

# Co-Location Data Centres

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October 2009

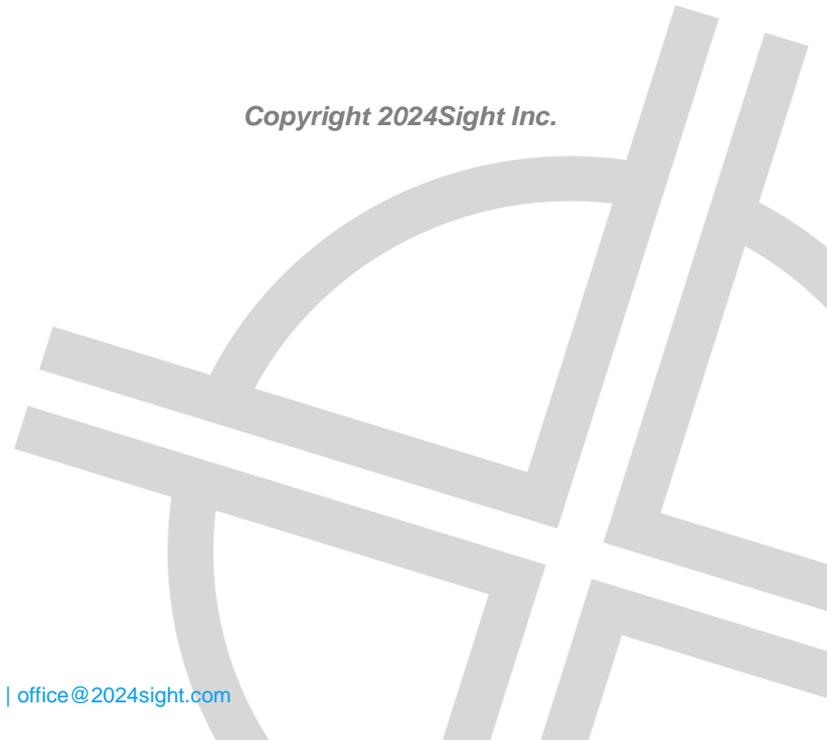


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# Introduction

The growth and popularity of digital media has created a new set of challenges for today's web-based businesses. The quantity of content and large file sizes have dramatically increased, along with the consumer's expectation for a richer web experience, driving rapid and unpredictable growth in site traffic. Traditional delivery methods are less effective, more costly, and increasingly risky for end-users. Furthermore, in the near future content delivery networks are expected to put additional strain on the global networks and add to the growing data traffic.

Increasingly, organizations are recognizing the benefits of co-locating their mission-critical equipment within a data centre. Co-location is becoming popular, because of the time and cost savings a company can realize as result of using shared data centre infrastructure, a very important factor especially at times of economic constrains. Benefits of scale result in large co-location data centres around the world with companies like Amazon, E-BAY, Microsoft, Google and Facebook amongst the heaviest users.

