White Paper

Cloud Services Business Model Transition

Motivation

Business Transition Major Trends

The major trends in IT that are in transition are:

- Distribution of service processes and responsibilities between (many) service partners
- Distribution of tasks and functions to higher specialized partners using technologies like virtualization, cloud services, managed services, and others

Business Models

Future and existing business models for IT solutions are not only based on architecture and technology, but on smart solutions consisting of a combination of services offered by service providers and centrally provided cloud services (private or public cloud). This follows the concept of distributing tasks and ownership to the most effective and specialized provider to optimize outcomes for the customer. We also believe that different types of ownership are one of the drivers of smarter services, transitioning from CAPEX models to consumption-based payment.

Focus on Effective Business Models

This also leads to a rapidly growing number of new business models and offerings based on existing and future Cisco product portfolios for enterprise and service provider customers. Identifying the most effective business models to grow revenue and margins is crucial to becoming the number one IT company.

Executive Summary

Cisco has traditionally been a networking and infrastructure company. While this direction worked well in past decades, disruptive changes—introduced through virtualization, software defined networking, application awareness, and cloud—have changed market dynamics. Today we no longer see just a network and infrastructure market segment, but also the cloud services market segment, which is gaining more importance and market share every year. If we look into market size and potential growth over the next years, it becomes clear that while the network and infrastructure market is still growing, it will fall far behind the growth of the cloud services market. Some of the most prominent cloud services covering Cisco native business areas are the Network as a Service

(NaaS) and Infrastructure as a Service (IaaS) markets. But these cloud services will need to expand into other areas soon. The goal of this white paper is to show ways for Cisco to move into the new cloud services market by defining new business models.

The cloud services market is much faster growing compared to the cloud infrastructure market. Therefore, moving into the cloud services market in addition to Cisco's existing network and infrastructure business is one of the mandatory requirements. There is no question that the major trend is moving ownership away from the end users or consumers to centralized providers of technology and services. While this is a clear requirement for future growth, it is not easy to follow these new trends for a company that has based their business on classic networking and infrastructure sales.

The basic rules of making business remain the same also apply to cloud services: to offer a successful solution for the target market. The solution itself has to cover three major elements, which are delivery, product, and service.

Cloud services are defined by new business models concentrated on service offerings instead of infrastructure and product offerings. These new business models are based on a new generation of payment models, require standard and reusable cloud architectures and comprehensive support organizations, all optimized for cloud offerings. One major attribute of these new business models are completely new delivery methods for all types of services.

Moving ownership from the customer to the provider opens an additional value of service offerings. It moves responsibility from the consumer of a service to the professional provider of a service, freeing up the consumer for their core business. This is already a key argument for many customers/enterprises and will gain even more significance over the next few years. This change will happen fast, as the market is not waiting on us and we need to adopt and disrupt ourselves quickly.

We propose that there are eight types of ownership. Combined with different owner types, they form a matrix of possible distributions of ownership. This leads to a much more precise definition of different delivery models, including different types of cloud services. We can show those different types of ownership in terms of technical ownership, financial ownership, location ownership, data ownership, process ownership, platform ownership, connectivity ownership, and intellectual property (IP) ownership can be used to describe clear profiles for future solution offerings.

Using this framework will lead to well-defined solutions with clear delivery methods, based on products matching cloud architecture requirements and a well-organized sales and support structure.

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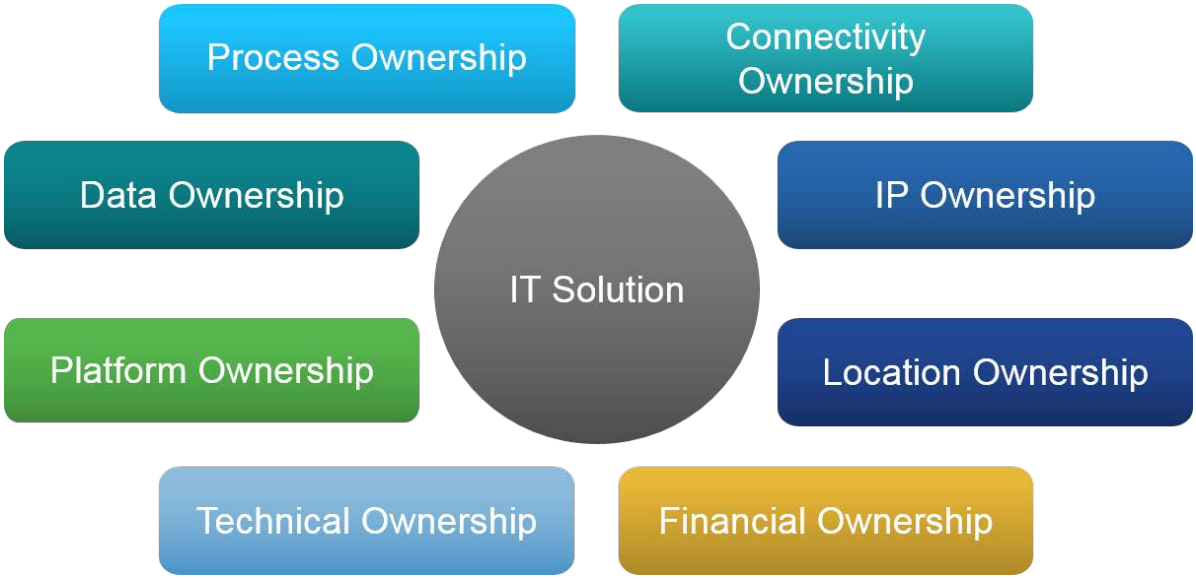
1. Ownership

The organization of the service and business solutions is influenced by the ownership of the IT infrastructure. Speaking about ownership means to clarify which of the partners in the service process (end user, customer, managed service provider, provider or vendor) has control over the IT infrastructure and thus carries the responsibility for managing it. There are at least eight different types of ownership

1.1 Ownership Types

We propose that there are eight types of ownership combined with owner types; a matrix of possible distributions of ownership and leading to a much more precise definition of different delivery models including (among others) the different types of cloud services.

Figure 1. Ownership Types



Process ownership defines the property right on the business processes and also includes the responsibility for completeness and correctness of these processes.

Connectivity ownership defines the property rights for connections between the user or consumer of the IT solution and the provider of the service.

Intellectual property (IP) ownership includes the property rights of the applied technology, patents, knowledge, and skills for operating the infrastructure and knowledge and skills regarding the implemented processes.

Data ownership includes the property right on data stored and the responsibility for completeness and correctness of data stored and processed.

Platform ownership is the power to control the platform, having the power to request and confirm changes. Platform ownership is the major attribute to distinguish between public, private, or community clouds.

Location ownership means unlimited physical access to the infrastructure, e.g., hosting it in their own data center.

Technical ownership means access to all layers of the infrastructure, e.g, being in possession of the root password. The technical ownership is the leading indicator and also prerequisite for the service responsibility of the infrastructure.

Financial ownership means being in possession (or being lessee) of the infrastructure. The financial ownership may be with the customer or the provider.

Taking over ownership by the provider of a service has major influences on the underlying technical architecture, the delivery model, and the operation of the solution.

1.1.1 Process Ownership

Process ownership defines the property right on the business processes and also includes the responsibility for completeness and correctness of these processes. It includes also the power to change processes or confirm change requests on process level.

Process ownership includes the following tasks and responsibilities:

- Process design
- Match of processes with the business architecture
- Completeness and correctness of the process
- Quality assurance of processes
- Implementation of the process
- Change of processes

In most cases, process ownership is with the customer. Within provider-centric ownership models, you may find process ownership with the provider. Samples for this model are Microsoft Windows or Apple's app store, where the consumer uses processes for provisioning or updating services, which are controlled and owned by the provider of the service (Microsoft or Apple).

Process ownership with a provider often leads to a higher level of service. The provider offers processes as part of its product, including expertise and high quality implementation and operation.

1.1.2 Connectivity Ownership

Connectivity ownership defines the property rights for connections between the user or consumer of the IT solution and the provider of the service.

1.1.3 Intellectual Property Ownership

Intellectual property (IP) includes the property rights of the applied technology, patents, knowledge and skills for operating the infrastructure and knowledge and skills regarding the implemented processes. In a nutshell IP

ownership is with the partner that is writing the operating handbook (and also able to provide the services described).

IP may include:

- Configuration
- Architecture
- Implementation
- Standard operating procedures
- Backup
- Security measurements
- Capacity parameters
- Technology used
- Patents
- Operating handbook

1.1.4 Data Ownership

Data ownership defines the property rights for the data, but may also define the responsibility for completeness and correctness of data. Data ownership today is, in most cases, with the customer.

1.1.5 Platform Ownership

Platform ownership is the power to control the platform, having the power to request and confirm changes. Platform ownership is the major attribute to distinguish between public, private or community clouds.

1.1.6 Location Ownership

Location ownership defines the physical access rights to the IT infrastructure. IT infrastructure located within the premises of the customer (in the customer data center) is in the location ownership of the customer. Service providers offering and providing shared data center resources have the location ownership over the IT infrastructure. Insisting on the location ownership by the customer has in most cases security related or legal (data privacy) reasons.

Location ownership does not go along with (most) other types of ownerships. In extrema it could be the case that the location ownership is with the customer, but financial, technical, IP and process ownership is with the service provider. Data ownership is usually connected to location ownership, due to the already mentioned security and legal requirements.

1.1.7 Technical Ownership

Technical ownership defines the technical access rights to the infrastructure, and includes responsibility for the proper functionality in terms of availability, capacity, and continuity. Technical ownership can be defined as possession of the root access or password for a specific layer of the infrastructure. Like other types of ownership, the technical ownership is hard to share. Defining the borders between different infrastructure layers and the related technical ownerships is a key element for proper distribution of responsibility.

The clear definition of technical ownership goes hand-in-hand with the responsibility for operating the infrastructure. Technical ownership is tightly coupled with most of the processes within service transition and service operation.

Technical ownership is independent from financial ownership and location ownership. IT solutions may be in the financial and location ownership of the customer, but operated by a service provider.

1.1.8 Financial Ownership

Financial ownership is one of the major drivers for infrastructure outsourcing. Moving the financial ownership from the customer to the provider and applying flexible consumption payment models has a major impact on the financial strategy of the customer moving expenses from CAPEX to OPEX. It also has a major effect on the product and service strategy of the provider forcing him to implement alternative financing and appreciation models.

Different types of OPEX payment methods have been developed during the last years:

Infrastructure (box) oriented:

- Buy
- Leasing

Usage or consumption oriented:

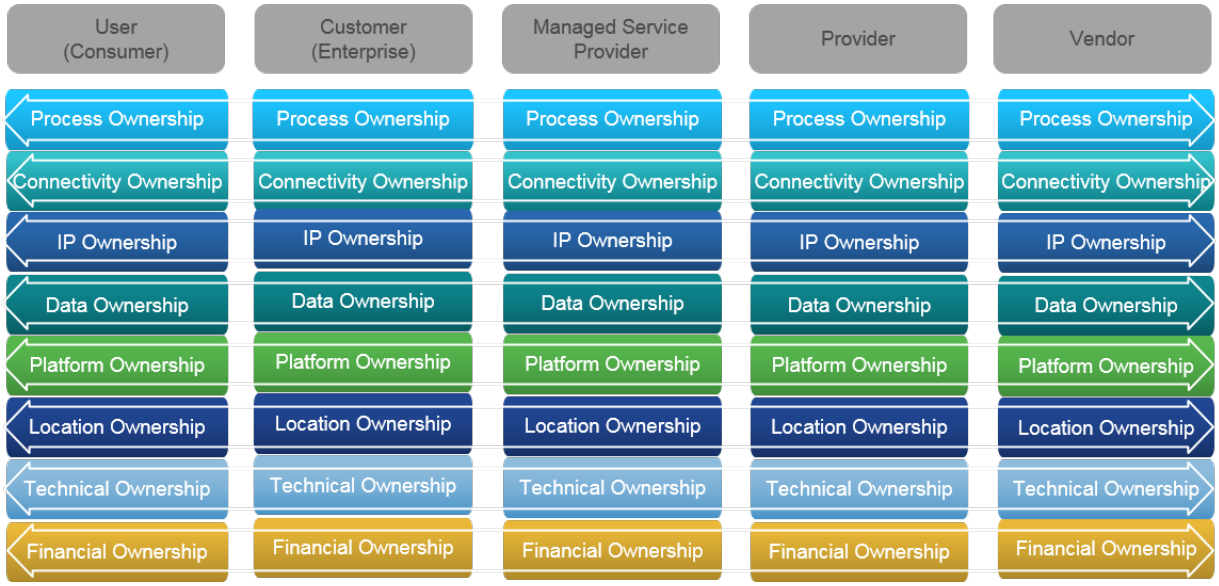
- Pay per user and month
- Flexible consumption, pay per service unit (e.g., storage consumption, CPU consumption, transaction consumption, etc.)

Moving financial ownership from the customer to the provider does not necessarily mean that other types of ownerships are also moved to the IT solution provider. In extreme cases, it could be that IT infrastructure is owned by the provider and all other types of ownerships are still with the customer.

1.2 Owners

Owners are persons or organizations owning certain aspects of an IT solution. Owning an aspect of an IT solution means having the responsibility for this aspect or layer. Giving ownership to a provider means paying for getting rid of the responsibility of owning the service layer or aspects.

Figure 2. Ownership Matrix



1.2.1 End User

The end user is the consumer of a service. They require a sufficient service level supporting the business need. End user satisfaction is the most important parameter in all service related processes.

1.2.2 Customer

Service customers have service contracts with one or many service providers or vendors. The end users of IT solutions are members of the service customer organization consuming services enabling them to fulfill their business. Internal service providers are organizations within or attached to the service customer organization, e.g. as IT department of the service customer. They are delivering services within the service customer based on (internal) service agreements.

1.2.3 Managed Service Provider

Managed service providers have service contracts with many service customers and service relations with one or many vendors or other service providers. Their business is to organize services managing the proper fulfillment of service requests with the help of service providers specialized on certain parts of the infrastructure.

1.2.4 Service Provider

Service providers deliver services for specific parts of the IT infrastructure. In most cases they are specialized and focused on particular products or technologies. Their business is to provide highly standardized service processes for a clearly defined range of IT infrastructure.

