

THE “NEW” INTERNET:

NEXT-GENERATION CAPABILITIES ENABLING AN EVER-INCREASING SET OF APPLICATIONS

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INTRODUCTION

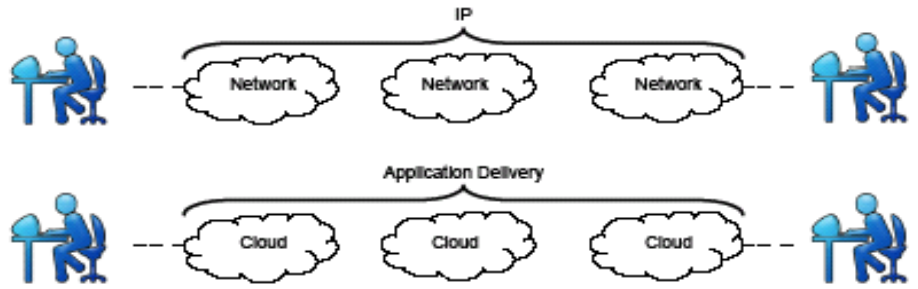
The Internet, as we came to know it beginning in the mid-1990s, has continued to evolve and now offers an entirely new set of capabilities and applications. The Internet of ten years ago, while fascinating and useful, has developed into an expansive, intelligent infrastructure enabling productivity enhancements for businesses and consumers, as well as a seemingly ever-increasing set of applications. Effectively, the way people use the Internet today has changed dramatically from how they used it ten, or even five, years ago. This evolution continues and sets the stage for a range of investment opportunities today and in the coming years. There are three primary themes and massive shifts underway today, that each play a major role in the evolution of this new Internet – the proliferation of cloud computing, the mobile Internet revolution, and virtualization.

PROLIFERATION OF CLOUD COMPUTING

“Cloud computing” is simply the notion of a user accessing data and applications that reside on the Internet – not on the user’s own computer. Throughout the development of the personal computer (PC) industry, each computer would be loaded with software applications, and these programs would run “locally” on each computer. As the Internet has evolved, more and more companies are offering applications that run “in the cloud”, or on the Internet. This frees up a consumer or an employee of a company to access applications and data from wherever they are, no matter which computer or access device they are using.

The diagram on the following page illustrates the parallels between how the Internet used to be – a set of networks connected via Internet Protocol (IP) to transmit data – and how it is evolving. Today, the Internet is becoming a network of “clouds” delivering a broad set of applications.

Figure 4: The Parallel Between Application Delivery and IP Routing



Source: J.P. Morgan

The network infrastructure continues to be implemented and upgraded to accommodate these cloud-based initiatives, and as a result, cloud computing continues to proliferate and gain popularity. Consumers and businesses are increasingly demanding access to their data and applications remotely, through mobile devices, loving the flexibility – and cost effectiveness of the new business model. Whereas in the “old” model, businesses and consumers had to purchase software up front and load it on their PC, now users can subscribe to a service – the notion of “Software as a Service”, or SaaS – and access their data and applications from any device with Internet access. This notion opens a large opportunity for new business formation and many of the old leaders in the software industry are forced to adapt or potentially be surpassed by the “new” way of doing things – a very old concept and process in the business world.

THE MOBILE INTERNET REVOLUTION

It is pretty clear as you look around today that the Internet is now a mobile phenomenon. With the introduction of the “smartphone” – typically a mobile phone with email, camera, music, and Internet browsing capabilities – the window opened very wide and very quickly to a whole new industry. The Apple iPhone is the most impactful, clear example of this evolution. The iPhone has redefined how people use their mobile device, and it has had an amazing impact on everything from wireless networks to the Internet, cloud computing, and it effectively created the entirely new industry of mobile applications, affectionately called mobile “Apps”.

