Employing SaaS and Cloud Technologies to Create an Internet-Based Cloud Computing Model for Personal Computing

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The paper will explore the technologies necessary to move the Internet Service Provider (ISP) away from a purely logistical role, to that of a true service provider in the same vein as cellular companies. Basic service offerings can be upgraded with the addition of premium content in the form of increased performance or packages of premium services. In addition to considering the technological requirements of such a system, it will also be necessary to acknowledge the dramatic shift in IT such a system would require and in some cases prompt.

Software as a Service (SaaS) will provide the framework on which the ISP will build their individual "Internet Packages." Selected groups of Internet and cloud-based offerings, including options such as gaming packages or an upgraded office suite, can be bundled and then purchased much like a cable or satellite package. Combining this SaaS-style model with cloud processing allows the ISP to divorce most of the processing requirements from the hardware itself. Removing the hardware consideration will allow the ISP to provide a line of dummy (or not-so-dummy) terminals, which customers choose from, much like a cell phone plan.

Virtualized desktops will provide the user with their familiar applications and Internet service options as a single unit. Services, such as Google Docs or Netflix, will be presented as if they were traditional installed programs, giving the user a familiar face to interact with. The fact that these programs will in fact be cloud or Internet based activities will be invisible to the casual user, reducing any anxiety from less tech-savvy customers. Alternatively, a savvier user could interact with his or her services through a customizable homepage providing a workspace which replaces the traditional GUI desktop with a series of panels and widgets.

By hosting all of the software and processing requirements that a customer requires inside a cloud, it will be possible for the ISP to provide a unified view to the end-user regardless of their access point. A cloud-based service removes the need to provide separate services for computers and smartphones. Content can simply be reformatted to accommodate the specific hardware, thus allowing the user access to all of their files and services independent of platform.

To support this type of Internet service it will be necessary to invest heavily in the development of clouds large enough to support this level of demand, and an infrastructure capable of carrying such a demand. Additionally, it will require a shift on the part of software providers, away from the individual customer, and toward an adaptation of the enterprise model as software becomes more SaaS oriented.

While the deployment of a service-based Internet is unlikely in the short term, a move to hardware-independent ISPs is the next logical extension of America's service-oriented media model.

Software as a Service, SaaS, Infrastructure as a Service, IaaS, Cloud Computing, Service Oriented Internet, SOI

I. INTRODUCTION

To overcome the "Digital Divide" and continue to increase market size, it is necessary to rethink consumer, or home, computing. The computing paradigm has to shift away from a hardware-centric world view towards a more service-oriented approach. The focus on ever increasing processor power and RAM has created a distorted view of system requirements among the average users. The typical consumer believes that it is necessary to use a top-of-the-line desktop to support even the simplest activities. This misperception has been a boon to the hardware industry, but its perpetuation is a disservice to the user community. Already there have been moves to make software more accessible to the average user and it is time for hardware to follow.

Rather than focusing on the hardware requirements of the most demanding users (computer science professionals and gamers), instead consider the needs of the average consumer. The average user treats their computer as a glorified web terminal most of the time. A smaller portion of time is devoted to such activities as word processing, photo/media management, and casual gaming. The programs that these users rely on often require little hardware, and in fact may already exist as web applications. However, these same users have been convinced that only the newest multi-core system will be able to handle their workload. What's actually needed is a system that delivers the desired services to the consumer in a transparent manner with the minimum hardware necessary.

Before a system can be created in practice, it must be defined in theory. It will be necessary to establish an understanding of how current cloud technologies fit into the model. After that the larger business model needs to be fleshed out to provide a plan for profitable implementation. Finally, while enumerating the advantages of the model is significant, it is more important to acknowledge the challenges to success and plan how to overcome them.