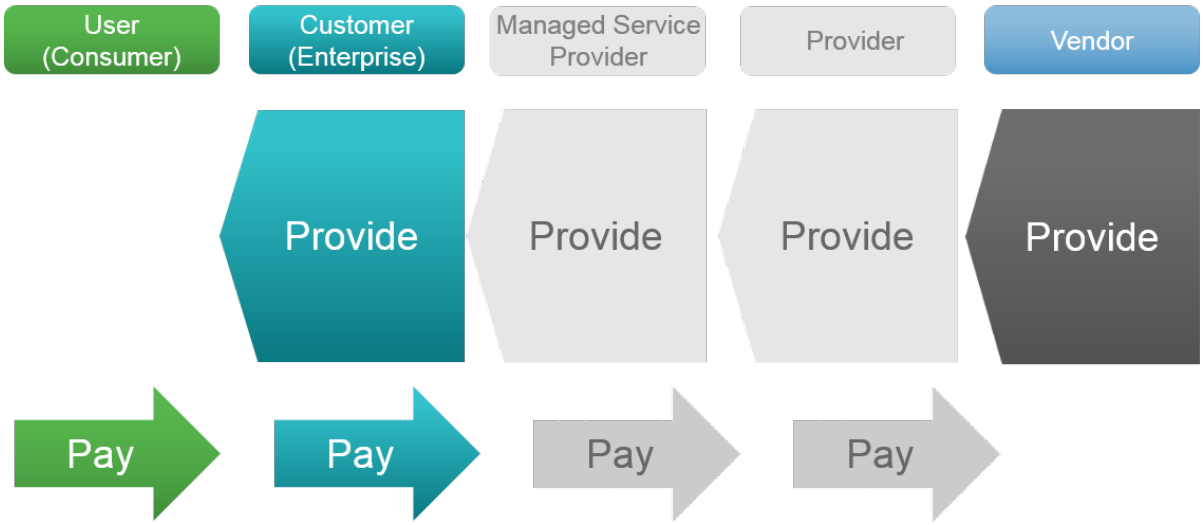
1.2.5 Vendor

Vendors of IT products deliver services on top of their products. They have service agreements with managed service providers or larger service customers. Like service providers vendors apply highly standardized service processes shaped for the services bundled with their products.

1.3 Value Chain

The value chain shows who is providing a (value add) service to its customers and who (as a customer) is paying for it.

Figure 3. Value Chain



Having a big part of the value chain means being in possession of a large part of the revenue created by consuming services.

Growing revenue and margin can be achieved by offering and selling more value within the value chain, moving offerings and services from the right more to the left side of the above chart.

2. Market

The total cloud market consists of two completely different segments, cloud infrastructure and cloud services. Worldwide growth until 2018 of cloud infrastructure will be to $81B, whereas cloud services will be even faster to $284 billion. By 2018, this will be a total market of $365 billion. Therefore, it is important to address both market segments accordingly.

This section gives details about our current market share as well as potential growth rates until 2018.

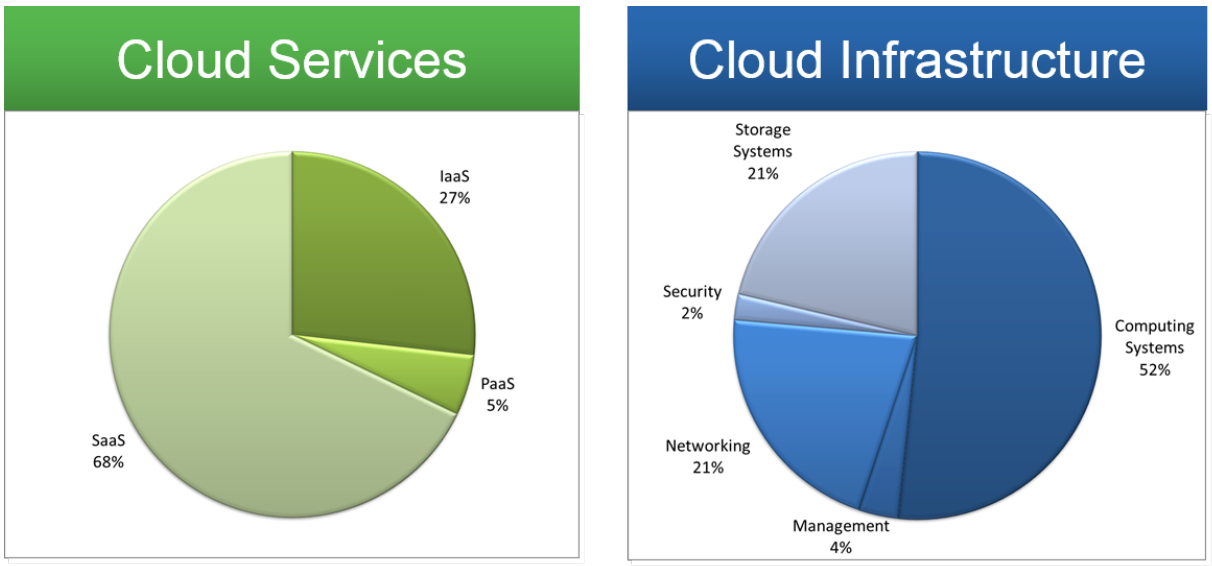
Data and Reports used are:

- Technology Business Research - TBR
  "Cloud Business Qarterly, Public Cloud Landscape,"
  First Calendar Quarter 2013
- Technology Business Research - TBR
  "Cloud Business Qarterly, Public Cloud Landscape,"
  Fourth Calendar Quarter 2013
- Synergy Research Group - SRG
  "Cloud Infrastructure Services Worldwide Market Share Analysis,"
  1Q 2013
- Synergy Research Group - SRG
  "Cloud Infrastructure Services Worldwide Market Share Report,"
  Data File, 4Q 2013
- Synergy Research Group - SRG
  "Cloud Infrastructure Equipment - Totals Worldwide Market Share Report,"
  Data File, 4Q 2013

2.1 Cloud Infrastructure and Cloud Services

There are two different cloud market segments—cloud services and cloud infrastructure. Figure 4 shows how these are further divided into three major service categories and five major infrastructure categories by TBR and SRG.

Figure 4. Cloud Infrastructure and Cloud Services Categories



Public Cloud Market Landscape 2013,
Technology Business Review

2013 Cloud Infrastructure Equipment
Totals Worldwide Market Share Report, Synergy Research Group

2.1.1 Cloud Services

- **Software as a Service (SaaS)**: SaaS providers offer hosted applications to customers on an on-demand or per-use basis; therefore, customers can use the application or applications they need when they need them and can avoid the cost of installing and maintaining supporting infrastructures. Typical software includes: customer relationship management (CRM), analytics, asset management, knowledge management, document, IT service management (ITSM), security and content management, and similar software.
- **Platform as a Service (PaaS)**: PaaS provides customers the supporting infrastructure to either conduct software application development or run existing software. This includes the operating environment, which manages workflow and collaboration, and the underlying hardware, such as servers and networking.
- **Infrastructure as a Service (IaaS)**: Under IaaS, customers pay to gain access to infrastructure (hardware: compute and storage; and/or networking) on a utility basis to run their licensed software.

With 68 percent, SaaS is the biggest segment of cloud services, followed by IaaS and by PaaS.

2.1.2 Cloud Infrastructure

Major cloud infrastructure components are:

- Computing systems
- Networking
- Storage systems
- Management
- Security

The largest component of cloud infrastructure is computing systems with 52 percent, followed by networking and storage systems with 21 percent each, and then by management with 4 percent, and security with 2 percent.

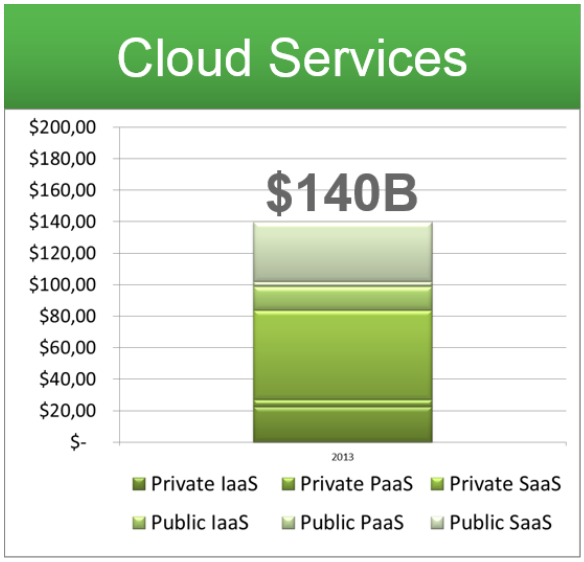
2.2 Cloud Market Size 2013

Before looking into cloud market size, we need to further categorize:

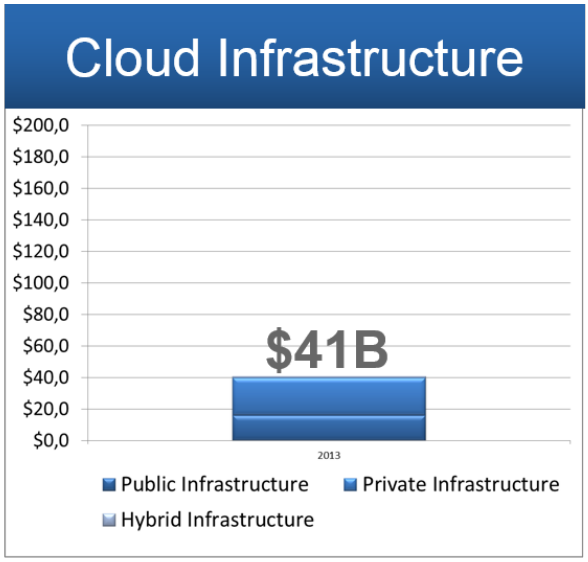
- Private and public services
- Private, public, and hybrid infrastructure

Figure 5 shows the total market size of cloud services and cloud infrastructure in 2013 respectively, which is $140 billion plus $41 billion, for a total of $181 billion (all figures in U.S. dollars).

Figure 5. Total Market Size of Cloud Services and Cloud Infrastructure in 2013



Public Cloud Market Landscape 2013,
Technology Business Review

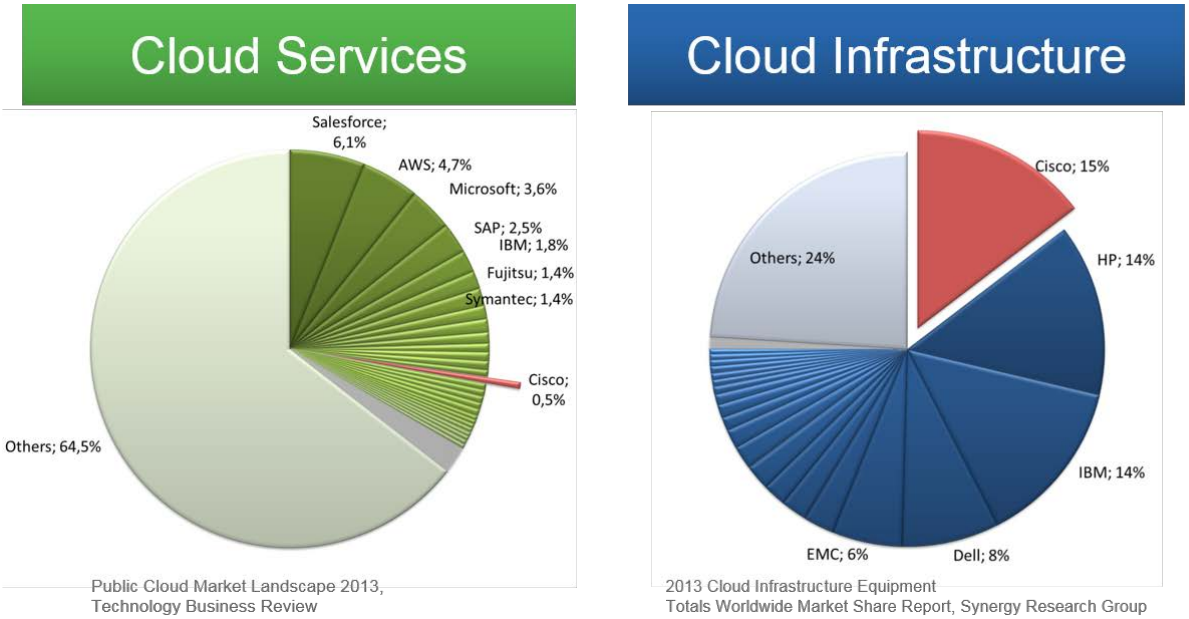


2013 Cloud Infrastructure Equipment
Totals Worldwide Market Share Report, Synergy Research Group

2.3 Cloud Market Shares and Players 2013

When looking at 2013 cloud market share (Figure 6), we see that in cloud infrastructure Cisco is leading with 15 percent, followed by HP and IBM with 14 percent each, and then Dell with 8 percent, and EMC with 6 percent. In cloud services, Cisco has a market share of just 0.5 percent, with Salesforce leading with 6.1 percent, followed by Amazon Web Services with 4.7 percent, Microsoft with 3.6 percent, SAP with 2.5 percent, and Fujitsu and Symantec with 1.4 percent each.

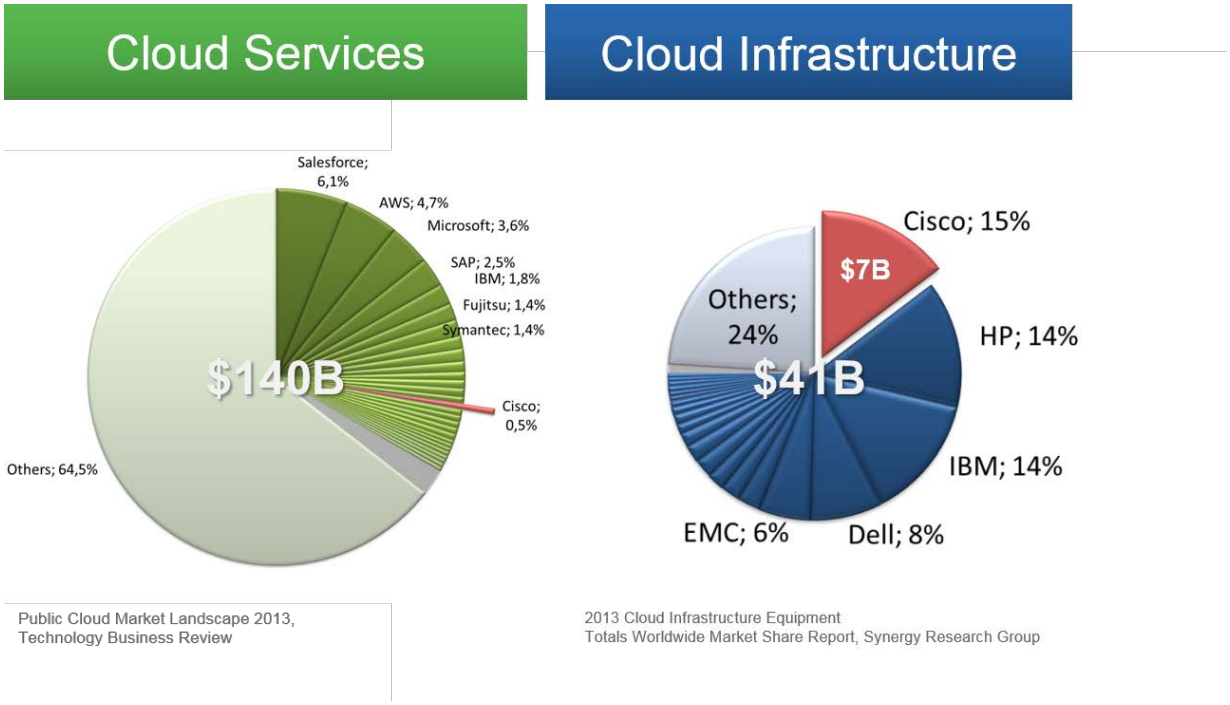
Figure 6. Cloud Market Shares and Players 2013



2.4 Cloud Market Shares and Players 2013 – Normalized View

As we have seen, Cisco is leading in the cloud infrastructure market with 15 percent and almost non-existent in the cloud services market in 2013. When we normalize this view it becomes even more obvious that getting some significant market share in cloud services is a must (See Figure 7).

