



The transformation from application delivery to service delivery

Cloud computing and the consumerization of IT are accelerating the transformation of the enterprise IT organization from the builder and operator of technology into the internal provider of services to the enterprise. The role of IT is shifting away from building applications and operating infrastructure, towards establishing effective combinations of internally and externally sourced services and delivering them to the business while ensuring requisite service levels. But traditional application delivery products and technologies can't fully support IT in achieving these new goals.

What are services?

“Services” traditionally describes IT capabilities and solutions delivered by external service providers such as telecommunications companies and ISPs. Common examples include Internet connectivity, wide area network (WAN) transport and managed email. “Service delivery” traditionally describes how these services are made available to enterprises, covering everything from security and performance-related features to availability and technical support service level agreements (SLAs).

Services and services delivery contrast to the physical and relatively static product—such as software, hardware and systems—that IT organizations design, build, implement and operate themselves.

With the changes stemming from the consumerization of IT and widespread adoption of cloud computing, however, the services terminology, approach and underlying benefits now apply equally to the enterprise IT department as it steadily evolves into an internal provider of services.

IT organizations are learning that they can benefit from a services approach, as a provider, acquirer and integrator, by taking advantage of highly leveraged infrastructure and frequent iteration on features, functions and content in a way that steadily delivers greater value without incurring significant disruptions.

Instead of its traditional tools—a build-it-yourself collection of hardware and software networking and application management components—the modern IT department needs a full-fledged service delivery fabric featuring:

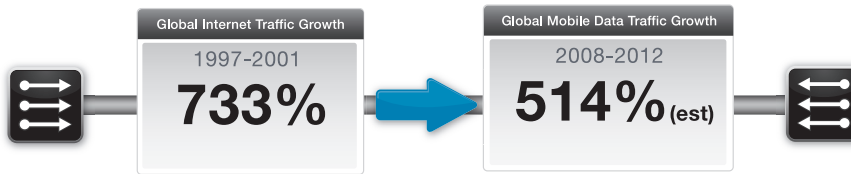
- A comprehensive set of network-based service and user-centric delivery capabilities (as opposed to application-centric capabilities)
- A datacenter platform that can consolidate the full range of both core and adjunct service delivery capabilities, as well as any other functions required in the future
- Implementation options that deliver capabilities tailored for use at branch offices, on user endpoints, in the cloud, at the edge of the enterprise network and in the immediate vicinity of the servers supporting individual applications
- A management architecture and system that provides an intelligent control plane and enables cohesive and coordinated service delivery

The impact of cloud computing and consumerization

Cloud computing and consumerization are fundamentally changing the way organizations use IT—even changing what an IT organization is responsible for delivering. The primary role of the modern IT department is no longer just to build and deliver application-specific corporate-owned desktops and laptops from one or more enterprise datacenters. Rather, the job of IT is to pull together a variety of both internally developed and externally sourced application and infrastructure services and orchestrate their delivery to the business. This change affects everything: what IT is supposed to deliver, how it delivers it, where from and where to.

The “what” of IT delivery – from applications to services. The target of IT delivery is changing from applications and other IT “products” to services. This shifts the role of IT from a builder of products to an internal provider of services that can help to achieve significant differentiation. Also, with the trend towards consumerization, IT is being asked to support more devices—some of which are owned by individuals rather than IT—and provide them a broader range of items delivered as services: from applications to individual files or desktop environments.

Growth of Internet data → Mobile data



Growth of Web Apps → Cloud Services



Just as the dramatic growth of Internet data in the late 1990s drove tremendous ongoing growth in web applications, the current growth in mobile data is driving dramatic growth in cloud-based services.

The “how” of IT delivery – from static to on-demand services. With a traditional approach, IT statically provisions applications primarily using dedicated infrastructure augmented by a handful of shared, centralized services such as user directories. However, widespread adoption of cloud computing methods, technologies and services is now enabling the delivery of IT as an on-demand service. In this scenario, IT manages a broad portfolio of ready-to-use applications and flexible infrastructure components, dynamically re-purposing and sharing them to maximize utilization and cost effectiveness while minimizing development and turn-up times for business units and users alike.

