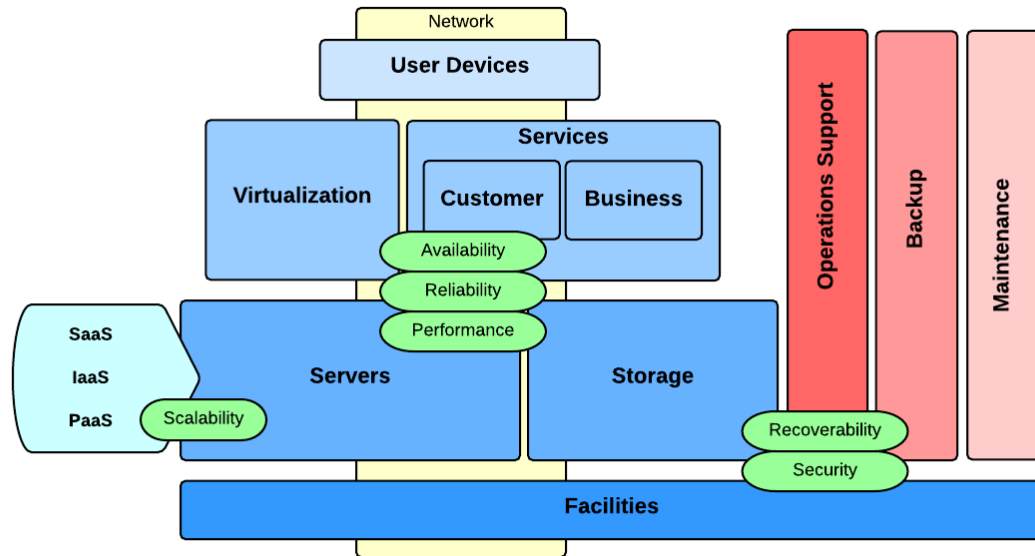


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Group 2-B: Enterprise Infrastructure Framework



The overall picture of this framework was developed under the consideration that all technologies "build off" of each other. Some higher-level components could not exist or could not be fully realized without having the base components in place. Each component is an essential building block that allows an enterprise to focus on their core business strategy and, ultimately, be profitable. The combination of several of these layers can be cross examined to identify and quantify nonfunctional attributes that also contribute to the successful implementation of technology in an enterprise environment. It is usually more than one technology layer that contributes to the qualification of a nonfunctional attribute.

Facilities

All businesses, from a single-person to an enormous corporation, are based out of a physical location that is essential for continuing business operations. No matter the size of the facility, the following aspects are common among all: plumbing, electric, heating/cooling, network cabling, and the space necessary to carry out business operations. Since facilities are so fundamental to the entity of a business and its infrastructure, it lies at the base of the enterprise infrastructure framework.

Magic Quadrant: Integrated Workplace Management Systems



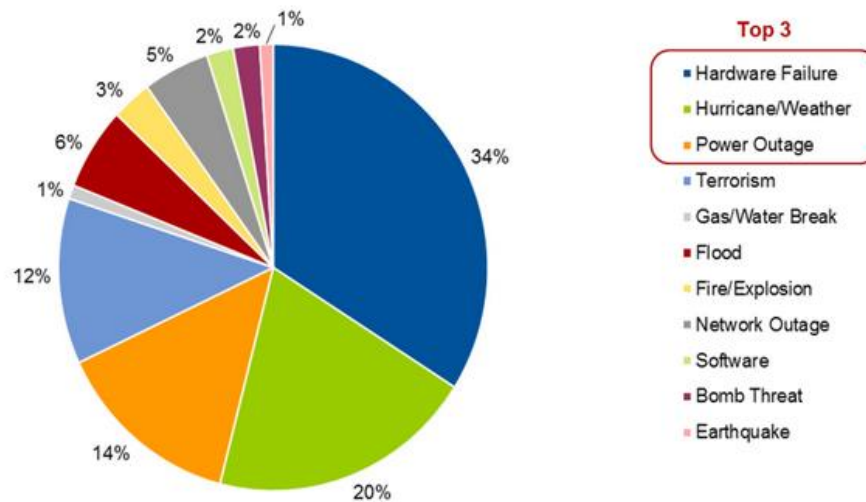
An integrated workplace management system (IWMS) is a software solution that helps enterprises manage their facilities effectively and efficiently. IBM and Manhattan Software are leaders among their peer companies, with Archibus and Planon Software following behind. Indus Systems and MCS both have small user bases, but offer robust software solutions that are used by their respective national governments.

Hype Cycle: Data Center Power and Cooling



In addition to IWMS solutions, many technologies are being developed to help organizations manage facilities effectively. A great example of this is the cooling technologies being used in data centers. Direct AC to Rack is a popular solution that routes 480-volt AC power directly to the server racks instead of routing it through multiple power converters. In-rack cooling takes a similar approach by placing cooling units directly in the server racks.