II. Definitions

Service-Oriented Internet (SOI) is the evolution of the computer industry to keep pace with the way consumers actually use technology. SOI does not rely on the invention of new technologies; instead it is the reinterpretation of current business solutions for the average user. Cloud computing, software as a service, and increasingly infrastructure/platform as a service have been adopted by some businesses in order control costs and gain access to technological resources without staggering hardware costs (Carr, 2011). These same principles can be applied to the personal computing market.

The cloud computing industry is still in its infancy, and so terms are often used in a variety of ways with varying definitions. So before an actual SOI definition can be proposed, it is necessary to pin down how the four main components will be considered.

Software as a service (SaaS) represents the ability to lease software from a company without actually needing the resources to run or install the software itself (Tolliver-Nigro, 2009). All of the processing, and the application itself, are hosted off-site, usually by a third-party, which the client accesses according to a Service-Level Agreement (SLA). Infrastructure as a service (IaaS) is the ability to utilize remote servers as a flexible source of processing power and storage. Platform as a service (PaaS) is currently defined as a remote, platform independent environment for the development of applications (Misra & Mondal, 2011).

The definitions of SaaS and IaaS are appropriate and will stand unmodified, but it will be necessary to bring the definition of PaaS into alignment with the common usage of the word platform. With the deployment of a consumer focused cloud computing model, it will be appropriate to refer to PaaS as the actual virtual operating system deployed to subscribers. In this way the line between infrastructure and platform will be blurred into a single package representing both the IaaS and PaaS SLA for a given consumer, in much the same way we refer to a physical processor and OS in a standard computer.

Misra and Mondal (2011) noted that cloud computing can be defined as a “collection [of] disembodied services accessible from anywhere using any mobile device with an Internet connection, provided by a ... system of virtualized computers that are interconnected and that can be dynamically provisioned and presented as one or more unified computing resources ” (p. 506). This definition closely mirrors the definition of SOI. In fact, it is only the emphasis of the Internet in SOI which distinguishes the two.

In the development of recent MS Office applications and Windows 8, Microsoft has decided to anchor menus around the actual actions of its users (Adhukari, 2011). In the same way SOI anchors the entire cloud computing model around the core consumer “application”: the Internet. Traditional models of cloud computing seek to replace activities which are relatively computationally intensive. The SOI paradigm approaches the question from the position of supplemental processing as opposed to replacement. Since most of the subscribers' time is spent surfing the Internet over an established system of web servers, it is unnecessary to deploy SOI servers or services to support this activity. SOI providers will instead focus on providing and codifying all other user processes to ensure a complete, quality computing experience to the subscriber.

The evaluation model proposed by Misra and Mondal (2011) favors the processing and security profile of the SOI architecture. Since the major consumer activities will be handled by current server resources, it will only be necessary for SOI server farms to handle low loads with varying spikes in processing demand. This type of variable processing load is seen as a good candidate for cloud migration. Security concerns in the SOI are high, and will be considered in depth later, but critical information is distributed across a number of secure networks which mitigates the possibility of massive data loss through a single attack. This combination of processor load and low overall security concern makes individual consumers ideal candidates for a cloud solution.

Gathering together all of these individual pieces allow the creation of a simple, working definition for the Service-Oriented Internet:

A consumer centric cloud computing model that utilizes current web applications and resources to (a) reduce the level of new technology and infrastructure necessary to implement the cloud; (b) reduce the processing load of the cloud servers; and (c) create a business model with immediate feasibility

III. What does a SOI look like?

The SOI environment should be transparent to the end-user. Despite the fact that most of the SOI content is provided by or geared towards the Internet experience, the main user interface will be based around the traditional desktop. The icons will link to web applications instead of files. The file structure will display the contents of the consumer's cloud storage rather than a physical drive. The user will be presented with a familiar landscape, but the underlying system will be operating from miles away.

The one caveat to this transparency will be the fact that the interface will at best be Windows-like to start. A true

Windows environment will likely remain an example of premier SOI content, since the

cost of developing a virtual Windows will inevitably be passed along to the consumer. The standard SOI "OS" will most likely be a proprietary derivative of Linux exclusive to the individual providers. Linux allows providers the freedom to develop an environment customized for their needs, while at the same time keeping costs down. Cost control is critical to creating a system that can be distributed for little or no cost, a key factor in mirroring the successful cellular phone sales model.