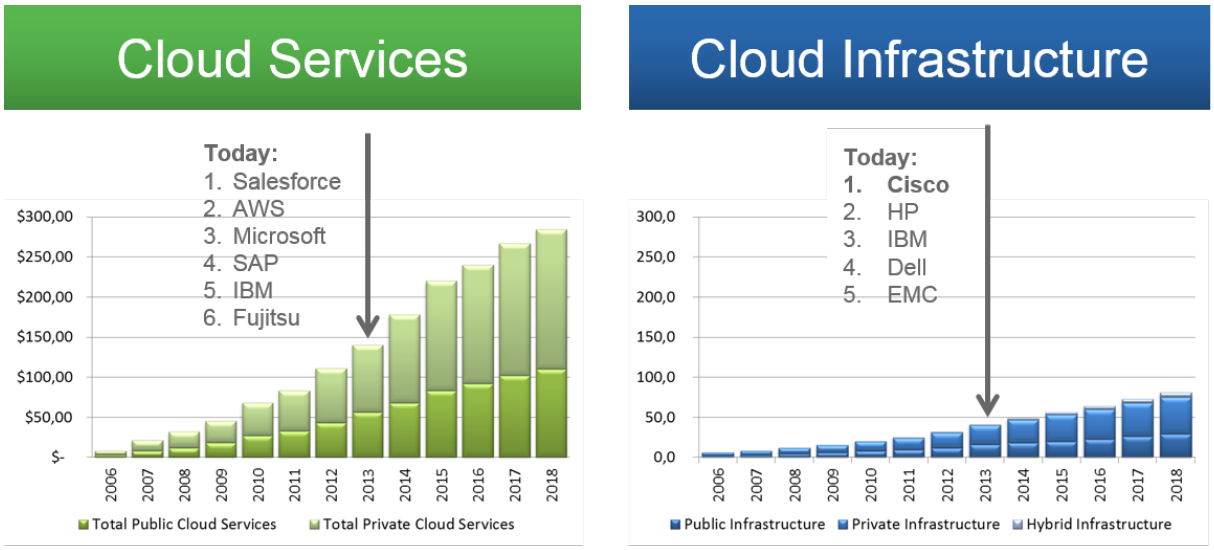
Figure 7. Cloud Market Shares 2013 – Normalized View



2.5 Cloud Market Trends and Growth Rates Until 2018

Figure 8 shows that while cloud infrastructure is steadily growing over the next years until 2018 ($41B to $81B), cloud services is even growing much faster until 2018 ($126B to $284B). Currently Cisco has almost no market share in cloud services, but it makes a lot of sense to become a major player in this area in order to significantly grow our revenue.

Figure 8. Cloud Market Trend and Growth Rates



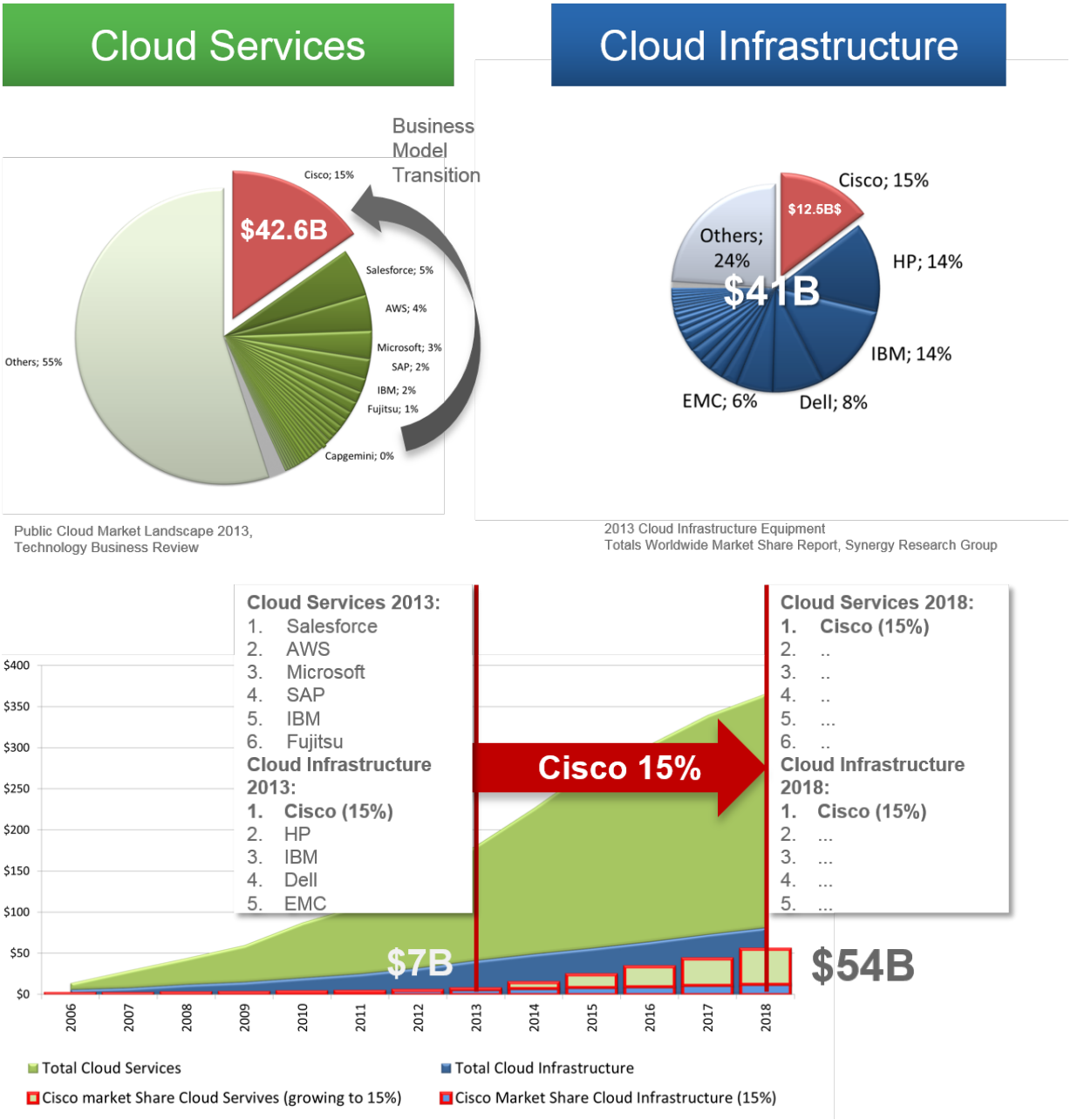
Public Cloud Market Landscape 2013,
Technology Business Review

2013 Cloud Infrastructure Equipment
Totals Worldwide Market Share Report, Synergy Research Group

2.6 How to Lead the Cloud Market by 2018

The cloud service market ($284 billion in 2018) is much faster growing compared to the cloud infrastructure market ($81 billion in 2018), thus it makes sense to gain as much market share as possible for cloud services over the next years. If our goal is to grow to a 15 percent market share in cloud services by 2018 (same as today in cloud infrastructure) and keep the 15 percent market share in cloud infrastructure, this would lead to a total revenue of $42.6 billion plus $12.5 billion equals $55.1 billion in 2018 for Cisco (see Figure 9). This would enable Cisco to become the number one IT company by 2018.

Figure 9. Cisco to Become Number One IT Company by 2018



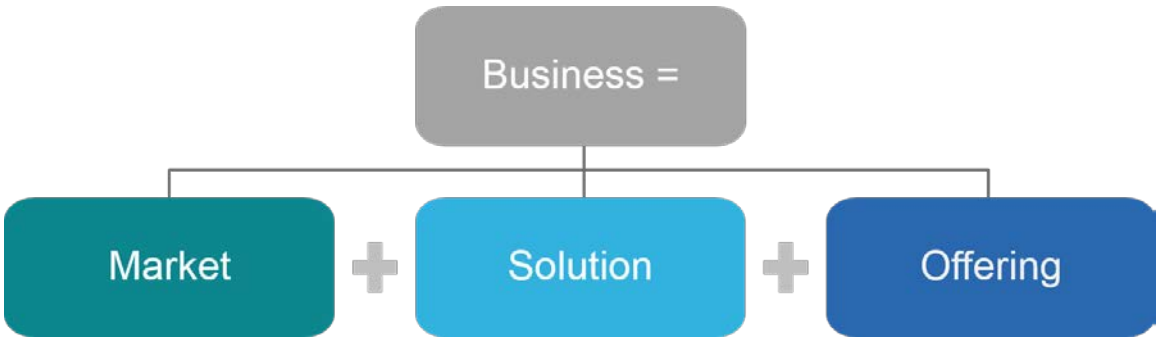
In order to achieve this, we need to undergo a complete business model transition, which is described throughout the remainder of this paper.

3. Business Model Transition

3.1 Elements of a Business Model

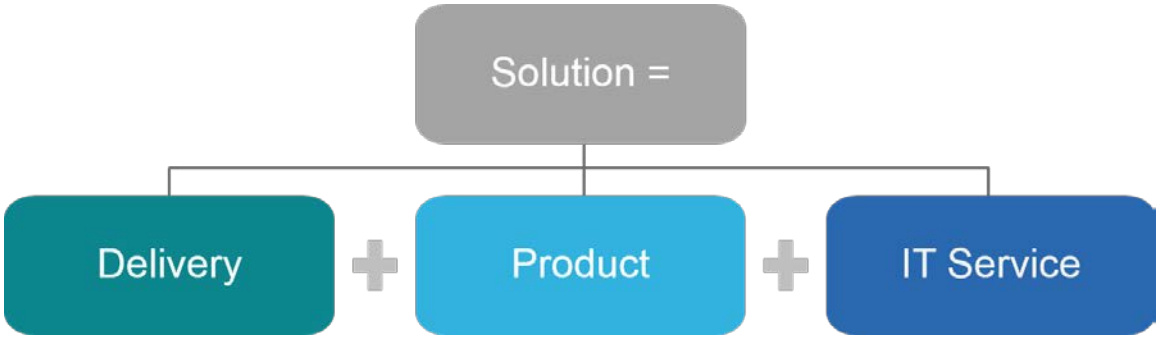
Business models must include the market approach, the solution itself, and the offering that matches the market requirements and provided solution, as shown in Figure 10.

Figure 10. Elements of a Business Model



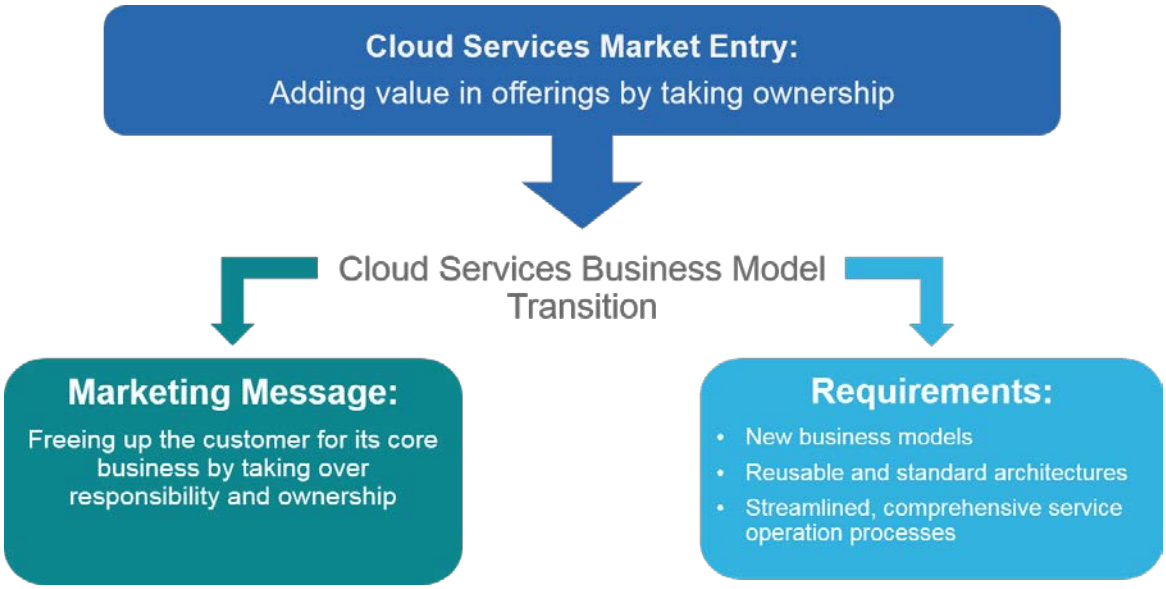
The solution itself must include the technical product as well as the delivery method and the provided service and support, as shown in Figure 11.

Figure 11. Elements of a Solution



The focus of a cloud services market entry must be on the marketing message and the internal requirements for planning, building, and operating cloud solutions, as shown in Figure 12.

Figure 12. Elements of a Cloud Services Business Model



3.1.1 Taking Ownership

Changing ownership from the customer to the provider or vendor is an additional value of a service offering. It moves responsibility from the consumer of a service to the professional provider of a service and frees the consumer to concentrate on its core business.

Having the provider be responsible for processes, connectivity, IP, data, platform, location, technical (management), and financial planning of a service maximizes the outcome for the customer. It releases the customer from investing resources into management of the IT infrastructure.

3.1.2 Marketing Message

From the customer perspective, the provider of a cloud service offers additional value to the customer:

Process Ownership	As a provider of processes, we deliver standard processes that are easy to integrate with your business partners.
Connectivity Ownership	As owner of connections between different clouds, we manage your connections secure and with a high level of availability.
IP Ownership	Our know how and skills are based on a deep understanding of technology and infrastructure operation.
Data Ownership	We provide complete and correct data, applying leading edge data quality assurance methods and top level security and data privacy policies.

Platform Ownership	Our platform management guarantees high availability and top performance of your private or public platform.
Location Ownership	We manage and run high performace data centers around the world, providing the top level of security and continuity.
Technical Ownership	Our technical management of infrastructure is based on comprehensive service operations to guarantee a seemless coverage of all service tasks.
Financial Ownership	We provide the best payment models for your enterprise based on consumption or capacity pricing.