Statistics on Disaster Declarations

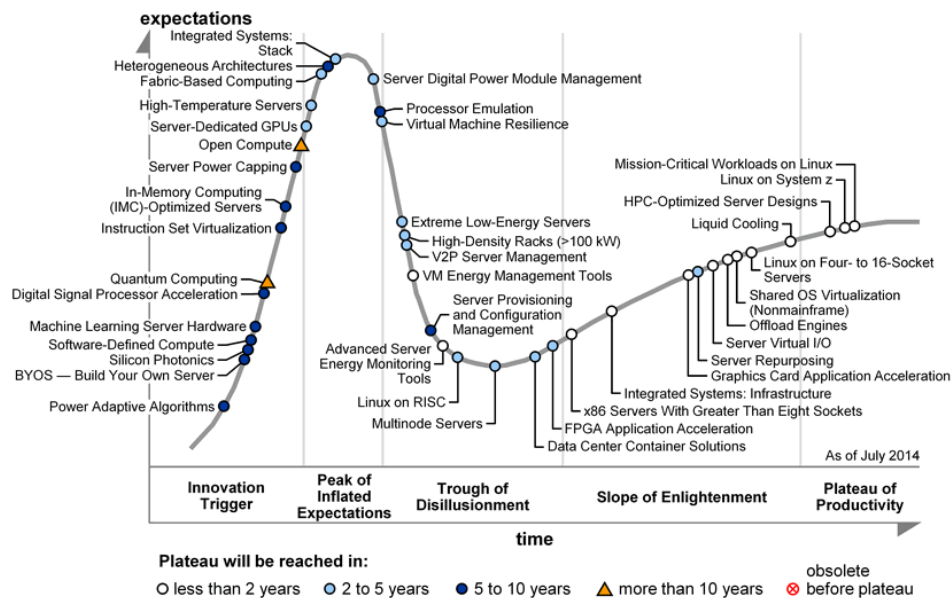


Of more than 2,800 disaster declarations as reported by SunGard in August 2014, 45% were directly related to facilities management.

Servers

Servers are needed to host a myriad of business functions such as applications hosting and service distribution. This component appears in the middle layer of the network framework because servers are usually stored in data-centers (facilities), and are used to host applications on virtual machines. In addition to their high-end hardware specifications, each server must be properly installed and configured, balanced, optimized, and maintained. Those manufacturers who are able to produce a server product that requires very little configuration and optimization are the ones who lead the market.

Hype Cycle: Server Technologies



The most productive server technologies are mostly all Linux-based, and other Linux-based technologies are also approaching the slope of enlightenment. One of the most interesting technologies on this hype cycle is the concept of BYOS (Build Your Own Server), which allows companies to build servers that are very specific to their business needs.

Magic Quadrant: Integrated Systems

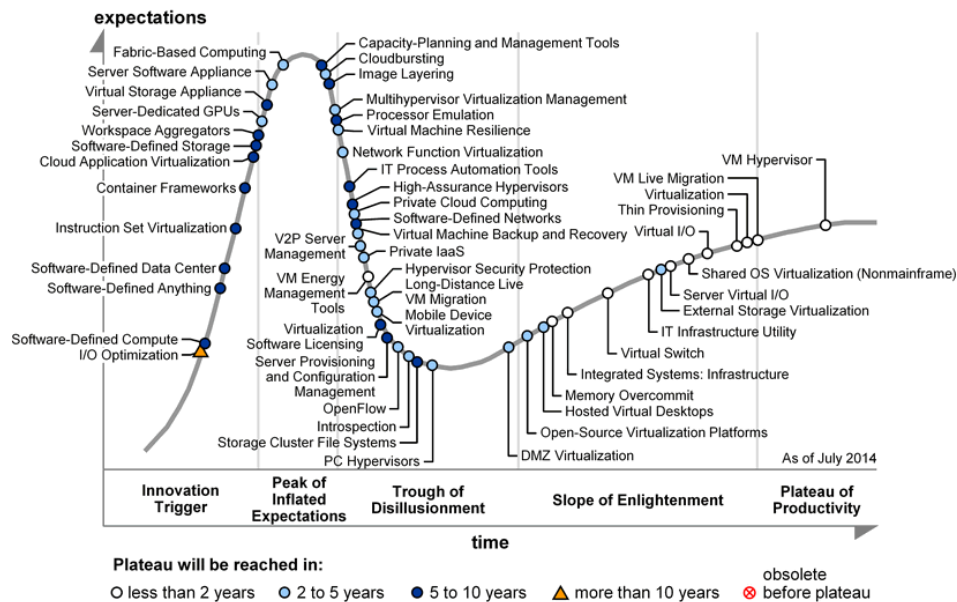


Unlike most magic quadrants, most companies that compete to provide integrated solutions have a complete vision, although some are much better when it comes to execution. For example VCE is private company whose Vblock systems are primarily used in large global organizations. Huawei and Unisys lag behind mainly due to an immature product, and lack of integration with third-party applications.

Virtualization

Virtualization has proven to be an extremely useful and cost-efficient technology. Allowing companies to create virtual servers on demand and allocating resources to them as needed, this block of technology rests on top of the servers used to host each virtual machine.