SOI is more than a user interface, the structure that it represents provides the possibility to develop bundles of services and target them at an audience. Choosing an SOI service will mirror the process of selecting a cable or satellite carrier. Consumers will have the option of selecting bundles of content (gaming, entertainment, applications, subscriptions, and apps) or select desired services a la carte. The particular services will be a collection of current services and new sources of content design to take advantage of the SOI format.

Gaming:

The gaming industry has a solid slate of services which are ready to be bundled. There are already hundreds of browser based games, ranging from casual puzzles to complex strategic simulations, which need only be bundled for sale or compiled into a central marketplace/hub. These games are already designed to take advantage of the SOI business model, and will serve as an excellent initial gaming option. Readily adaptable to this model are the many casual gaming services offered via social networking sites. Companies, such as Zynga (company.zynga.com), would simply need to offer a dedicated server resource independent of a particular social network. In fact, Zynga has already developed a "zTag" which allows users to connect with each other independently of their established social circles.

Another important existing resource is the cloud gaming site OnLive (www.onlive.com). OnLive is a true cloud/SaaS gaming model, depending on how the consumer chooses to interact with the site. Users can choose to either purchase a digital copy of a particular title, or to subscribe to a monthly service which allows unlimited access to a rotating collection of games. In either case, all processing is handled by OnLive's servers; the user simply provides the I/O. The service works independent of the users platform, and can even be extended to the television through a specially made "console". The OnLive model serves as an excellent example to any other gaming company interested in developing a SOI service. The most likely first movers are the MMOs whose activities already require vast server resources. Following them are likely to be extensions of digital gaming sources such as Playstation Network, Xbox LIVE, and Steam (store.steampowered.com). These services will require more time to transition to a server-based architecture, but they have a quality brand and are seen as 'in touch' with the gaming community. In addition to bringing their current line-up to the table, these services would most likely continue to be the preferred marketplaces for smaller developers.

The last to move, if they even bother doing an in-house SaaS, would be the remaining large-scale developers. It is likely that most designers will utilize third party marketplaces to distribute their games, but a few will follow in the footsteps of Steam. Some developers have already started to acquire companies that give them a toe-hold on the casual gaming market. Electronic Arts (EA) has recently added the social game developer KlickNation to its stable of talent (Ribeiro, 2011). They intend to combine the resources at KlickNation with the brand strength of BioWare in order to develop a new line of social gaming offerings under the banner of BioWare Social. Acquisitions such as these not only allow major developers access to current markets, they position them to quickly capitalize on a cloud computing model.

Entertainment:

The entertainment industry has a number of services available, and some exciting possibilities for new cloud applications. Initially the entertainment offerings will be dominated by the established streaming content providers such as Amazon (www.amazon.com/gp/video/ontv/start) and Netflix (www.netflix.com). However, there will be a great incentive for traditional premium channels to adopt their own streaming services in order to capture a new revenue stream by providing new content immediately after it premieres. These types of services are already beginning to appear. HBO GO (ww.hbogo.com) offers this type of content either through traditional channels or as streaming content. Eventually, the cable and SOI industry will become indistinguishable as the entire entertainment, sporting, and movie industry adopts a streaming architecture in order to maintain competitiveness in the home market.

