GIGAOM RESEARCH

Tech trends for 2014

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a cleantech report

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The tech industry saw as many ups as downs in 2013, from the (seemingly) starting revelations in the wake of the NSA/PRISM scandal to the demise of Fisker Automotive and Twitter's highly publicized IPO.

As the year winds to a close, the Gigaom Research curators set their sights on 2014, and share thoughts on what to expect, what not to. Will the NSA revelations have any long-term effect on U.S. cloud computing or have we simply moved on? Are wearables really worth their hype? And when it comes to social business, how fast is too fast in terms of when it comes to changing the nature of the way we work?

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Utilities see first hints of revenue issues

It may be early but we're getting close to the inflection point where distributed solar starts to have a slight impact on utility revenue. There have been some disparate data points showing that year-over-year utility revenue is down a percentage in sun-rich states like Arizona.

Not coincidently, Arizona is the focal point of one of the more acrimonious fights over net metering, the program under which states require utilities to buy pack power from solar customers. While utilities could dismiss distributed power generation for some time, it's looking more and more like they understand that it's a real competitive threat. In places like Germany we're seeing Toshiba step in and installing megawatt scale rooftop solar projects at large residential buildings because the company thinks it can sell more price competitive electricity than utilities.

And while soft costs remain stubbornly high for rooftop solar, the overall installed price per watt will continue to creep down as retail electricity rates creep up, creating a situation where rooftop solar installation rates should continue to grow and shave revenue from utilities.

What are the utilities to do? Well, many will continue the push to eliminate or throttle back net metering programs as they attempt to get public utility commissions to accept more lucrative "connection fees" targeted at homes that install solar and use the grid for power at night. They may have some success here, and will argue that they must shoulder the burden of energy transmission and distribution. But what happens when technology comes along — like battery storage or gas powered fuel cells — that when paired with solar allows for total grid independence?

Home energy management evolves

While home energy recommendation leader and cleantech success story Opower bats down recent reports that it's nearing an IPO, the stage is set for a truly competitive growth market in home energy management. And the trend will center around home energy management players like Opower, Nest and Ecofactor, all of whom are building closer relationships with utilities.

Look for the first area of closer relationship to center around demand response. Opower has launched what it calls "behavioral demand response." The company has made its

living through simple energy recommendations that it distributes via mailed reports, texts, and emails. But it was inevitable that it would need to grow beyond this low-hanging fruit and is attempting to use similar avenues of communication to get residential customers to curb power use during peak power events, something it can do with highly developed smart meter analytics tools.

While Opower remains a software-focused company, hardware design leader Nest will itself continue to work with utilities. We'll know in 2014 whether the company can execute its own demand response program, dubbed "Rush Hour Rewards," which gives utilities direct control over customers' thermostats during peak power usage. Nest also acquired MyEnergy in May, a company that has a platform to aggregate utility energy data and deliver energy efficiency services.

So, yes, Nest and Opower will start to compete against in each other, though these are early days with a massive market where much of the growth is actually in Asia and abroad, not just the U.S. From my perspective, the interesting part will be whether software- or analytics-only solutions like those of Opower prove sufficient to succeed at demand response, or whether hardware solutions like connected thermostats are more effective.

Solar in Asia is a bright spot

At this point we've exited the bottom of the solar market as the panel price plunge has ended and we're actually seeing some stability in pricing. In fact, the MAC Global Solar Energy Stock Index increased by a whopping 130 percent over the past 12 months.

So what's next? I continue to believe that domestically we'll see continued growth in utility scale and residential solar, even though the 2016 expiration of the Investment Tax Credit looms in the distant future as an issue. Its expiration will mark a point when financing costs for rooftop solar could spike.

But in terms of the year ahead, East Asia could prove a very promising focal point for continued solar deployment. In December The Chinese Bureau of Energy increased the 2014 solar forecast for China to 12 gigawatts, including 8 gigawatts of distributed PV and 4 gigawatts of ground-mount systems. I wouldn't be shocked if, over the next 12-24 months, we see revisions keep going up as the government attempts to stabilize Chinese solar manufacturers and avoid bankruptcies by enforcing larger quotas for solar deployment.