Hype Cycle: Virtualization



Virtualization has reached the plateau of productivity, while also having many new technologies among the various stages of the hype cycle. Niche players will have many points where they could find a possible foothold, while still allowing industry leaders to refine and polish older technology components.

Magic Quadrant: Server Virtualization



Virtualization software has two primary leaders in VMware and Microsoft's Hyper-V. Many enterprises lean towards Hyper-V because it has a similar feel to other Microsoft products; however, VMWare still dominates the market with superior customer support and an extremely mature product.

Storage

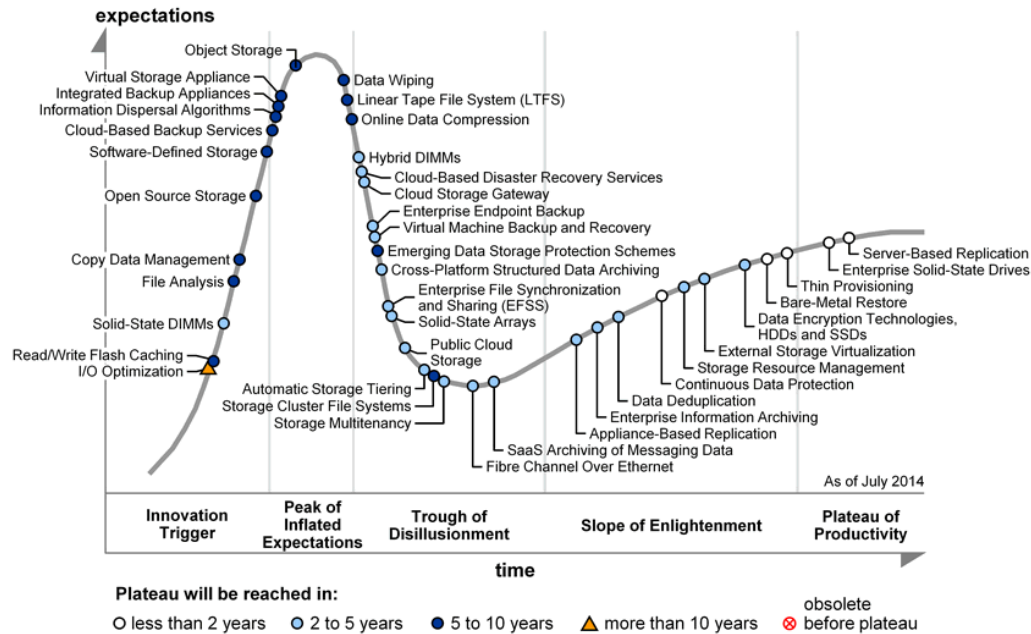
Data storage is an essential part to a enterprise's infrastructure. Storage serves as one of the foundations of our framework in that all of the companies data resides in this category. It sits besides Servers because it hosts the data that is accessed through the servers, and is also connected to Ops Support and Backup/Maintenance through essential non-functional activities.

Magic Quadrant: Data Warehouse, Data Management Systems



Oracle, IBM, and SAP are well-known companies that have been leading this industry for many years. Teradata, a lesser-known company, succeeds by offering durable hardware and analytics-focused database software.

Hype Cycle: Storage Technology



One of the most prevalent technologies in the industry is Enterprise Solid-State Drive. These high-end drives have been replacing or enhancing standard Optical Hard drives and provide up to 100x faster speeds and require far less space and energy to run. An upcoming technology is data deduplication which eliminates redundant data. A piece of data is only stored once, and all entities that use the data use pointers to use the same single piece of data, rather than having the data duplicated for the various entities. A new technology that will not become mainstream for quite some time is Cloud based backups, or BaaS, which is similar to the other cloud services, but specifically meant for large enterprise data. Because links to the internet are becoming cheaper and more readily available, data can be passed through the internet to the cloud ore quickly and in greater quantity than before, making BaaS a viable option in the next decade.

Services

Every enterprise has a set of services that it must offer, both internally and externally, that drive its business processes. These include base systems such as the following:

- Applications (e.g. Word Processing, Service Management, CRM, etc.)
- Email
- Performance Reports and Analytics
- VoIP
- Web Services
- Developer APIs (REST, SOAP, XML, RSS, etc.)

In the framework model, services appear in the middle because they are run by applications installed on the company's servers, which read and write to stored data. End user devices use these services, and a network connection is required.

There are multiple strategies for implementing IT services in a company. A business may decide to host all services internally (insourcing) or hire other companies provide specific services (outsourcing). Most companies do both (co-sourcing), especially outsourcing specific business processes that are common in all enterprises, but not specific to any of them, such as human resources and payroll. A model that is becoming more and more popular is using a cloud provider to outsource their server hardware and maintenance, which allows the company to focus on their services.

User Devices

User devices can be anything from a desktop computer to a smart TV. In the context of an enterprise, user devices can be considered anything that can connect to the company network and provide value to an organization.

