Welcome to CMP4103
Computer Systems and Network Security

Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com

Data Centres

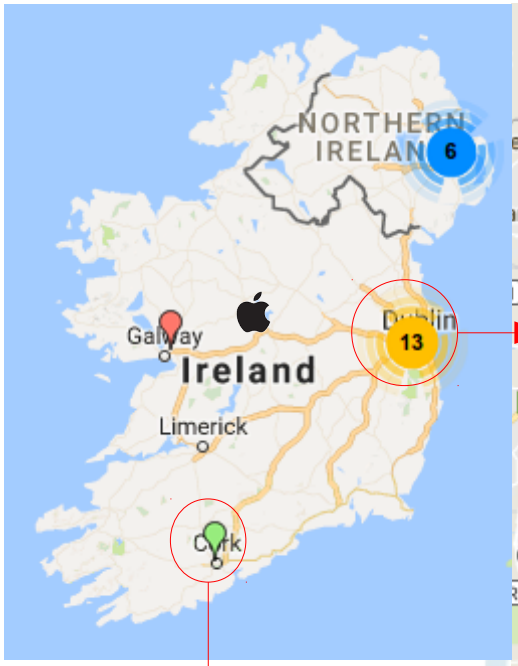
CISSP®

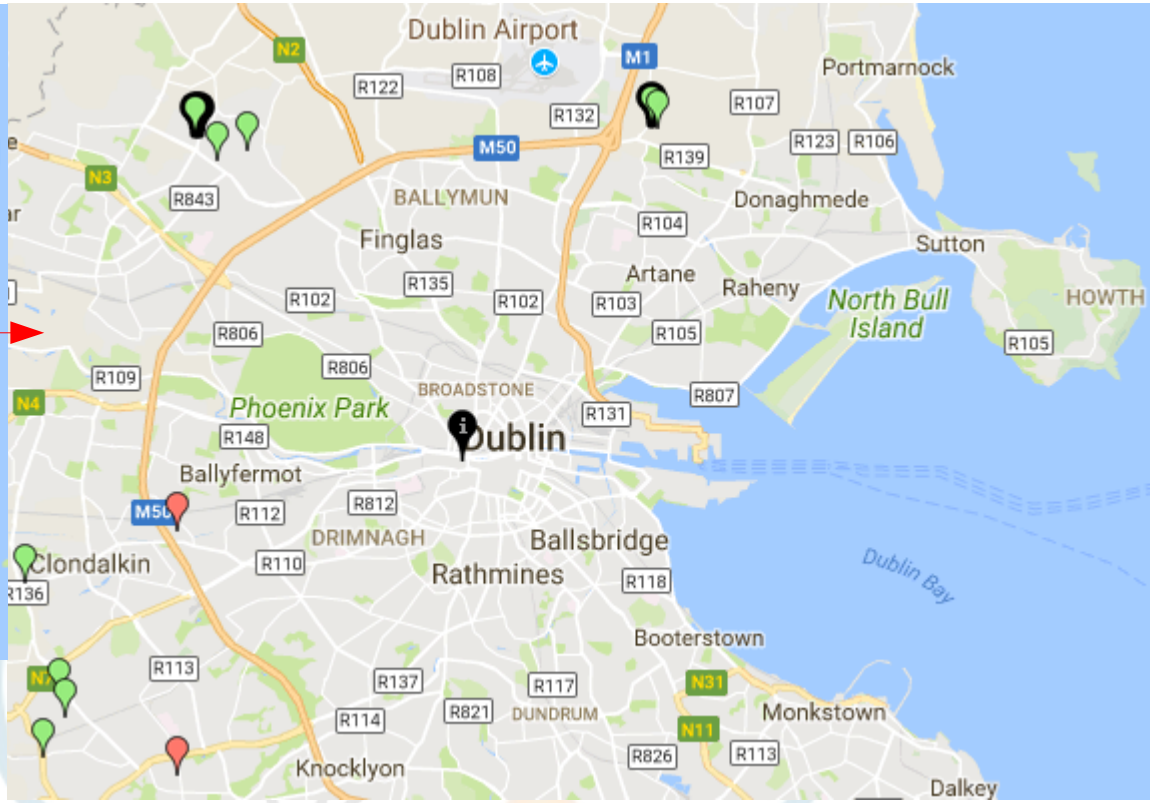
Diarmuid Ó Briain

CEng, FIEI, FIET, CISSP

diarmuid@obriain.com

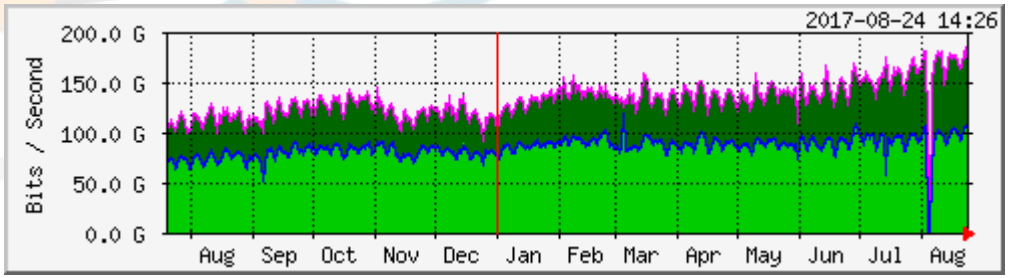
Ireland - ‘data capital of Europe’