3.1.3 Requirements

Cloud services are defined through new business models concentrated on service offerings instead of infrastructure and product offerings. These new business models are based on a new generation of payment models (consumption or usage based payment), requires standard and reusable cloud architectures, and a streamlined and comprehensive support organization.

Table 1. Cloud Services Requirements

	On-Premises Infrastructure and Application	Cloud Computing and Cloud Services
Attributes	• Internally managed service • Dedicated resources • Long term planning, not agile • No or less transparency of KPIs	• On demand self-service • Resource pooling • Rapid elasticity • Measured service
Business Model	• Ownership by consumer, customer • Buy and use	• Ownership by provider • Consumption or demand oriented
Architecture	• Applications, platforms owned by customer • Rigid blueprint • Integration via tightly coupled methods (RPC, file, direct database access, etc.)	• Distributed services in different (private, public) clouds • Flexible customization (applications) • Integration via loosely coupled methods (SOA, SOAP, REST)

3.2 History and Future

3.2.1 IT Industry

Within IT we have seen the following development of IT:

Last century: It's about warranty: Customers are complete owners of the IT infrastructure, they are also running most of their service process in their internal IT departments. External service relations are limited to warranty agreements with vendors.

2000: Outtasking: Customer start to out-task certain parts of their IT infrastructure services to managed service providers and service providers.

2005: Outsourcing: Large outsourcing contracts cover the complete IT infrastructure services of customers. The infrastructure itself is still in the ownership of the customer.

2010: Multisourcing, CAPEX: Growing complexity of IT infrastructure leads to multi-sourcing models engaging a growing number of managed service providerds and service providers for specific layers of the infrastructure.

Future: Multisourcing, OPEX: The complete IT infrastructure is outsourced to service and XaaS providers, ownership goes to the service provider, service management is completely in the responsibility of the service provider.

3.2.2 Consumer and Business

It is evident that provider-centric service offerings are already highly accepted by consumers more than by business customers. Today consumers have widely adopted ideas like using infrastructure as a service, app stores, consuming music or video via streaming platforms instead buying CDs or DVDs, or using car sharing offers.

Looking at the list of potential obstacles it seems that consumer behavior is much more outcome-driven and disregarding of security threads or independence from their service providers.

3.2.3 Future Business Distribution

Like in many other industries, the trend of moving ownership to providers will also lead to new and different business models supporting a new distribution of businesses and creating new types of companies. These companies will concentrate on a certain segment in the value chain providing highly specialized services and connecting to their neighbors in the value chain in a highly efficient way. It is hard to predict if that leads to a large number of competing companies or to reduced but global acting providers. Following the development in other industries like telecommunication or airlines we could see a two phase process starting with a large number of regional providers followed by a concentration of only a few international enterprises.

3.2.4 Other Industries

Compared to other industries, IT has a short history of about 50 years. The development of other services to provider-centric ownership models can lead to the prediction that IT will follow that trend.

Centralized water supplies have existed for more than 2000 years. Public transport and mail was invented 400 years ago by companies like Thurn and Taxis in Europe and, later, Wells Fargo and Butterfield Overland in the United States. Worldwide communication services was developed in the mid-nineteenth century using telegraph technology and powered by the first successful transatlantic cable connection. Energy supply and distribution was industrialized more than 100 years ago with the electric power stations and gas works, together with connected distribution networks. Music and video entertainment is already highly provider-centric, using information technology.

The examples in Figure 13 illustrate that there is a marked natural movement of ownership from the consumer to the provider of products and services. All the samples mentioned have the basic attributes of cloud services.

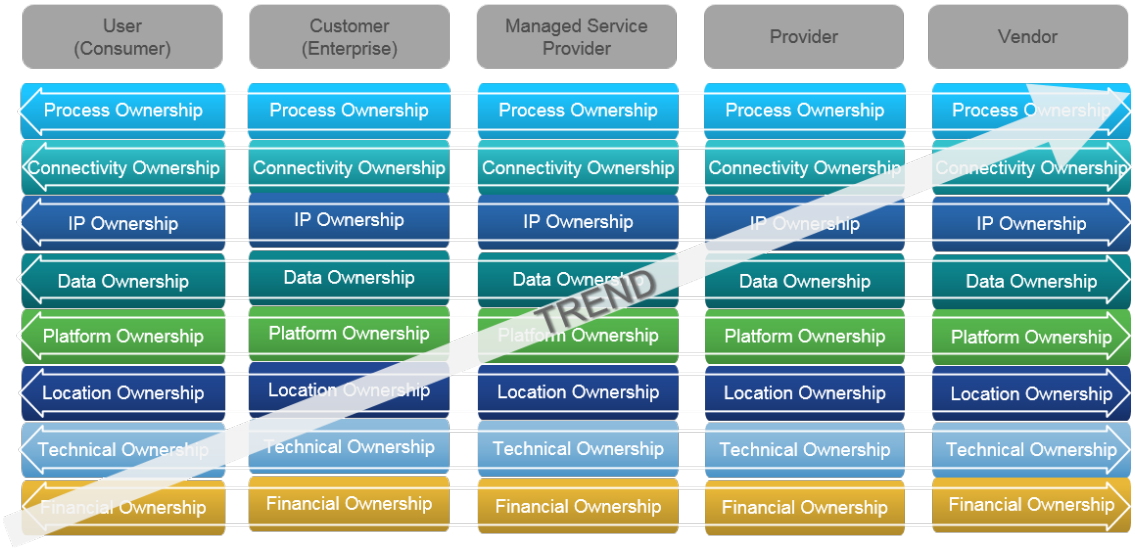
Figure 13. Sample: Get Around by Car

3.3 Trends, Drivers, Obstacles, and Enablers

3.3.1 Provider-centric Ownership

There is a major trend to move ownership away from the end user or consumer to centralized providers of technology and services. For centuries, this has been a strategy of industrial and economic development following the idea of resource sharing and work distribution. Historically, it can be said that when the ancient Romans built the first public water pipeline from the mountains into the city of Rome, they used the basic idea of cloud services. Reasons were the same as today: quality (avoiding unhealthy water supply), resource sharing by moving the process, financial, intellectual property, and location ownership away from the end user to public administration. This strategy can be observed with many products and services since then: energy distribution, public traffic, tool sharing, car sharing, and many more.

Figure 14. Ownership Trend



3.3.2 Drivers

The basic drivers behind this development are similar and follow the idea of focusing on the outcome and not on the production processes of systems, technology and services:

Growing complexity: Technical systems and services—as IT—are growing dramatically in complexity. Building and operating complete IT infrastructures and solutions is a highly complex business today. Collecting and maintaining skills, know how, and intellectual property is a major component of success.

Distributed usage: Compared to the IT usage 10 or 20 years ago, the geographical distribution and the number of consumers and end users has grown. This requires sophisticated support organizations and a much higher level of system availability around-the-clock.

Rapid change: IT technology is changing rapidly, even accelerating. Following these changes and staying on track is one of the major challenges in the industry.

Higher specialization: Meeting those challenges, the industry moves into a higher degree of specialization, which again leads to a higher distribution of tasks and services to a growing number of service providers and vendors.

Multisourcing: Vendor management and control.

Cost control: Enterprises facing higher cost pressure tend to move to usage or consumption based models (OPEX), instead of long-term investments into technology (CAPEX).

3.3.3 Obstacles

A number of obstacles may hinder the rapid development of a completely provider-centric ownership model.

Access Speed and Availability

Access speed and availability continue to be limiting factors in many parts of the world, especially in emerging countries. There are different requirements depending on the cloud service type; communication services need guaranteed high-speed Internet access, low latency, and high uptime. Today, wireless is one of the most feasible methods for connectivity, especially if it offers a certain level of bandwidth and availability. The latest deployments of Wi-Fi and/or long-term evolution (LTE) increasingly help to provide these requirements for cloud services, and future enhancements in mobility will play a significant role.

Security

Security is a major consideration when outsourcing any kind of IT related processes. Security is also one of the most rapidly changing segments in IT. There is no question that global communication based on Internet technology has opened a wide range of security related issues, many of them hard to predict, appearing without warning, and not easy to mitigate through preemptive measures.

The Cloud Security Alliance (CSA) has identified the top nine cloud computing threats for 2013. These are:

- **Data breaches**: If a multitenant cloud service database isn't designed properly, a single flaw in one client's application could allow an attacker to get at not just that client's data, but every other clients' data as well.
- **Data loss**: The prospect of seeing valuable data disappear into the ether without a trace. One also could lose data to a careless cloud service provider or a disaster, such as a fire, flood, or earthquake.
- **Account or service traffic hijacking**: If an attacker gains access to credentials, he or she can eavesdrop on activities and transactions, manipulate data, return falsified information, and redirect clients to illegitimate sites.
- **Insecure interfaces and APIs**: IT admins rely on interfaces for cloud provisioning, management, orchestration, and monitoring. Organizations and third parties are known to build on these interfaces, injecting add-on services which introduces the complexity of the new layered API and also increases risk, as organizations may be required to relinquish their credentials to third parties in order to enable their agency.
- **Denial of Service (DoS)**: DoS has been an Internet threat for years, but it becomes more problematic in the age of cloud computing when organizations are dependent on the around-the-clock availability of one or more services.
- **Malicious insiders**: This can be a current or former employee, a contractor, or a business partner who gains access to a network, system, or data for malicious purposes. From IaaS to PaaS to SaaS, the malicious insider has increasing levels of access to more critical systems and eventually to data.
- **Cloud abuse**: This could be someone with malicious intent using a cloud service to break an encryption key too difficult to crack on a standard computer. Another example might be a malicious hacker using cloud servers to launch a DDoS attack, propagate malware, or share pirated software.
- **Insufficient due diligence**: Organizations embrace the cloud without fully understanding the cloud environment and associated risks.
- **Shared technology vulnerabilities**: Cloud service providers share infrastructure, platforms, and applications to deliver their services in a scalable way.

Rules and Regulations

Related to the security field is the growing number of rules and regulations covering data security and privacy. Many of those regulations are regional (e.g., European or U.S.) and tend to protect a certain geographical ecosphere. This leads to global inconsistency and hinders the development of global applicable services.

Losing Control

Controlling the complete business architecture internally is a major driver against any outsourcing model. In those cases internal organizations claim to be more efficient and effective than external providers

Dependence

Being dependent from others is a basic fear for organizations. They tend to rely on internal resources and tools instead of trusting an external provider.

3.3.4 Enablers

Technology Network Access

Many companies are changing their overall IT strategies to embrace cloud computing in order to open business opportunities. The National Institute of Standards and Technology (NIST) defines cloud computing as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources like networks, servers, storage (commonly called Infrastructure), and applications and services that can be rapidly provisioned and released with minimal management effort or service provider interaction.

As such cloud computing represents a convergence of two major trends—IT efficiency and business agility—in information technology.

- **IT efficiency** refers to using computing resources more efficiently through highly scalable hardware and software resources
- **Business agility** is the ability of a business to use computational tools rapidly, to adapt quickly and cost effectively in response to changes in the business environment

Cloud computing can remove traditional boundaries between businesses, make the entire organization more business agile and responsive, help enterprises to scale their services, enhance industrial competitiveness, reduce the operational costs and the total cost of computing, and decrease energy consumption. Thus cloud computing can provide new opportunities for innovation by allowing companies to focus on business rather than be limited and blocked by changes in technology.

Resource Sharing Using Virtualization

Resource sharing and management is a core function required of any man-made system. It affects the three basic criteria for system evaluation: performance, functionality, and cost. Inefficient resource management has a direct negative effect on performance and cost. It can also indirectly affect system functionality. Some functions the system provides might become too expensive or ineffective due to poor performance.

The strategies for cloud resource management associated with the three cloud delivery models (IaaS, PaaS and SaaS) differ from one another, but in all cases the cloud services providers are faced with large, fluctuating loads

that challenge the claim of cloud elasticity. In some cases, when a spike can be predicted, they can provision resources in advance. For example, seasonal web services may be subject to spikes.

Cost Reduction through Mass Distribution

The cost of cloud services will decrease significantly because of growing market and offerings. As investments and competition among Internet cloud providers accelerate, tech giants are finding new ways to distinguish their offerings. Amazon, Google and Microsoft recently engaged in a pricing war that drove down the fee for their public cloud services. HP is trying a different tack — emphasizing its open-source approach and encouraging businesses, its main customers, to use its product to create their own cloud services instead of relying on others.

While cost reduction of cloud services seems to be imperative for the next time to come, it might be a good idea to build business based on value and not go into price competition with AWS, MSFT, Google, HP, RackSpace, Softlayer, and others.

Accepted Industry Standards

Standards-based cloud computing ensures that cloud services can readily interoperate, based on open standard interfaces. Standards allow workloads to be readily moved from one cloud provider to a different cloud provider. Services created for one cloud computing environment can be employed in another cloud computing environment, eliminating the need to rewrite or duplicate code. Some of the proposed standards are based on open-source initiatives. This has the advantage of making all the code transparent, available for inspection, and more readily suited for an interoperable environment.

Quality is Growing

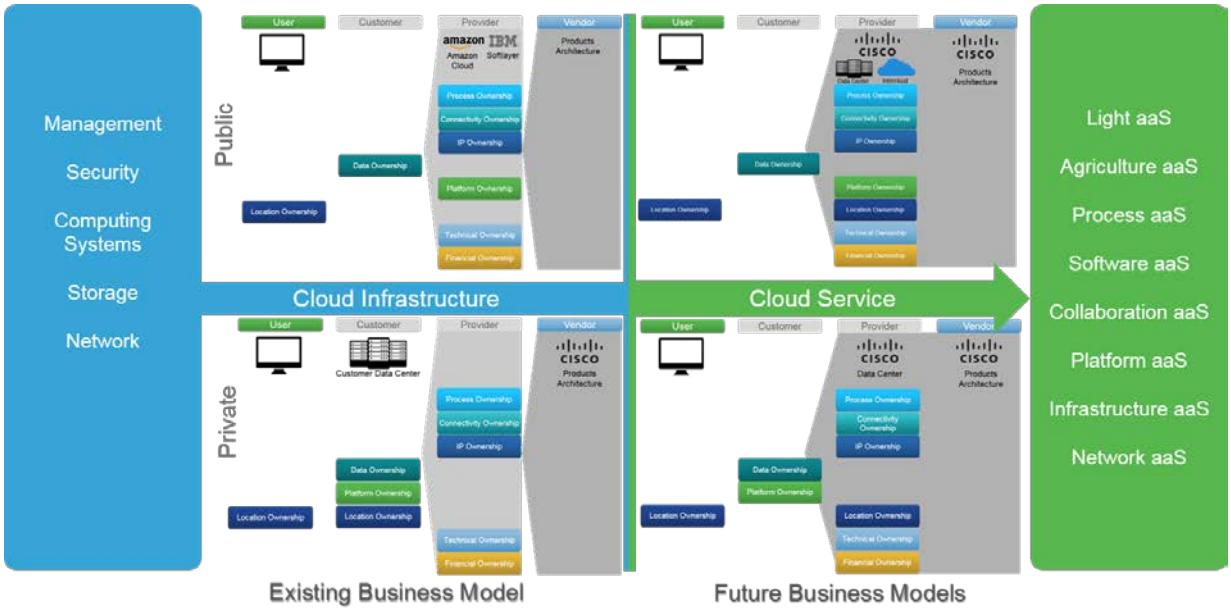
Cloud service providers are gaining experience in how to design, build, and run their cloud services. Service providers like AWS are active in the market for many years and have consistently improved through their experience with multiple failures.

