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Abstract:

This teaching case describes how eLoanDocs, a professional services business serving the mortgage loan industry, recognized the benefits of emerging technologies to reduce costs and improve process throughput to establish a competitive position in its in marketplace. The case documents how the company adapted to changes in the technological landscape over the past two decades and presents the reader with the decisions the company now faces with the evolution of "cloud computing". The case gives students a fundamental understanding of the concept of cloud computing and presents the advantages and risks of this IT infrastructure.

Keywords: Cloud Computing, Outsourcing, Infrastructure, Teaching Case.

Editor's Note: A teaching note for this case can be obtained from douglas.havelka@miamioh.edu. Only active faculty who are currently listed in the AIS Faculty Directory are eligible to receive the teaching note.

I. INTRODUCTION

On a warm summer evening in Northeast Ohio, Albert Michaels, the Chief Technology Officer (CTO) of local software company eLoanDocs, was enjoying his evening drive home. Though his eyes were on the road in front of him, his mind was stuck on the topic of the day behind him: the "cloud". How could eLoanDocs take advantage of this emerging and exciting new technology platform? Cloud computing held the promise of greatly reduced costs and nearly unlimited scalability for a company like his and seemed like it might be the wave of the future for hosted software providers. But the barriers to his customers' adopting the cloud were potentially high. And if those barriers were overcome, the competitive landscape in which eLoanDocs operated might shift in unfavorable ways. As a technology professional, adopting the cloud seemed to him to be a forgone conclusion. But his years of experience had shown him that it's rarely easy to be one of the early adopters.

II. INEFFICIENCIES IN THE MORTGAGE INDUSTRY

The home mortgage closing process in the early 1990s was slow, paper intensive, and ripe for innovation. Realtors, mortgage lenders, title companies, and borrowers met and collaborated in primarily local marketplaces. The myriad documents required to support the mortgage approval process were exchanged through a combination of fax, mail, courier, and in-person reviews. Realtors, mortgage brokers, and escrow officers worked together to ensure that all of the necessary documents were generated, supporting services such as appraisals were ordered and performed, and required documents were signed by the borrower. The average time between a consumer application for a mortgage loan and the final closing was about 90 days. Closings were often delayed or rescheduled when late-breaking changes in the loan terms or associated costs required the lender to generate new documents. The majority of documents required for the mortgage closing were generated by the mortgage lender, but these documents were traditionally reviewed and signed by the borrower at the place of settlement (closing), generally at the title company. Mortgage lenders sent documents to the title company and to the borrower through mail, overnight express delivery, or courier. A successful closing required that the mortgage lender generate final documents and send them to the title company at least one day before the scheduled closing.

III. TECHNOLOGY TO THE RESCUE

In 1994, a Cleveland-based title and settlement services company, Premium Title, was determined to reduce their costs and differentiate their service to the market by adding technology to the mortgage-closing process. Premium Title's owners created a separate company, eLoanDocs, to connect the various parties involved in the process by using technology. eLoanDocs' founders wanted to improve the speed and accuracy of the mortgage-closing process while increasing market share for Premium Title and other connected business partners. The founders believed that they could create a company that would grow quickly and that would generate significant return for their investors.

In industries where larger companies with dedicated IT staff existed, standard protocols had been developed to exchange information electronically. For example, in the automotive industry, Electronic Data Interchange (EDI) had been used for years to exchange purchasing and billing information between manufacturers and their suppliers (Hart & Saunders, 1998; Roos, n.d.). There were no standards for electronic communication between business partners in the mortgage industry and, since the Internet was not being used broadly for commercial purposes, intercompany data exchange was dependent on proprietary communication networks.

eLoanDocs launched a proprietary electronic interchange in 1995 that connected Premium Title with several mortgage lenders in the Cleveland area along with a few local service providers such as appraisal vendors and surveyors. Proprietary data formats were defined for title insurance and appraisal orders, and mortgage documents were delivered electronically using the common HP Printer Command Language (PCL) print stream data format. The PCL (Hewlett Packard, 1992; "Printer command language", n.d.) is a page description language (PDL) that allows a document's appearance to be described at a high level. This allowed Premium Title, using equipment commonly available at the time, to define the documents needed in their industry and share them with the necessary business partners.

