

The POWER of the CLOUD

When Dave Powers, senior systems engineer, research and development IT at Eli Lilly and Company, talks about the advantages of cloud computing in the life-sciences industry, he gets pretty excited — as do others who have experienced first hand the benefits of the cloud. According to our thought leaders, cloud computing is game changing in the race to innovation, enabling scientists and technologists to quickly answer complicated analytical problems in record time and at record cost-savings.

Lilly has validated the ability to move large scientific computing workloads online, or to the cloud, if you prefer. Among other initiatives, Lilly runs a 64-machine cluster computer working on bioinformatics sequence information that is able to reduce a 12-week processing time to 20 minutes. The speed is remarkable, and so is the cost: using Amazon's EC2, the computer power costs all of about \$6 for the 20 minutes.

Is it any wonder Mr. Powers is excited? To further illustrate the significance of the speed and agility of using the cloud, he gives another example of its power: The company moved critical computations into the cloud and was able to consolidate 900 computing hours into just three hours. That warrants repeating: 900 CPUs of analysis, performed in 180 minutes.

"We were working internally within our own environment of computers and networks, and one of our computational biologists walked into the room and said he needed a data set analyzed and processed in 48 hours," he recalls. "It would have taken us weeks internally, so we had no other option but to use the cloud to meet the timeline needed. It was game changing."

Mr. Powers is also quite enthusiastic about the cloud's ability to level the playing field and to enable innovation at all levels.

"Frankly, I find that its accessibility is one of the most exciting opportunities of the cloud," he says. "Everybody, from the heads of multibillion dollar pharmaceutical companies studying biology and chemistry to a high school biology teacher, literally has access to the same computing environment. How cool would it be if a bunch of high school students and teachers discovered something meaningful

and took it to a pharma company? Before the cloud, we never would have even thought about this as a possibility."

The Need for Speeding Innovation

Although saving money is the most-often cited reason for moving applications online, Mr. Powers says it is the need for speeding innovation to patients that lured Lilly to the cloud.

"Leveraging the cloud became paramount to Lilly when it realized how using it could speed innovation," Mr. Powers says. "Everything we are doing in our research organization is all about speed and innovation, which are inseparable."

Lilly's use of cloud computing hits the mark on three main goals. First, it taps into the benefits of large-scale computing, as in the examples cited above. Second, the company is able to access — and pay for — huge amounts of computing power only as needed. And third, the cloud expands the company's opportunities for collaboration.

Working on the cloud has allowed Lilly to create what Mr. Powers calls a "vending machine full of applications" from which scientists and IT analysts can create an entire ecosystem of applications in a matter of minutes, without having to build elements

from the ground up.

Collaborating on the cloud is a natural extension for Lilly, which is transitioning from being a fully integrated pharmaceutical company — a FIPCO — to a fully integrated pharmaceutical network, or FIPNet, which involves casting a wider net with regard to external ideas, expertise, and resources.

"We now have our peers around the globe actively involved in cloud computing activities, so there's that additional aspect of collaboration around projects that were in the past just internal," Mr. Powers says.

(Editor's note: For more information about FIPNet, visit lilly.com/news/speeches/081119/default.html.)

Collaborating is one of the ultra advantages of using the cloud within the life-sciences industry, says Michael Naimoli, U.S. life sciences industry solutions director at Microsoft.

As the industry ventures into cloud computing for R&D, it will discover speed, agility, and deeper analysis — all at a cost savings.

The Cloud

If you have used any of these apps — Hotmail, Gmail, Skydrive, Live Mesh, Google Apps, Windows Live Messenger — you've been in the cloud.

What's in a cloud?

THE NAME: According to Wikipedia, the cloud got its name from the shape of the computer network diagrams used when someone tries to explain the infrastructure of Internet computing. It is described as Internet-based computing that provides shared resources, software, and information to computers and other devices from a cloud computing environment. Rather than storing software on a computer or a corporate server, applications and content run on remote servers and are accessed by Web-connected devices, including computers, phones, and TVs.

Gartner defines cloud computing as a style of computing in which massively scalable IT-related capabilities are provided "as a service" using Internet technologies to multiple external customers.

Forrester defines cloud computing as a pool of abstracted, highly scalable, and managed computer infrastructure capable of hosting end-customer applications and billed by consumption.

Currently, according to Wikipedia and other sources, there are four major companies that operate the servers that service the cloud computing environment and they are Google, Amazon, Microsoft, and Salesforce.com.