Full Applications:

Full fledged applications will develop along the same lines as the traditional gaming industry, but there are some current web applications that can serve as a base. Some obvious early winners will be current office and photo services. There will always be a demand for applications to handle reports and spreadsheets that have to be completed outside of work, word processors for schoolwork, and photo managers to catalog and tweak the family's digital history. Google's Docs (docs.google.com) and Microsoft's SkyDrive (skydrive.live.com) will have the advantage of a strong brand and user loyalty, but smaller niche applications will be introduced to fill markets or provide an "independent" alternative. Flickr (www.flickr.com) and snapfish (www.snapfish.com) have long been considered the powerhouses of online photo management, but that market has quickly been invaded by pharmacy and big box store sites offering the same services. As we approach the inevitable adoption of a cloud computing model, sites geared towards more professional clientèle have appeared. In an attempt provide a more serious photo option Adobe has launched a site featuring on line versions of their Photoshop

line (www.photoshop.com). As the SOI model is adopted, more "premiere" services will be launched in order to provide a more professional level of application sophistication, or to maintain the quality of a brand, like Adobe Photoshop, in the new market.

Office and photo services only represent a small portion of the Internet's application offerings, but the process will be the same regardless of the particular application's content. Initially, the market will be dominated by the established services. The whims of the people, and leaps in innovation, will determine if these or other services will end up as major cloud players. But there is another side to the cloud. Since it is not necessary to host and market SOI services, it will be possible for smaller businesses to capture markets that may have been unavailable under the current model.

Subscriptions:

Since SOI is not tied to a particular device, there are incredible possibilities for subscription based services. Already we have seen an explosion of devices capable of running Amazon's Kindle reader software. Cloud computing removes the need to generate multiple compatibility versions of a provider, making it easier to appeal to markets on a reputation for quality rather than ubiquity. A whole host of periodical, music, book and other media services exist; ready to take advantage of the opportunity that the cloud represents. It has long been the marketing slogan that a digital subscription allows you to take your media anywhere; SOI represents the first time that it might actually be true.

Apps:

The app has quickly become an important part of the consumer software landscape. Flurry Analytics' Peter Farago (Farago, 2011) estimates total revenue of $1.9 billion in 2011 for the app gaming industry alone. These small, self-contained, efficient apps represent the ideal package to deliver targeted services to the SOI user. Whether it is the newest casual gaming craze or an app for comparing the efficiency of appliances, the app format has captured consumers' desire to have a suite of services which address their individual needs. This need for a truly personalized computer will flourish in the cloud. Traditional app sources, Android Market (market.android.com) and iTunes (www.apple.com/itunes/) will be the model for a whole host of SOI marketplaces offered by service-providers or even independent third parties. Apple and Google have already begun to position themselves for the eventual decentralization of the app by opening their markets to non-phone/tablet platforms. Google has made the Android Market available through its Chrome browser, while Apple has launched the Mac App store and iCloud. The first test of the SOI Platform architecture will likely come from the delivery of users' apps through the cloud.

The Current State:

The Internet is already shifting to provide users with services to satisfy most of the traditional software needs. What is necessary now is to deliver on the promise of being able to access files and services anywhere regardless of interface and operating system. With the advent of 4G phones consumers have begun to expect true data independence and on demand delivery. Google has attempted to meet this demand with the introduction of the Chromebook (www.google.com/chromebook/). Google has stripped all of the software out of the system and utilized their own suite of services and apps to meet the user's needs. The Chromebook fails in that it still relies on traditional hardware processors, RAM, and storage. With a starting cost of $299 there is little economic incentive to draw users away from traditional hardware options.

IV. The Cellular Model

SOI, in order to reach an even larger market than traditional computing options, needs to take its cues from the cellular phone market. The Digital Divide has long been a topic of concern both politically and economically. Whether it is the increased chance of finding employment, the educational benefits of the Internet, or the simple convenience of ordering products and services on line the importance of computers is unquestionable in the modern world (Gupta, 2006). How to make these resources available is a little less clear.

Traditional barriers to computing can often be boiled down to a single factor: money. The initial investment in hardware is often times more than some consumers can afford. This is illustrated in the most recent census numbers: 77% of all adults in America, almost 238 million, were categorized as computer users and 78% as Internet users. That means an estimated 71 million adults do not have access to a computer at home (www.census.gov). At the same time the CTIA reports that there were 300 million cell subscribers (www.infoplease.com/ipa/A0933563.html). While the number of subscribers is not the true number of Americans who have cell phones, it is clear that something about the cell industry has managed to overcome some the traditional barriers to technology adoption.