eLoanDocs purchased off-the-shelf communications software and customized it to their needs; they also purchased computer servers, network equipment, and modems to run their electronic interchange. The computer equipment and telephone lines were hosted in their modest office space in Cleveland, Ohio. The small network of participating companies each installed modems, standard communication software, and eLoanDocs' proprietary software

application to exchange documents that represented orders for services and the delivered real estate products such as appraisals, flood search certificates, and surveys. The electronically delivered documents replaced slower, lower-quality, or less-reliable courier and fax deliveries. eLoanDocs was successful in building a network of local mortgage service providers, but struggled to extend the technology and business model outside of Northeast Ohio.

IV. RIGHT TECHNOLOGY, RIGHT PLACE, RIGHT TIME

In the late 1990s, eLoanDocs realized that the emergence of the Internet as a driver of commerce would present both a threat to their network and an opportunity to extend their mortgage data interchange to more parties across the country at a lower cost. In 2000, eLoanDocs re-launched their mortgage industry electronic collaboration network on the Internet with the debut of their new software product, Document Posting Service (DPS). DPS used standard communication protocols such as HTTPS and SFTP over the Internet, which eliminated the need for modems and proprietary communications software. DPS also featured HTML Web user interfaces for settlement agents to avoid the need for software to be installed at each customer location. DPS was a multi-tenant application (Figure 1) that provided software as a service (SaaS) to the mortgage industry.
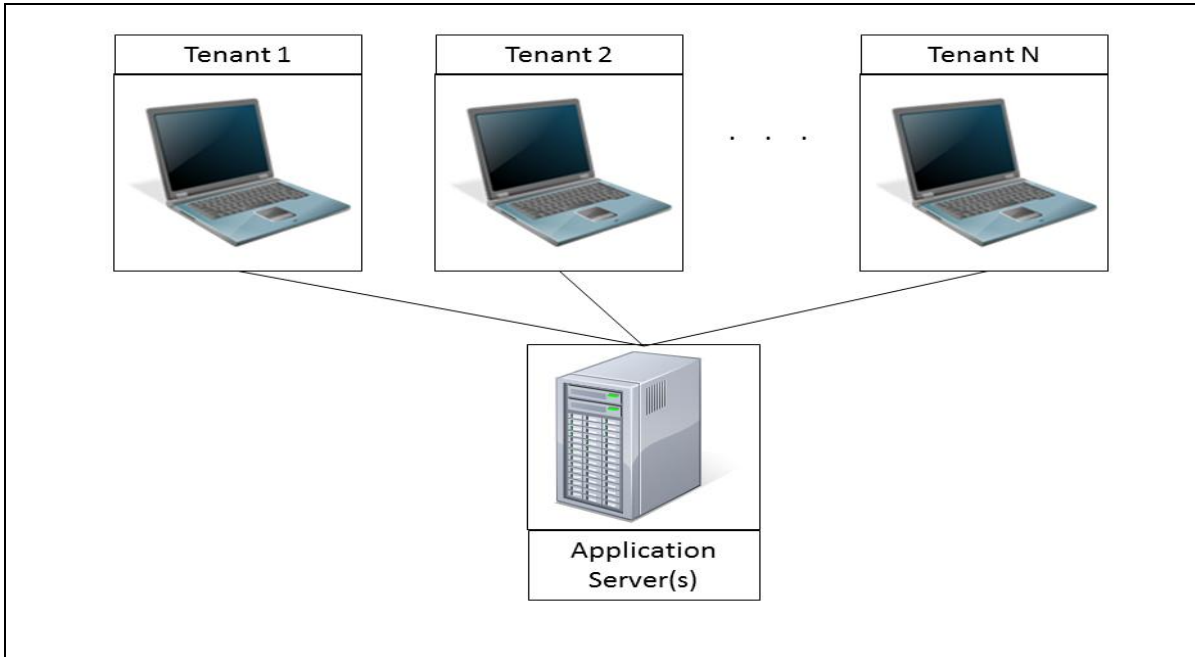

Figure 1. Multi-Tenant Architecture

SaaS allows customers to use software that is owned, delivered, and managed remotely by one (or more) providers (Singleton, 2011). This model allows the provider to maintain one set of code and data for many different customers. In essence, SaaS allows customers to rent software rather than buy it. The advantages of SaaS for customers include cost savings, scalability, accessibility, upgrades without disruption, and resilience. Some disadvantages also exist, the primary one being security (McLellan, 2013).