Total Asia-Pacific (APAC) forecasts are up to 24 gigawatts. Many see upsides as high as 32 gigawatts. Part of that upside is China, but part of that is also Japan, which post-

Fukushima has become a hot market for solar. In fact some analysts have already predicted that Japan will be the largest solar market by revenue this year.

Are East Asian markets tough markets to crack for North American and European manufacturers and developers? Often, but where there's growth lies opportunity.

Share economy regulatory battles

When many share economy business models are considered, I tend to hear two concerns. First, what's the liability and how does the startup get insurance? Second, what about regulators and the market that's being disrupted?

Markets and economics tend to address the first issue: Some brave insurance company takes the leave of faith at a hefty premium. But the second issue is often less clear, and we hear a lot of noise about how everything from ride sharing to vacation sharing is just a government decision away from non-existence.

While I think we'll continue to see grumbling from regulators in states like New York, where the Attorney General has subpoenaed Airbnb for transaction information about many of its New York City hosts, I also think that in the next year or two we'll begin to move toward a tacit cultural acceptance that the share economy is here to stay. What this will mean is that governments will stop fighting these companies over their mere existence. It will also mean that governments begin to do what they have always done, and begin regulating these businesses.

If you're thinking taxes, then you'd be right on the money.

Internet of things keeps growing

The internet of things probably where big data was three years ago in terms of buzz, but as the ease with which sensors come online and devices are connected increases, we'll see a few trends. First, more consumer devices will get connected, from wearables to thermostats. Second, startups will continue to learn the lesson that it's not what you connect but what you can do with the data that you collect. Finally, sectors in industries like manufacturing, industrial and health care, which have historically lagged in terms of their engagement with the internet of things, will begin to deploy solutions.

The big IT players, ranging from Microsoft to GE to Cisco, will go after the industrial IoT space with newfound focus that starts by connecting legacy sources of data to the network. From there software vendors can jump in and attempt to drive business

intelligence from all of this data, and hopefully operational efficiency. For companies like Cisco, this'll mean selling hardware that has embedded software.

For cleantech, much of the early value revolves around better monitoring. Waste management will start tracking garbage cans so that collection routes save money, solar-PV monitoring and optimization will grow, smart grid analytics will lower costs for utilities, connected appliances enter the consumer space, and we'll even see the beginning of smart agriculture or the integration of weather data to produce predictive analytics for farming.

In the end, cleantech isn't all that different from other internet of things applications that span industries from manufacturing to health care. The goal is always efficiency. And in the case of devices like smart thermostats, the efficiency opportunity lies in reducing power consumption.

What (and what not) to expect in mobile in 2014

We predicted 2013 would be a tremendously eventful year for the mobile industry, and we weren't disappointed: Some major carriers began to move away from handset subsidies and two-year contracts, a small army of new operating systems came to market, and mobile marketing finally began to take off in a big way. And 2014 may be even more tumultuous. As we enter the holidays, then, I offer a few important things to look for in the coming year – and one market to expect very little from:

Mobile will continue to revolutionize shopping, but not proximity payments. Mobile devices have become powerful tools for tech-savvy shoppers, whether those consumers are making purchases on their couch via tablets, redeeming coupons at the sales counter, or showrooming on the retail floor to access information and find the best deals. Mobile accounted for nearly one-third of all online traffic during Cyber Monday this year, according to IBM Digital Analytics Benchmark, up from 4 percent just three years ago.

Shoppers will lean on their mobile gadgets even more in 2014 thanks to the emergence of systems powered by Bluetooth low energy, or BLE. Offerings like Apple's iBeacon (which is in trials at two Macy's locations) and Qualcomm's Gimbal (which is in trials at the Miami Dolphins' home stadium) enable retailers and other businesses to engage with users on a remarkably intimate level: Customers are automatically greeted through an app on their phones as they walk into the store, and can receive personalized, location-based offers and other marketing content as they move throughout the venue.

Some have suggested BLE-powered systems could "blow NFC right out of the water" in proximity mobile payments, perhaps giving the market a much-needed boost. BLE's range is wider, so it can be used to conduct transactions without having to tap a phone against a reader, and beacon deployments may be more affordable than integrating NFC readers at the retail counter.