Cisco can excel in this area by leveraging knowledge and IP ownership of most of the equipment used throughout the cloud infrastructure, while combining with new secure and trusted service offerings.

3.3.5 Focus on Selected Business Models

Moving from existing business models built around products to future business models built around services and cloud services is a major transition. This process must focus on all elements of a solution, covering not only the technical product, but also the delivery strategy and methods and the service and support organization (see Figure 15).

Figure 15. Existing to Future Business Models

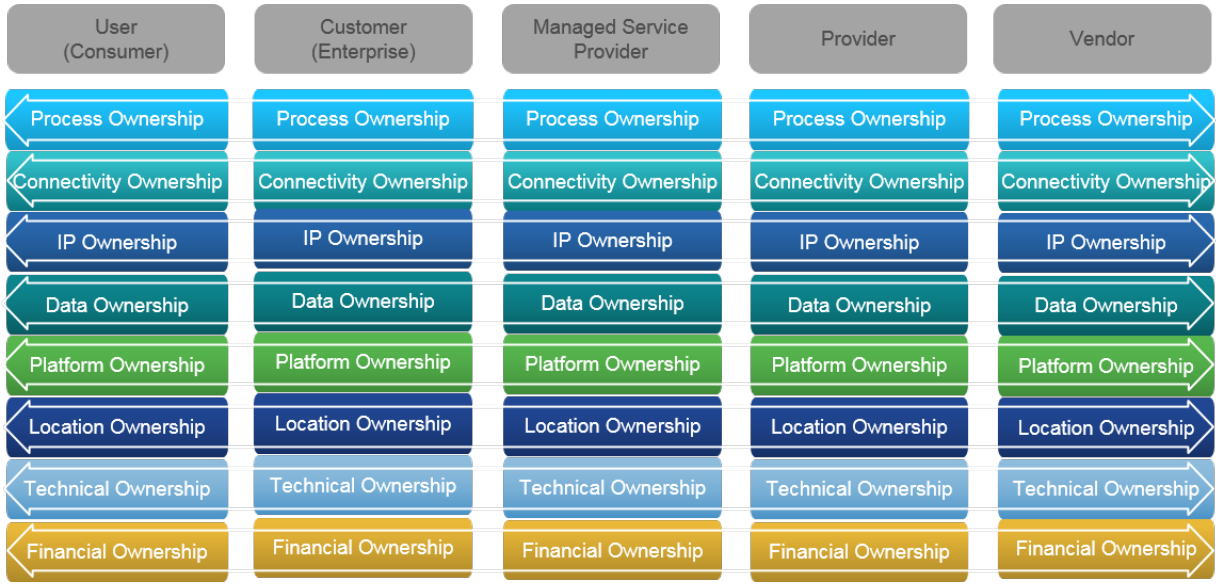


The selection of these business models, including technical architecture, offering, and delivery, is critical for success. Building technical products and architectures must be based on the planned delivery methods and include the support and service processes and organization. This can only be achieved if all three elements of the solution are designed in tight cooperation and follow a clear plan that includes market requirements and offer strategy.

4. Appendix: Ownership Samples and Delivery Models

A growing set of different delivery models has been proposed and implemented during the last couple of years. All of those delivery models are categorized under the term “cloud” or “cloud computing.” Drilling down into the different cloud delivery models shows that the major differences are different settings of the ownership types. (See Figure 16.)

Figure 16. Ownership Types



A large variety of combinations can be found in real-world scenarios. It is evident that the transitions happening in the IT market today and in the upcoming years will lead to more ownership profiles supported by new business models. (See Table 2.)

Table 2. Possible Ownership Profile Combinations

Cloud	Private, on premises	Private, hosted	Private, hosted	Public
Data Center	Private	Private, supported	Private, hosted	Private, managed
Network	Private	Private, managed	Private, hosted	Public
Workplace	Private	Private, managed	Private, hosted	Public

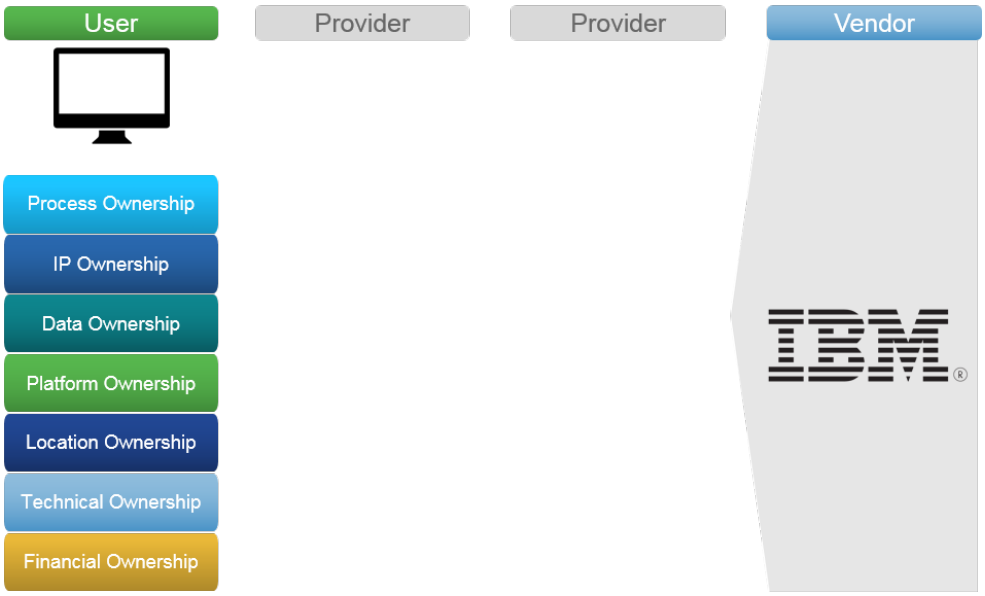
In the following sections, a number of different examples are presented using the ownership model to show the profile of the offer.

4.1 Workplace

4.1.1 Private PC of Yesterday

It used to be that the private PC was completely owned by the user. Configuration, installation, and updates were completed by the user as owner of all layers of the infrastructure. (See Figure 17.)

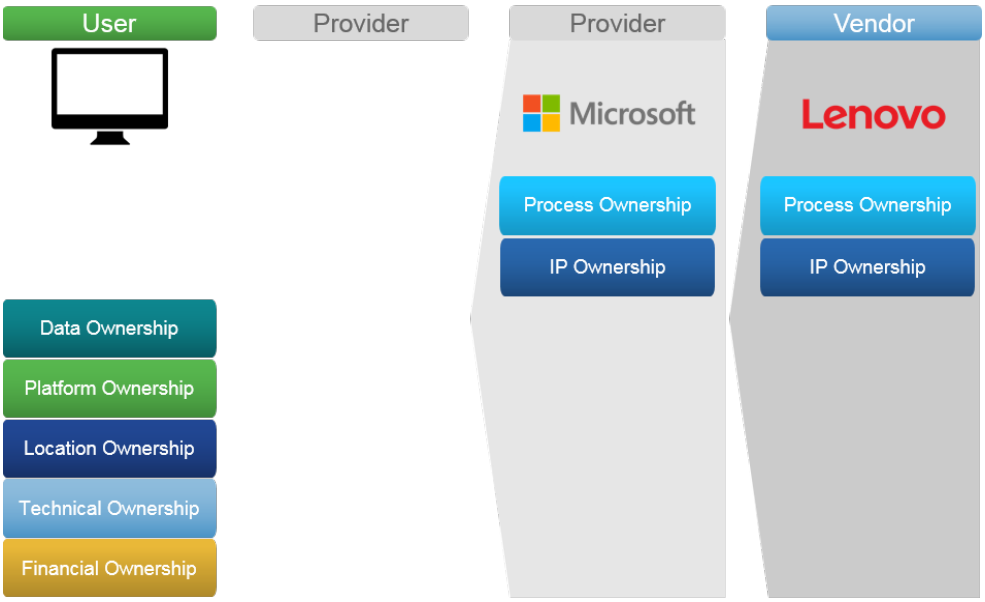
Figure 17. Private PC Yesterday



4.1.2 Private PC Today

Today PCs are widely managed by the vendors of the hardware, the operating system, and the application software. Process ownership regarding operating updates or monitoring the system is distributed between the user of the PC and vendors like Microsoft, Lenovo, and others. IP ownership (skills, know how) is about architecture, fun. (See Figure 18.)

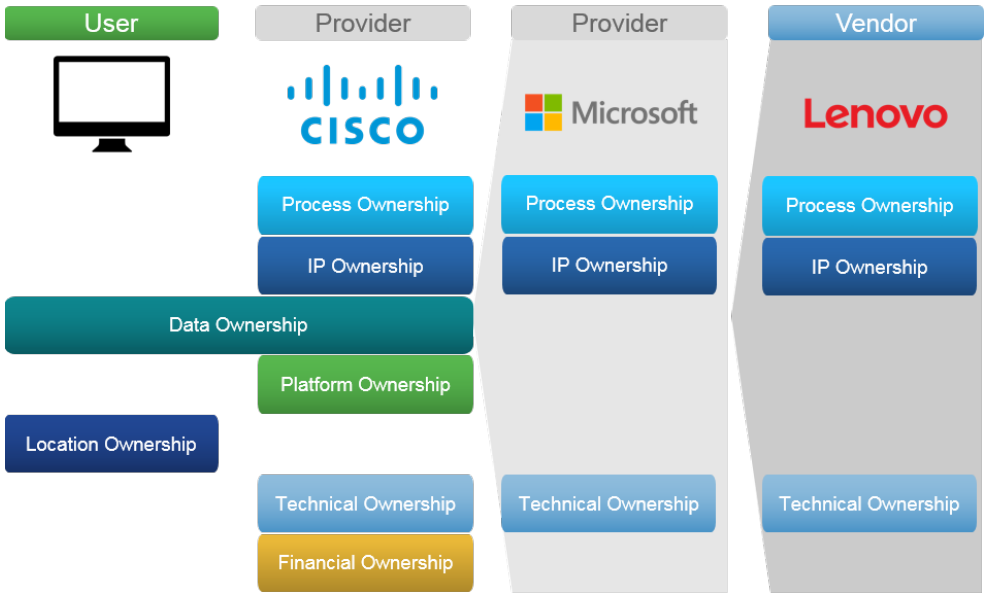
Figure 18. Private PC Today



4.1.3 Your Company Workplace

Workplace infrastructure within a company is a good example for distributed ownerships. The user of the workplace (e.g., laptop or tablet) has the location ownership and shares the responsibility for data with the enterprise. Process ownership may be within the company and is shared with the vendors of the workplace elements (operating system, applications). IP ownership is distributed between the customer enterprise and the providers and vendors of the workplace components. Technical ownership may be distributed between the customer company and dedicated service providers. (See Figure 19.)

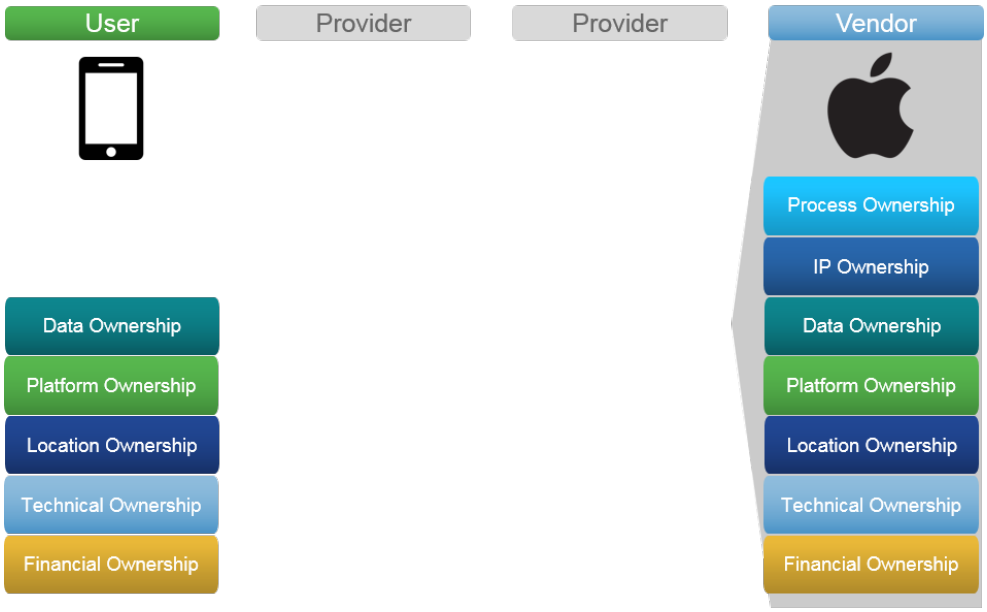
Figure 19. Workplace Within a Company



4.1.4 Your Private Smart Device: Consumer Cloud Services

In consumer-oriented cloud offerings, the end user is also owner of the workplace device (PC, smart phone, tablet), having service agreements with vendors of cloud applications (Apple, Google, etc.). (See Figure 20.)

Figure 20. Consumer Cloud Services

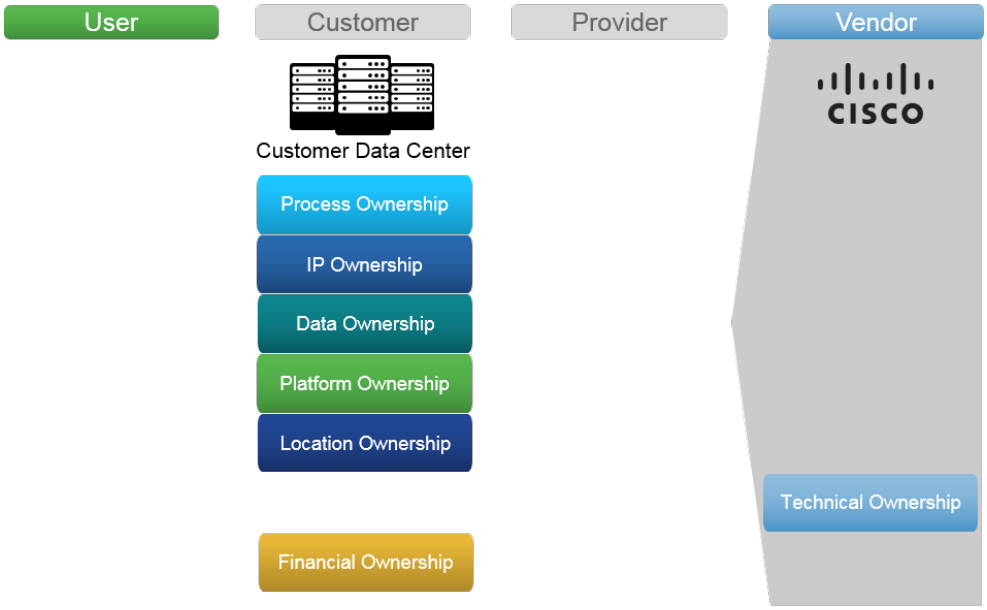


4.2 Software

4.2.1 Application within the Premesis of the Customer

Installing and operating a software application within the premises of the customer is the traditional way of application delivery. In this case, the ownership is with the customer, and the provider may have the technical ownership delivering technology services to the customer based on a support contract. (See Figure 21.)

