Public Cloud Providers
 - Amazon Web Services
 - Dropbox
 - Linode
 - Apple iCloud
 - Google Drive, Docs, Gmail
 - Microsoft SkyDrive, Office 365, Office, Azure
 - SugarSync
 - Symform



Big Data

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- Big data is the term for a collection of datasets so large and complex that it becomes difficult to process using database management tools or traditional data processing applications.
- The challenges include:
 - Capture.
 - Preservation.
 - Maintenance.
 - Storage.
 - Search.
 - Sharing.
 - Transfer.
 - Analysis.
 - Visualisation.
- Examples: research, disease prevention, linking legal citations, combating crime, Internet and telephony real time monitoring, and real-time roadway traffic conditions.



- 2015 in the order of 10 Zettabytes (ZB) (10^{21} bytes), by 2025 it will rise to 180 Zettabytes (180 trillion GB)
- Growth because of information-sensing mobile devices, aerial sensory technologies, software logs, cameras, microphones, radio-frequency identification readers, and wireless sensor networks etc...
- *“by 2020 the world market of solutions and services related to Big Data will reach \$ 203 billion” IDC*
- In the next few years the world market of solutions and services related to Big Data, will grow by almost 12% year on year.
 - By comparison that is 7 times greater than the global IT and telecommunications market combined.

Big Data dimensions



- Volume
 - Enterprises with Terrabytes (10^{12}) and Petabytes (10^{15}).
 - Exabytes (10^{18}) and Zettabytes (10^{21}).
- Velocity
 - Speed of transactions.
- Variety
 - Text, video, sensor streams, log files, databases.
- Veracity
 - Truth, more abstract results, are they trustworthy ?

Solutions



- Dell (EMC²)
- Amazon Web Services
- Cloudera
- Google Analytics
- Microsoft Predictive Analytics