RESEARCHERS SPEND 80% OF THEIR TIME ACQUIRING, CLEANING, AND INTEGRATING DATA. CLOUD-BASED DATA MANAGEMENT AND ANALYTICS ALLOW THEM TO FOCUS ON THEIR RESEARCH, INCREASING AGILITY AND PRODUCTIVITY.

LYNETTE FERRARA
CSC Health Informatics Practice



PHARMA HAS TAKEN SOME OPERATIONAL STEPS IN THE CLOUD, BUT ONCE IT REALIZES THE TREMENDOUS OPPORTUNITY FOR R&D, THERE WILL BE RAPID ADOPTION BY MANY COMPANIES.

MICHAEL NAIMOLI
Microsoft

"When organizations collaborate on pre-competitive analysis, they need to pool resources around large sets of data," he says. "Using a platform as a service, research organizations can easily move large amounts of data to the cloud and work around it on a platform that is scalable, and everyone can be working simultaneously. In terms of cost reduction for the industry, being able to get and pay for only the computer power needed while adding more efficiency around this most important data processing development is a total win-win for the industry."

The Cloud Movement

The concept behind cloud computing is not new. According to German-based Business & Information Systems Engineering journal, cloud computing is the modern version of the time-sharing computing model of

the 1960s, with the exception being that today's cloud is accessed through a Web browser instead of across mainframes. The second major computing paradigm occurred in the 1980s, when the 1960s host-centric, time-shared computing model evolved into client/server group computing. Today's latest shift to the cloud — on a very simple level — means that everything that has been done before is still being done, but now it is facilitated through the Internet.

According to our thought leaders, there has been a steady five-year growth in use of cloud computing in this industry that is expected to continue well into the next five years. Interest in the pharma space in particular has heated up over the past 18 months or so, driven by a renewed focus on cost-cutting measures and the time sensitivity pressure because of drying drug pipelines. Another

driver is the newer applications, platforms, and solutions that are hitting the market, such as Microsoft's Windows Azure Platform, which became commercially available in February of this year. Just two months after its launch, Microsoft announced that the new platform was expanding its reach commercially to 40 more countries.

Eric Olden, CEO of Symplified, believes the industry is only in the beginning stages of widespread cloud adoption.

"Today cloud computing is 90% hype and only 10% substance, but over the coming years there will be a shift that will impact even the very large organizations," he says. "Everyone can operate more efficiently on the cloud."

Matt Wallach, executive VP and general manager of Veeva Systems, believes that the industry has moved beyond the hype and is



THE CLOUD LEVELS THE PLAYING FIELD: COMPANIES CAN COMPUTE LIKE LILLY, BUT THEY DON'T HAVE TO SPEND LIKE LILLY.

ERIC OLDEN

Symplified

WHEN CLOUD SOURCING COMES TOGETHER WITH CLOUD COMPUTING, WE CAN'T EVEN IMAGINE ALL THE POSSIBILITIES.

DAVE POWERS

Eli Lilly and Company



Life-Sciences' R&D Increasingly Adopts Cloud Computing Model

The cloud computing model is still in its early days, and most life-sciences organizations are still testing its feasibility and determining which applications run best in the model's Web-based applications mode. Yet driven by continual acceleration in the rates of data generation and the desire for processor-intensive applications, these organizations continue to increase their cloud use and the diversity of applications they run there.

According to a recent publication from Insight Pharma Reports, Cloud Computing in Life Sciences R&D, cloud computing is rapidly growing in importance as life-sciences R&D organizations face economic restrictions, trends toward outsourcing, and a deluge of data from multiple sources. Simultaneously, demand for computationally complex modeling and simulation studies continues to rise dramatically. Limited funding and budgets make it difficult for many organizations to build the infrastructure necessary to keep pace with these challenges, making cloud computing a promising alternative to in-house expansion.

According to the report, areas particularly suited to cloud computing include next-generation sequencing, with its ever-increasing burden of data that needs to be processed and interpreted; protein docking; modeling and simulation; and data mining. And given bullish signals for the future of cloud computing in the life sciences, analysts expect the number and diversity of applications to increase markedly over the next five years, the report notes.

For more information, visit insightpharmareports.com.

adamant that cloud use in the life sciences is here to stay.

"Every new system will be cloud computing-based within five years — where appropriate," Mr. Wallach predicts. "There are some areas that may never move to the cloud, simply because there is no advantage to doing so, such as where flexibility may actually be detrimental. For example, accounting, manufacturing, supply chain, or contract management systems may never move to the cloud."

Today, every life-sciences company is considering or starting to implement some form of cloud computing into its business operations.