But convenience and cost aren't even the biggest challenges that continue to shackle mobile payments: A variety of competing technologies and systems are holding back the market, leaving consumers confused and retailers wondering which horse — or horses — to back. All that competition has also slowed the development of the complex business models that will be necessary to reward every player in the value chain including the end users who need some sort of incentive to reach for their phones rather than their wallets at the point of sale.

Disruption will increase among service providers, benefiting consumers. The primary business model for mobile carriers in the U.S. and elsewhere has remained largely

unchanged for years: Entice customers with handsets that are sold for far less than their actual costs then recoup those costs by locking users into lengthy contracts with monthly payments for allotted amounts of voice and data access. That model is evolving, though, thanks in large part to the "uncarrier" strategy T-Mobile began pursuing this year. The nation's fourth-largest carrier dropped handset subsidies and service contracts and launched installment plans for users who can't (or don't want to) pay the entire cost of the phone up front. Which means the overall monthly cost to consumers decreases dramatically once the phone is paid off, unlike the traditional model.

T-Mobile enjoyed 1 million net subscriber additions in the third quarter thanks largely to its bold moves, and AT&T — the nation's second-largest carrier — has followed suit with new, no-contract rate plans for users who don't buy a subsidized handset. I expect Verizon and Sprint will begin to experiment with those strategies next year as well.

T-Mobile isn't the only player rocking the mobile boat. A small army of MVNOs are leaning on non-cellular technologies to offer services that drastically undercut even traditional prepaid plans. FreedomPop, for instance, recently launched a $99 smartphone that comes with a free monthly voice and data plan; users pay extra for usage that exceeds those allotments. Republic Wireless recently began selling the Moto X for $299 without a contract along with a Wi-Fi-only talk, text, and data plan for $5 a month — an additional $10 a month buys cellular access, and 3G and 4G plans are also available. Whether any of these new MVNOs can build a viable business is far from clear, but the increased competition they provide may force traditional cellular operators to cut their prices to compete. That's happening in France thanks to Free Mobile, a subsidiary of the telecom Iliad that is forcing the competition to lower their rates.

Apple's iOS will make strong progress in the mobile enterprise. BlackBerry was once the de facto mobile platform of the corporate world, but the company's slide into oblivion leaves a huge opportunity for any user-friendly operating system that can offer airtight security and other enterprise must-haves. Every other mobile OS has struggled to inherit BlackBerry's throne, though. Android's massive market share is a powerful weapon in the era of BYOD, but its security has been dubious (although it is improving) and fragmentation remains a major concern. Samsung is trying to address both those concerns with Knox, a forked version of Android targeted at that enterprise, but the platform isn't yet ready for prime time. Microsoft's Windows Phone, which seems like a natural fit for the mobile enterprise, simply hasn't achieved the traction necessary to tap that market when BYOD has tremendous impact. And while BlackBerry had a chance to regain its footing this year, it's circling of the drain has only accelerated.

Apple has yet to conquer the mobile enterprise for several reasons: IT departments have been reluctant to embrace iOS because it is so tightly controlled by the iPhone manufacturer; the platform is supported by an extremely limited lineup of smartphones

and tablets; and Apple simply hasn't pursued that market as aggressively as it could. But while IT departments don't always love the battened-down nature of iOS, which can make managing devices and apps difficult, Apple's share of the worldwide mobile enterprise device market has grown to 72 percent, according to recent data from Good Technology. That figure will almost certainly increase thanks to a slew of new, enterprise-targeted features included with iOS 7. Apple won't win the mobile enterprise in 2014 — the growing BYOD trend will ensure no single player dominates that market in the foreseeable future — but its dominance will increase dramatically.

Consolidation among U.S. service providers will slow and the ranks of major network operators may grow (by one). This first part sounds like a no-brainer, I know, because the 2013 M&A feeding frenzy has left very few smaller operators ripe for acquisition. But the rumor started cranking again late this year with a report from *The Wall Street Journal* that Sprint is considering a takeover of T-Mobile in a deal that could be worth $20 billion or more, depending on the size of the stake. Some onlookers claim a tie-up between the third- and fourth-largest carriers would actually spur competition among service providers, providing a market where three operators of roughly equal size vie for customers. But I think a Sprint takeover would likely spell the end to T-Mobile's disruptive streak, creating more complacency among three tier-one operators and a huge gap between them and much smaller regionals. Which is why I think the Federal Communications Commission and U.S. Justice Department are unlikely to approve any such deal.