A growing list of new mobile devices – including smartphones, tablet devices (such as the iPad and new products on the way), and eReaders (such as Amazon.com’s Kindle) – has given consumers access to a new world. This access and the consumer’s desire to use this growing set of applications results in exponential growth in the amounts of data that are transmitted across wireless networks. “Mobile data”, as it is called, is on an impressive growth trajectory and is forcing carriers like AT&T, Verizon, and others to re-think

Figure 10: AT&T's mobile broadband usage

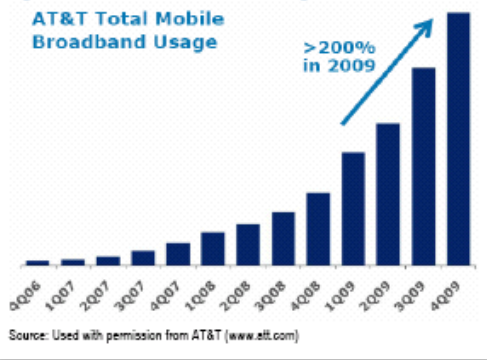
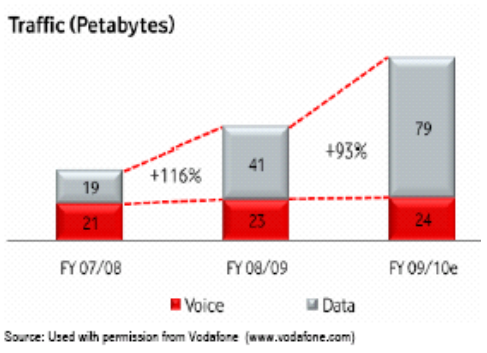


Figure 11: Vodafone Europe traffic growth

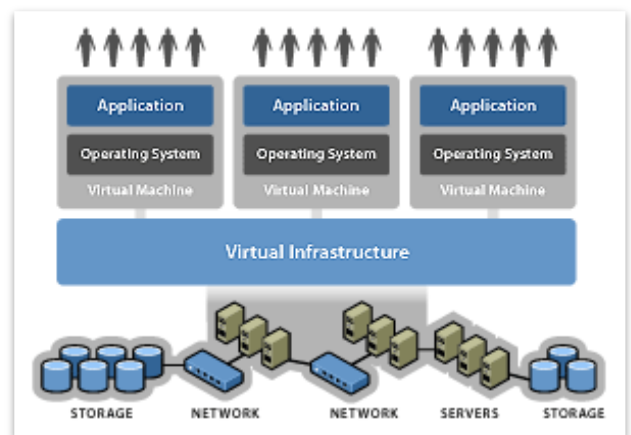


their wireless networks and aggressively expand capacity so they handle this quickly increasing demand and strain on today's networks. This provides numerous opportunities for suppliers of network infrastructure, as well as many of the requirements that the "new" Internet demands.

VIRTUALIZATION

Another key transition underway today is the virtualization of datacenters and servers. A simple way to describe virtualization is the notion that through software and hardware, a single physical server can be turned into a large number of "virtual" servers. Historically, a server might be dedicated to a certain task, application, or location.

This oftentimes results in a vast underutilization of each server, leaving large amounts of unused, high-cost resources or capacity on the table. Today, through the use of virtualization, a small number of servers