"Pharmaceutical companies of every size have one or more experiments or pilot projects in the cloud," says Lynette Ferrara, partner, practice healthcare sector, CSC Informatics. "Large pharmaceutical companies, such as Lilly, Pfizer, and J&J are conducting research using the cloud infrastructure as a service. Pfizer's Biotherapeutics & Bioinnovation Center business unit also began using Amazon cloud services earlier this year to develop and refine models in antibody docking runs. According to many media reports, by using EC2, Pfizer can process models in as little as two to three hours, instead of the usual two to three days it would take on an internal server."

Mr. Powers of Lilly agrees. "If one were to survey 10 pharma companies, probably 10 out of 10 would have something to share about pilot programs in cloud computing," he says.

For example, bioinformatics firm GenomeQuest moved its entire gene-sequencing process and related information-sharing portal to the cloud.

"Pharma companies of all sizes have been quick to embrace the cloud as a platform for

development and testing of enterprise software such SAP," Ms. Ferrara says.

Small companies such as Amylin Pharmaceuticals are reducing cost and complexity by leveraging e-mail from Google, human resources applications from Amazon, and salesforce automation from Salesforce.com.

According to Jason Stowe, founder and CEO of Cycle Computing, Amylin moved six of its most costly operations to the cloud, ranging from e-mail systems to collaborative business applications from SAP and CRM.

Industry sources state that Amylin moved its e-mail solution to a SaaS application and employed virtual data center capabilities in four major areas using Amazon EC2 and other providers.

Proportion of Life-Sciences R&D Informatics Budgets Devoted to Cloud Computing

Response %	Current Year	Coming Year	Response %	Three Years
0%	25%	0.0%	0%	0.0%
1% to 2%	16.7%	9.1%	1% to 5%	27.3%
3% to 5%	25.0%	36.4%	6% to 10%	18.2%
6% to 10%	8.3%	9.1%	11% to 25%	9.1%
11% to 20%	16.7%	36.4%	26% to 50%	36.4%
>20%	8.3%	9.1%	>50%	9.1%

Source: Insight Pharma Reports, Cloud Computing in Life Sciences R&D. For more information, visit insightpharmareports.com.

The company also uses the cloud for infrastructure power that allows fast provisioning, software development tools, and disaster recovery.

GlaxoSmithKline was Microsoft's first major customer for its hosted communications software suite when it migrated 100,000 employees from IBM's Lotus Notes to Microsoft's hosted suite, which includes Exchange for e-mail, SharePoint, Office Communications Online, and Office Live Meeting, all managed from Microsoft's own data centers.

According to Mr. Naimoli of Microsoft, the industry is testing the waters by using the cloud for communications systems, but once it understands the power of the cloud for gene sequencing or data set analysis, for example, it will dive in a bit deeper.

"GlaxoSmithKline has been an early adopter, and once the industry starts realizing the tremendous opportunity in research and development, other companies will be next," he says.

According to Veeva Systems' Mr. Wallach, Genentech's recent move to take its corporate e-mail and calendar off its internal servers and move them to the Google cloud was a "watershed event for the industry."

Mr. Powers' vision for the cloud computing future is for it to be the first thing the industry thinks about using. He says the usual MO for a company has been to spend years building an internal system to only outgrow it, and then have to move to the cloud.

"I hope that by 2015, cloud computing is very much the first and foremost consideration, in reverse of today's strategy, which is how can we build this system internally and then think about moving into the cloud," Mr. Powers says. "The pharma industry is at least two or three years away from a complete-production type environment on the cloud, but each administrative piece that can be moved there is a step in the right direction." ♦

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CRM ON THE CLOUD IS AT 100%; NO COMPANY WILL INSTALL A CRM ON SITE AGAIN IN THIS INDUSTRY.

MATT WALLACH

Veeva Systems

Experts on This Topic

LYNETTE FERRARA. Partner, CSC's Health Informatics Practice, a global provider of technology-enabled business solutions. For more information, visit csc.com or e-mail Ms. Ferrara at gferrara@csc.com.

MICHAEL NAIMOLI. U.S. Life Sciences Industry Solutions Director, Microsoft Corp., a provider of software, services, and solutions. For more information, visit microsoft.com.

ERIC OLDEN. Founder and CEO, Symplified, a cloud security company that secures and optimizes Internet business by simplifying online identities and complex relationships. For more information, visit symplified.com.

DAVE POWERS. Senior Systems Engineer,

Research and Development IT, Eli Lilly and Company, a Fortune 500 biopharmaceutical company, which is developing pharmaceutical products by applying the latest research from its own worldwide laboratories and from collaboration. For more information, visit lilly.com.

JASON STOWE. Founder and CEO, Cycle Computing, a provider of open-source, high-performance computing technology on internal desktops, servers, and in the cloud. For more information, visit cyclecomputing.com.