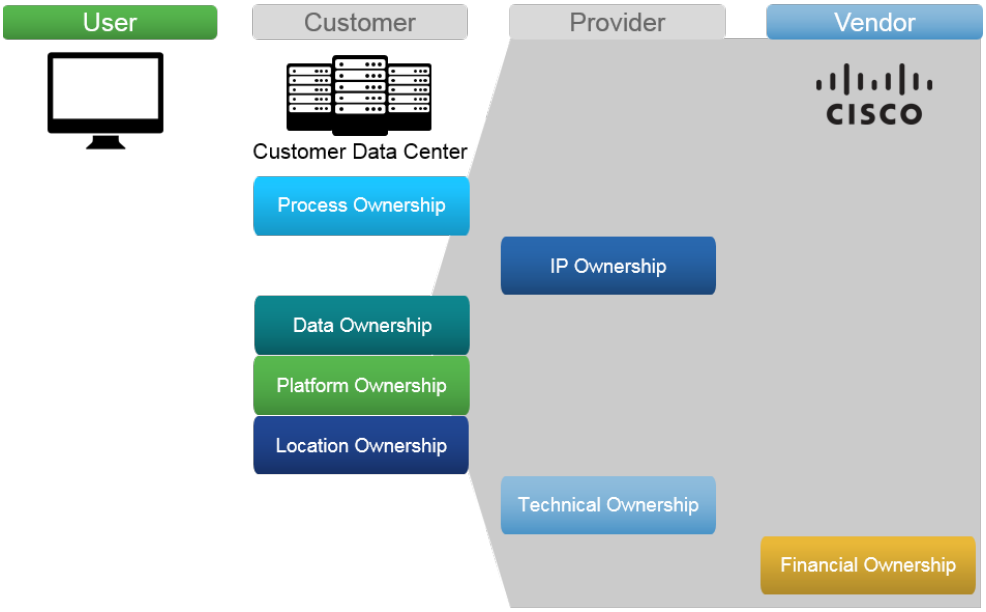
Figure 21. Apps within the Premises of the Customer



4.2.2 Software as a Service (SaaS) within the Premises of the Customer

Using a SaaS solution within the premises of the customer can lead to financial and technical ownership of the provider of the SaaS, and location ownership with the customer. (See Figure 22.)

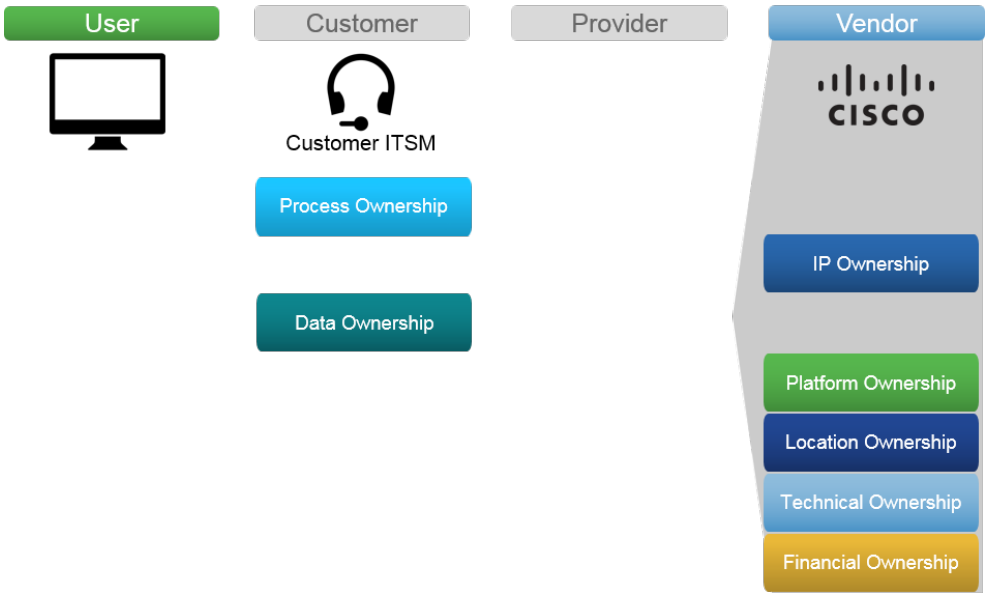
Figure 22. Software as a Service within the Premises of the Customer



4.2.3 Cloud Service: Cisco ServiceGrid

Cisco® ServiceGrid® is delivered as a cloud service to customers. It is operated by Cisco out of Cisco data centers. The payment model is capacity based (pay per connection). The customer retains process and data ownership. (See Figure 23.)

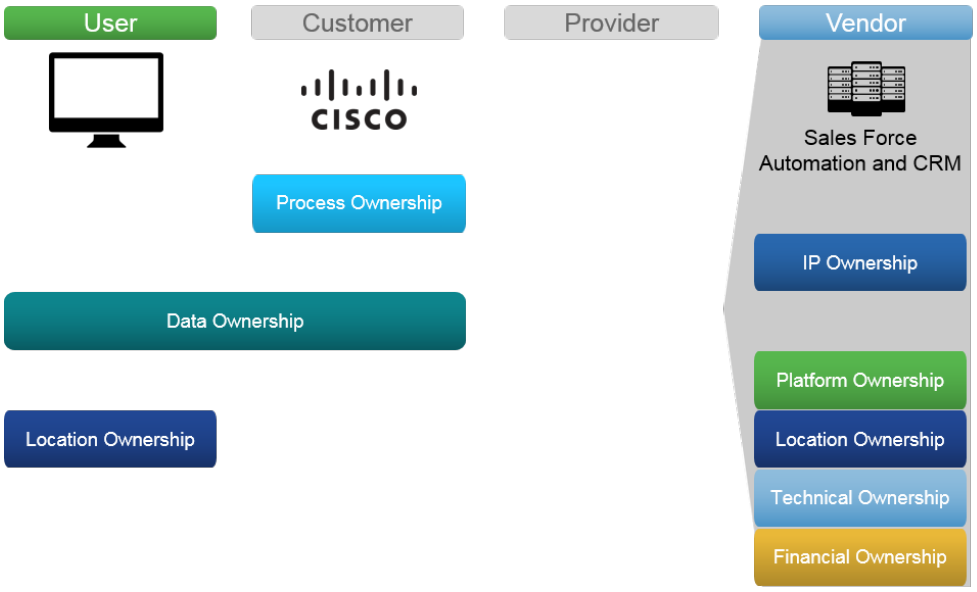
Figure 23. Cisco ServiceGrid™



4.2.4 Application as a Service – Salesforce

More and more vendors offer XaaS for horizontal services or (vertical) business solutions. In this case, the complete ownership of the solution infrastructure is with the vendor (e.g., ServiceNow, Salesforce). The customer has a certain level of process ownership, and is responsible for shaping its business processes following the guidelines and parameters provided by the vendor's business solution. Data ownership is completely with the customer. (See Figure 24.)

Figure 24. Application as a Service

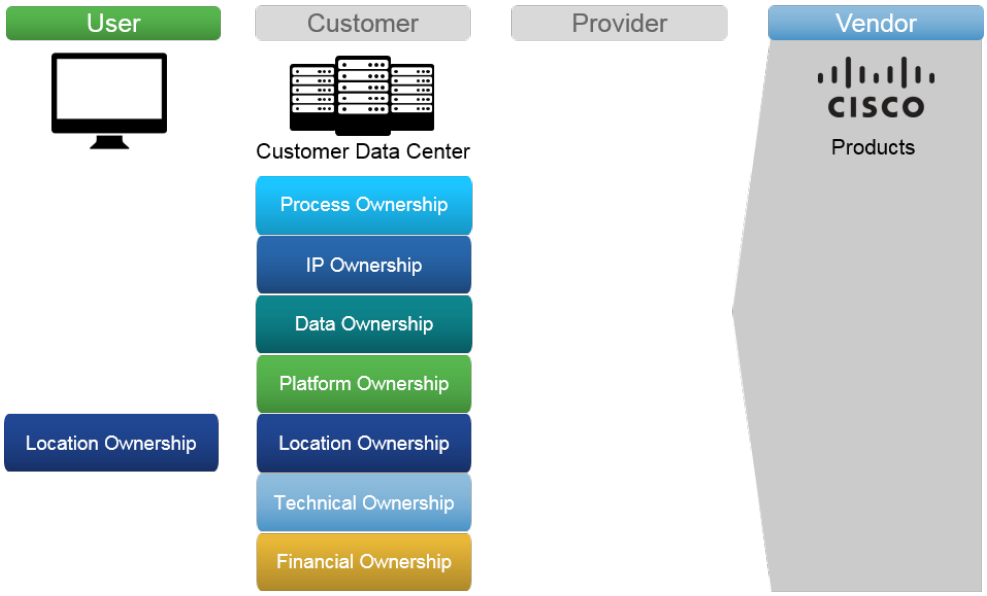


4.3 Data Center

4.3.1 Traditional Customer Data Center

In a traditional data center environment, the financial, technical, location, IP, data, and process ownership resides with the customer. All tasks and responsibilities are completed by internal IT organizations. The external service relations are reduced to procurement of hardware and licenses. (See Figure 25.)

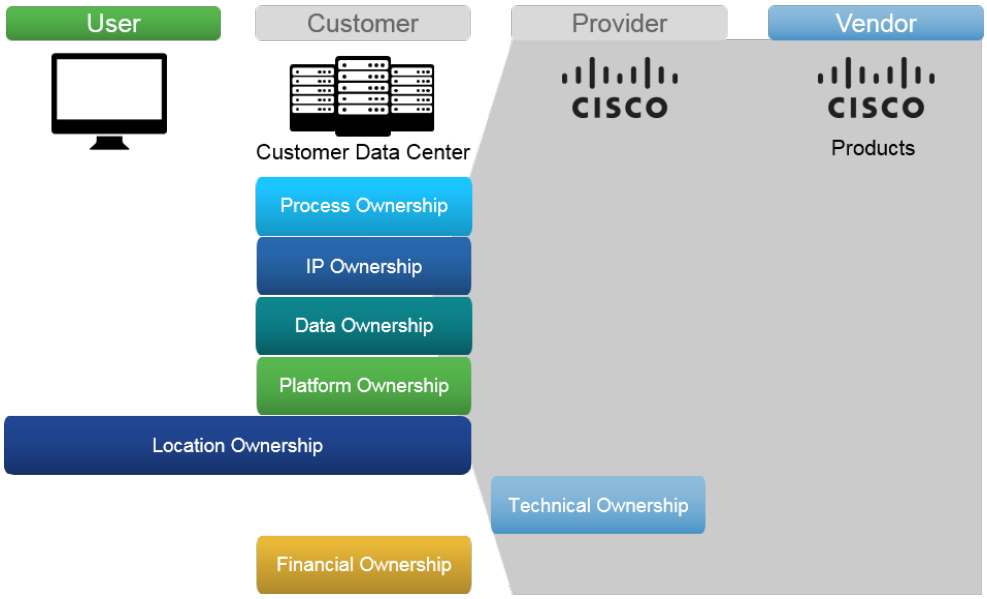
Figure 25. Traditional Customer Data Center



4.3.2 Traditional Data Center with Managed Services

In a managed service agreement, the customer retains most ownership elements. The service provider delivers managed servicers and thus holds technical ownership of the infrastructure. (See Figure 26.)

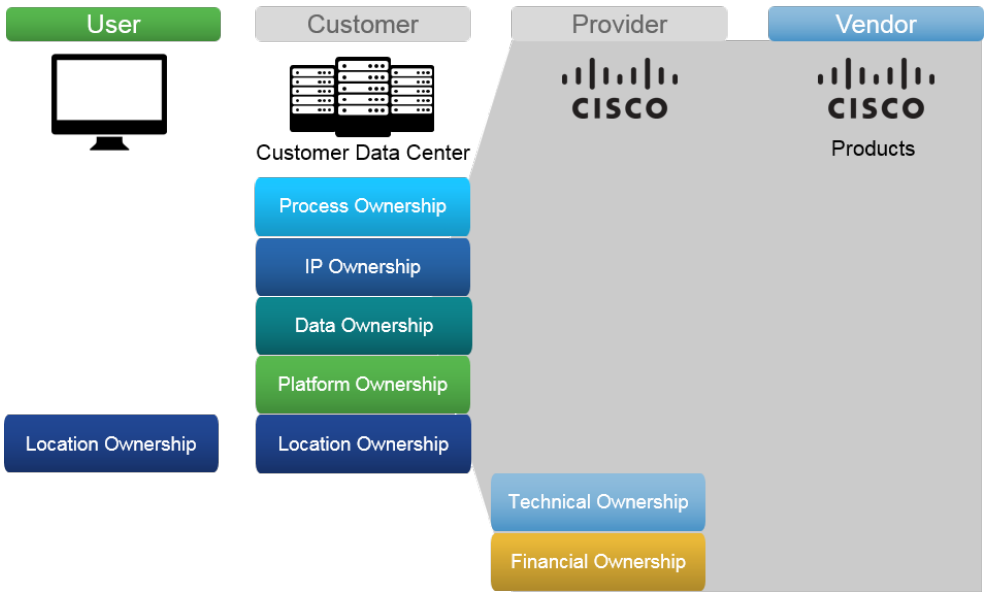
Figure 26. Traditional Data Center with Managed Services



4.3.3 Capacity-based Model

In a capacity based model (pay per processing capacity or storage capacity), the customer may hold all elements of ownership except financial and technical ownership. The provider manages the infrastructure and charges the customer for provided capacity. (See Figure 27.)