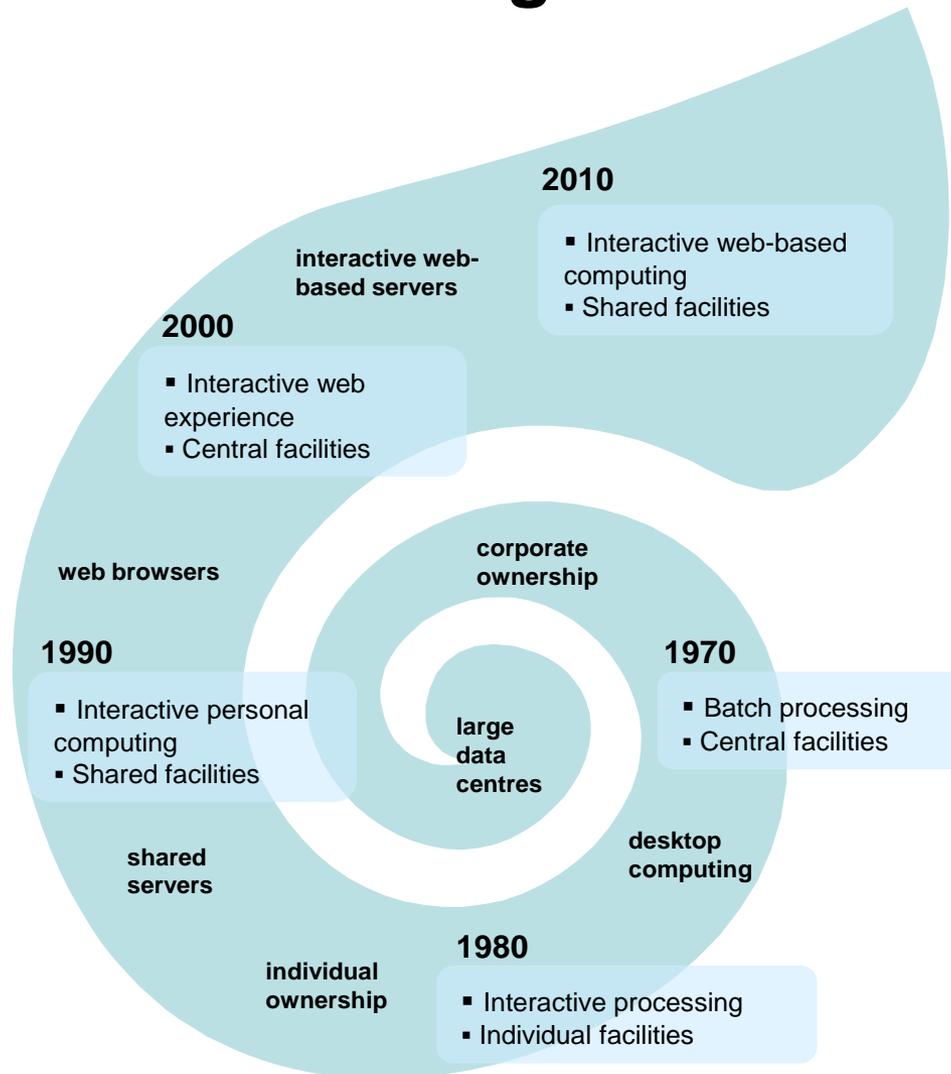
In addition to telecommunications-, internet-, application service- and content providers, increasingly enterprises look at co-location data centres, where IT and communications facilities are in safe, secure hands, and where the end-user enjoys less latency and the company gains the freedom to focus on their core business.

Whilst co-location data centres are principally about outsourcing parts or all of a company's physical IT and communication needs, the next level of outsourcing has already arrived, 'cloud computing'. This is a style of computing in which dynamically scalable, virtualized resources are provided as a service over the Internet and where the physical location of the asset is less relevant. For Cloud Computing to succeed high levels of security, continued power supply, adequate cooling and reliable communications are the challenges.

As a result of all of these developments the competitive landscape of data centres and data centre operators is constantly changing, thus creating a myriad of untapped opportunities for operators in the Middle East, especially since the large data centres are presently located in Europe and the US. Coverage for the Middle East, Asia and Africa remains patchy despite several investments in 2009 and 2010 and relays on a few long-haul sub-sea cables to provide the connectivity to the data centres of the world.

With customers in the developing world of the Middle East, Asia and Africa leapfrogging radio, television and telephone and using personal computers and mobile phones to access entertainment and information, the information and entertainment needs of these regions is expected to explode, thereby justifying the case for an increased number of data centres and further investment in subsea cables and connectivity to and from as well as within the regions.

# Historic Background



Since the inception of the computer shortly after World War II systems computer systems have been operated out of specialised government or corporate data centres with highly qualified staff maintaining and securing them.

It was genuinely believed at the time that the world would only require 5 computers (a quote attributed to Thomas J Watson, IBM, 1943) and that they would have to be located in centres close to the railways to facilitate the logistics of delivery of the punch cards. Hence, one could conclude that only 5 data centres would be required world-wide. While this believe was rapidly proven wrong, computer systems and their associated data centres largely remained the prerogative of governments, large corporations and universities. Only they had the financial muscle and staff to build and operate such facilities.

During the 60's mini-computers were developed. While still the size of a of today's racks, they were small enough to be used widely outside data centres. Typical applications on these computers included process control in manufacturing. Mini-computers started to erode the position of data centres, but it wasn't until the 70's that the large data centres really came under threat.

During the mid-70's the first personal computers found their way onto the market, followed in the early 80's by the IBM PC and the personal productivity tools punted by a little known company, Microsoft. The days of centralised control and large data centres seemed over. Instead the user was in control and fully responsible for maintenance and security of their desktop systems.