MATT WALLACH. Executive VP and General Manager, Veeva Systems, which offers SaaS-based solutions for the global life-sciences industry. For more information, visit veevasystems.com.

BY ROBIN ROBINSON

SECURITY *and The* CLOUD

IF YOU WANT TO PROTECT YOUR DATA, BEGIN WITH A VIRTUAL PRIVATE CLOUD.

LYNETTE FERRARA

CSC Health Informatics Practice



According to our thought leaders, the No. 1 objection to moving proprietary information to the cloud is security, and our experts say those fears are mostly unfounded today. Cloud computing has been around long enough for there to be a level of maturity in the architectures and data centers to alleviate any breach, loss, or unauthorized access to data, our experts say. However, in this risk-averse industry, the idea of hard-earned, intellectual data “floating” in a public cloud is daunting.

Let go, let cloud

Dave Powers, senior systems engineer, research and development IT, at Eli Lilly and Company, says the issue is more of a mindset problem than a technical problem. Lilly has worked for several years in the cloud and has become very comfortable with its role there.

“Early on, we were asked quite a lot about security and risks, and now we are quite confident in the cloud providers with whom we are working that they know how critical security is for this industry,” Mr. Powers says. “I think there was an uncertainty around what the security paradigm and model was, and as we understand more from cloud providers about their security implementation now the concern does not need to be as fearful as in the beginning.”

But letting go — both physically and metaphorically — of data is not an easy transition for the industry to make and requires ongoing conversations to build trust with the scientists, Mr. Powers says.

“We had a lot of discussions around the concerns regarding security, privacy, regulatory, and compliance risks,” he says. “Don’t underestimate the energy and effort involved in making that transition. “We wouldn’t pick up everything and

drop it in the cloud today nor would we not consider the cloud because it is too insecure,” he continues. “It’s a balance and in the end it comes down to risk assessment. We are very careful and very thoughtful about what we are doing.”

If finance and defense are doing it ...

According to Jason Stowe, CEO of Cycle Computing, concern around the security of data is very similar to the privacy concerns around healthcare data. Other industries, such as the financial services and the Department of Defense, have moved processes to the cloud through secure clusters in a classified environment, very similar to Amazon’s EC2 platform, he says.

Mr. Stowe also believes that the issue is analogous to when consumers were first hesitant to buy products over the Internet.

“Now look at the retail success of Amazon,” he says. “Once more life-sciences companies start to move toward the cloud, others will follow. There are pharma companies out there taking the risk and reaping the benefits. Pfizer has conducted molecular modeling on the cloud on top of Cycle Computing clusters. Johnson & Johnson and Lilly share information to run various forms of discovery or clinical-oriented calculations.”

Mr. Stowe tells us that another unnamed large pharma is sharing its compound data base and “putting all it knows about various compounds that could be potential drug candidates on EC2.”

Security risk is one of the most common misperceptions about cloud computing, says Lynette Ferrara, partner at CSC’s Health Informatics.

“It is often believed that the cloud is a lawless wasteland where data and programs float

IN THE END, SECURITY IS A TECHNICAL WORD FOR TRUST.

ERIC OLDEN
Simplified

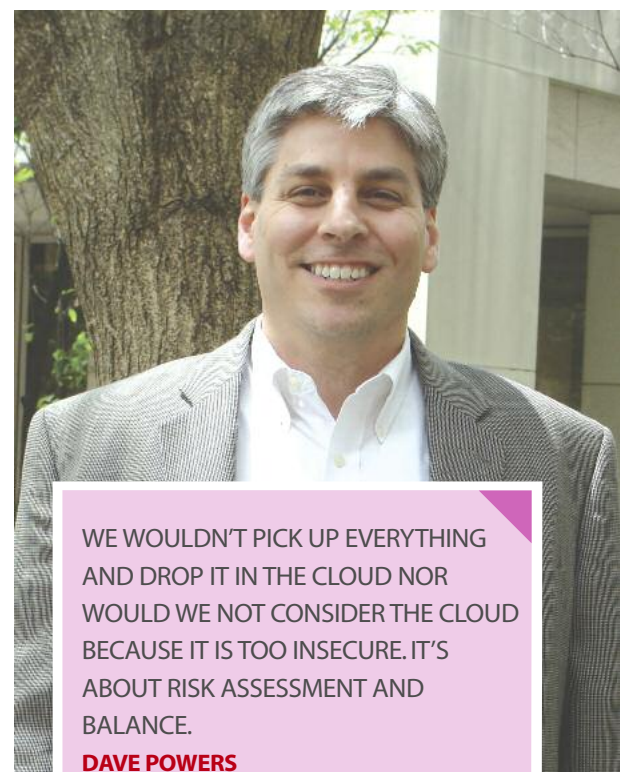


Cloud Service Levels

Cloud computing is layered into four distinct levels of service, with a fifth level emerging to provide the management and security services currently offered by the internal data center and IT groups. These are the descriptions of each below.