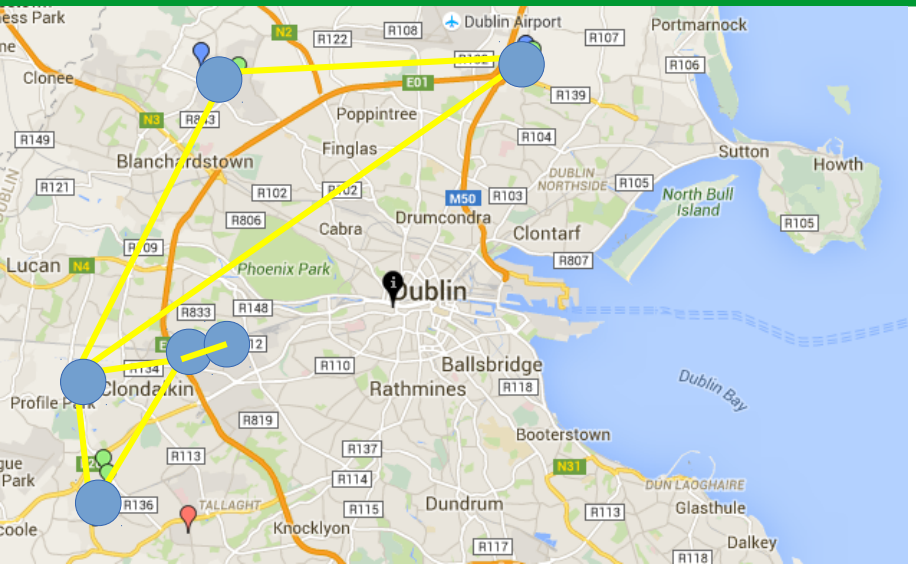
INEX Cork

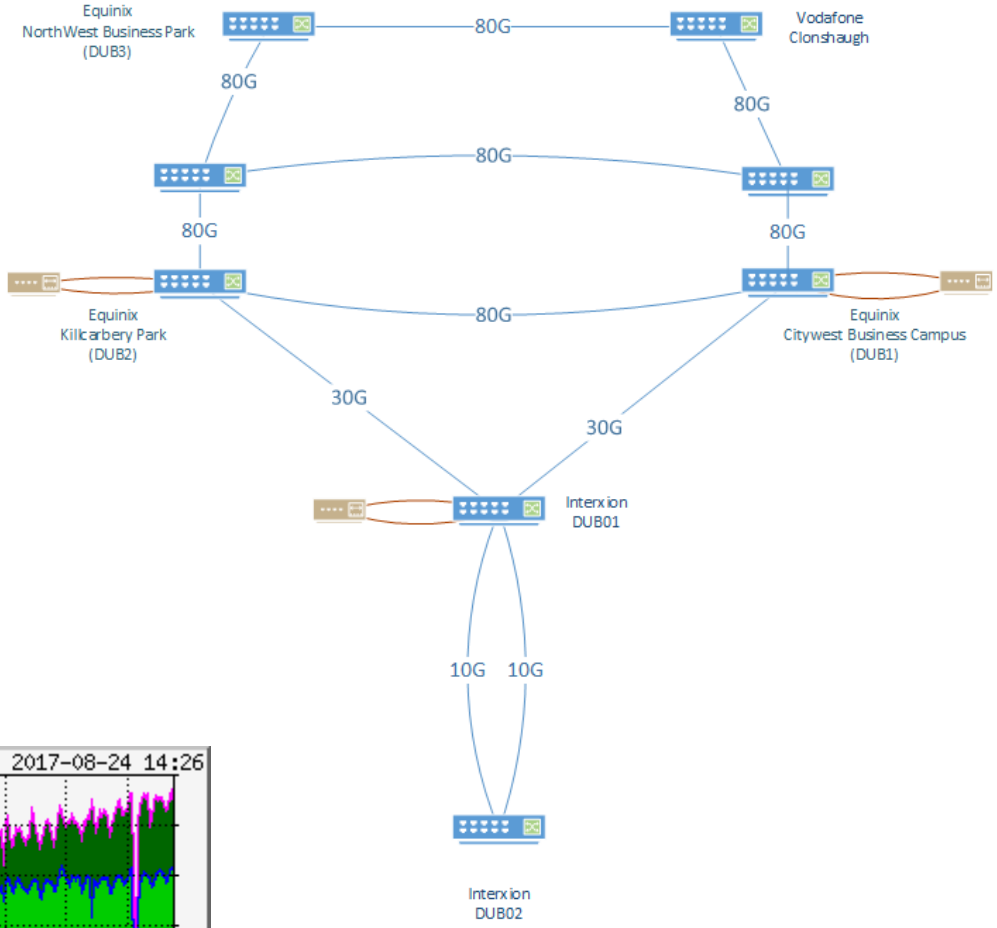
CIX cork internet exchange



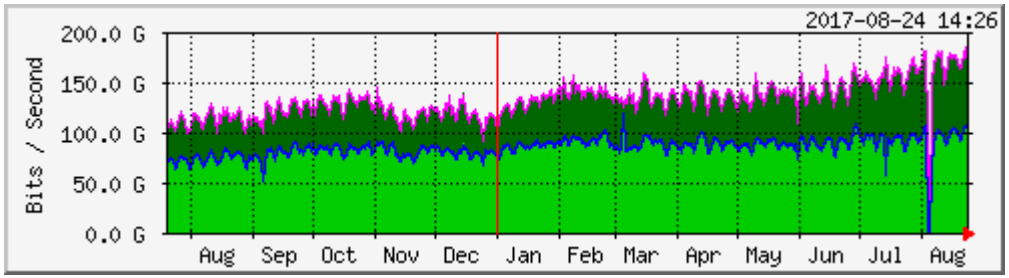
- Data Centres in Ireland

Irish iNternet EXchange





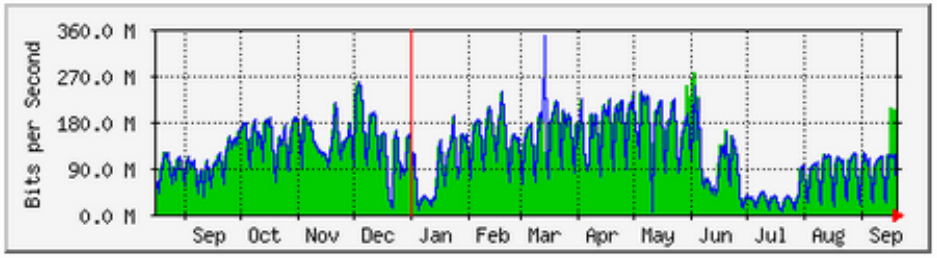
- INEX (Irish Internet eXchange)
  - 5 Data Centres in Dublin
  - Connection to CIX