In the mid-80's computing evolved further with the development of client server computing to satisfy requirements for certain data and systems to be shared and available centrally. Client server computing has been largely enabled by the advent of the UNIX operating system, a system that in various guises is still one of the mainstays of the internet, although many mainframe based applications were reinvented as client server applications with the mainframe as the giant server. Servers required a managed and secured environment, which was typically provided by reinvigorated data centres.

# ... and Future Developments

In the early 90's the next computer craze conquered the world, the world wide web, seen by many mainframe buffs as the return of, albeit fancy, so-called 'green screens', a reference to the display systems used by mainframes until the 80's. The world wide web requires large amounts of server power and storage, provided by server farms, installed in ever larger data centres. Increasingly those data centres were and are not owned by the operator of the server farms. Instead server farm operators rent space in co-location facilities, frequently owned and operated by telecommunications carriers or specialised data centre operators (carrier neutral).

A few years into the 21<sup>st</sup> century, with what has been dubbed the Web 2.0, applications which have since the mid-80's been thought of as the exclusive domain of the personal computer, have also started to move to servers and thus data centres. Examples include GoogleDocs and Citrix. This move has only just started and still has a long way to go.

During the last 15 to 20 years corporations but small and mediums sized enterprises (SME's) have been building large number of private data centres. Information Technology departments have seen their empires grow with growth of the business. Having said that, IT departments are often criticised by their business sponsors as 'not business aligned'. And then the economic crisis arrived.

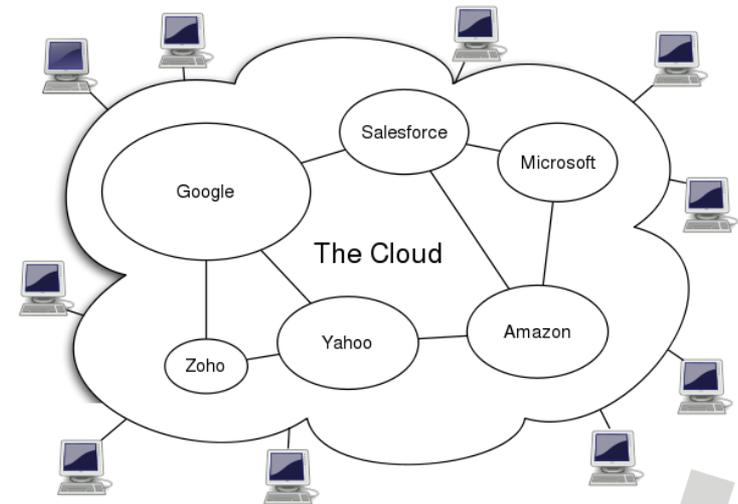
It appears that many CEO's and CFO's are actively considering whether IT in its current implementation form is strategic to the business. In particular, businesses want IT to focus more on business aligned opportunities while cutting its cost base while maintaining or improving the service level.

As the internet and communications are getting more ubiquitous by the day and will soon be available everywhere, including in-flight, it seems inevitable that IT services and non-differentiating applications may very well be provided by generic, cloud-based computing services.

Amazon, Google, Microsoft, IBM and SUN to name but a few have all launched services in the last few years that allow users to move applications into completely managed, virtual server environments on which many standard application are provided by default. In addition, the user can install their own applications, create his own databases and use storage as required.

But it is not just the corporate world that is seeing large changes. The entertainment industry is impacted by the advances of the Internet-enabled world. Gaming applications are increasingly networked and there is a threat to the traditional gaming PC and console from the unlike direction of 'Thin Clients'. Offerings by OnLive ([www.onlive.com](http://www.onlive.com)) and AMD (Fusion Render Cloud) point in the direction of server-based gaming.