There are three factors that the cell phones, even the smartphone, have in appealing to consumers. The first is long running the cultural perception that everyone has a cell phone. The ubiquity of the cell phone in television, movies, and in everyday life, makes the technology more accessible. Second, phones are not seen as requiring any special skills to use. Since the smartphone requires a simple user

interface, this impression has carried over despite the sophistication of these devices. Finally, it is possible to start a cellular contract with little or no money down. These three principles can and should be applied to the SOI model.

The first and second, public image and usability, need to be pursued in concert. The image of the PC has reached the same level of awareness as the cell or smartphone in the public consciousness. The problem is that every positive representation of computers is matched by an image of complex code, stories of cybercrime, and fears of viruses and identity theft. The last two can not be prevented, crimes will be committed, but it is possible to address the perceived

complexity of the personal computer. The new generation of smartphones possesses processing power that outstrips desktops from less than ten years ago, but they are viewed with less trepidation than those same computers. The key to this level of user comfort comes from the easily accessible user interface that is utilized by the smartphone industry. It will be necessary for developers to take the simplistic interface of the smartphone or tablet and bring it to the personal computer.

The Windows 8 development team is already trying to bring elements of the Windows Phone OS to the newest desktop distribution (Adhukari, 2011). Instead of the traditional desktop environment the user is greeted with a full-screen Start menu that is reminiscent of a smartphone or tablet. First there are a number of widgets which can be customized to display information pertinent to the user. After that is the space reserved for apps. Windows 8 will support a suite of apps specially designed for the OS utilizing the Metro style, which will be available in their exclusive marketplace (Arthur, 2011). The final area of the interface will contain app style buttons representing all of the users installed software. All of a consumer's basic interactions will be possible without ever leaving the initial menu. It will be possible for many average users to avoid ever having to navigate the traditional desktop again. This type of simplified UI is exactly what the computer industry needs to reach that portion of the market whom are comfortable with cellular technology but still view the computer with trepidation.

No matter how intuitive the interface, if the customer can not afford it, it is all for nothing. The SOI model, by divorcing the user terminal from the processing hardware, makes it possible to offer a basic terminal for free. Just as this sales model opened up markets for the cellular industry, by removing the cost barrier, it will be possible for more people to have at least basic access to the Internet and a computer.

The cellular industry has more to offer SOI providers than just lessons on how to bridge the Digital Divide. By mimicking the premium and vanity hardware offerings of the cellphone companies, it will be possible to generate hardware-based income.

Premium offerings would consist of fat clients geared towards gamers and computer professionals. These systems would resemble the traditional personal computer, with all of the hardware associated with such a machine. Fat client will appeal to those users who can not or will not rely on the cloud for their processing needs. There is an advantage to this for both the user and the system at large. The user has access to traditional processing resources for sensitive or computationally intensive processes. At the same time the users' data will be instantly backed-up in the cloud and available from any thin SOI client. The system at large has the benefit of avoiding or distributing processes which would be a drag on the systems resources.

Vanity offerings will be identical to other clients, either thin or flat, but would incorporate branding to appeal to a particular market. On one end will be clients which are skinned to feature a sports team, university, cultural icon, or some other marketable design. The prices of these will vary based on agreements with the controlling entity, and may include options to re-skin the OS itself in addition to the user's terminal. The other type of vanity offering will be terminals which feature a particular virtual operating system (vOS). Microsoft, Apple, and other major developers will eventually develop a vOS which will be compatible with SOI. While these systems will offer a few proprietary services, they will for the most part be equivalent to any other SOI terminal. However, there will be a large number of consumers who will flock to these offerings out of brand loyalty.

By mining the cellular industry for successful business and marketing models it will be possible to place the SOI industry on a strong footing for success from the outset.