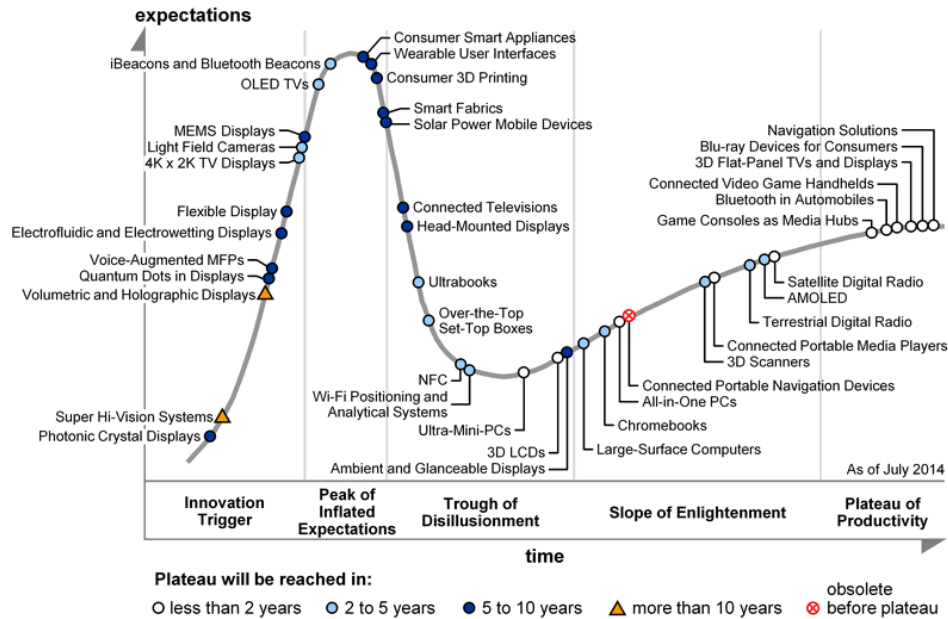
The user device category is on top of all of the other categories because the employee uses their devices to access all of the services, data, and information within the business. In order to benefit from the lower elements in the framework, user devices must be connected to the network.

Magic Quadrant: Global Enterprise Desktops and Notebooks



The great majority of end-user devices within an organization are either desktop computers or laptops. When purchasing devices for thousands of employees, companies are less worried about the quality of the machine, and more concerned with the quality of the service it offers. Lenovo continues to offer laptops at competitive prices with their well-established brand, ThinkPad. HP and Dell both offer similar services, but do not have the global reach or superior supply-chain strategy that Lenovo enjoys. Although companies such as Apple and Toshiba create quality products, they target consumers more than businesses.

Hype Cycle: Consumer Devices



Although not all devices in this hype cycle would be used at a large sized company, it serves to illustrate how new consumer devices will eventually impact businesses. Ultra-mini PCs are starting to climb the slope of enlightenment, and may find there way into mid-size corporations. Flat-Panel TVs and displays are starting to be used effectively for meetings and presentations, while emerging technologies such as 4k x 2k TV Displays and OLED TVs look to be challengers in the next 2-5 years.

Network

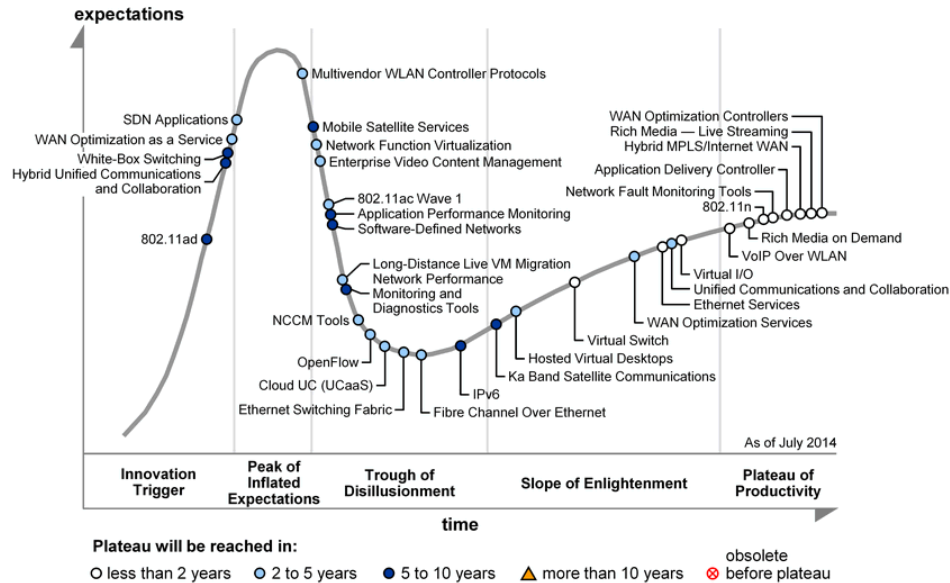
Networking is the pillar in a company's infrastructure that links all of the other categories together. No matter how efficient and advanced the other aspects of an infrastructure are, without a solid network base, none of the other categories can function together.