But while consolidation was a major theme in 2013, Dish Network could actually join the field of mobile service providers next year. The satellite TV provider already owns some spectrum that it can use to build out a terrestrial 4G network, it may yet acquire some airwaves from LightSquared and it is highly likely to pony up $1.56 billion to pick up the so-called H Block during the FCC's spectrum auction in January 2014. It still isn't clear whether Dish truly wants to provide mobile services or whether it simply is hoarding spectrum to sell off to the highest bidder, and building a nationwide network from the ground up will take an enormous investment and no small amount of time. But I think it's likely that in 2014 Dish finally commits to joining the mobile industry with its own branded service.

Wearable devices will spin their wheels. The tech market was transfixed in 2013 by the concept of wearable devices, from smartwatches to Google Glass to, yes, a SmartWig. I think the hype surrounding the wearable segment is generally warranted, largely because of the breadth of potential use-case scenarios: As the father of seven- and 10-year-olds, for instance, I think there's a huge potential market for smartwatches for kids who aren't yet ready for, say, an iPhone (and for parents who aren't yet willing to take on another smartphone data plan). I can see why running enthusiasts would buy smart athletic shoes that help them correct their gait. And I think the day is coming where most of us are in

front of a screen during nearly all our waking hours, even if that screen is our car windshield or our eyeglasses.

But the market simply has too many obstacles to overcome to break out of the gate in a big way. Not only must prices come down drastically for many of these gadgets—— there's no way many consumers are going to pay $199 up front plus $10 a month for a kids' watch with extremely limited functionality — but it will take quite a while for manufacturers and developers to find the right combinations of form, function and style. Also, while Google Glass is certainly compelling, mass-market adoption will require huge changes in some fundamental behaviors, including how we drive, walk down the street and talk to each other in person. (It also will have to overcome some major privacy concerns.)

Finally, there's the looming question of business models: Will users pay extra monthly fees for data for each device, or will they pay a single service provider for data across all their devices? Will they be willing to pay for each gadget up front, or will carriers or other service providers subsidize some devices? And what kind of role will advertising play in bringing devices and services to consumers?

The world of wearable devices holds enormous promise, to be sure, and there are endless opportunities in that space. But very few of them will be realized in 2014.

The future of work: 4 trends for 2014

We are all in the gutter, but some of us are looking at the stars. – Oscar Wilde

I confess that at times I feel whiplash from swinging back and forth from the review of the new release of a tool to broad prognostications about society and culture, but the Oscar Wilde quote at the top is a good backdrop to my feelings about that.

This past year has been a time of great change and turbulence in the tools, practices, and thinking around the rapidly shifting world of work. Social technologies have been a key part of that, but practices like remote work — due to Marissa Mayer's decision to drastically curtail it at Yahoo — and new approaches to management occupied as much of the 2013 news hole here at Gigaom Research as the release of new devices and software.

As a result, like an astrologer looking into the canopy above with my feet in the gutter, I won't spend much time discussing individual stars in the 2014 skies, but instead I've come up with four constellations where I expect to see a lot of action in the coming year.

The consumerization of work

One trend that has recently upended the business world has been the adoption of consumer technologies — and their architectures and user experience — either directly into business use or as a forcing function leading to redesign and replacement of older hardware and software.

This has been most obvious with regard to the adoption of companion devices like smartphones and tablets in the enterprise. This Bring Your Own Device phenomenon offers companies the possibility of real cost savings on purchase and provisioning of "computications" tools. But it also terrifies the risk-averse IT staff of most firms.

I wrote earlier this year that this trend might better be called Bring Your Own Mind, since we become so dependent on the companion tools we use that leaving them at home would be something like a lobotomy:

> The capabilities of tablets and smart phones are growing so rapidly it is hard to even recall what it was like a few years back, using dumb phones. [...] These devices are a central aspect of personal productivity and identity. People want to choose these tools based on how they do their work.
>
> So BYOD should really be considered a shift of the boundary where the company's control over the way we work — which equates to the way we think — is receding.