V. Advantages of SOI

The biggest advantage of SOI is the cost. As discussed above, the creation of a service oriented marketplace allows the consumer to enter the computing market with no money down. Eliminating the up front cost should make it possible for more consumers, particularly those at or below the poverty line, to finally have access to quality computing.

Since the consumer's entire computer is virtual, it is actually possible for them to access all of their files regardless of where they are. Since each computer is actually just a empty terminal until a user logs on, every computer is the user's computer. There is no need to synchronize files or back-up work to a pendrive. Simply save the file to your personal cloud and know that no matter where you are the file is a logon away.

Data is more than location independent, it is also device and interface independent. Whole lines of devices can take advantage of the SOI model to handle the overhead of providing services and processing power. Each device will require a specially developed UI, but most of the major changes will be a matter of scale. Tablets and laptops will provide users with an experience nearly identical to that of the desktop computer. Phones will require major alterations to take into account the smaller size, but will be able to deliver services that would exceed the resources available to them.

SOI will also open up new possibilities for device interaction. Already there have been a number of exciting developments in device interactivity with the wireless TV and the iPad. Wireless televisions have introduced the idea of SaaS style apps to the average consumer. Streaming movie services, widgets, and full-fledged apps are all available for use directly on the television (http://www.samsung.com/us/appstore/). Similarly, the iPad has begun to utilize the AppleTV service to allow games to

be played on either the iPad itself or on the user's HDTV (Herter, 2011). The SOI model offers an even greater degree of interactivity since each terminal is simply another I/O device. Within a user's home, or business, network it is possible to instantaneously transfer either input or output to another networked device with no loss of quality. A user could locate a movie on their phone ,while at work, and then display it instantly on any of the networked devices in their home.

SOI represents an opportunity for both users and developers to profit. There is an opportunity to provide access to a segment of the population that has long been priced out of the personal computing market. At the same time developers will gain access to new markets and new technologies sure to bring in new sources of revenue.

VI. Challenges to Implementing the SOI

Cost:

One of the greatest challenges to the implementation of the SOI model is the cost of developing the infrastructure necessary to support the demands of a cloud computing network. The cost of developing the protocols and building the physical networks required of a nationwide cloud are beyond the scope of this paper, but it is safe to assume that they are greater than any one company could shoulder. To this end it will be necessary for either a combined telecommunication industry alliance or the government to cover the costs of creating the necessary infrastructure. Most likely it will be combination of both approaches, with a business led group, utilizing government funding, to direct the necessary research and development.

Even ignoring the larger picture, the cost, in capital and manpower, would overwhelm the individual service provider if they had to develop all of the necessary services in-house. Instead providers will serve merely as portals and marketplaces to a system of third-party services. Individual providers may develop certain service in order to differentiate themselves from the competition, but their main purpose in the model is to serve as an access point. Most providers will also farm out the day to day storage of data to outside data centers, allowing them to focus on business and premiere customers in-house.

Data Ownership:

Utilizing a third-party for data storage is an excellent business idea, but it raises additional security and ownership concerns. A user wants to be sure that the files stored on their virtual hard drive are both secure and private. Singh, Sharma and Lehal (2011) call for a system where all of the user's transmissions are uniquely encrypted. This guarantees that only they will be able to retrieve the data in a usable format. This solution is sound theoretically, but lacks practicality. Most security holes are a result of user apathy. Users fail to update passwords, go through the extra steps necessary to encrypt data, or even activate the most basic security services. It is necessary to take the question of security away from the user, and instead make it an invisible part of the process.

The easiest way to do this is to create a two part security scheme. The user is required to use the traditional username/password pair in combination with a physical security key. This key will be a secure USB which will handle not only the encryption of the user's data, but also serve as a second layer of authentication. Without the key it will be impossible to access a user's account, rendering the practice of stealing passwords worthless. This key will also have the location of a user's provider and service terms encoded, freeing the consumer from having to keep such information handy when away from their home terminal. Users will be presented with an interface which only requires the authentication of a username/password pair, while enjoying the security of a fully encrypted data stream.