Magic Quadrant: Data Center Networking



The networking magic quadrant has no true leaders, although Cisco has shown an ability to execute on a global scale. VMWare leads the way as a visionary company in this technology, but lacks widespread adoption in part because it does not sell networking hardware and it has a very limited number of production deployments in the market currently.

Hype Cycle: Network Infrastructure



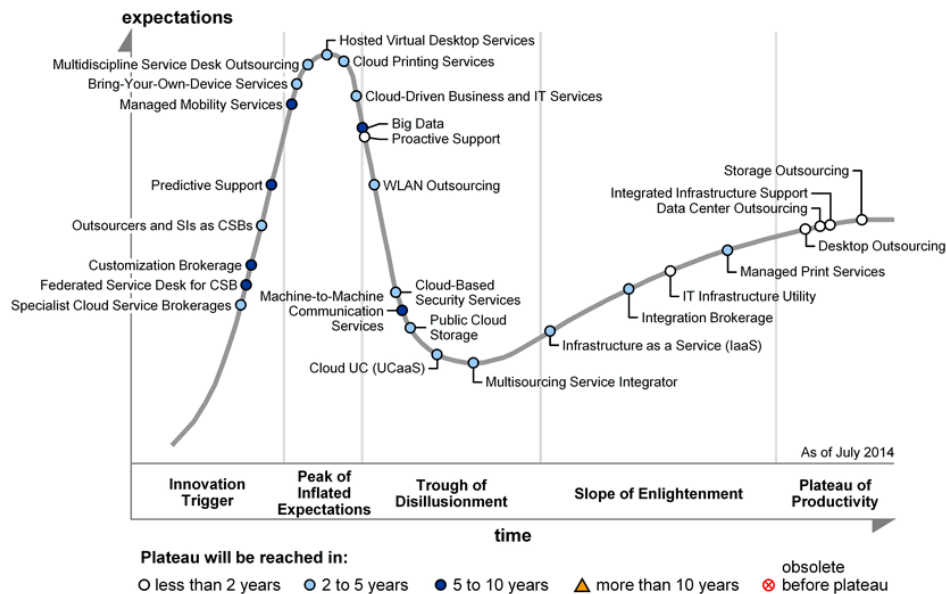
The most mainstream technology in the industry is WOCs, or WAN Optimization Controllers, which enables application centralization. This reduces bandwidth uses and also minimizes latency through network optimization. Gartner also reported, that although they report WOC's being at the Plateau of Productivity they continue to evolve and become better and will likely remain plateaued long after some of the upcoming technologies. IPv6 is an upcoming technology that exists primarily to step in, as we are running out of IPv4 addresses to use.

Network infrastructure serves as a backdrop for a large portion of the system architecture. The network in this case consists of hardware (wiring, network switches, etc.) as well as internet connectivity. These elements link the rest of the infrastructure components together.

SaaS, PaaS, IaaS

Outsourcing software, platforms and infrastructure needs to other companies can significantly help a company focus on its core competency. The different facets of services provided by *aaS companies can be customized depending on the need of the customer enterprise. These services are shown on the side of our framework because they allow a company scale outward. The cloud shape communicates that these services are usually accessible over the internet.

Hype Cycle: IT Infrastructure and Outsourcing

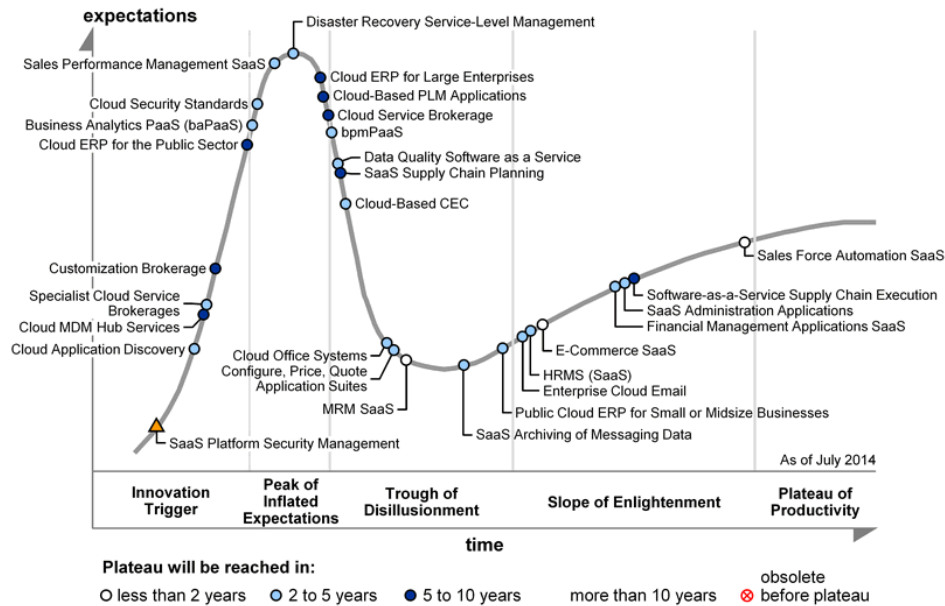


Storage Outsourcing is one of the technologies on the plateau of production. It consists of transferring the storage management responsibilities to an external provider. Predictive support is a newer technology that gives the support needed, when it is needed, through continuous monitoring and asynchronous trend analysis.