BYOM is a trend that will accelerate — if that is even possible — in 2014, as devices become more capable, and a new generation of apps and services are rolled out that increasingly counter the security concerns of the CIO.

The deepest and broadest aspect of the consumerization of work is the central role that file sync-and-share — as implemented by a growing list of companies like Box, Dropbox, Hightail, Intralinks, and SugarSync — now plays in the way that work is done. I have written a great deal about what I call the distributed-core architecture (see "Hightail raises $35M: the file sync-and-share market is red hot"), where file sync-and-share acts as a virtual distributed file system. This is, in fact, plugging a hole in the operating systems that dominate our world today (OS X, Windows, iOS, and Android) all of which treat the web basically as an afterthought.

These, and related trends, will continue to converge on an increasingly consumerized workplace and workforce, where consumer technologies and practices will displace entrenched alternatives. Consider Salesforce's decision to drop its own file sync-and-share application, Chatterbox, to partner more closely with Box (see "Salesforce drops Chatterbox, announces Salesforce Files"), as just one past example.

(Disclosure: Hightail is backed by Alloy Ventures, a venture capital firm that invests in the parent company of Gigaom Research, Giga Omni Media.)

Dominance of mobile OS and the emergence of social OS

The real growth area for hardware continues to be companion devices (smartphones, tablets, and wearables), and so we are moving to a mobile-first work of work, as well. Already we have seen groundbreaking consumerized work-related products rolled out first or exclusively on mobile devices. That includes Mailbox on iOS (almost

instantaneously, parent company Orchestra was acquired by Dropbox), and Anchor by Tomfoolery.

So we can expect that the most innovative, and disruptive notions will appear there, first.

I am expecting to see someone roll out a phone in 2014 where the distributed core file system is *the* file system built into the phone's OS, where sharing of files, folders, and messages is a built-in aspect of the system, not a bunch of apps loaded later. This will most likely occur as some variant of Android and from a small-fry upstart like Jolla. But it could also be from a market disruptor like Amazon, who is rumored to be planning a smartphone roll-out in 2014.

Consider the disruptive power of social connection built into the operating system, as opposed to 10,000 siloed apps. And consider also the explosion of productivity that came from the emergence of email standards that allowed interoperability of email back in the 1990s. We'll see some rumblings of this tectonic shift in 2014, I'll bet.

Quantified self and the "me-ization" of productivity and performance

The Quantified Self is a trend being precipitated by consumerized companion devices and the growing existence of tracking performance on a daily level. Originally kicked off by the desire to track physical activity (e.g., Nike Fuel band and other dedicated devices), this trend is becoming more mainstream as smartphones and other wearables are capable of tracking location, motion, velocity, and who we are interacting with.

Consider the work of Sandy Pentland, the director of the Human Dynamics Laboratory at MIT, who has had pioneered the tracking of people geographically within business offices using customized 'e-badges' that transmit data:

> As he [Pentland] described last year in the Harvard Business Review, he tried the badges out on about 2,500 people, in 21 different organizations, and learned a number of interesting lessons. About a third of team performance, he discovered, can usually be predicted merely by the number of face-to-face exchanges among team members. (Too many is as much of a problem as too few.) Using data gathered by the badges, he was able to predict which teams would win a business-plan contest, and which workers would (rightly) say they'd had a "productive" or "creative" day. Not only that, but he claimed that his researchers had discovered the "data signature" of natural leaders, whom he

> called “charismatic connectors” and all of whom, he reported, circulate actively, give their time democratically to others, engage in brief but energetic conversations, and listen at least as much as they talk.
>
> [...]
>
> His group is developing apps to allow team members to view their own metrics more or less in real time, so that they can see, relative to the benchmarks of highly successful employees, whether they’re getting out of their offices enough, or listening enough, or spending enough time with people outside their own team.

Pentland’s work shows the potential for tools of this sort, but the advance is more likely to come from individuals option to use low-cost apps on conventional companion devices, and the community’s data pooled for the purpose of everyone getting at the key factors for being more creative, productive, and learning the skills of becoming a charismatic connector.

It will arise from an almost obsessive “me-ization” around productivity and performance rather than company-imposed tracking of the sort that Pentland applied, I think, but it might be both sides at once.