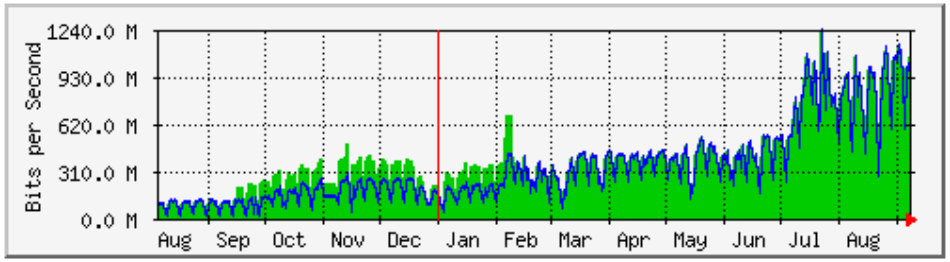
Uganda Internet eXchange Point

UIXP The Uganda Internet eXchange Point

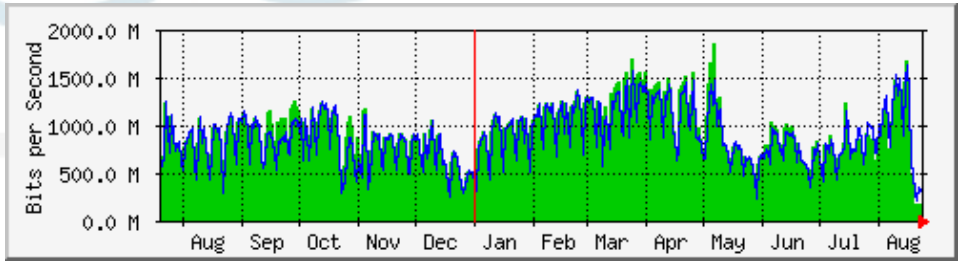
2015



2016



2017

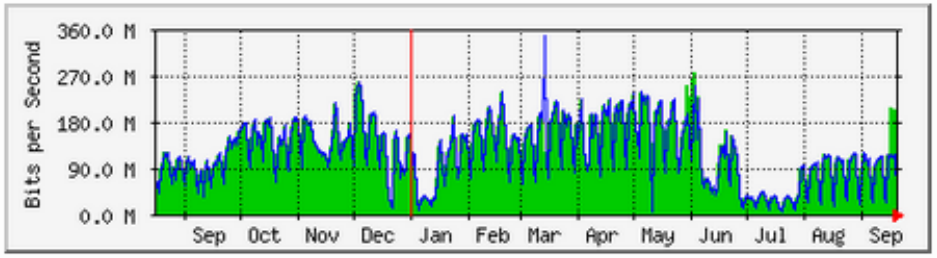


- UIXP (Uganda Internet eXchange Point)
  - 3 x 19” racks (1 in 2015)
- Akamai joined as first ASP
  - Traffic jump over 1 Gb/s
- Google Global Cache (GGC)
  - On its way, Sept 2017

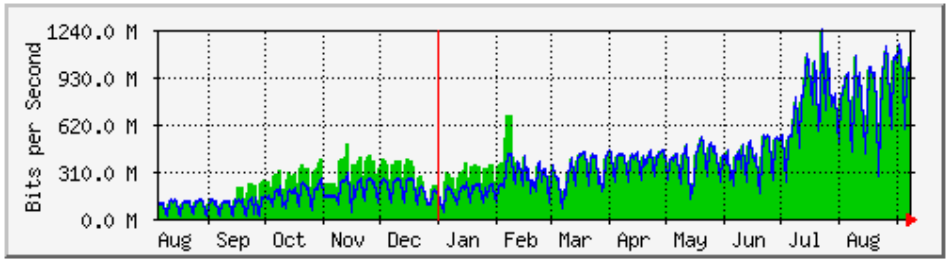
Uganda Internet eXchange Point

UIXP The Uganda Internet eXchange Point

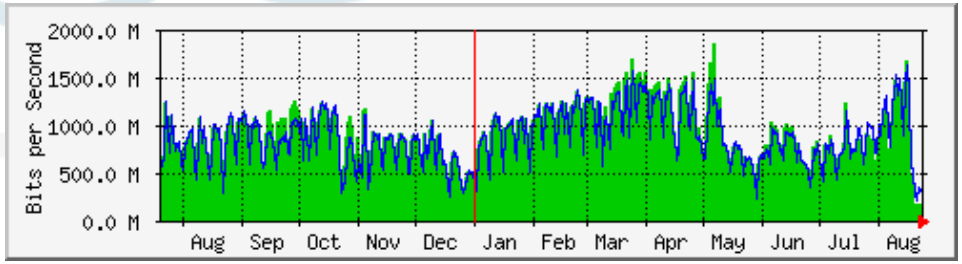
2015



2016



2017



- 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

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

Aurora TELECOM

BT

Complete telecom

colt smarter / faster / further

open eir

e|net enasc éireann teoranta

ESB Telecoms

HIBERNIA NETWORKS

IMS Integrated Media Solutions

MAGNET BUSINESS

STRENCOM Connectivity · Cloud Computing

Virgin media

verizon

Viatel

vodafone

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: • 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