The “where from” of IT delivery – from enterprise datacenters to hybrid clouds. The growing popularity of SaaS and external IaaS offerings means that delivery is no longer taking place solely from enterprise datacenters. Instead, today’s IT departments need to orchestrate delivery across enterprise datacenters, public clouds and combinations of the two, such as hybrid clouds. Effective delivery requires detailed insight into services and their operation both for SLA management purposes and to achieve seamless delivery from the user’s perspective. Even though a given service might depend on multiple, underlying networks and infrastructures, IT must ensure these resources operate and appear to users and higher-order services as a single cohesive solution.

The “where to” of IT delivery – from devices to users. The consumerization of IT means that instead of outfitting users with fully provisioned desktops and laptops, IT’s job is now to make applications and other services available to a much broader array of devices, many of which—such as smartphones and tablets—are user-owned, user-controlled and highly mobile. Further, now that there is no longer a definitive one-to-one mapping between users and devices, IT must focus its management and delivery efforts on users instead of devices. IT can no longer use the device as a proxy for a user.

Aspect of IT delivery	From...	To...
What	Applications	Services
Where from	Enterprise datacenter	Hybrid cloud
Where to	Corporate-owned: Desktops and laptops	User-owned: Wide variety of devices
How	Static delivery: Fixed infrastructure	On-demand: Flexible infrastructure

Traditional application delivery must evolve into a seamless service delivery fabric

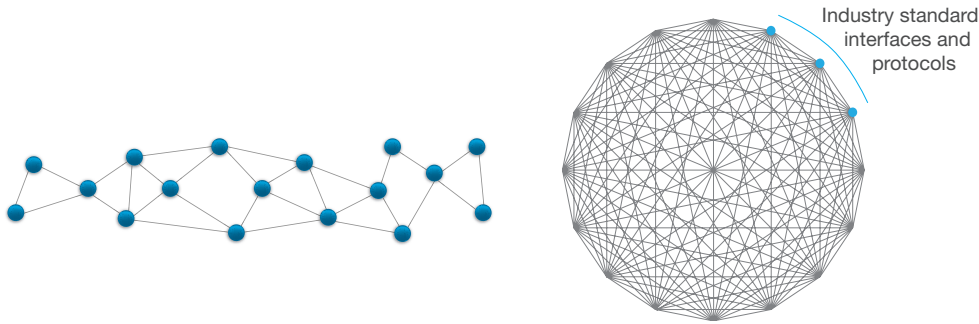
As the role of IT changes from application delivery to service delivery, application delivery products and technologies must evolve as well. Effective service delivery requires additional capabilities to support:

- Delivery from more locations, such as public clouds
- Delivery to more types of endpoints, including smartphones and tablets
- Load balancing, scaling and otherwise optimizing a greater variety of infrastructure components such as databases and directories

Also, as IT shifts from infrastructure operator to aggregator, manager and guarantor of services, it must ensure services meet SLAs and that the business is getting its money's worth. As a result today's IT departments require capabilities that enable them to control, monitor and even enhance all enterprise services—not just SaaS, IaaS and other externally provisioned offerings, but internally fielded ones too—all without impeding service delivery in any way.

Today's enterprises need a service delivery fabric, a solution that simultaneously provides:

- In-depth insight into services and their operation
- A comprehensive set of capabilities for enhancing the availability, performance and security of services, as well as ensuring compliance with applicable policies, regulations and SLAs
- Ubiquitous coverage, to enable monitoring and enforcement of delivery policies from the user endpoint, at branch offices, in the cloud, at the network edge, in the enterprise datacenter and/or in the immediate vicinity of individual application servers
- A management architecture and system that effectively pulls everything together by enabling intelligent control and coordination of all service delivery capabilities and components



Networks must transform from complex hierarchies of fixed architecture into flat standards-based topologies that are optimal for the any-to-any requirements of service delivery.

IT needs such a service delivery fabric in order to effectively and efficiently keep pace with the industry's rapid and irrevocable transformation from application delivery to service delivery. Such a fabric is also essential to the next step for IT organizations: embracing cloud computing architectures and solutions for the ultimate in highly agile and elastic computing infrastructures.