Software as a Service

Software as a service is completely managed by the servicing company. Applications are provided and managed as a service to the customer, and require very little configuration. This is the quickest return on investment that an enterprise can procure since the service is up and running the minute the customer purchases the service. SaaS is becoming an ever increasing model for even larger enterprise users and functions. Many organizations are offering their software as a service as a result of the hype around "the cloud" and how simple and easy cloud services are.

Hype Cycle: Software as a Service

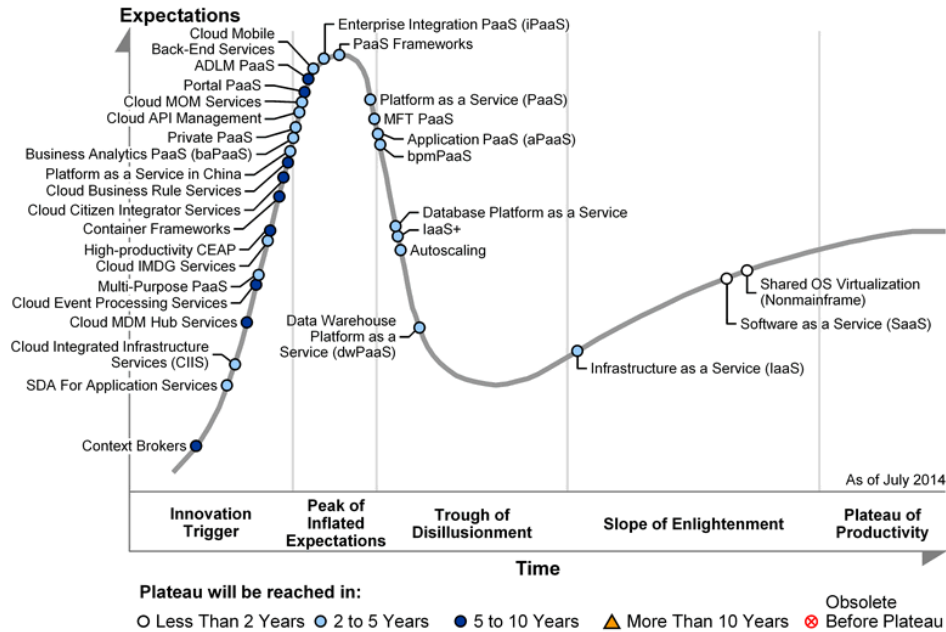


The most mainstream technology in the SaaS industry is the Sales Force Automation which is application software owned and managed by a remote provider. SaaS Platform security management is brand new and will not become mainstream for over 10 years according to Gartner. This will allow the provider's APIs to be used to create a dashboard to allow complete control over all activities.

Platform as a Service

Platform as a service is more customizable than SaaS because you are given the ability to build custom applications on top of the platforms provided by other companies. The operating system and other infrastructure components such as servers and networking are provided by the servicing company while only the data and application are managed by the customer. Again, the main benefit is that the customer can focus on their application while the PaaS provider only has to worry about server configuration, maintenance, and hardware. This exchange ends up being cheaper for both parties.

Hype Cycle: Platform as a Service



The Innovation Slope for this industry is much more crowded. A major trend is not reinventing platforms but rather how we are "containerizing" them for both specific and widespread uses. A technology that will become mainstream in several years is Autoscaling, which determines if the system needs to expand or contract automatically, and then scales the system appropriately for its current need. dbPaaS is a database management system-specific cloud service that allows scalability of the database as it grows.

Infrastructure as a Service

Infrastructure as a service provides the networking, the storage and the servers to the customer, while still allowing them control over the operating system, data and the application itself. Two major players in this sector are Amazon Web Services (AWS) and Rackspace. AWS got the ball rolling when it comes to cloud services. By providing an easy means to scale up and scale down (see scalability), AWS gives customers flexibility according to their needs.

Similar to AWS, Rackspace provides servers, storage and other infrastructure components to allow customers access to these devices without having to handle the maintenance costs and procedures.

Customers benefit from the flexibility provided by Infrastructure service companies, as well as the decreased maintenance costs. Physical facilities and data centers are expensive and cumbersome to maintain. By distributing those costs across multiple customers, the price per customer decreases significantly.

These services are directly associated with scalability. Because they are provided as a service, they can be scaled up and scaled down. In this case, we decided that these services are contained within the server level and do not expand beyond that because they are services that we consume, rather than services we are producing.