Market acceptance for DPS was tremendous, with several major mortgage lenders signing contracts to deliver all of their closing documents to settlement agents using eLoanDocs. As a small company facing growth challenges brought on in part by a boom-or-bust mortgage industry, eLoanDocs took a pragmatic approach to new product development. Product development investments were guided by immediate opportunities with existing customers that would lead to short-term revenue and possible broader market appeal. Following this model, eLoanDocs extended their product line beyond closing-document delivery to include borrower-disclosure delivery and electronic-signature capability.

V. SUPPORTIVE REGULATORY CHANGES

Federal and state legislation in 1999 opened the market for electronic signatures in the real estate industry, and eLoanDocs developed services to take advantage of this legislation. The Uniform Electronic Transaction Act (UETA) was first adopted by California and Pennsylvania in 1999 (Whitaker, 1999). At the time of writing in 2015, 47 of the 50 U.S. states have adopted this act. The remaining three states (New York, Illinois, and Washington) have not adopted the act, but have statutes pertaining to electronic transactions. The UETA's purpose is to bring into line the

differing state laws over such areas as retention of paper records and the validity of electronic signatures to support the validity of electronic contracts as a viable medium of agreement. The Electronic Signatures in Global and National Commerce Act (ESIGN) is similar to the UETA with the exception that it pertains to the validity of electronic signatures on the federal level instead of the state level (Stern, 2001). It also brings validity to signatures for foreign commerce.

VI. THE CHANGING BUSINESS TIDES

eLoanDocs' business was growing fast, but the computers that hosted eLoanDocs' services were still run out of a small office computer room. On a hot summer day in late July 2000, Cleveland faced scattered power outages due to heavy draw on the power grid for air conditioning. Power was lost in eLoanDocs' office for over eight hours, well beyond the two-hour battery backup that was in place to support the computer systems. Dave Griffith, data center manager for eLoanDocs, said "we tried to find portable generators for rent but there was nothing available big enough and we couldn't even get the generators close enough to our computer room to run extension cords" (personal communication). eLoanDocs' electronic services were unavailable to customers for most of the day. Customers suffered costly business delays due to this extended system outage on one of the busiest days of the month for mortgage closings.

It was clear that eLoanDocs needed to improve their computer hosting infrastructure in order to maintain a leadership position as a provider of electronic services to the mortgage industry. Up until this time, eLoanDocs did not have the necessary financial strength or the technical management experience to bring their computer infrastructure up to the needed levels of scalability and reliability. With major new customers ready to sign contracts and the memory of the 2000 power outage fresh in their minds, eLoanDocs management raised the needed capital and engaged a technology consulting firm to prepare for the next level of capability. In early 2001, eLoanDocs moved their computer servers to a private cage in a dedicated third party co-location data center in Chicago, Secure Hosting. The Secure Hosting facility in Chicago featured redundant power feeds, on-site generators, multiple Internet providers, and state-of-the-art physical and network security. Secure Hosting quickly became eLoanDocs' most important and most expensive vendor.

VII. SECURITY CONSIDERATIONS

By 2004, eLoanDocs was doing business with seven of the top 10 mortgage lenders in the US, and documents and data for over 50% of the mortgages in the country flowed through eLoanDocs' systems. eLoanDocs had become a critical part of the mortgage industry, but with fewer than 50 employees and under $15 million in annual revenue, the company was hundreds of times smaller than most of its giant financial institution customers.