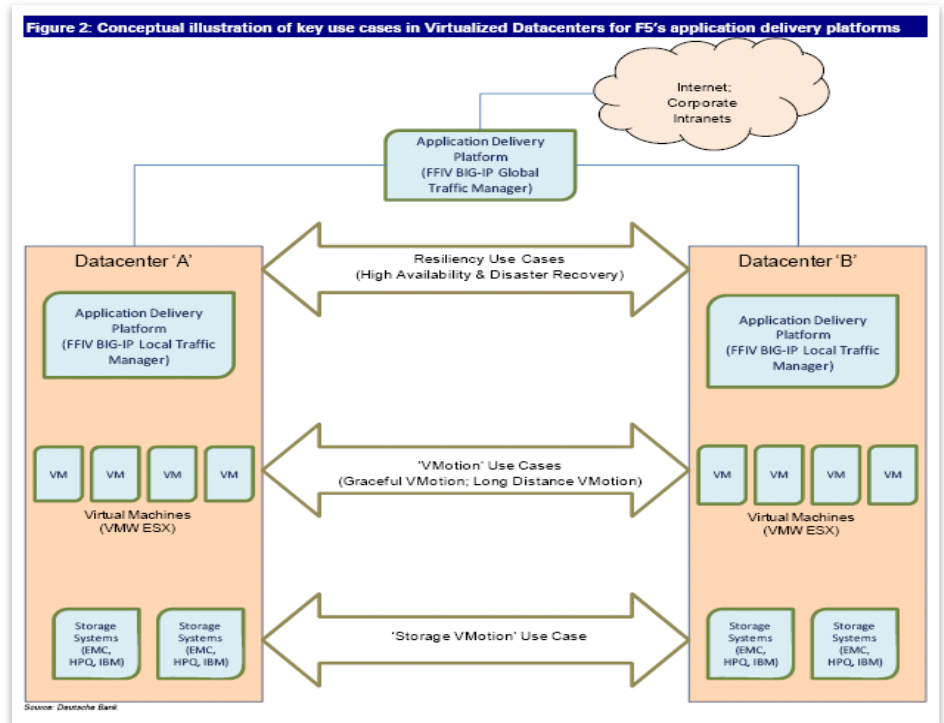


can effectively be turned into a much larger number of servers – perhaps by orders of magnitude – and these physical resources can be much more efficiently deployed.

Because of the intelligence of the software and new hardware being used, the user has no idea he is using a "virtualized" server, because it is made to look just like a traditional physical server. Datacenters – essentially large farms of servers – are increasingly going the virtualization route to maximize their capabilities, resources, and their cost, and it is opening the door to new opportunities and capabilities. Some estimates state that the utilization of today's servers stands at only 15%. This is an immense waste of resources. Virtualization promises to take this utilization toward 80%, potentially. Virtualization also creates a much more flexible, intelligent, and capable network, that enables the themes discussed in this white paper. To accomplish this feat, new software and hardware capabilities must be implemented throughout the network, representing growth opportunities for numerous suppliers.

As an illustration of how a virtualized datacenter looks, the diagram on the next page (based on F5 Networks', VMware's and several other

companies' technology) attempts to simplify the architecture. At the bottom, you have the servers and storage devices, then the “virtual machines” at the next-higher level, and the top layer is the application delivery platform, which is the interface to the Internet. The concept of virtualization is still relatively early in its evolution, and should provide ample growth opportunities in the coming years.



CONCLUSION AND INVESTMENT OPPORTUNITIES

The Internet is evolving, and the technology implemented to accomplish and further this evolution will continue to be in demand in the coming years. Some of the fastest-growing areas of the technology sector today are driven by the themes discussed above. We anticipate that this will continue to be an important growth area and investment opportunity in the coming years. We see investment opportunity in the following areas.

- ❖ **Network infrastructure** – New hardware and software capabilities are required to achieve the intelligent, interactive, and flexible networks described above.
- ❖ **Software-as-a-Service (SaaS)** – A new generation of software companies is utilizing cloud computing to deliver its applications across business and consumer segments. These companies can offer superior growth and rapid adoption versus traditional software companies in many cases.

- ❖ **Mobile devices and applications** – The companies designing, producing and supplying the newest successful mobile devices, and the applications that run on them, offer exciting growth opportunity and can lead the direction and development of how the Internet is used.
- ❖ **Multimedia applications and content creation/delivery** – As all of these new mobile devices utilize the new capabilities of the Internet, the content becomes critical in who will win. Companies developing innovative content creation, delivery, and other applications, can represent a key piece in the puzzle, and drive strong growth.

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