Operations Support

A crucial component of any infrastructure are the support operations that humans perform. These activities help the different systems to operate together and have many functions such as: physical maintenance, patching and updating, incident and problem management, and recovery solutions. Technologies have been created to facilitate and enhance each of the different aspects of IT Management.

Magic Quadrant: IT Service Support Management Tools



Unfortunately because each enterprise has vastly different requirements for the tools that they use to manage their IT assets, a single tool cannot fulfill every need of every company. That is why there is no clear leader in the ITSM industry.

Operations Support spans across multiple layers of the infrastructure environment. It is shown to the right side with other support functions including maintenance and backup. These attributes are related because they are features that are not always associated with the core requirements of the infrastructure, but they are necessary to provide some of the non-functional attributes necessary for a successful system.

Backup

Backup procedures, including hardware and software are extremely important to the infrastructure of an organization. Information can be a significant company asset, and if it is lost, the company will be negatively impacted. On the infrastructure diagram, backup is listed in red because it is support function and not necessarily an everyday activity.

Magic Quadrant: Backup Technologies



The leading vendors for backup services are CommVault, EMC and IBM. While CommVault is not comparable in size to EMC and IBM, it has implemented successful marketing strategies to make the company appear larger than it really is. In regards to new technologies, CommVault has been the largest proponent for the value of a unified data management platform, which refers to the blending of data management software across an enterprise. Their emphasis on UDM has helped them build their business by offering enterprise wide solutions rather than keeping data in isolated silos.

Barracuda Networks has found their niche in the backup as a service (BaaS) arena. They are able to deploy hypervisor software to a server, allowing the server to be booted within the Barracuda cloud. With cloud data centers located in the US, Canada, Germany, U.K., Japan and Australia, they have significant diversification to provide significant assurances to customers that their data is safe.

Backup procedures are essential to business infrastructure. Both of these players provide a significant service to customers by giving them peace of mind regarding the recoverability of their data. Ideally, the backup data would never be needed, but it is required to resume business if data loss occurs.

Maintenance

All equipment, whether virtual or physical, needs to go through consistent maintenance no matter how well it was built when first introduced. Maintenance activities include regular updates for software applications, custodial work for datacenters and facilities, and upgrading servers and user devices that are outdated. These activities are the oil that help a company operate smoothly by ensuring that each aspect of the enterprise architecture can continue at optimal performance.

Scalability

Scalability refers to a company's capacity to expand its computing power as the needs of the business grows. Horizontal scalability is achieved by adding more servers, while vertical scalability involves adding more processing power to existing servers. With the increasing popularity of cloud computing, companies are finding it easier to outsource their computing needs. SaaS, PaaS, and IaaS, are allowing small companies to scale up without hiring personnel to take care of their servers.

Scalability serves as the link between service providers (IaaS, PaaS, SaaS) and the servers because it is an essential non-functional attribute which makes these services necessary. By connecting these external services with internal servers, we are recognizing the need for increased scalability.

Availability

To operate efficiently, every company needs makes sure that it's services are running and available when needed. Datacenters make sure they have an uninterrupted power supply, so they keep multiple generators on-site in case of a power outage. Availability also includes constant access to the company's network, as well as the customer's access to the company's services.

Availability is a product of Virtualization and Services.

Reliability

Reliability refers to the ability of a system to perform its intended function for a specified period of time. Reliability is a vital component in a company's infrastructure because without a dependable system, all other components of the infrastructure are less effective.

Hype Cycle for IT Service Continuity Management



Continuous Data Protection (CDP) is a rising technology that continuously tracks and journals and changes made to files or blocks of data, rather than just once a day. CDP is currently being used by 20%-50% of its target market. Cloudbursting uses cloud services to assist in handling the system during peak traffic time and essentially is a back up that ensures continual service even if the system becomes overloaded. This can be implemented on-premises, through one cloud provider, or through several cloud providers.

Reliability is central to servers, storage, virtualization, and services. Each of these components are codependent, and if one or all are undependable, they will all suffer. Reliability is displayed overlapping all four of these components.

Performance

An additional non-functional attribute is the need for performance. Performance refers to how well the system responds to a heavy workload. There might be a large number of users or a few users using significant resources. By monitoring these metrics, the company can determine what changes can be made to improve.

Magic Quadrant: Network Performance Monitoring and Diagnostics



As one of the industry leaders, Riverbed Performance Management provides end-to-end visibility and analytics to deliver actionable information to resolve performance problem rapidly and proactively. Developing metrics to monitor the performance of a system is imperative to improving the overall effectiveness of the structure.

On the other hand, Paessler focuses on selling via Web and resale channels. The product is often used in segments of system environments, instead of implemented as an enterprise standard. By focusing on their individual niche, they are able to successfully gain market share in that field.

Performance monitoring is an important tool for making positive changes to the system. The feedback provided by the monitoring tools allows the business to persist into the future. Performance begins with

servers and storage. In the infrastructure diagram, the upper tier components rely upon the performance of the servers and storage. While performance is a factor in some of the other components on the diagram, the main focus of the performance monitoring technologies in the magic quadrant above are focused on providing feedback about the performance of the servers and storage. For this purpose we chose to display performance across the servers and storage components.