Given the sensitive nature of the information that eLoanDocs was handling, the attention given to cybersecurity breaches at well-known companies like Apple, JP Morgan Chase, Target, and The Home Depot, and the consequences of these breaches (Snyder, 2014), many of eLoanDocs' largest customers began to demand that it demonstrate the reliability and security of their computer hosting facility through extensive load testing, system failure testing, and third party security audits. Some customers sent their own security teams to the eLoanDocs office in Cleveland and to the Secure Hosting data center in Chicago to review eLoanDocs' policies, procedures, and capabilities. Paul Hunter, eLoanDocs CEO, was excited to show off Secure Hosting to the top mortgage companies:

> The first time the National Mortgage security team visited the Secure Hosting facility they were thrilled to see the biometric security, diesel generators with 3 days of fuel on-site, and our private cage that was secured on all sides. eLoanDocs finally looks like the big player that we are. (personal communication)

By 2007, demands for additional capacity in the network and customer requirements to maintain an active disaster recovery data center drove eLoanDocs to make several significant investments. First, eLoanDocs acquired a competing mortgage technology company based in Seattle, WA, FastForms. eLoanDocs then moved their primary data center from Secure Hosting in Chicago to FastForms's co-location provider in Seattle, SunGuard. Finally, eLoanDocs built an identical redundant hosting facility in Cleveland using another co-location provider. In late 2009, eLoanDocs completed implementing a highly scalable and virtualized computer hosting infrastructure in Seattle with real-time replication of all customer documents and data to the backup site in Cleveland. The Cleveland facility could automatically take over all of eLoanDocs' services in the event of an extended outage in the Seattle data center (Figure 2). The time and expense required to build and maintain their services in secure and redundant data centers gave eLoanDocs a significant advantage in the market because few technology providers could make the necessary investments in infrastructure and software required to compete. In addition, eLoansDocs implemented best practices for disaster recovery (DR) planning including risk assessment and business impact analysis and training for and testing of the DR plan (ComuterWeekly.com, 2011; McBeth, 2014).
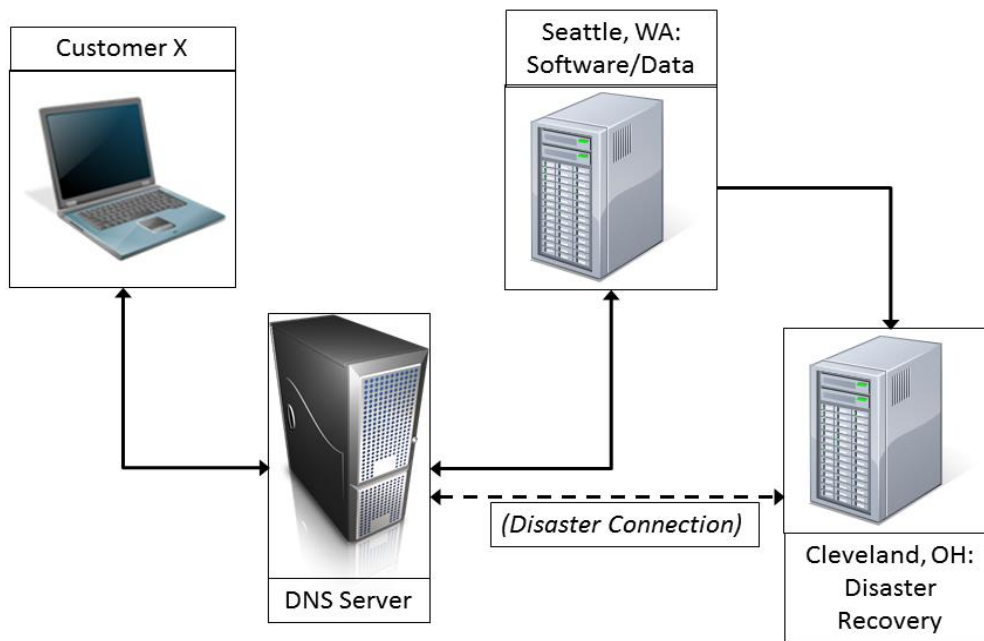
Figure 2. Existing Infrastructure

With the new infrastructure in place, eLoanDocs met customer service level agreements (SLAs) for 99.9% uptime of services in 2011 and 2012. eLoanDocs had developed a mature set of policies and procedures around information security and had published results of a third party SSAE 16 Type II compliance audit twice a year to customers. The organization had six full-time staff dedicated to data center operations and a full-time information security officer. Their internal staff had accumulated significant expertise in data center operations, but the company experienced, on average, a 20 percent annual turnover rate due to an active job market for their staff members' highly sought-after skills. One eLoanDocs employee was recruited to manage networks for Microsoft's hosting facilities in Washington. Michelle Fletcher, eLoanDocs' Director of Technical Operations, complained "I'm having a hard time keeping my best people working here at eLoanDocs. We just don't have enough scale to keep these people challenged and there is no way that eLoanDocs can match the pay of the big guys." (personal communication).

eLoanDocs' annual vendor expenses for data center hosting, data networks, computer hardware maintenance, and software support subscriptions were nearly US$2 million per year. Employee costs and third party audit expenses brought the overall cost of eLoanDocs' data center hosting, security, and compliance to about US$3.5 million annually.