AiBridges
airfibre
AirSpeed TELECOM
AIRWAVE INTERNET
East Cork Broadband
imagine
IMS
IRISH TELECOM
ripplecom connecting business
Viatel
digital.forge
nova broadband

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

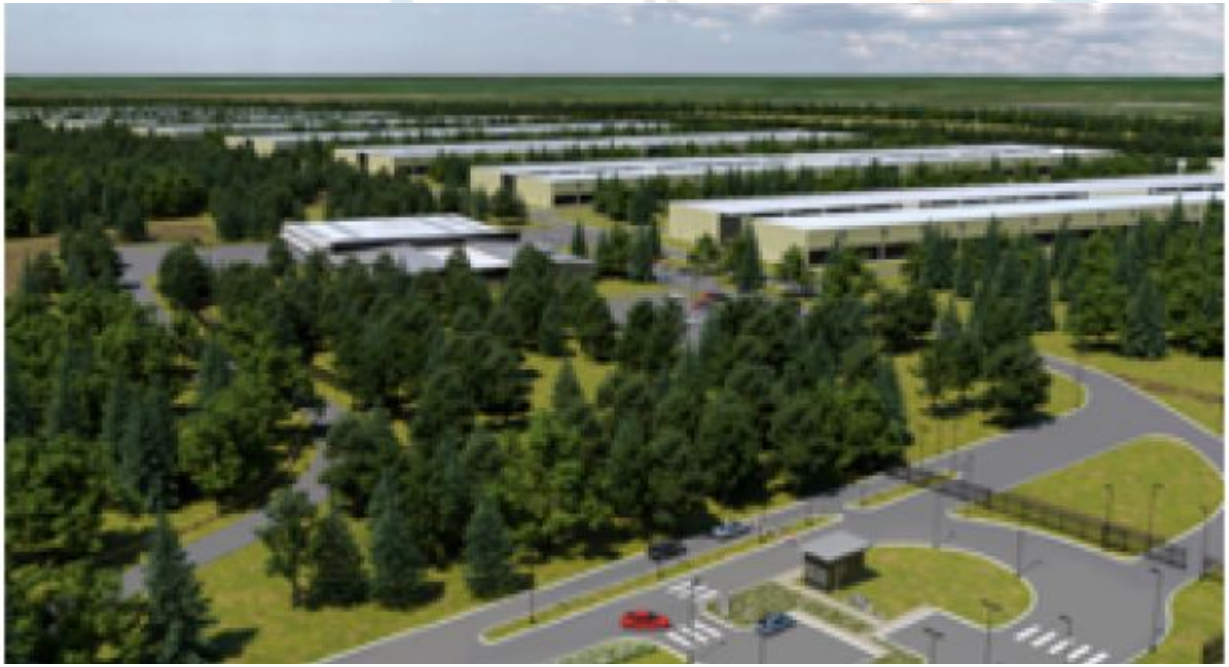
CIX 1A/1B	CIX 1C
800mm Raised floor	Concrete floor
Racks must be built in situ.	Racks (upto 1,500 kg) can be rolled into place.
Pallet truck and fork truck available.	Pallet truck and fork truck available.