Required capabilities of a service delivery fabric

Creating a service delivery fabric requires understanding and redefining traditional application delivery controllers (ADCs), such as Citrix® NetScaler®, in a services context. For example, application availability becomes service availability, while application optimization becomes service optimization. More than just a name change, the transition to a service delivery fabric needs infrastructure and user-centric delivery capabilities that enable the delivery of services as well as applications. Since this fabric will become the foundation of enterprise IT and an essential element of an organization's competitive differentiation, it needs enterprise-class power, flexibility and manageability too.

In some instances developers will be able to meet the new requirements by transforming an existing capability, typically by extending its scope of coverage. In other cases, though—such as with the need for broader and deeper visibility—developers are likely to have to create entirely new capabilities.

Infrastructure-centric delivery capabilities solve IT challenges

New and enhanced infrastructure-centric capabilities appropriate for an enterprise service delivery fabric include in-depth application/service visibility, broader load balancing coverage, WAN transparency and advanced security capabilities.

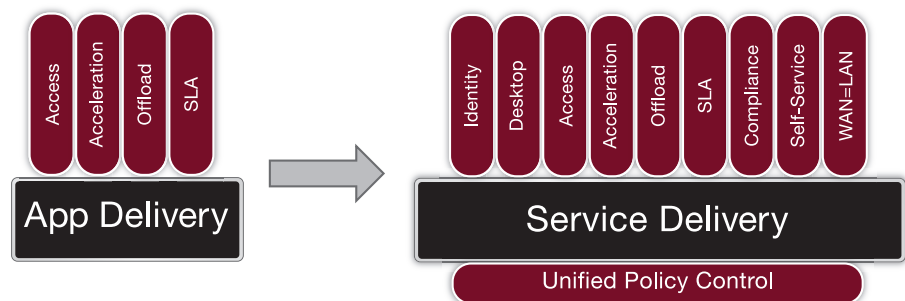
Application/service visibility. This capability involves the collection, organization and exposure of granular details pertaining to application/service operation, including who is using which services, when, to what extent and from where. The goal is to provide useful intelligence not only

to support ongoing operational tasks (such as troubleshooting, capacity management and SLA management), but also to monitor and manage compliance with both internal policies and externally imposed regulations.

Broader load balancing coverage. This capability entails extending the benefits of load balancers to other key elements of the infrastructure, such as the database tier. In addition to load balancing database servers, the goal would be to offload suitable processes (such as connection setup and management) and include advanced policy support (such as switching/distributing load based on transaction details). The net result is to deliver to the database infrastructure a set of benefits comparable to those achieved with L4 to L7 load balancing for web servers: improved reliability, simplified scaling, better performance and lower TCO.

WAN transparency. The growing popularity of SaaS and IaaS increases the percentage of services being delivered over a WAN, so IT should make operational performance over the WAN equivalent to that of the LAN. This is particularly true for hybrid cloud implementations and other configurations that require enterprise-cloud synchronization and/or sharing of services—such as user authentication—across these environments. Two capabilities in particular make sense in this case:

- A “bridging” capability connects an enterprise datacenter with a cloud datacenter at layer 2, in effect extending the on-premise datacenter and network core off-premises. This approach enables seamless cross-environment communication without requiring network addressing and architecture changes. Such a capability would also need to provide protection, ideally in the form of an encrypted tunnel, for all information traversing the public networks upon which the bridge would inevitably rely.
- A WAN optimization capability ensures performance levels remain on par with those achieved when operating over the LAN. IT should leverage compression, caching, data de-duplication and protocol optimization technologies common to existing WAN optimization products, such as Citrix Branch Repeater™, in addition to possibly leveraging the products themselves for service in the cloud and/or at branch office locations.



The transformation from application delivery to service delivery leverages shared capabilities, functions and optimizations, driven by unified policy.

Advanced security. As both the “from” and “to” aspects of the delivery model become increasingly distributed and outside the control of IT, organizations must seek to incorporate compensating controls. Two capabilities that help

provide additional security functionality are entitlements management and layer 7 access control. The former establishes who has rights to which services under which conditions, while the latter enables enforcement of these rights and associated policies across the network based on the specific applications and services being used.

User-centric delivery capabilities

An enterprise-class service delivery fabric also requires user-centric capabilities, including identity federation, self-service access and mobility enablement.