VIII. CLOUDS AHEAD?

Just as the rise of the Internet enabled eLoanDocs' explosive growth in the 2000's, technological changes beginning in 2010 led to new opportunities and competitive challenges for the company. Giant technology vendors such as Amazon began to offer comprehensive computer hosting services with a new model: cloud computing (see Figure 3). Amazon, Microsoft, Google, and other companies built data centers at massive scale that were designed to allow them to sell computing capacity to the market at prices significantly below what companies could achieve on their own (cloud computing tutorial: http://www.tutorialspoint.com/cloud_computing/). Cloud computing vendors offered a model where a company could simply purchase the needed amount of processing power, memory, disk storage, and Internet bandwidth on a monthly subscription model. Customers could increase or decrease their usage on demand. Public cloud providers also offered high availability, multi-site data replication, and full disaster recovery capabilities as optional or standard services (Beal, 2015; IBM, n.d.; Strickland, n.d.).
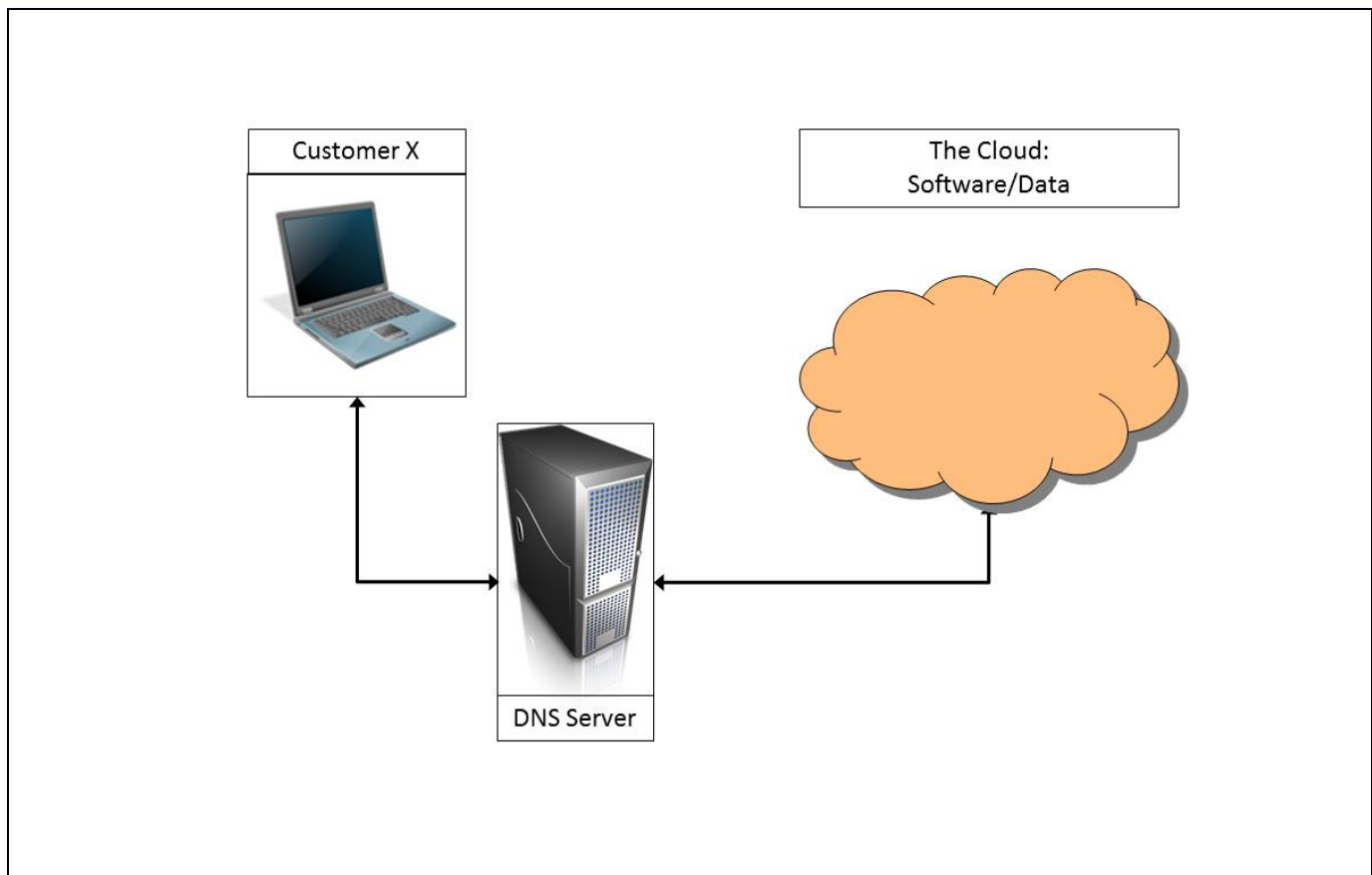
Figure 3. Cloud Infrastructure