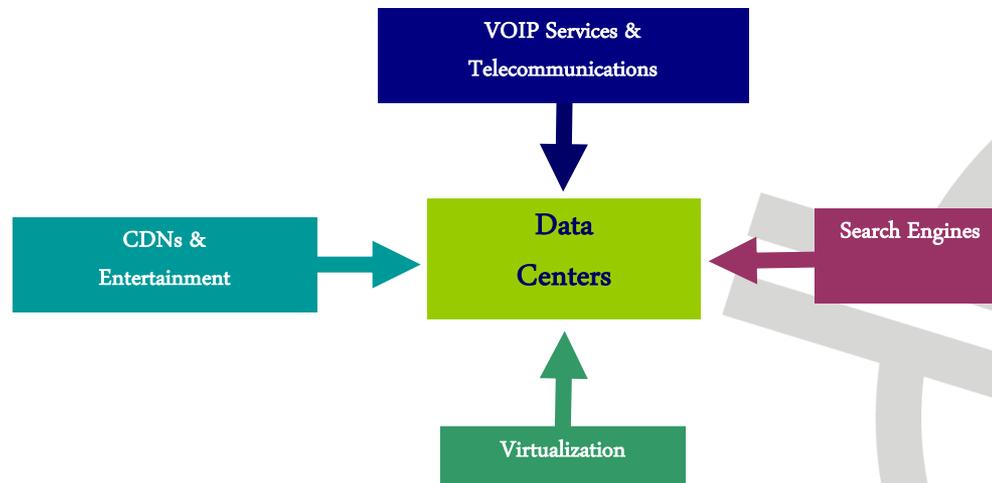
More traditional forms of entertainment too are under pressure. The music industry is being decimated by the advent of on-line music sales but the biggest threat of all appears to be the Content Delivery Network (Source: The Diffusion Group). Many large internet powers, including Google and Time Warner, have announced their entrance into the Content Delivery Network (CDN) space. It is estimated that by 2013 80% of all internet traffic will be video (Source: Cisco) while internet traffic itself seems to still be responding to Moore's Law, i.e. it doubles every 18 months.