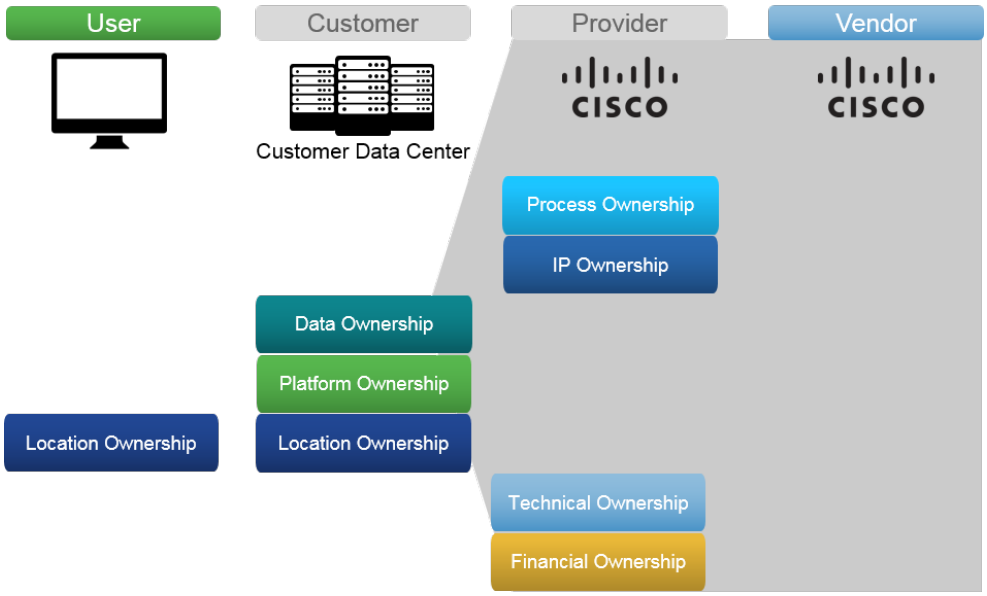
Figure 27. Capacity-based Model



4.3.4 Consumption-based Model

In the more advanced consumption-based model, the infrastructure is provided by the provider, but within the premises of the customer. The customer is charged for used capacity or consumption (e.g., storage usage or processor usage). This model is similar to private cloud or IaaS. (See Figure 28.)

Figure 28. Consumption-based Model

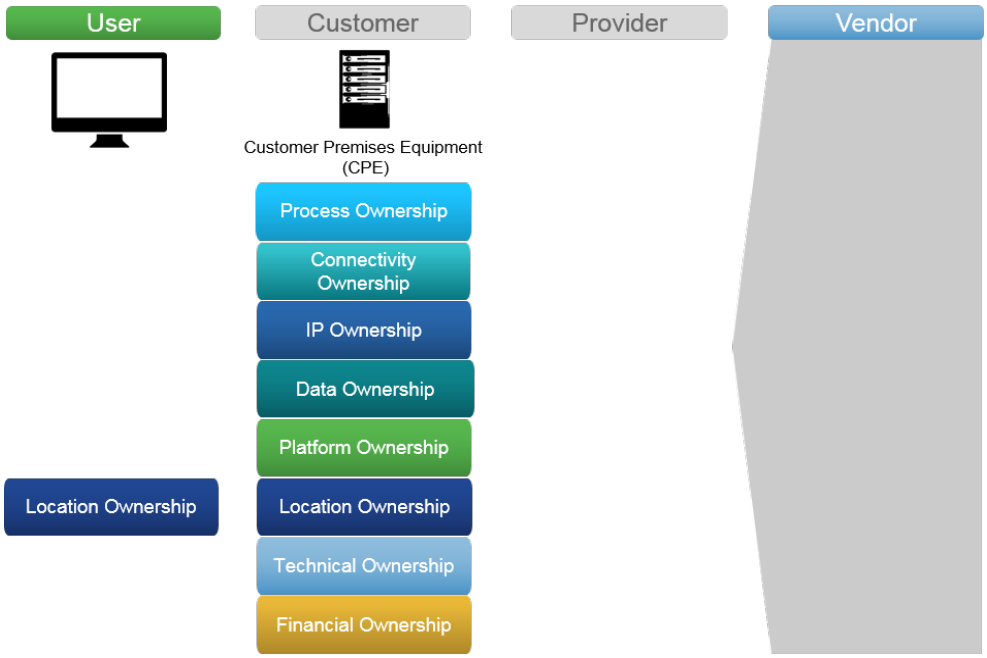


4.4 Network

4.4.1 Network LAN

The classic LAN example shows all ownerships at the customer/enterprise including customer premises equipment (CPE). In the example in Figure 30, the enterprise buys all equipment from their preferred vendors and operates all via their IT department. The CPE can be either provider or customer owned.

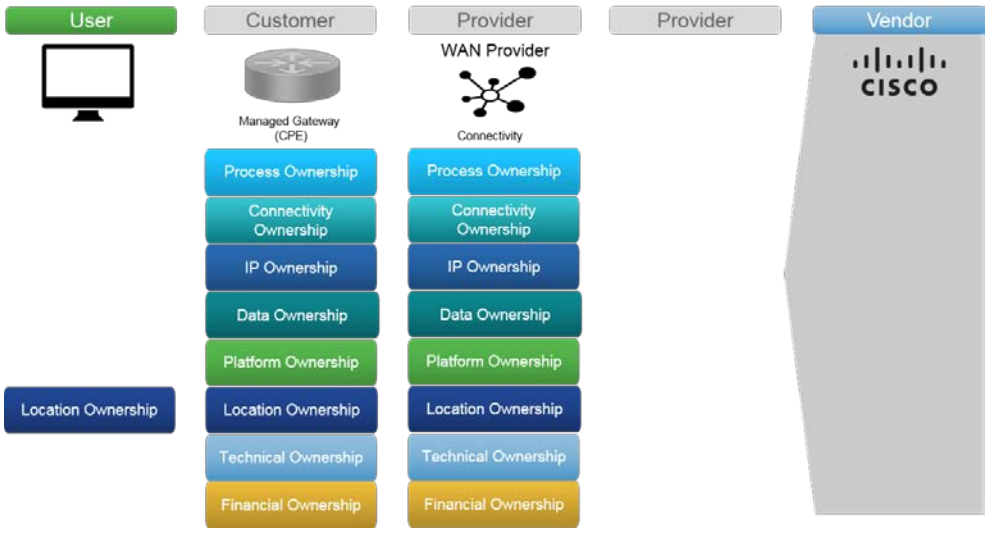
Figure 29. Network LAN



4.4.2 Network WAN (Classic Provider)

The network WAN example in Figure 30 shows the clear separation between the customer/enterprise owned LAN and the WAN provider-owned WAN connectivity. In many cases, the CPE is managed by the WAN provider on the customer site.

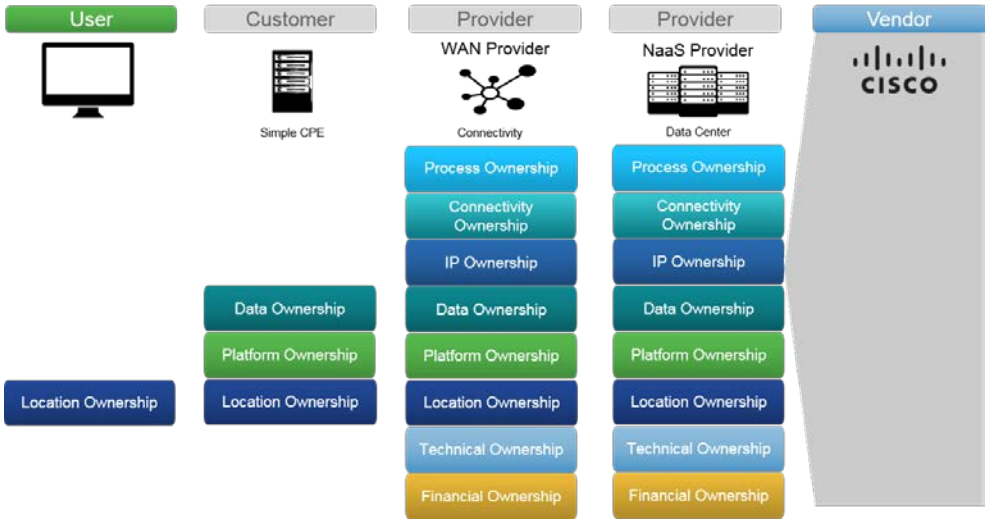
Figure 30. Network WAN



4.4.3 Network Virtualized (OPEX)

The example of the virtualized network in Figure 31 is based on the previous example (Figure 30), with the addition of using a NaaS provider running many of the customer connectivity functions in its data center. There is no longer a need for a complex CPE at the customer site, which is replaced by a simple CPE. This configuration allows you to optimize OPEX by moving many of the different ownerships away from the customer under the NaaS provider responsibility.

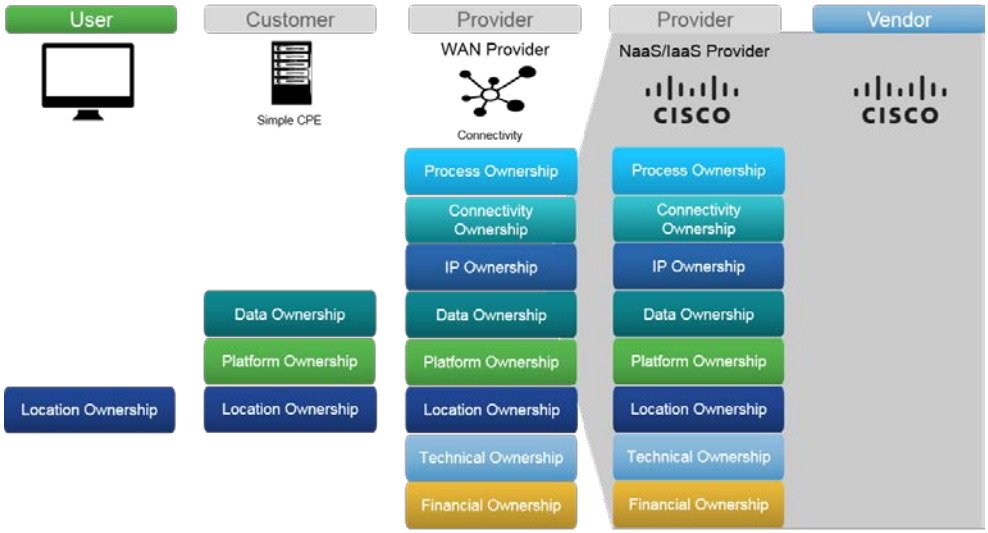
Figure 31. Network Virtualized (OPEX)



4.4.4. Network Virtualized (OPEX), Cisco as NaaS Provider

In the example contained in Figure 32, Cisco assumes the role of the NaaS provider. This approach not only allows for the sale of NaaS services to our customers, but also guarantees a smooth transition over time of ownership away from the customer/enterprise to the NaaS provider. The timing of this transition is ideally controlled by the customer/enterprise, whenever they feel safe and ready to outsource network and network services as much as possible so they can concentrate on their core business.

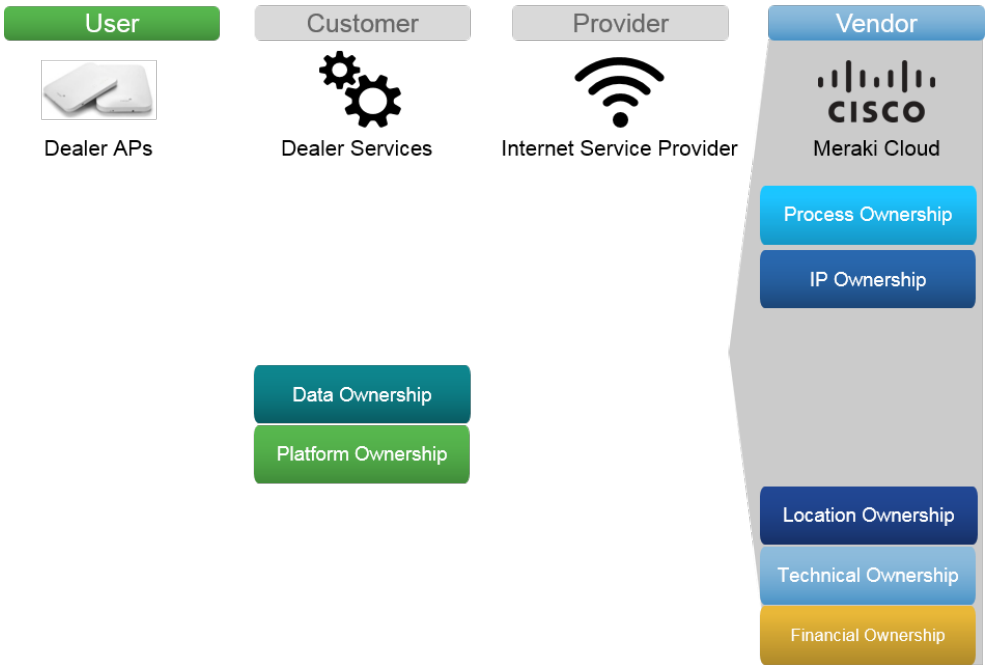
Figure 32. Network Virtualized: Cisco as NaaS Provider



4.4.5 Meraki Cloud

Meraki®, owned by Cisco, already demonstrates a great approach for outsourcing network services from the customer to the cloud. (See Figure 33.)

Figure 33. Meraki Cloud

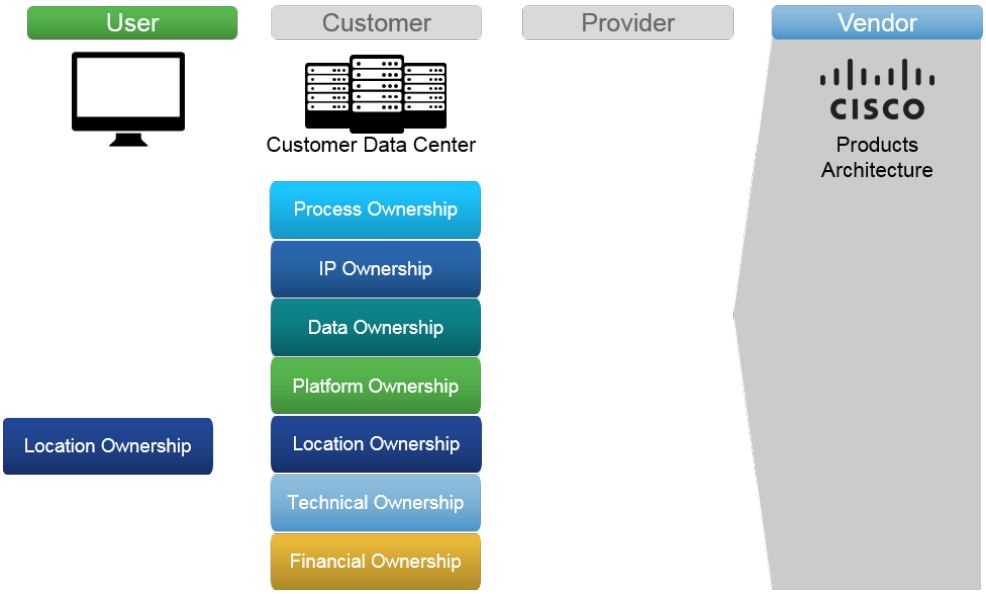


4.5 Cloud

4.5.1 Private Cloud within the Customer's Premises

Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party and hosted internally or externally. (See Figure 29.)