Using a cloud hosting service such as Amazon Web Services (AWS), a small software vendor could launch a new service with twice the computing capacity of eLoanDocs in a matter of days. Matt Pittman, VP of Sales for eLoanDocs, said:

> *I can't compete on price with mortgage technology competitors like EchoSign that launched their products hosted at Amazon. Their costs are so low that they are giving away basic services with a freemium model. I just hope that companies like this don't start cutting into our core client base.* (personal communication)

Services like AWS were examples of the "public cloud"—inexpensive computing capacity that can be purchased on demand, with many different customers' workloads and information intermingled on the same computer servers and storage devices. Cost advantages available to customers of public cloud services were enhanced by aggressive competition in the industry, which sparked an ongoing price war between providers. Amazon reduced their prices a total of 41 times between 2008 and late 2013. CFO Marty Buckley had calculated that, by switching to a public cloud provider for all of their data center needs, eLoanDocs' annual technology costs (including expected staff reductions) would be $750,000 less than current spending levels.

Public cloud providers also maintained strict security policies and published third party security audit results, but large financial institutions were not ready to trust their most critical information and systems to the public cloud as of 2013. eLoanDocs' security officer Randy Wallace had his doubts about the viability of cloud hosting for eLoanDocs:

> *I just finished another grueling vendor audit from a giant mortgage lender's security team. These guys want visibility into all of our processes and they want to make sure that eLoanDocs has control over every aspect of our systems. I just don't know how we could ever convince them that a cloud service is secure.* (personal communication)

Concerns regarding the security of data stored in the cloud continue to be an on-going challenge for many IT executives (Corbin, 2015).

Recognizing the need for more-secure and more-flexible cloud computing options, computer hosting vendors such as Rackspace began to offer private cloud solutions to the market. Rackspace provisioned and supported a set of

dedicated hardware to any customer that wanted to keep their applications and information segregated from other customers. The private cloud offerings used the same technologies as public cloud providers and still provided cost advantages due to economies of scale. Buckley had calculated a US$350,000 annual savings should eLoanDocs move to a private cloud solution. However, Albert Michaels was concerned about service availability and uptime with a third party private cloud solution:

> *With our services hosted in our data centers I know 100% for certain that my team can find the source of any problem and fix it within minutes, helping us to meet our customer SLAs. How do I know that a cloud provider will have the same ability and motivation to get things back up and running when there's a problem?* (personal communication)