Business Continuity Management (BCM) software is full of industry leaders and challengers, but lacks visionaries, likely due to low interest in disaster recovery from the companies that use these products. The current industry leader is Strategic BCP, who maintains an edge because of the number of emergency plans it can manage. One customer using Strategic's software has 100,000 plans and about 3,000 employees.

In the diagram recoverability is shown as the link between storage and backup, spanning maintenance. Each of these components are required to allow an organization to recover in a timely manner. Data are stored in a number of different ways, and must be maintained. Similarly, data must be backed up on a regular basis. If a system recovery is necessary, Operations Support is responsible for making that happen. Each of these components are essential to providing recoverability to a system.

Security

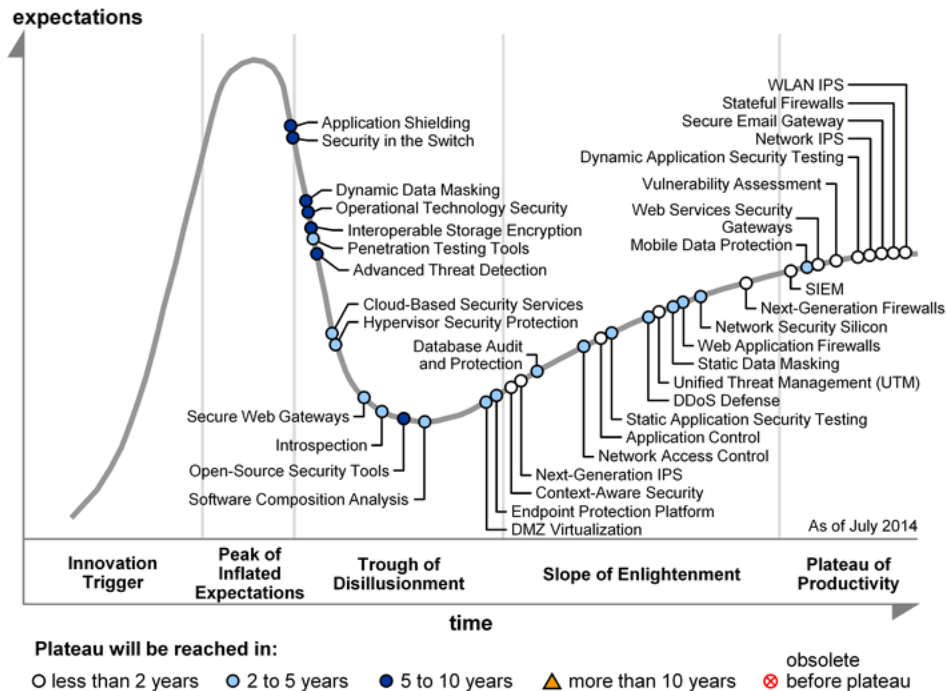
Ensuring a secure environment is absolutely crucial to protecting business-essential data. Things like proprietary source code, payment card data, and even customer credentials need to be protected at every cost. Because this need is so prevalent among all companies, it has driven the technology forward much more rapidly.

Magic Quadrant: Security Information and Event Management



Part of the complexity of maintaining a secure environment is monitoring and analyzing security events. Companies like Splunk and McAfee are leaders in this segment of the market. These companies focus their efforts to provide robust, enterprise-wide solutions. Each of these solutions provide dashboards with up to the minute data about security events. McAfee specializes in high event volumes while Splunk focuses on custom reporting and event handling. By using reporting software to monitor and discover a security event, companies can properly allocate resources to produce a response.

Hype Cycle: Infrastructure Protection



As noted in the above hype cycle, there are many innovations that are being pushed through to fully developed stages. In light of recent security breaches, many companies have been forced to take drastic measures to ensure the security of their data.

A significant portion of internal and external communication for an organization takes place over email. Secure Email Gateway (SEG) is a technology that is reaching the plateau of productivity on this hype cycle. SEG provides tools such as spam filters for inbound messages as well as outbound email monitoring. Many security threats can be detected using this technology, and it will continue to persist through the foreseeable future.

Despite the plethora of security features that could be implemented from this hype cycle, a significant weakness in security is the people themselves. Training and education must be implemented in addition to other security measures. Inadequate processes and personnel are a frequent cause of ineffective infrastructure protection. Dynamic Data Masking (DDM) is a technology that has some maturing to do, but will eventually do some good to safeguard against intentional or unintentional disclosure of data. By hiding the data from unauthorized users. The data masking is considered dynamic because the amount of data hidden depends on the rights of the user. Many low-level employees do not have a need to see some of the more sensitive data for a particular customer. Based on their access rights, this information will be hidden.

We decided to display security on our diagram encompassing the servers as well as end user devices. Security begins with the servers, but should all-encompassing. User devices, in addition to user error, provide significant holes in the security of a system. Technologies like those listed above focus on protecting the actions of the end user in order to prevent security breaches.