- **BUSINESS PROCESS AS A SERVICE (BPaaS)** — Within the BPaaS level, a business function is essentially outsourced to a cloud-based service provider. Today, the most prevalent business processes provided by cloud vendors are back-office functions such as billing, payroll, and collections. In the future, pharma companies will demand more pharma specific services. Soon a wide range of cloud-hosted business services, including clinical data and document management, safety signal monitoring, and comparative effectiveness research, will be available. Pharma companies that use these services will improve the ROI from their data assets, better understand the performance and relative effectiveness of their products and services in real-world conditions, and enable the next wave of product innovation.
- **SOFTWARE AS A SERVICE (SaaS)** — At the SaaS level, it is possible to license fully functional software programs as a service eliminating the time and cost needed to procure, install, maintain, and upgrade software. Today, pharma companies have begun to use cloud-based software for office productivity applications, such as e-mail (Gmail), talent management (Taleo), and travel and expense management (Concur). Many companies have adopted Salesforce.com to support sales teams and to provide business intelligence for sales management. Enterprise applications such as SAP and Oracle are now available as SaaS. Pharma IT has begun to use these SaaS options as an agile, inexpensive development and test environment. In the future, pharma R&D will begin to adopt a SaaS version of popular analysis tools.
- **PLATFORM AS A SERVICE (PaaS)** — The PaaS level of cloud service provides an integrated and configurable set of tools to support research, document management, and collaboration. There are few examples of working platforms today. However, this level of cloud services, along with orchestration services, promises to take much of the time, cost, and risk out of the drug development and commercialization cycles. In the future, the pharma industry will be heavy users of cloud-based platforms for collaborative research along with the cloud-based business services enabled by the platform.
- **INFRASTRUCTURE AS A SERVICE (IaaS)** — IaaS is the most basic level and heavily used level of cloud services today. Pharma companies use IaaS vendors for access to processors, storage, and upload/download bandwidth. Today's examples of cloud computing make use of this inexpensive, easy-to-access hardware for everything from gene sequencing to clinical data management. But the users and the IT groups take on many of the functions of the traditional data center such as loading data and software, security, and management. In the future, IaaS will be less used because the proliferation of orchestration services offers users more business capability with less risk.
- **ORCHESTRATION SERVICES** — An emerging level of service that provides the full range of services needed to ensure that cloud-based services provide the secure and reliable services available from conventional data center-based services. This includes basic tasks such as managing user access to cloud-based services and managing security, backups, and accounting. Today, there are few orchestration services available, but expect to see many new orchestrated services over the next year. Most cloud vendors offer a premium-priced virtual private cloud that reduces the level of effort needed to provide orchestration. Systems integrators are also developing cloud orchestration services that enable companies to manage the cloud like any other data center. In the future, pharma is unlikely to buy cloud-based services without some level of orchestration.

Source: Lynette Ferrara, CSC. For more information, visit csc.com.



WE WOULDN'T PICK UP EVERYTHING AND DROP IT IN THE CLOUD NOR WOULD WE NOT CONSIDER THE CLOUD BECAUSE IT IS TOO INSECURE. IT'S ABOUT RISK ASSESSMENT AND BALANCE.

DAVE POWERS

Lilly

across the globe, vulnerable to predators and user naivety," she says. "But an equally prevalent misconception is that the cloud is secure and ready for use by any application."

The reality is more nuanced and reflects the range of cloud configurations now available. The good news is that cloud vendors are growing up; they are developing the operating and business models aligned to the needs of corporate customers. The public cloud services now available from vendors such as Google, Amazon, Salesforce.com, and Microsoft provide the tools to control access, manage where data resides, and support data encryption. The public cloud is, however, best suited for applications where the data and the tool sets are open source.

If a company is leery and wants to protect the data and research findings, it can start with more of a hybrid virtual private cloud that provides higher levels of security and where identity management remains behind the firewalls and robust security is provided by robust standard operating procedures and technology.

People are mostly concerned that the cloud is not as secure as something they can maintain themselves, when actually the cloud is more secure than many in-house systems.

"In the end, security is a technical word for trust," says Eric Olden, CEO of Symplified. "The biggest hurdle for the industry will be to get over the perception that the cloud is less secure." ♦