A third cloud hosting model appeared called hybrid cloud (Figure 4). This model allowed customers to take a measured approach to moving some of their computing to outsourced cloud providers. With a hybrid cloud offering such as VMware's vCloud, a software company could easily host some of their applications and data on their internal servers while moving their development, test, or disaster recovery systems to the cloud. Hybrid cloud solutions offered many of the security benefits of internally hosted systems while also providing scalability on demand. Arlene Christianson, eLoanDocs' VP of Operations, felt that hybrid cloud was not a good fit for eLoanDocs because "if we go with a hybrid cloud solution, we will need two separate security and compliance audits and sets of controls" (personal communication). Buckley estimated that moving to a hybrid cloud solution would reduce eLoanDocs' technology costs by about US$200,000 per year.
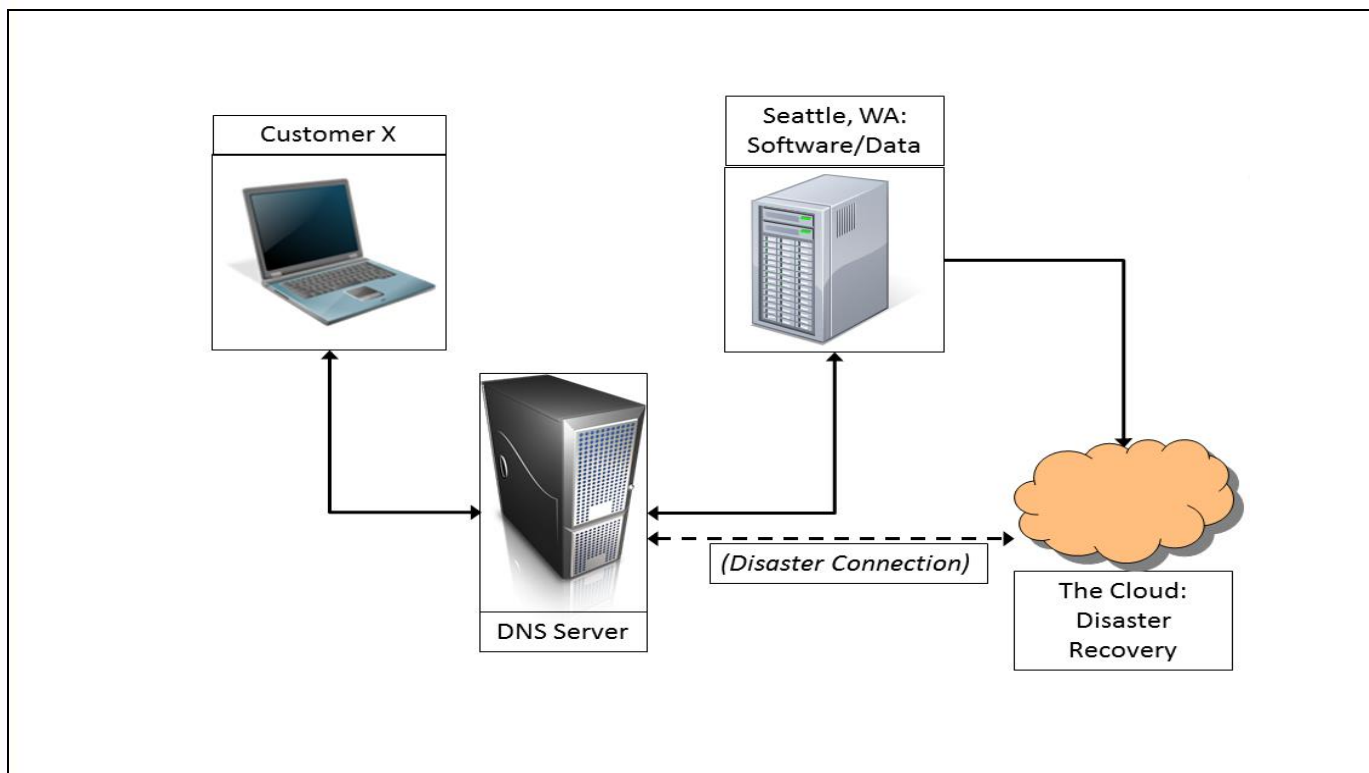
Figure 4. Hybrid Cloud Infrastructure

IX. A NECESSARY DECISION

By the middle of 2014, the computer systems that eLoanDocs had installed in 2009 were nearing the end of their useful life and had no more capacity for expansion. As eLoanDocs prepares for their next generation of data center hosting architecture for 2015 and beyond, the choices they face are complex and will have significant implications for the future of the company.

- Should eLoanDocs continue with their current model of designing, building, and managing their own computer hosting infrastructure using their co-location partners?

- Would eLoanDocs' financial institution customers accept a move of eLoanDocs' services to a public or private cloud provider?