Source: Wikipedia, Sam Johnston 2009

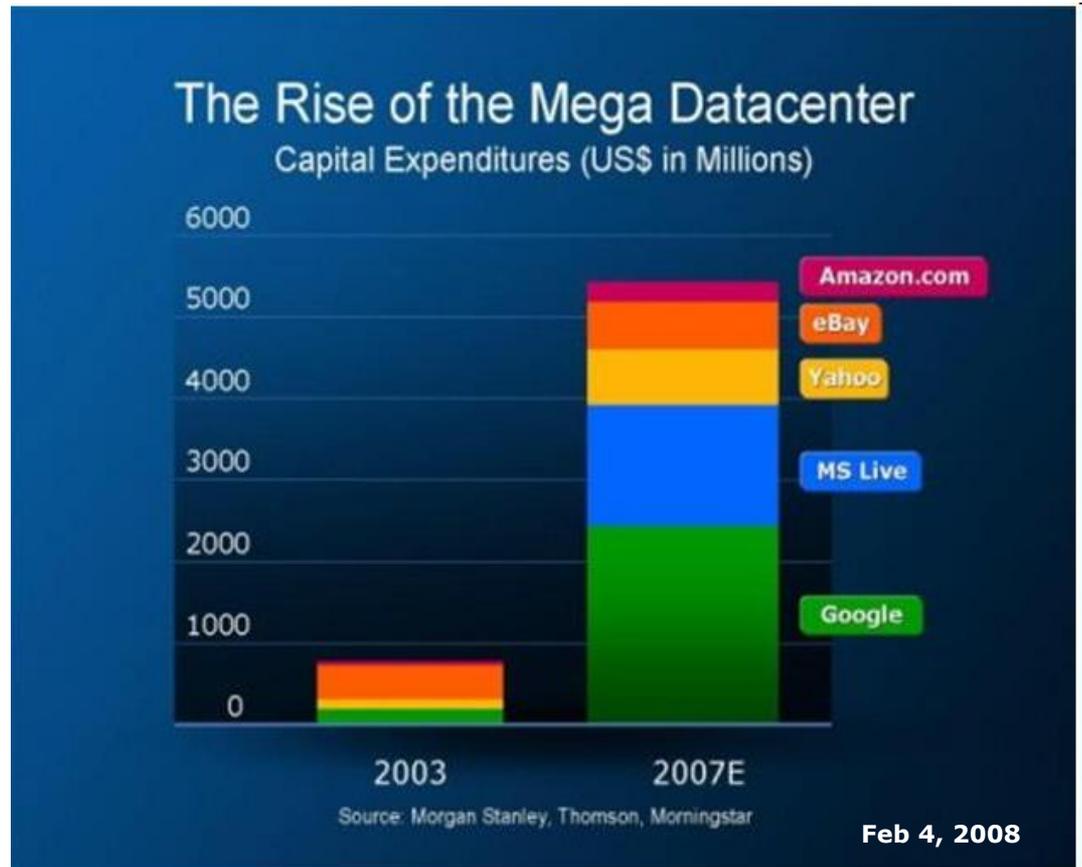
# Data Centre Demand Drivers

- Corporates, and possibly governments, will increasingly look to outsource their data centre operation by using co-location facilities as pressures on their IT organisations increase to streamline and become more business aligned. The increasing use of Business Analysis tools, which require increasingly large databases, sometimes reaching sizes of multiple Petabytes ( $10^{15}$  Bytes), is of particular interest.
- Corporates and governments will also consider the use of virtualised servers to provide their bread-and-butter applications and storage while focusing their slimmed-down IT department exclusively on strategic applications.
- Search engines are still increasing their global reach and require server capacity and thus data centre space relatively close to their user base.
- Telecommunications services will likely change. We assume that over the next few years telecommunications providers will increasingly virtualise their services, and will instead of building large exchanges, start using local and regional existing data centres. In the process they will likely unburden their balance sheet and release enormous amounts of capital, as most established telecommunications providers have significant real estate assets.
- Voice of IP services and alike, I.e. SKYPE, ooVoo and others, have traditionally relied on grids of personal computers, but are no longer able to do so as a result of increased global demand. Thus these types of providers will likely start seeking data centre space to extend there server networks.
- CDN's (Content Delivery Networks) have only just started to come to the table. By 2013, Cisco expect Internet traffic to reach 56 Exabyte per months, up from nice Exabyte in 2008. More than 90% of this increase will come from video. It will be the CDN business that will require data centre space more than any other player in the market.