Data Transmission:

There are two distinct challenges to SOI in relation to data transmission: the lack of standards and protocols and high speed networks and wireless transmitters. The standardization of data throughout the SOI cloud will simplify the processes involved in migrating data. A complete overhaul of the physical telecommunications infrastructure will be necessary to handle the volume and types of transmissions that a nationwide cloud will produce.

Gagnon, Nabelsi, Passerini, and Cakici (2011) identify the need for both new standards to regulate processes within the cloud and a framework based on the Business Process Execution Language (BPEL). Standardized protocols are necessary to provide developers a concrete set of processes on which applications can be built. These protocols will also ensure that current services can interact with the SOI cloud without concern about what vOS the user is running. Standardization of protocols will lead to smoother interactions on the micro-level of the cloud, advancements in BPEL will organize the cloud on a macro-level. BPEL is a language that focuses on orchestrating the flow between larger process groups to ensure that the overall system executes correctly. It will be necessary for the current framework to be modified to enable "provisioning in a multitenant environment...[with] more customization for Business Process Management (BPM) rules, events, interfaces, and mashups" (Gagnon et al., 46). Standardizing the processes in the SOI cloud will ensure that things run smoothly behind the scenes, standardizing data will free consumers from the tyranny of proprietary software suites.

For too long the Internet, and the computer industry as a whole, has been plagued by the competition between file formats. The launch of SOI provides an opportunity to standardize all existing file types into a single universal format, and establish a governing body to oversee adoption of new formats. A universal set of formats will free developers from the process of adapting their programs to every individual proprietary file, and allow them to focus on innovation. Standardization will also remove the problem of file corruption or data loss from format translation between

systems. This will eliminate questions of compatibility when the user chooses an application. Bringing together leaders in the software field, under the auspices of an independent committee, will ensure that future formats will be thoroughly vetted before introduction to the public.

Huge amounts of data will be shifted between data centers to support customer migration, both geographically and between providers. The current wired infrastructure will not hold up under the added stress of so many transmissions. Additionally, consumers will require high speed connections in order to handle the throughput requirements of the cloud.

The answer to replacing the backbone infrastructure of the Internet lies in dark fiber. The fiber optic network that has been left to molder in the ground will serve as the starting point in a larger network. The sheer magnitude of data that will need to be passed between data centers will require speeds that only fiber optic cable is capable of. Additional cable will have to be laid in order to provide service for regional data centers in areas outside of the current network. Additional speed may be possible by utilizing a dark pulse laser which has been shown to deliver data with far less distortion, lending itself to fewer relays (Feng, Silverman, Mirin, & Cundiff, 2010). Replacing the core infrastructure will enable the necessary data transmission between providers, but an increasingly mobile user will require an equally fast wireless network.

The ideal medium for the consumer is the 7Gbps network (WiGig) envisioned by the Wireless Gigabit Alliance (wirelessgigabitalliance.org). While there have been significant advances in the WiGig development, widespread commercial availability is still years away. A more immediate solution is the new 802.11ac standard which will be available before the 2012 holiday season (Hachman, 2011). This new wireless technology will provide speeds above 1 Gbps, and will be available for the home market. Providing speeds at least three times faster than the current 802.11n, this will allow consumers to begin the transition away from a wired network.

VII. Conclusion

Businesses have struggled with how to bridge the Digital Divide. As consumers have become more comfortable with technology, the barrier of economics has remained. No matter how much someone wants something; if they can not afford it they will never have it. To reach these consumers it is necessary to rethink personal computing. Moving consumers away from hardware dominated paradigm into the cloud is the answer. The service-oriented Internet is the first, crucial step to realizing the public cloud. By emphasizing a cloud computing model that incorporates existing web applications, rather than replacing them, SOI is a powerful and feasible solution to the adoption of a national or global cloud.

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