How Cisco is Progressing Toward IT as a Service

Cisco Data Center Business Advantage and the Cisco Unified Computing System power a new and planet-friendly data center in Allen, Texas.

Power, space, and cooling are vital commodities in data center environments. As Cisco managed through a period of explosive growth in 2007, its IT department was in demand of all three. Faced with a critical situation, a group of key decision makers saw an opportunity to transform Cisco IT into a services organization—one that could enable new business models and position the company for continued success.

EXECUTIVE SUMMARY

Challenge:

- Address capacity, business resiliency, and geographic risk in data center infrastructure
- Transform Cisco IT into a services organization that drives the business forward
- Demonstrate how Cisco products can be deployed to achieve a high-density footprint, virtualization, and a cloud-enabled model
- Consolidate from 50+ data centers to under 20 and reduce overall data hall footprint

Solution:

- Multisite data center strategy that called for building out and retrofitting six data centers globally
- New 162,000-square-foot Tier 3 facility in Allen, Texas designed, developed, and built from the ground up by Cisco
- 10 mW facility, two data halls: total 38,000-square-foot, 5.25 mW nominal
- Deployment of Cisco technologies, including Cisco Unified Computing System™ (UCS) as the compute platform, Nexus® for switching, and MDS for storage networks
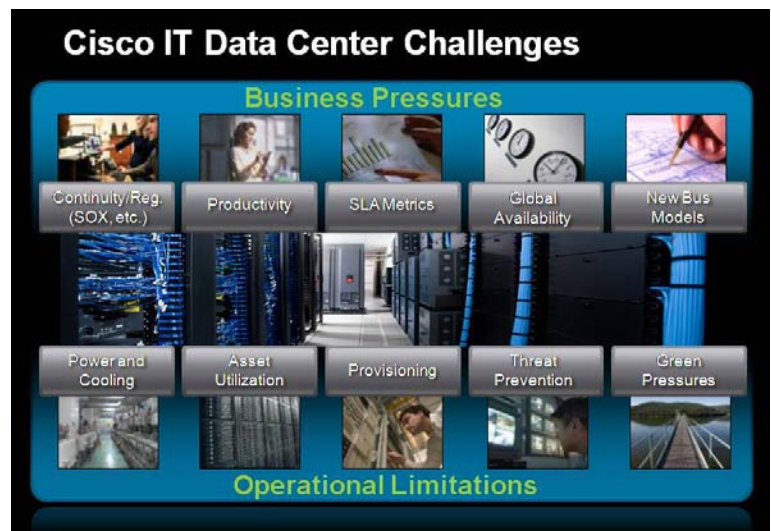
Results:

- Faster provisioning of IT services (from 6 weeks to 2 days)
- Improved scalability and agility of data center infrastructure
- Active-active Metro Virtual Data Center capabilities that enable zero downtime for critical business systems
- Lower total cost of ownership for compute services

CHALLENGE

With IT resources in short supply and growth in servers and applications exceeding 20 percent per year, a next-generation data center strategy became an imperative for Cisco. Services that accounted for 90 percent of the company's revenue were hosted in constrained facilities worldwide. It took most of the available resources across more than 50 data centers to keep the business running, and this reality left little time for innovation that could deliver new value back to the business.

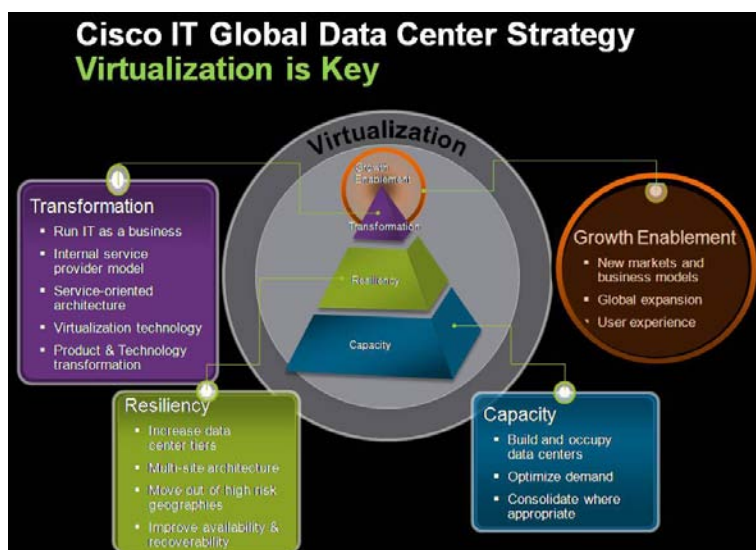**Figure 1.** Cisco Faced Many Business Challenges in the Data Center