Identity federation. With the proliferation of endpoint devices the user becomes a point of control and the most meaningful attribute for related delivery. Users need IT to aggregate several identity-related functions that serve a range of purposes from establishing granular access control to achieving identity consolidation and enhancing the end-user experience. Specific sub-capabilities include:

- The ability to extend corporate identities into the cloud
- Single sign on (SSO) that spans all services, including enterprise applications, SaaS and IaaS offerings
- The ability to control and personalize access to services based on virtually any combination of user identity and measurable device characteristics

IT will probably want to include support for a bring-your-own-identity option, where users can authenticate with their “civilian” credentials—for example, from Facebook or Google—and the delivery infrastructure then maps those credentials to both internally and externally sourced services.

Self-service access. This capability complements the delivery of IT as an on-demand service. Users should be able to identify available applications and services, request authorization to ones they need, be provisioned with the appropriate entitlements and gain access to the services they require, all in a straightforward, user-friendly manner that requires minimal effort on the part of IT staff.

Mobility enablement. Another aggregation of multiple related functions, mobility enablement supports user mobility in general, as well as the proliferation of user devices that are not owned, provisioned and managed by IT. One important sub-capability is desktop delivery: supporting the use of desktop virtualization technology, for example, by consolidating associated infrastructure components and incorporating features that help optimize related communications traffic. Other potential sub-capabilities include connection persistence and proximity-based routing when there are alternate source locations for accessing available services.

Strength and flexibility features for an enterprise-class service delivery fabric

Service delivery components need to work everywhere—on a user’s device, at branch offices, in the cloud, at the network edge at the application edge—including in the heart of the datacenter. The minimum requirements for such a platform include the following.



Consolidation and extensibility. A datacenter platform should be able to consolidate the full suite of existing service delivery capabilities, and accommodate new ones over time without the need for forklift hardware upgrades or significant disruption to ongoing operations.

Third-party support. The platform should be architected to support the use of open source and third-party capabilities as a way to further expand functionality and address the diverse and ever-changing needs of modern enterprises.

Multi-tenancy. The platform should incorporate partitioning, resource sharing and other related features and architectural elements that enable a single physical device to simultaneously address the distinct needs of numerous tenants (such as applications/services, business units and customers).

Wire-speed delivery. The platform should incorporate features and architectural elements, such as separate control and data planes, to enable execution of all delivery capabilities at datacenter throughput levels with minimal introduced latency.

Robust, unified management. The platform should incorporate a management architecture and include features that both provide essential, single-unit administrative functionality and support the concept of unified policy management and an intelligent control plane, as described below.

Unified policy management and the intelligent control plane

A service-oriented approach to management brings together the disparate capabilities described above into a cohesive enterprise service delivery fabric. First, IT must have the capabilities to:

- Manage all instances of an individual delivery capability simultaneously, across all physical locations and types of platforms in use by the enterprise and its providers.
- View and control sets of capabilities that support a given service (or other type of tenant) in an aggregate manner, including across physical instances. For example, it should be possible to set all of the delivery policies for a given application or service using a single management screen, or to get a view of the overall delivery status/health for a given service.
- Accommodate third-party services without the need for separate policy management tools.

A second, more strategic step is to unify all of the distributed platforms and capabilities of the delivery infrastructure using inter-component discovery, communication and coordination. Whether IT creates this intelligent control plane using custom or standard protocols doesn't matter. The intelligent control plane provides an overlay network between separate service delivery devices, regardless of whether they are virtual or physical. It also provides some "intelligence"—such as an advanced management application—capable of coordinating the activities of the separate devices such that they automatically operate in a manner that ensures optimum delivery.

How Citrix is meeting the service delivery challenge

Citrix is committed to helping its customers transform from application delivery to service delivery. While pushing forward with planning and constructing a seamless enterprise service delivery fabric, Citrix already offers customers individual elements of the fabric.

A new service delivery fabric

In order for the network to deliver on the requirements of services-oriented IT, it must be logically flattened. Hierarchical connections and the traditional siloes of perimeter, edge and cloud must give way to a logical, peer-interconnected structure that allows for consolidated delivery of service-centric capabilities.

At the core of the new network architecture is an overlay fabric that seamlessly and securely connects multiple discrete regions and devices across discrete domains of physical connection and ownership. This fabric delivers services as IaaS or SaaS to all devices, whether the devices or applications are owned by enterprises or providers, and whether they are located on-premise or at cloud providers.