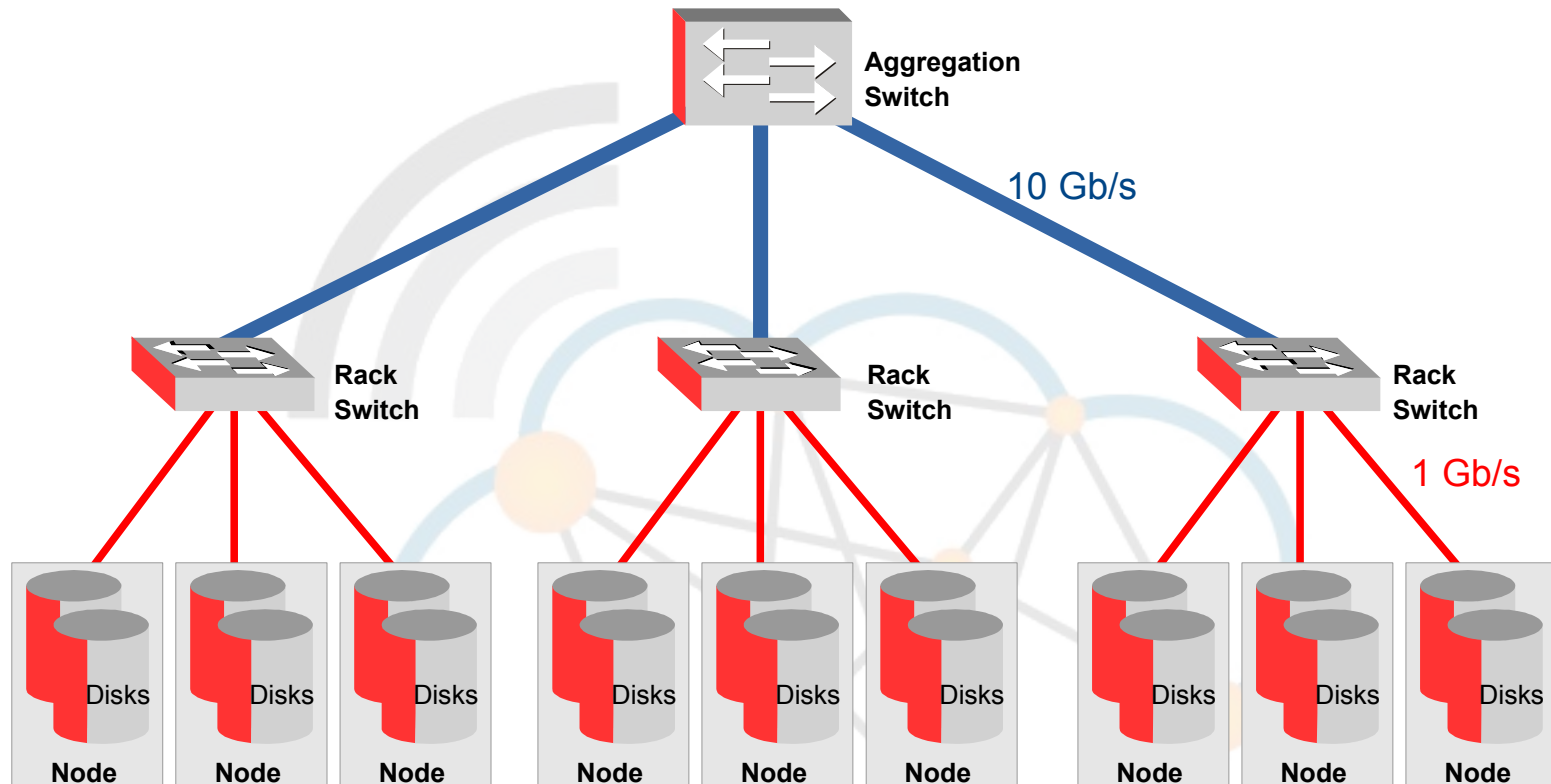
cloudera





- Open source software project that enables the distributed processing of large data sets across clusters of commodity servers.
- Can scale up from a single server to thousands of machines, with a very high degree of fault tolerance.
- Resiliency of these clusters comes from the software's ability to detect and handle failures at the application layer.
- Hadoop enables a computing solution that is:
 - Scalable.
 - Cost effective.
 - Flexible.
 - Fault tolerant.

Typical Hadoop cluster



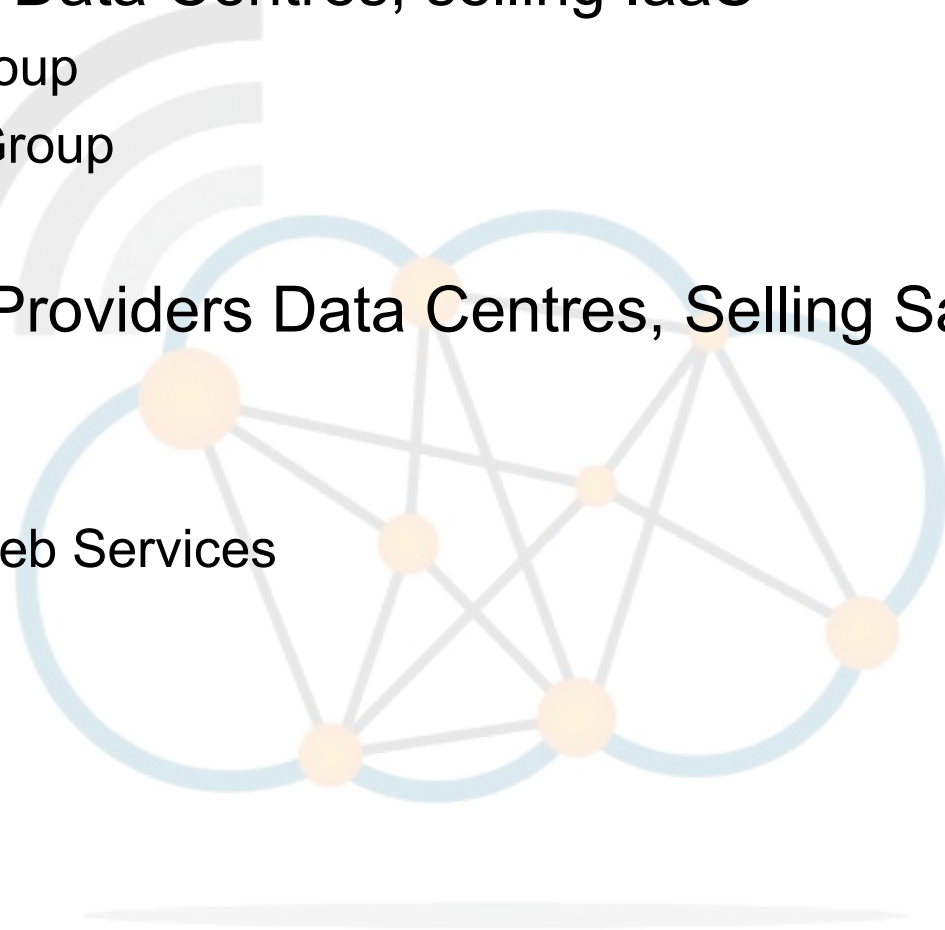
- 40 nodes/rack, 1000-4000 nodes in cluster
- 1 Gbps bandwidth in rack, 8-10 Gbps out of rack
- Node specs: 8 cores, 16 GB RAM, 8 x 1.5 TB disks, no RAID

Typical Hadoop cluster environment





- Commercial Data Centres, selling IaaS
 - Telecity Group
 - InterXion Group
 - Citadel
- Application Providers Data Centres, Selling SaaS
 - Apple
 - Google
 - Amazon Web Services
 - Microsoft
 - Facebook
 - LinkedIn
 - Twitter





Thank you

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