SOLUTION

An IT task force came together in 2008 and framed a vision for a multisite data center strategy that would address the challenges of capacity, business resiliency, and geographic risk. The Global Data Center Program called for building out three new data centers and retrofitting three more. Designed, developed, and built from the ground up by Cisco, the new data centers would support global teams working in all times zones around the clock; facilitate collaboration using virtual, video, mobile, and social networking technologies; and meet ever-increasing compliance needs. Firmly believing that innovation and operational excellence in the data center could drive the business forward, Cisco's IT leaders set out to prove the concept.

"Showing the benefits of a data center strategy in business terms was very important in our resiliency improvements and providing the foundation for future growth," says John Manville, VP, Cisco Network and Data Center Services.

> Cisco's Global Data Center Strategy calls for increasing resiliency in the data center, expanding data center capacity, and transforming the way IT provides and supports network and data capabilities to enable business growth.

Figure 2. Cisco Embarked On a Six-Year, Multisite Data Center Strategy

Allen, Texas made the shortlist of 26 sites for the first Greenfield data center, due to its proximity to an existing production data center in nearby Richardson. Less than 16 months after builders broke ground, the flagship Allen data center opened on a 34-acre site in the middle of Texas. Free of legacy equipment and environmentally leading edge, it represents a cornerstone of Cisco's Global Data Center Strategy. Every design element supports the goal of delivering capacity on demand. From the Cisco Unified Computing System™ (UCS) servers that power the operations to a full line-up of Nexus® switches and MDS storage networks, the Allen data center is a showcase of Cisco technology. The network is the platform in this purpose-built environment, an approach that has paved the way for continued consolidation, virtualization, and cloud computing.

> "Showing the benefits of a data center strategy in business terms was very important in our resiliency improvements and providing the foundation for future growth."
> **—John Manville, VP, Cisco Network and Data Center Services**

Built exclusively with technology from Cisco and ecosystem partners including EMC, VMware, and NetApp, the 162,000-square-foot, 10 mW, Tier 3 Allen, Texas data center facility hosts two data halls: total 38,000-square-foot, 5.25 mW nominal.
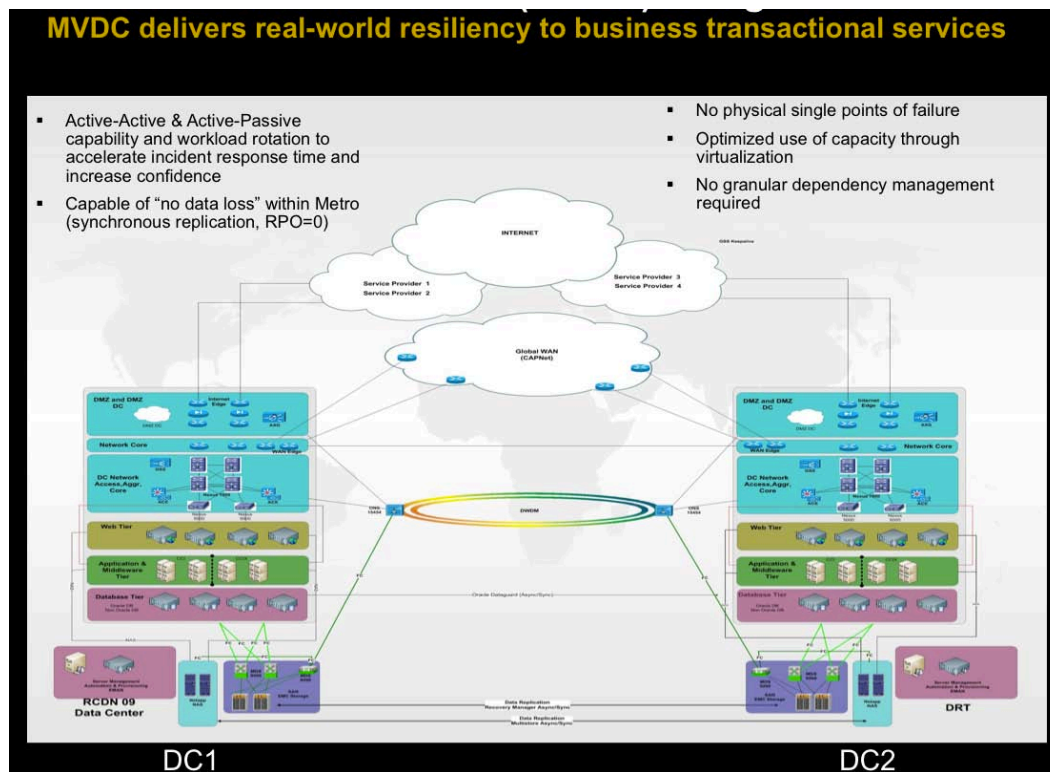
Figure 3.   Aerial View of the New Allen Data Center