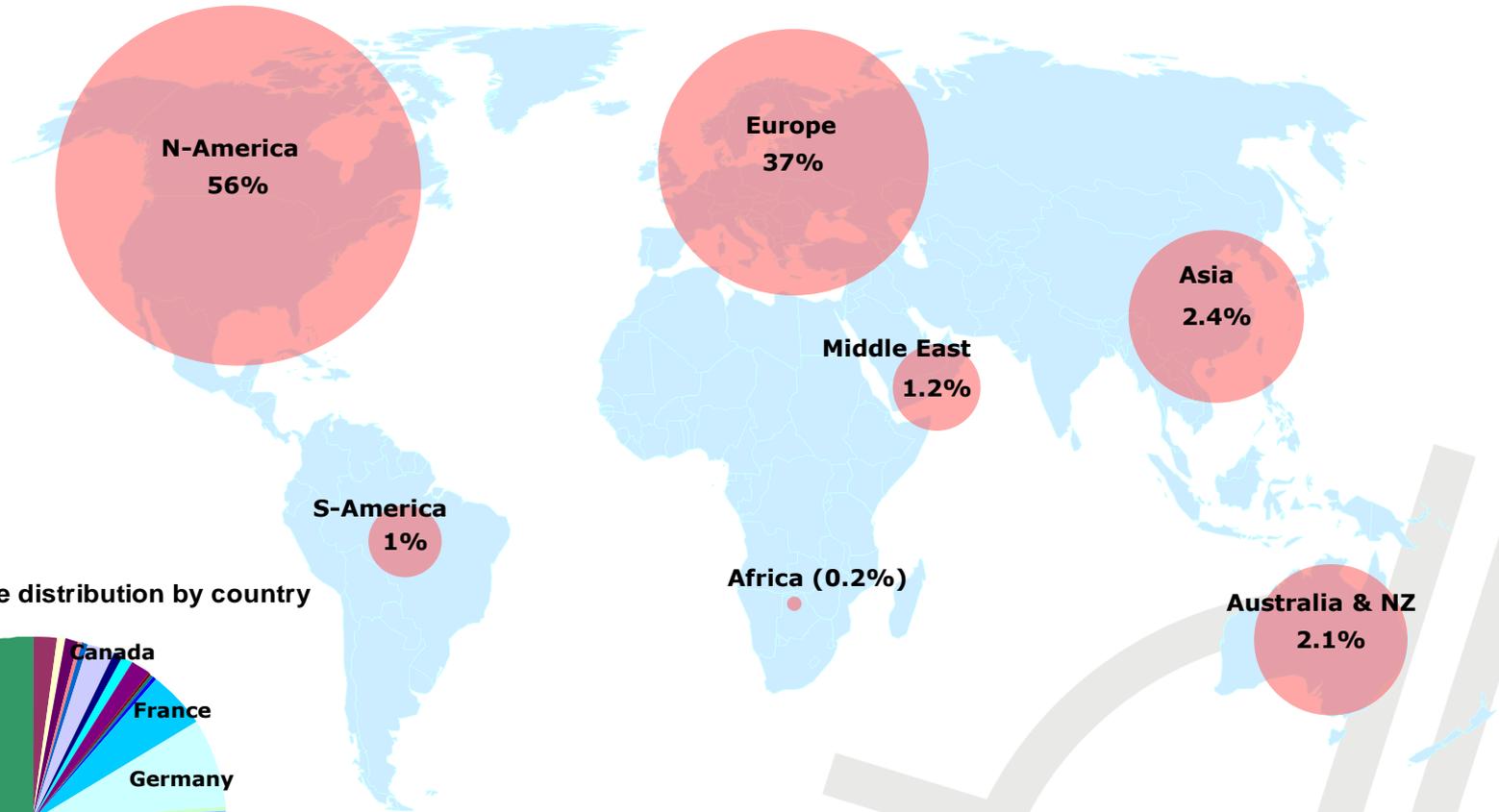


# Data Centre Growth & Data Warehousing

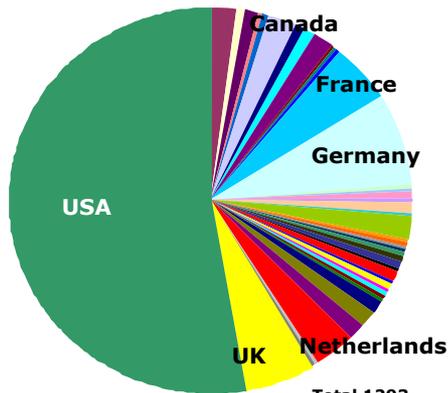
- Size and capacity of data centres have risen steadily over the past years with super users such as e-bay (5 pt bytes), Wal-Mart (2.5 pt bytes), Bank of America (1.5 pt bytes), Dell (1 pt byte), Facebook (2.5 tr bytes), as well as Google, Microsoft, Amazon, Yahoo, Wal-Mart, Tesco and others.
- Capital expenditure has increased approximately six-fold in the four years between 2003 and 2007 as has the amount of data stored.
- Teradata, Greenplum, Aster Data are amongst the leading data warehousing DBMS providers. Greenplum and Aster Data provide in-database support for MapReduce technology. Runners-up are companies such as, Exasol and Calpont.
- Hadoop is the open source implementation of Google's MapReduce (used by e.g. Facebook and Yahoo), an important component to enable large data warehousing.



# Global Distribution Co-location Data Centres



Global data centre distribution by country



Total 1293  
Source: datacentermap.com

Source: datacentermap.com, 2009

# Co-Location Business Models



The majority of co-location data centres are carrier neutral. Service offerings range from office space over suites, cages, racks and footprint to hosted, dedicated and virtual servers.

Customers are government bodies, financial institutions, healthcare, small and medium enterprises, private entities for data hosting and management as well as connectivity (web hosting).

Most data centre operators offer flexible solutions catering for a wide range of customer needs, ability and comfort levels (data and physical security, as well as perceived reliability). They offer hands and eyes, managing backups security, emergency services and consultancy. To expand the connectivity into other markets and follow customer needs strategic partnerships and alliances with data centre operators in other countries and across continents have appeared.