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



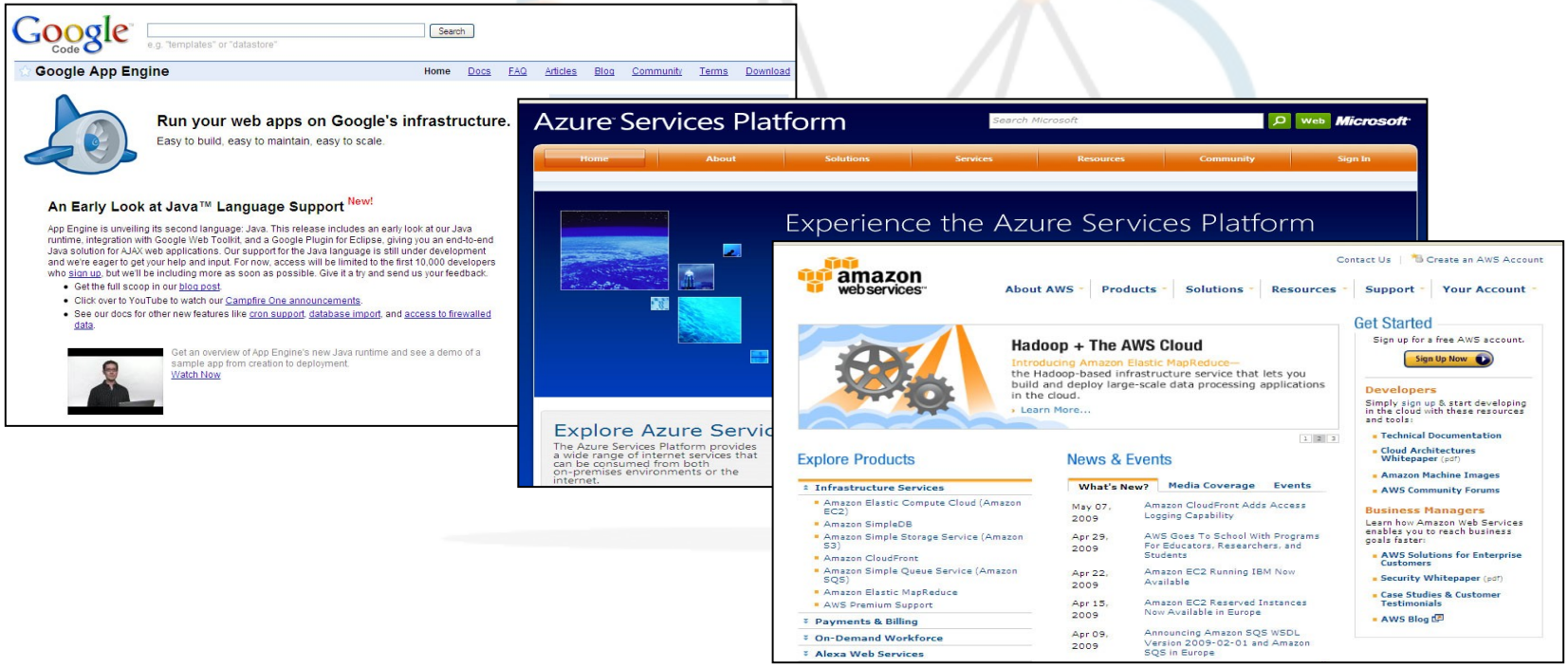
Exercise

- 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


Application
Cloud computing ?

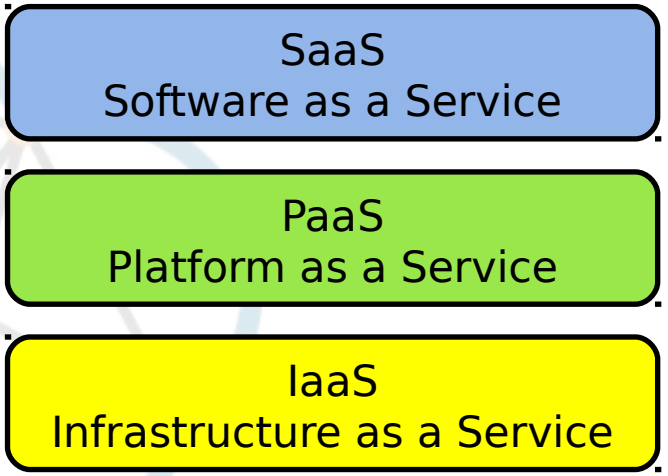
What is Cloud Computing

- 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.



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

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

PaaS

- Platforms are built upon Infrastructure, which is expensive
- Estimating demand is not a science
- Platform management can be difficult

- Examples
  - AWS: S3
  - Google App Engine

- Popular services
  - Storage
  - Database
  - Scalability

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

amazon web services

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.

IaaS

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

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

- Examples
  - AWS: EC2
  - CloudCIX

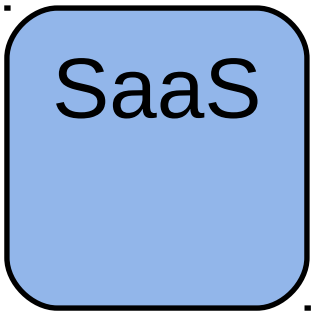
IaaS

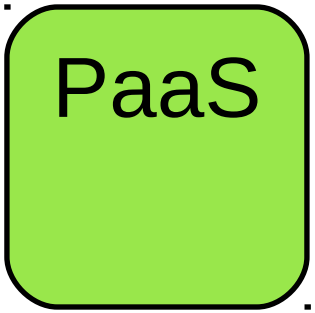
Amazon Elastic Compute Cloud (Amazon EC2)

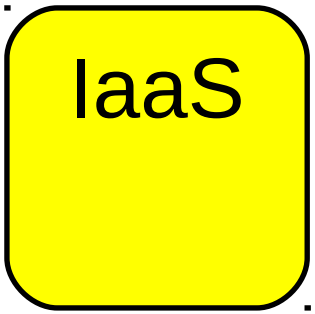
AWS EC2 is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers.