Algorithmic science displaces folklore: AI in the workplace

It’s astonishing to realize how bad the results are from many common, everyday business practices. Consider hiring: Even a company like Google, filled with some of the world’s smartest people and nearly unlimited resources to spend on hiring, had for years applied a notorious brainteaser-based approach to winnowing out job candidates that, in point of fact, did a lousy job of predicting future performance.

Ultimately, sanity has prevailed, and they no longer ask people, “How many basketballs can fit in a school bus,” or the like. They researched themselves and found out that riddles don’t work, and also that no one was particularly good at hiring, as outlined in this piece:

> Years ago, we did a study to determine whether anyone at Google is particularly good at hiring. We looked at tens of thousands of interviews, and everyone who had done the interviews and what they scored the candidate, and how that person ultimately performed in their job. We found zero relationship. It's a complete random mess, except for one guy who was highly predictive because he only interviewed people for a very specialized area, where he happened to be the world's leading expert.

No surprise, perhaps, that making hiring more formalized and oriented toward "behavioral interviewing" where candidates are asked questions that place them in a specific context and where they spell out their perceptions, like "give me an example of when you solved an analytically difficult problem."

The reality remains that the conventional approach to interviewing people for jobs is a total mess: complete folklore, and ungrounded in any predictive way.

However there is a great deal of new science that shows that analytic tools can be a very good job of predicting success in well-defined domains, so long as a large body of data is available for algorithmic analysis. For example, Gild has developed software that can read the open-source submissions of programmers, evaluate how good the code is likely to be, and cross-correlate that with the programmer's social media involvement. Based on the manner in which other programmers treat a candidate, and the first-order assessment of their coding, Gild has pretty good success determining who is the real deal and who is the wannabe.

Most importantly, even for those who have not contributed to open source projects, Gild can make inference on a candidate with strong certainty simply based on the way other programmers relate to the candidate.

Obviously, these capabilities could be directed to the developers within a company, to identity the plodders and the superstars, as well as with candidates. And increasingly, people will be less involved in the nuts and bolts of evaluations like this, leaving it to "engines of meaning" — that is, AI and big data algorithms — to operate in a spiderish, bottom-up way, and we'll put the top-down, cognitively-biased approaches of the past in the trashcan, and click on "empty."

A final thought

Things are changing so quickly we may start to suffer from something like the optical illusion that comes from looking at a fast-moving car's hubcaps: At certain speeds, they can appear to be rolling backwards. The equivalent in our case is to start to imagine that just because we are accelerating quickly these days we can see farther into the future than we could in the past: that the future is closer just because we are moving faster. Lamentably, this is not the truth. It is just sooner, not closer.

And in fact, we have to accept the increased levels of risk inherent in hurtling blindly into an unknown future, because the old techniques didn't work even when everything was moving 10 times slower.

Cloud computing and database 2014: The trend is your friend

The cloud-computing market faced some unique challenges in 2013, including the fact that moving clouds into production means new and difficult issues, many of which were not initially understood. Enterprises need to understand how to work properly with cloud-computing technology. In 2013 they had to learn how to design applications to take advantage of cloud-native features such as the ability to self- and auto-provision, as well as self- and auto-scale. Enterprises also learned to define strategic architectures that go beyond a single cloud deployment, and figured out an approach and management technology to make the cloud resources all march in the proper directions to provide automation in support of resources governance and DevOps.

There were some obvious bummers in the emerging cloud computing market. Many enterprises found out that cloud-based platforms may not be as cost-effective as we initially believed. This is due to unexpected operational costs, and migrating the wrong applications and data sets to the cloud. We're now in the process of dialing these metrics back into the cloud/no-cloud decisions.

On the upside, while many found that cloud computing was not a fit, more found that cloud computing does indeed live up to most of the promises made in 2013. This includes the ability to operate core business applications at a fraction of the cost of traditional platforms, and the ability to finally bring business agility and time-to-market advantages to the enterprise because of how easy it is to provision and deploy public cloud resources.