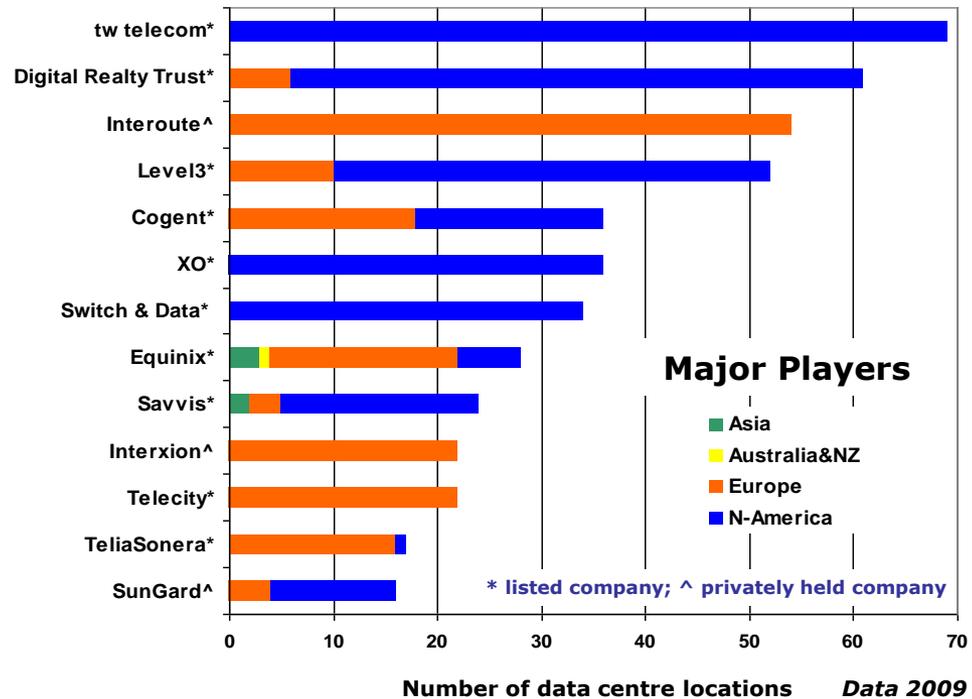
Special services or tools are available with selected suppliers, e.g. Child Safeguard™, an application free for all TeliaSonera customers, helps reducing the proliferation of child sexual abuse images and videos on the internet, in cooperation with the Internet Watch Foundation.

The first co-location brokers have also come into existence, i.e. 'The Collocation Exchange', based in the U.K.

# Players

Over the last years a myriad of small data centre operator have sprung up across the world owning and/or operating one or two data centre locations. Amongst the more than 600 co-location companies 75% operate one data centre location only. 20 % of all companies operate between 2 and 5 data centre locations. Small players and individual players tend to be represented only in one country, sometimes reaching out to the neighbouring country.

Less than 5% of all companies own or operate 6 or more data centre locations. Major Players are those with 16 or more data centre locations. Mid-sized players own or operate 6 to 15 data centres.



North American based companies are mostly domestic operators, where few have ventured into Europe. A possible explanation for the lack of expansion beyond North American borders is the cavernous domestic data centre appetite, thus rendering expansion beyond borders unnecessary to achieve healthy growth rates. In contrast European players are by nature regional operators and have locations in several European countries under different jurisdictions. Several European operators have reached out to Asia, the Middle East and Australia through ownership or strategic alliances.

Asian, South-American, African and Middle-Eastern data centres are generally operated by smaller, individual companies with the notable exception of Etisalat of the United Arab Emirates, which operates 8 data centres in 2009.

Larger North American companies are generally publicly traded as are several mid-sized players. However, many started as privately held companies in the late 90s and went through an IPO in later years. Examples are:

- Peer1 started in 1999 and has publicly trades since September 2008.
- Savvis started out as DiamondNet in 1995 and IPO-ed in September 2000.

Several large European players and mid-sized US players are privately held:

- Interoute and Interxion, Telx, Sungard, Peek10, MTI, CRG West and Tinet (formerly Tiscali) are all owned by one or a consortium of private equity companies.

# Super Data Centre Users



**Microsoft**<sup>®</sup>

- Microsoft's new Windows Azure cloud developer platform is powered by its data centre in Quincy, a 470,000 square foot facility in central Washington state.
- Microsoft will begin providing on-demand access to the full versions of retail video games. Titles can be downloaded through the Xbox Live online gaming service (more than 17 mill members). The growth of these type of bandwidth-draining services has been a major driver in Microsoft's decision to build its own content delivery network.
- Kevin Timmons, previously the head of Yahoo's data centre team, has joined MS to lead its Data Centre Services organization (June 2009). This is the 6th executive/senior researcher from Yahoo joining Microsoft within half a year.