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.

Common factors







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

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

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

Cloud providers

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

CISSP®

Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com

Big Data

- 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.

Big Data

- 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 ?

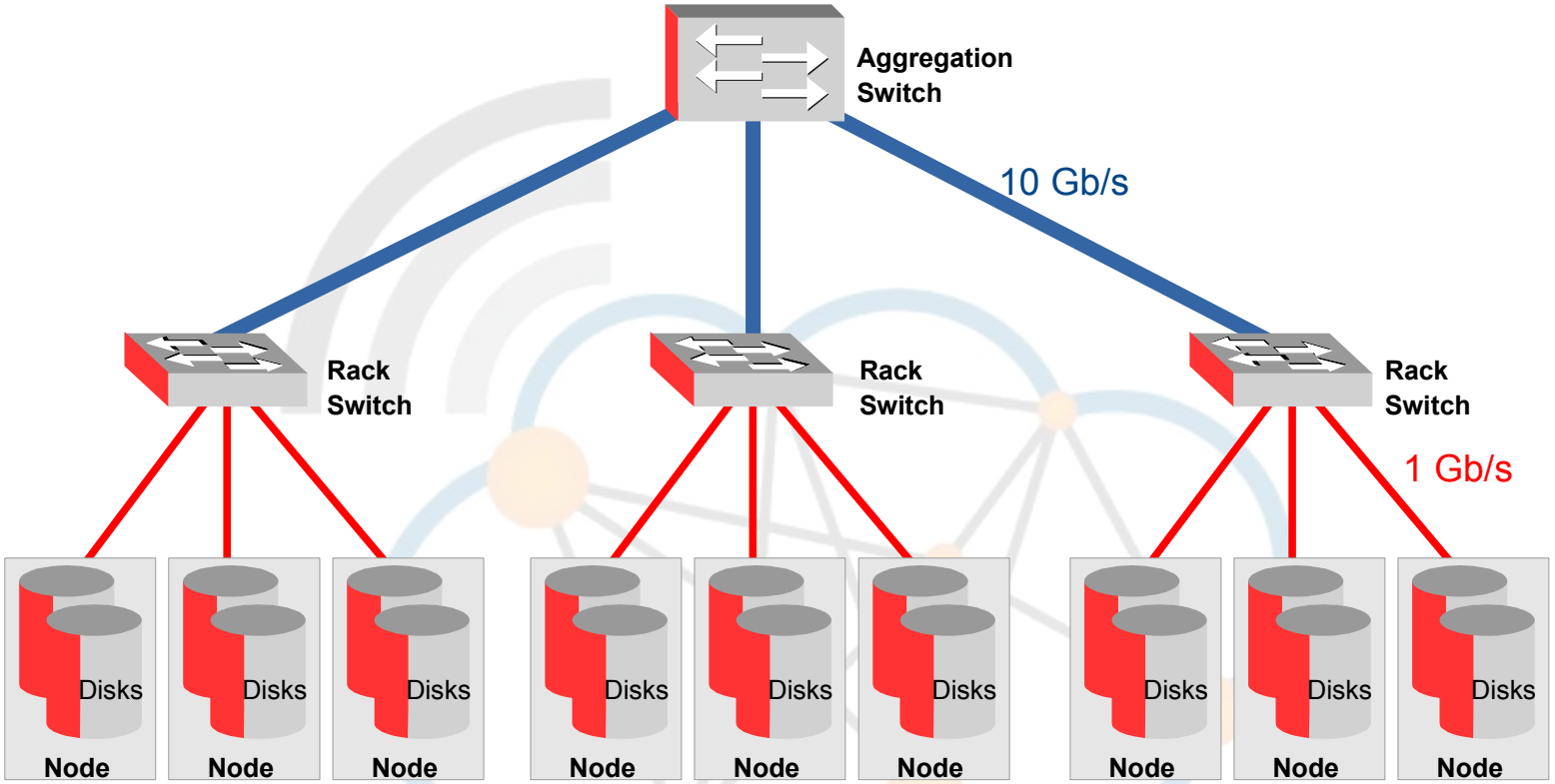
Solutions

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

Hadoop

- 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

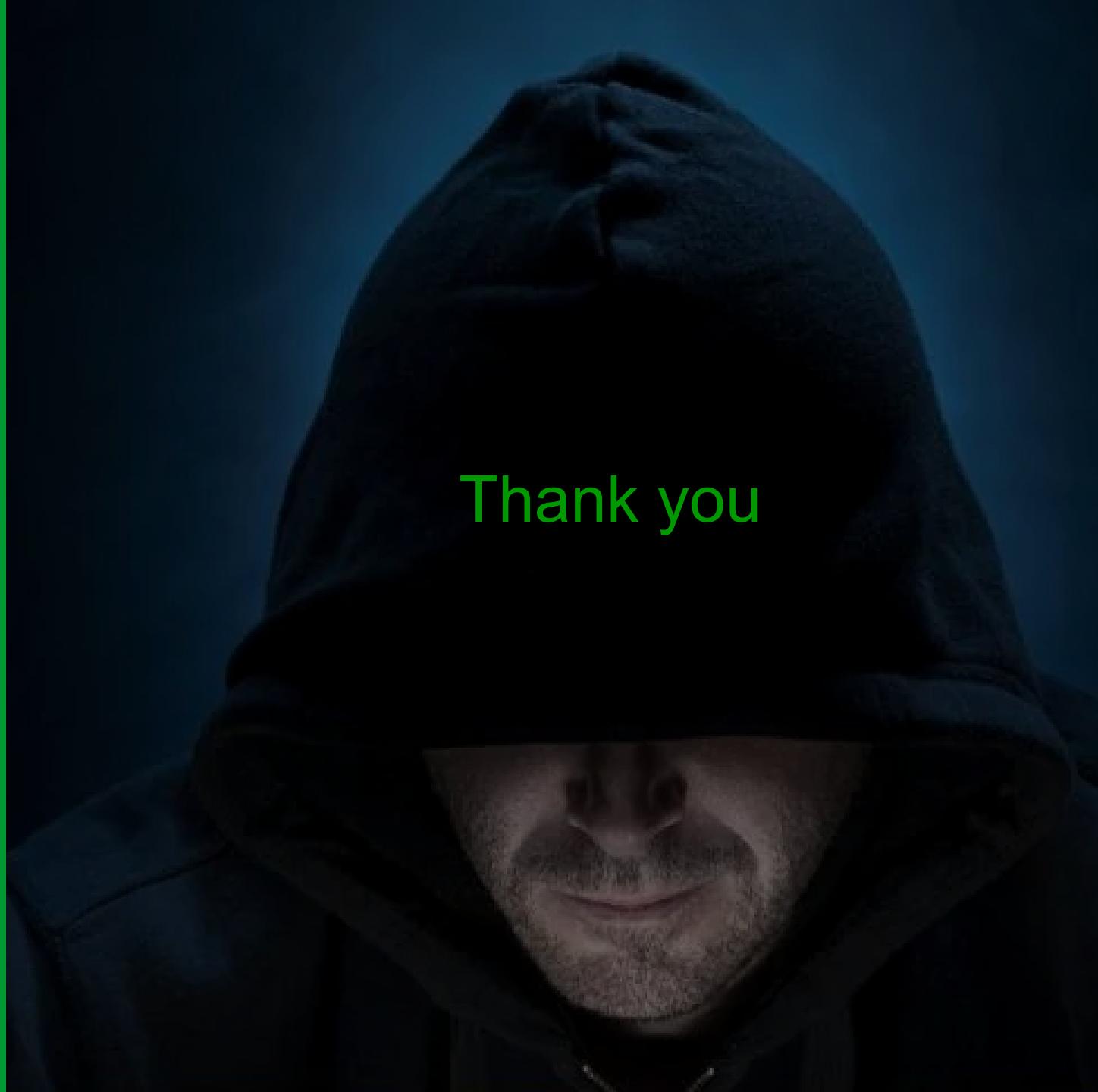


- 40 nodes/rack, 1000-4000 nodes in cluster
- 1 Gbps bandwidth in rack, 8-10 Gbps out of rack
- Node specs: 8 cores, 16 GB RAM, 8 x 1.5 TB disks, no RAID

Typical Hadoop cluster environment

Exercise

- 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



Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com