What worked in 2013

The dominance of AWS became very clear in 2013. Most analysts put the company at roughly a $20 billion USD total valuation. As AWS continues to nail the market, that valuation seems conservative. AWS's re:Invent conference held in November was packed, and provided enough data points that the company is indeed a vendor that can play in the enterprise, which many felt would be its Achilles' heel. Thus, far AWS has not shown many weaknesses, and seems to be defining the standard for IaaS clouds, and that has the other IaaS providers worried.

OpenStack grew in 2013. This was clear with the release of Grizzly in March, and the release of Havana in November. OpenStack turned three years old in 2013. It has a lot of momentum to show, including adding pretty much everybody but AWS to its ranks, including HP, IBM, and now Oracle. While you would think that this "dream team" of technology powerhouses would be enough to push down AWS a few clicks, the growth of OpenStack has been more within the private cloud portion of the market, where AWS does not play.

The cloud proved itself green. The release of new information from Berkley Labs supported the assertion that cloud computing is truly energy efficient. As the cloud providers build data centers the size of blimp hangers, the greenness of the cloud was called into question. However, given the sharing and the consolidation effect that cloud brings, energy use should go down, relative to the number of users.

The cloud can be managed though the use of cloud management platforms. These technologies are not new, but they found a new purpose in 2013 as multicloud deployments became the way to go. These tools handle provisioning and deprovisioning of cloud resources, such as storage and compute services, as well as place policies around the use of those services — even the ability to monitor and charge back for those services. The ability to provide a "single pane of glass" approach to cloud management removes the enterprises from having to deal with the underlying complexities, considering that cloud-based deployments are truly complex distributed systems at their essence.

The cloud proved itself. In other words, most deployments worked as advertised. In 2011 and 2012 we were largely at the POC stage with cloud computing as enterprises dipped a toe in. In 2013 we saw a few massive deployments to the cloud, with mission-critical applications running in production within the major cloud-computing providers. The world did not come to an end and the cloud did not drive massive layoffs, as many predicted. Some of the lessons learned include the fact that applications need some modification to take advantage of cloud-native features, such as provisioning services. The data typically should reside with the applications, when dealing with the public clouds, for performance and security purposes. Security and governance required some advanced planning.

What did not work in 2013

The dominance of AWS showed the strength of the cloud computing market but also represented a single cloud provider that got very big and powerful very fast. To many in the market, that brings to light some negative consequences. While somebody had to be in first place, the gap that AWS is building between itself and its closest competition widened in 2013, with Microsoft or Google being in second place, depending upon whose market data you read. AWS is already setting market prices for cloud services, driving many IaaS startups to drop well below profitability. The larger players that are spending billions to get deeper in the-cloud computing market are perplexed by the rise of AWS, and are not sure how to respond. AWS does not carry the legacy baggage of an IBM, Oracle, or HP, and thus can be more nimble and innovative. The downside for the user is that we could end up with a de-facto single solution for public cloud IaaS, which could make the market much more homogeneous much quicker than we had thought. Think Microsoft in the 1990s or IBM in the 1980s.

The NSA rained on our cloud parade, with some analysts firms predicting the PRISM scandal could cost cloud companies as much as $180 billion. This also placed cloud computing on center stage for the press, and the general public questioned the wisdom of the cloud, given proof that the government could cull through your personal and business data. While this did have a sobering effect on the emerging cloud computing space, the big pushback that everyone expected did not really happen. Or, if it did, the effect cannot yet be measured. While companies outside of the U.S. are indeed concerned, companies in the U.S. have dialed this fear into the mix along with the other fears around cloud usage. We have moved on, it seems.

Cloud companies went away, such as cloud storage providers MegaCloud and Nirvanix. This is perhaps the start of the dark side of cloud computing, where those holding your applications and data are here today and gone tomorrow. You're left out in the cold, and the use of cloud-based resources has actually caused you to take a step backward. In these events, and likely other events that will occur in 2014, we're learning to dial in viability and stability when we select cloud providers. This could mean another reason avoid smaller providers, and thus we have a narrower field of cloud-computing competitors.