**IBM**<sup>®</sup>

- IBM's global cloud computing initiative features Cloud Computing Centres in Dublin, Ireland; Beijing, China and Johannesburg (SA).
- IBM and Novell in close collaboration with Intel are driving an approach that will deliver greater agility in your data centre. This interactive session aims to bring together key industry players to present a more intelligent approach to managing your data centre.

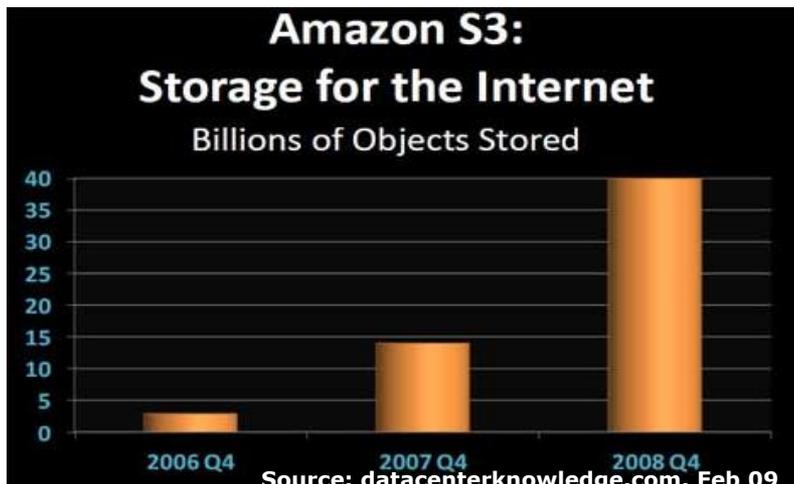


**eBay**<sup>®</sup>

- EBAY's Teradata data warehouse has 2 petabytes of user data, 10s of 1000s of users, millions of queries per day and 72 nodes.
- Its Greenplum data warehouse includes 6.5 petabytes of user data , 17 trillion records and 150 billion new records/day (which seems to suggest an ingest rate well over 50 terabytes/day), 96 nodes, 4.5 petabytes of storage capacity.

- Amazon's data centres (15 in 2009 and more planned) are located in:
  - USA: Ashburn, Virginia (owned by Digital Realty Trust), Dallas/Fort Worth, Los Angeles, Miami, Newark (NJ), Palo Alto (CA), Seattle, St. Louis
  - EUROPE: Amsterdam, Dublin, Frankfurt, London
  - ASIA: Hong Kong, Tokyo.
- Amazon's next data centre project is a \$100 million data centre in Boardman, Oregon.
- The company recently announced that AWS (Amazon Web Services) will soon be launching a content delivery network.
- Amazon uses an Aster Data database for its data warehousing.

- Google has 19 data centre locations in the US, 12 in Europe, one in Russia, 1 in South America, and 3 in Asia
  - Specific locations in the US include Lenoir (NC); Pryor (OK), Council Bluffs (IO), Goose Creek and Blythewood (both SC).
- There is notably white space in the ME and Africa, and in Asia and Australia.
- Google sometimes leases space in other companies' data centres.
- Expenditure on data centres: \$1.9 billion in 2006 and \$2.4 billion in 2007.
- Google Inc. opened a data centre last year near Lenoir in the western North Carolina foothills. In 2007, state and local governments offered Google an incentives package worth up to \$260 million over 30 years, one of the largest in state history, to land the \$600 million data complex.



# Final Remarks

- The co-location data centre landscape is constantly changing and developing. Africa for example stands out as a white continent with little internal connectivity and only a few major subsea cables along the coast. Since mid-2009 the east coast of Africa has seen the installation of two new cables and is now much better connected to the Middle East, Europe and East Asia. The huge market potential has been a great incentive for European players, for example UK-based Interoute, to invest in subsea cables and to play a key role in driving the opening of the African continent. For these latest cables fibre-optic technology is used generating digital super highways connecting Africa to the rest of the world. In particular Africa has seen a phenomenal increase in demand for internet connectivity, with users rising by 1,062% from 2000 to 2008 (\* Source: Internet World Stats, 21 December 2008).
- While the greater connectivity moves business operations to the internet, it becomes absolutely essential for businesses as well as individuals to understand and manage the legal and security challenges.