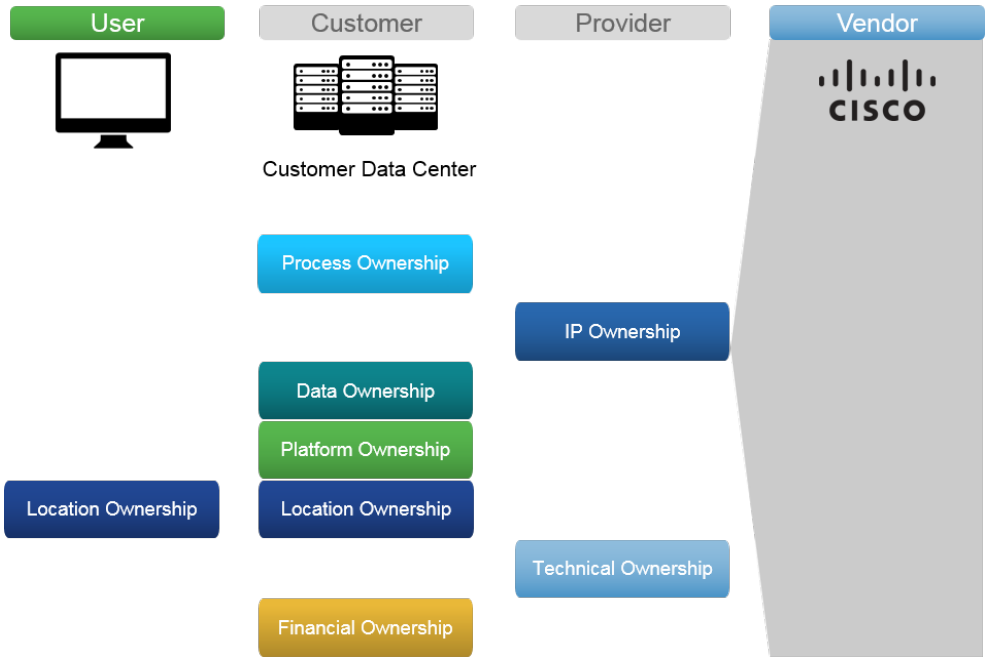
Figure 34. Private Cloud within the Customer's Premises



4.5.2 Private Cloud Managed by a Service Provider

Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party, and hosted internally or externally. (See Figure 35.)

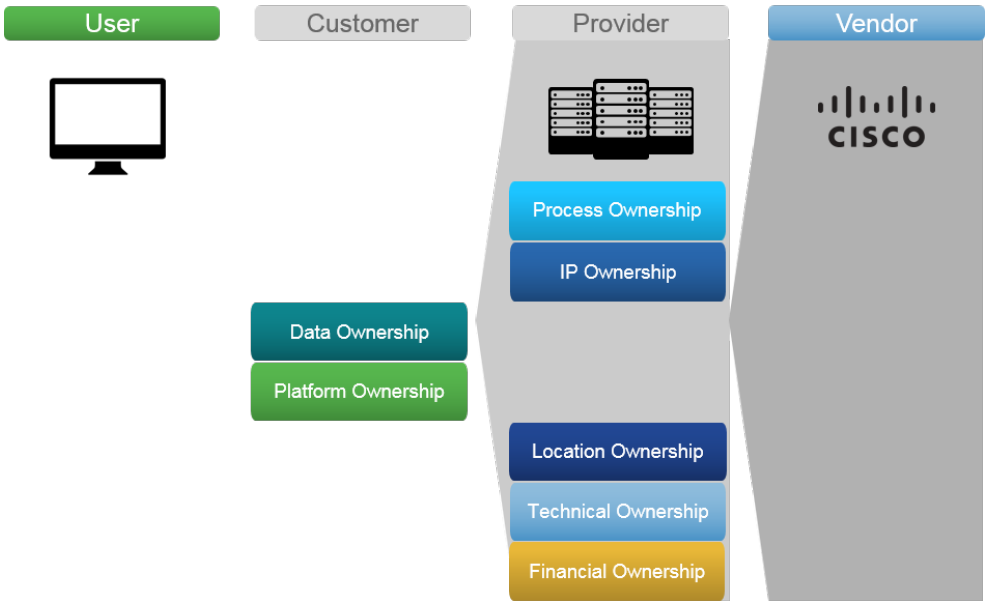
Figure 35. Private Cloud Managed by a Service Provider



4.5.3 Hosted Private Cloud Provider

Cloud providers offer cloud services or cloud solutions for a specific target group. They act as providers building and providing cloud platforms and using components, architecture and intellectual property delivered by cloud technology vendors (e.g., Cisco). (See Figure 36.)

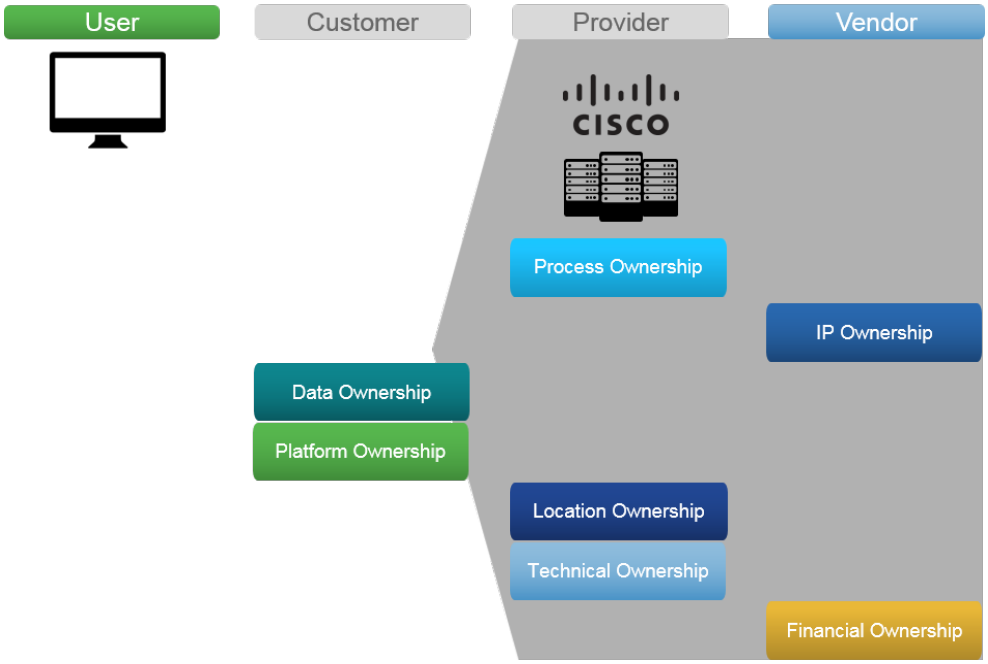
Figure 36. Hosted Private Cloud Provider



4.5.4 Private Cloud, Hosted and Managed by Cisco

In a private cloud situation, the cloud infrastructure is managed by the provider within its own premises. Data ownership and platform ownership (private) are owned by the customer. (See Figure 37.)

Figure 37. Private Cloud Hosted and Managed by Cisco

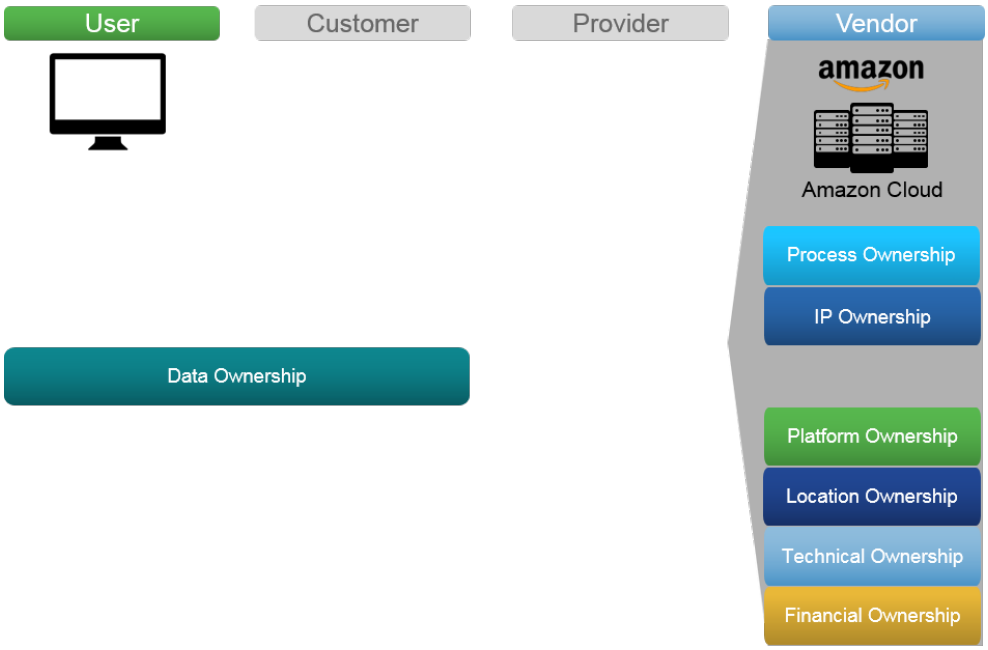


4.5.5 Public Cloud/Infrastructure as a Service

A cloud is called a public cloud when the services are rendered over a network that is open for public use. Technically there may be little or no difference between public and private cloud architecture, however, security consideration may be substantially different for services.

In a typical IaaS (Infrastructure as a Service) agreement the complete ownership (financial, technical, location) is with the provider of the IaaS.

Figure 38. Public Cloud/Infrastructure as a Service



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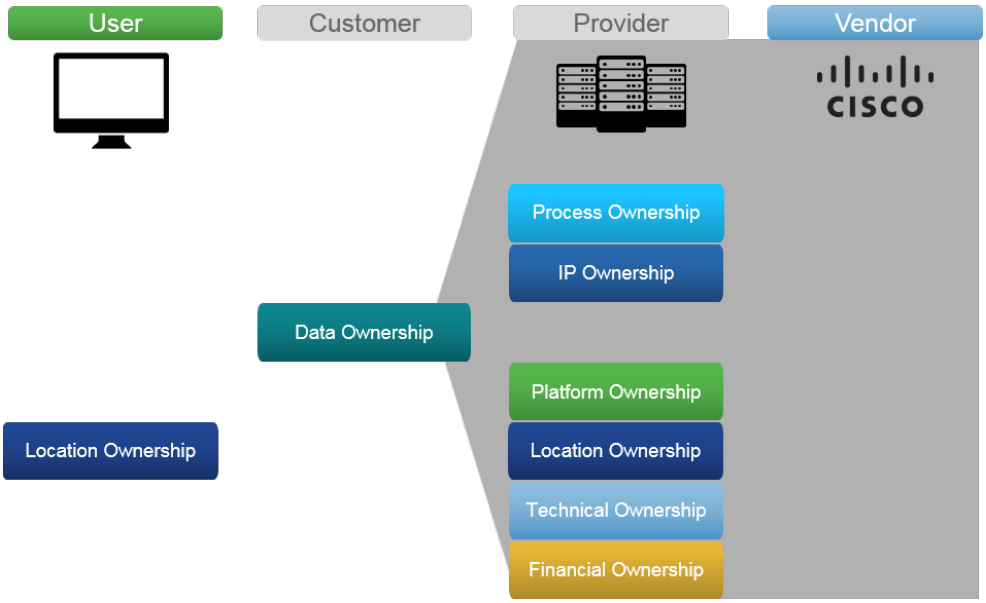

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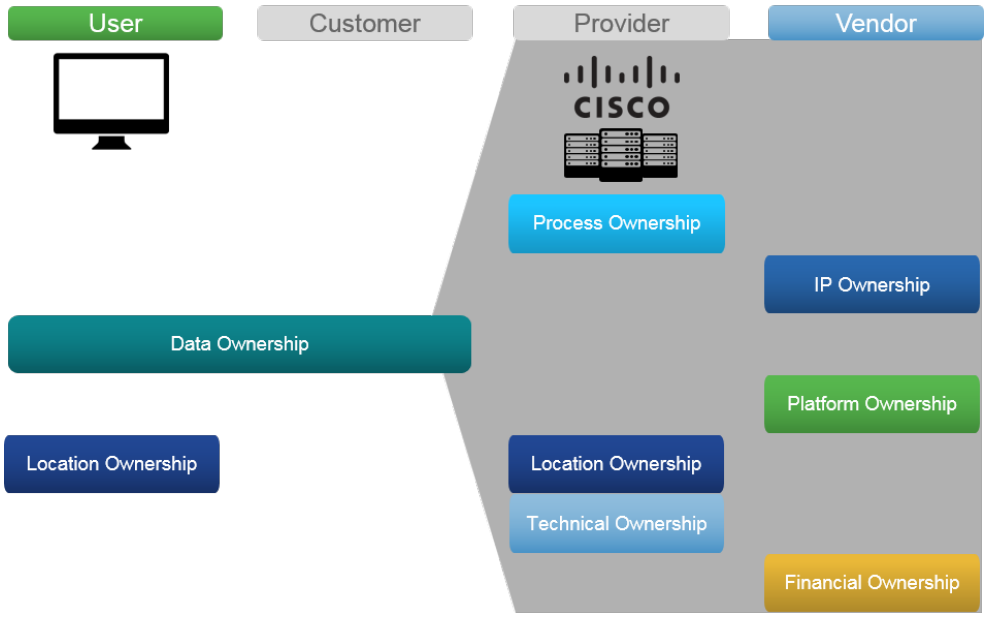
Figure 40. Public Cloud Managed by Cisco



About the Authors

Marcus Oppitz' professional roots are in computer science, specifically software engineering. As part of his activities at Technical University Vienna, he worked as assistant professor and university lecturer in research and education. In 2000, together with three partners, he founded SolveDirect, a company that developed and marketed a cloud solution for IT service management based in Austria and San Jose, California. After the successful acquisition of SolveDirect by Cisco in 2013, he worked for Cisco as a product manager, concentrating on the long-term strategy for cloud solutions providing for the integration of business processes. Marcus lives in Austria.

Peter Tomsu studied electrical engineering and received his PhD and MSC from Technical University Vienna. He has worked in the telecommunications and networking industries for more than 30 years. He joined Cisco in 1996 as an international consulting engineer, where he was involved in the development and deployment of numerous disrupting technologies like ATM, MPLS, Wi-Fi, mobile, IP NGN, and optical networking. He led research in advanced optical networking and high performance computing, as well as digital content and media distribution, cloud computing, and virtualization. He has also worked in standardization bodies such as DMTF, NIST, ITU-T, and ISO. Peter lives in Austria.

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Printed in USA 06/14