Trends and technologies to watch

The continued growth of CMP and other management platforms continues to drive the growth of cloud computing for larger enterprises. The ability to mix and match cloud-computing providers and other cloud-based technologies is a key enabler for enterprises that seek to leverage best-of-breed in the world of the cloud, both private and public. Cloud computing is now a team sport. Focus will move from simple operations — e.g., the ability to add, remove, monitor, and manage cloud resources — to DevOps that includes support for continuous integration and continuous development. Count on more consolidation in this space as many of the smaller players, such as Gravitant and RightScale, follow ServiceMesh's lead and move to larger players.

Enterprises will move to a security model that is a better fit for the distributed nature of cloud computing. This means security solutions that support identity-based approaches, such as Ping Identity and others, will be in increasing demand. Cloud providers will quickly learn how to provide the right guidance, perhaps building identity-based security systems in their cloud that can be had on-demand.

PaaS has found its place in DevOps. While PaaS has always been a part of cloud computing, most enterprises have yet to find it a proper place in their cloud computing strategies, and resulting technology stacks. Merging PaaS capabilities with DevOps automation will be a pairing that many enterprises will find valuable. Popular PaaS providers have been AWS, Microsoft, and Google, among others. PaaS' place is to provide automation around the delivery of business applications, as well as the ability to

continually update the capabilities of that solution to meet the needs of the business with reduced latency. The focus on automation, as well as continuous delivery and continuous integration, brings a new value to the use of PaaS providers in a space that has been somewhat confusing and thus bypassed by most enterprises.

AWS becomes the standard bearer, as discussed above. AWS is now in the same place as IBM, Microsoft, and Oracle in defining the standard for its technology space. It will continue to lead the trends in pricing, technology, and use cases, and will create a growing ecosystem around AWS that will drive the growth of other technology providers. This dominance will call many things into question, frustrate the existing technology powers-that-be, and provide enterprises with very simple choices when it comes to selecting a strategic IaaS player. The positive or negative effects are yet to be determined.

Concluding thoughts

The trend is your friend when considering cloud computing. The big players will become bigger, cloud management and governance will become more useful, and security will become more important. The year 2013 was all about getting serious with the use of cloud-based platforms, and most enterprises found success in the cloud. While the cloud is not to be used for everything, it should be a core consideration when an enterprise needs to improve time-to-market for business-critical applications, improve business agility, and reduce costs.

The challenges moving forward will be those of planning and architecture to deal with the complexity that cloud computing brings, including the movement to multicloud, which can provide more value through heterogeneity, or by providing choice of cloud resources to leverage. Most enterprises have a good handle on cloud computing, at least conceptually, but most have just begun to work with this technology. The learning curve will be steep, and a few failures are inevitable.

A near-term outlook for the consumer space

From cable consolidation to set-top integration, here are some trends to watch for in the consumer space in 2014.

Cable Consolidation. Toward the end of December, Charter Communications was reportedly preparing a bid to acquire Time Warner Cable, but that's unlikely to be the last word either on a possible sale of TWC or on M&A talk among cable MSOs. Comcast and Cox Communications were also thought to be interested in TWC should it be put in play. Cable providers, meanwhile, continue to lose video subscribers, even as programming costs soar, creating an environment that is probably ripe for consolidation — antitrust regulators permitting.

Speaking Privately. The diplomatic fallout from Edward Snowden's revelations about NSA spying has been severe but those revelations' potential impact on U.S. economic interests is only starting to be tallied. In December, Google, Facebook, Apple, Microsoft, Twitter, Yahoo, LinkedIn, and AOL jointly sent an open letter to Congress and President Barack Obama demanding strict limits on government surveillance as the tech companies seek to rebuild consumer trust, particularly overseas. At the same time, a bipartisan group of lawmakers sent a letter to the U.S. Trade Representative demanding U.S. allies back off proposed new restrictions on international data traffic the lawmakers fear could harm U.S. technology companies. This is just getting started.

Set-Top Integration. With more than 80 percent of U.S. TV households having some sort of internet-connected device paired with their TV, the time is ripe to integrate linear TV and OTT into a single user interface. Whether that interface runs on a cable box, a stream-top, or on a "second screen" mobile device will be a key question in the year ahead.

Wearing Well. Wearable technology was in the headlines in 2013, thanks to Google Glass, but the next 12 months is likely to see an explosion of wearable devices as companies and entrepreneurs grope for a killer app that can't be accomplished just as well or better on a smartphone.