- How should eLoanDocs go about choosing a cloud hosting provider?

As Albert Michaels considered his options, his mind was roiled by a number of questions:

1. Will eLoanDocs' customers—with their focus on data security—accept a cloud-based solution? If so, to what degree? And how many customers would accept some form of cloud-based solution?

2. If customers do accept one of the cost-saving cloud services solutions, what barriers exist to prevent new competitors from rapidly entering the market and eroding eLoanDocs' market share?

3. What is the value that customers believe they are receiving from eLoanDocs?

4. Could it be that customers actually value the secure environment that they can visit and audit in person? If so, might convincing those customers to adopt a cloud-based solution to their document delivery problems actually be a damaging move to eLoanDocs in the long term?

5. Speaking of security, which solution actually provides better protection of customers' data? Though ownership of the hosting hardware enables eLoanDocs to literally pull the plug if a breach is detected, how does that compare to the security benefits associated with outsourcing to a cloud provider? Is one solution more likely than the other to be targeted for attack? Is either solution better able to detect and prevent intrusions?

6. Assuming that the system will be attacked at some point, what ability will eLoanDocs have to identify the compromised data? How might that ability change if hosting services are outsourced to a cloud provider?

7. How robust is the existing disaster recovery strategy? Which solution best fits the redundancy needs of eLoanDocs?

8. How might the eLoanDocs employees react to adoption of a cloud-based hosting solution?

As Albert considered these and other questions, the only answer he felt sure about was that it was an exciting time to be alive and working in the technology industry.

REFERENCES

Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web, can gain direct access to these linked references. Readers are warned, however, that:
1. These links existed as of the date of publication but are not guaranteed to be working thereafter.
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APPENDIX A: GLOSSARY

Cloud computing: Using network resources to perform computations without the need, or often the ability, to determine the exact resources used at any time.

Co-location facility: Physical location that provides reliable power, secure physical facilities, and networking services to clients for a monthly operating fee. Clients provide their own hardware to run in the co-location facility.

Disaster recovery: Alternative to normal system operations intended to be used in case of catastrophic events (e.g., widespread power outages, local natural disasters)

High availability: High rate of system uptime, typically in excess of 99 percent. Also refers to technologies required to achieve a high rate of system uptime, such as redundant hardware components.

Hybrid cloud: System configuration in which some combination of public cloud, private cloud, and dedicated server solutions are mixed and used together to form the complete system.

Infrastructure as a service (IaaS): A type of cloud computing where the cloud provider provisions and maintains the computer hardware, storage, and networking for their clients, while the client is responsible for maintaining the operating systems and software.

Multitenant: Software configuration in which a single instance of the system serves multiple clients. Clients typically have no visibility or awareness of the data (or even the existence) of other clients.

Private cloud: Ownership and management of cloud computing resources win an organization's firewall, or optionally dedicated equipment managed by a cloud hosting provider on behalf of a customer.

Public cloud: Computing resources that are hypothetically available to any user connected to the same cloud service provider.

Recovery point objective (RPO): Amount of time for which data may be lost due to catastrophic events.

Recovery time objective (RTO): Amount of time that a system may be unavailable due to unexpected circumstances (e.g. a catastrophic event that prevents the function of the system)

Replication: Act of making exact copies of systems. Disaster recovery plans often use replication in order to minimize the RPO of a running system by using identical hardware located at geographically remote sites and synchronizing the data storage in real time.

Software as a service (SaaS): Licensing software solutions such that the hardware and the software are typically remote to the licensees and administered and maintained by the licensors.

SSAE 16 Type II: Statement on Standards for Attestation Engagements (SSAE) 16 is the professional standard used for issuing reports in accordance with the American Institute of Certified Public Accountants' Service Organization Control (SOC) reporting framework, which consists of SOC 1 (SSAE 16) along with SOC 2 and SOC 3 (AT 101) reporting. Additionally, the SSAE 16 standard effectively replaced the aging and antiquated SAS 70 auditing standard that had been in use for approximately twenty (20) years.

Virtualization: Creating a logical instance of a real system in such a way that it appears to an end user as a real system. A virtual machine—configurations of powerful servers so that multiple operating systems can be run with their own disk storage partitions—is a common example of virtualization.

ABOUT THE AUTHORS

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