As a foundation of service delivery networking, Citrix OpenCloud Bridge fuses IPSec and Layer 2 tunneling, global server load balancing and WAN optimization to provide the location, performance and network transparency required to build hybrid clouds that span on- and off-premise datacenters. With OpenCloud Bridge, hybrid clouds appear as one contiguous network: users are automatically routed to the location that will best meet their needs and they continue to experience LAN-like performance even when accessing services that aren't local to them. Another major benefit is that it provides a way for distributed service delivery components to communicate with each other—an essential ingredient for an intelligent control plane.

To ensure trust and secure control, Citrix OpenCloud Access extends the “single pane of glass user experience”—just like the one Citrix Receiver™ already provides for desktop and client-server applications—to enterprise web and cloud-hosted applications as well. It also helps ensure hassle-free support for the broadest set of SaaS and IaaS offerings through a combination of innovative and open techniques for extending the identity of internal users into a service provider's domain. With OpenCloud Access users also benefit from a seamless and consistent access experience, single sign-on and an extensive set of self-service features. Administrators gain the advantage of powerful workflow automation, user provisioning and entitlements management capabilities.

Centralized management and visibility provide with a unified control plane, enabling IT to configure and enforce policies and guarantee service levels across locations and domains of ownership. IT administrators can access these capabilities through products such as Citrix Command Center or by plugging into third-party management frameworks through open interfaces.

Addressing the change requires the development of service delivery networking technologies including:

- A new service delivery fabric
- A new service delivery controller
- New service-centric networking capabilities

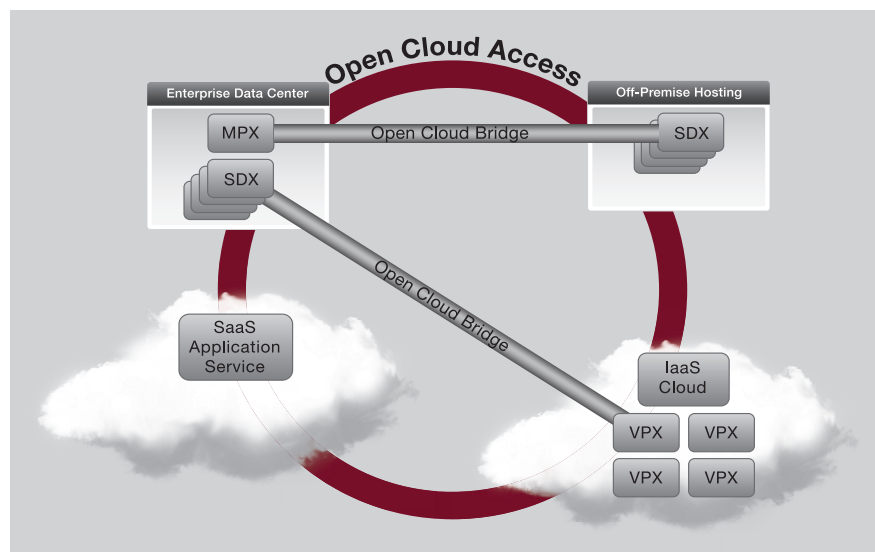
Together, these technologies make up a ubiquitous policy enforcement framework, with unified policy definition and control guaranteeing required levels of performance, reliability and security for every service, no matter where it runs and regardless of the devices used to access it.

A new service delivery controller

Citrix NetScaler SDX™ is a new purpose-built service delivery platform tailored especially for datacenter workloads and operating conditions.

Features and characteristics that make NetScaler SDX an ideal service delivery platform for the datacenter environment include the following:

- A next-generation fully virtualized architecture to deliver fully isolated NetScaler instances running on a single appliance platform. NetScaler SDX provides full resource and network isolation, per instance (rather than per device) high availability and per instance (rather than per device) version control and lifecycle management.
- Scalable architecture that enables NetScaler SDX appliances to offer the same HTTP throughput as comparable NetScaler MPX appliances.
- The full feature set of NetScaler 9.3. Each instance is a full-blown NetScaler environment.
- The next-generation architecture provides the foundation for further consolidation of adjacent service delivery capabilities such as WAN optimization, network security and desktop delivery services.
- A single control plane provides unified provisioning, monitoring and management of all instances.
- A transparent services delivery fabric network overlay. NetScaler instances running on NetScaler SDX can be bridged to NetScaler MPX™ and NetScaler VPX™ instances.



Citrix NetScaler appliances are optimized for their roles in the fabric: MPX for the highest throughput at the edge, VPX for policy of individual customers in shared infrastructure and SDX forming the any-to-any service delivery fabric.

New service-centric networking capabilities

IT must extend the capabilities of the traditional ADC to support services fully. This means bringing the functionality once reserved for web apps to the data tier as well as to other methods such as desktop and user app delivery. IT also needs to add deep application resource visibility to the data previously gathered only at the network protocol level. In short, IT needs the following capabilities:

Data delivery. Corporations of all sizes today are dealing with an explosive growth in data. To manage this growth, IT needs to bring to data networking the same kind of visibility and policy that was previously available only for web apps. The new NetScaler DataStream technology inspects data traffic in real time and applies optimization and security policies. It is the first networking solution of its kind to apply native data protocol and transaction intelligence to both structured and unstructured data. For databases like Oracle MySQL and Microsoft SQL Server, NetScaler with DataStream technology enables enterprises to scale-up their data infrastructure by offloading CPU and memory-intensive database server connections. The new NetScaler DataStream technology helps companies scale out their datacenters and private clouds by intelligently load balancing SQL requests to the most appropriate and available servers. It also allows customers to set policies that secure, control and audit data access in real time.

Desktop and user app delivery. For greater assurance of desktop delivery and increased user satisfaction, IT can optimize the Citrix XenDesktop® desktop virtualization solution in two ways. First, by running a full-featured version of the web interface service for XenDesktop on NetScaler appliances, IT can lower costs by reducing server count, strengthen security by leveraging a hardened platform and improve performance by taking advantage of dedicated SSL accelerators and a multi-processor, built-for-purpose hardware platform. Second, IT can conduct customized application-level health checks. These help ensure essential components of the desktop delivery infrastructure are running and that corresponding software elements are operating properly.

Ubiquitous app visibility. NewAppFlow™ capabilities extend the visibility of network protocols to the applications and components of services, adding app-level detail to network monitoring. Because AppFlow delivers this information in standards-based formats, IT can work with it using a wide variety of tools to monitor service levels, plan capacity, tune performance and enhance reliability. Because the information is available through these standard interfaces and formats, IT doesn't need to subvert configurations by adding network taps or port-spanning.

Conclusion

Cloud computing and the consumerization of IT are accelerating a change in the role of the IT department from builder and operator of “products” into an internal provider of services to the enterprise. Traditional application delivery technologies must evolve to support this change, providing a solution that combines:

- A collection of physical and virtual form factors that provide best-fit coverage across all locations, from user devices and the cloud to the edge of the enterprise network, heart of the datacenter and immediate vicinity of individual servers.
- An intelligent control plane that enables operation of all service delivery capabilities and components in cohesive and highly coordinated manner.
- A comprehensive set of service- and user-centric delivery capabilities, rather than ones that are just focused on applications.

To provide a seamless user experience with in-depth visibility and control over the full portfolio of IT services—regardless of whether they are delivered from the enterprise datacenter, the service provider cloud, or a combination—IT needs to implement a service delivery fabric. And with the recent introductions of Citrix OpenCloud Access, Citrix OpenCloud Bridge, the NetScaler DataStream technology and now the new Citrix NetScaler SDX datacenter service delivery platform, Citrix is continuing to execute on its vision of enabling a true, enterprise-class service delivery fabric.



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About Citrix

Citrix Systems, Inc. (NASDAQ:CTXS) is a leading provider of virtual computing solutions that help companies deliver IT as an on-demand service. Founded in 1989, Citrix combines virtualization, networking, and cloud computing technologies into a full portfolio of products that enable virtual workstyles for users and virtual datacenters for IT. More than 230,000 organizations worldwide rely on Citrix to help them build simpler and more cost-effective IT environments. Citrix partners with over 10,000 companies in more than 100 countries. Annual revenue in 2010 was \$1.87 billion.

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