The Allen data center facility was handed over to Cisco IT in December 2010. Cisco IT is currently fitting out the data center with the necessary network, compute and storage gear in preparation for application migration. Here are some of its defining features:

- **Core platform:** Cisco UCS unifies compute, network, and virtualization capabilities into a single energy-efficient platform with embedded management. The Allen data center launched with 10 Cisco UCS seed clusters, or 400 servers total, and the number will grow as demand rises. UCS is the ideal compute platform for virtualization as it enables IT to reduce provisioning times, improve scalability, and lower the total cost of ownership of compute services.

- **Metro Virtual Data Center:** The proximity of Allen to Richardson, Texas, the site of an existing production data center about 13 miles from Allen, fulfilled the goal of having a dual data center physical infrastructure, called a Metro Virtual Data Center. This pair of active-active data centers runs critical applications in both places simultaneously for ultimate resiliency. In the case of a disaster at one site, the other can protect the uptime and availability of data. Together, the Allen and Richardson data centers will run the majority of the company's critical business systems and platforms, such as Cisco.com and Oracle ERP.
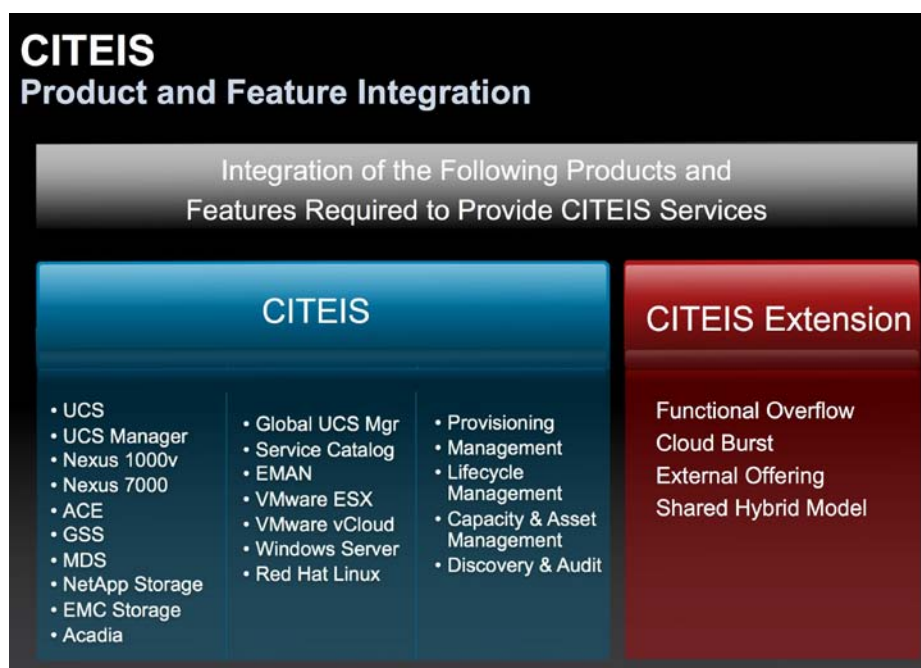
Figure 4.   Metro-Virtual Data Center (MVDC – Logical Architecture)

- **Cisco network:** The Cisco backbone network connects the new Allen data center to other Cisco data centers around the globe. This is accomplished via service provider rings, which can support multiple 10 Gigabit Ethernet circuits for connectivity and up to a total of 40 channels. Additionally, a dark fiber circuit between the Richardson and Allen data centers supports the Metro Virtual Data Center model. The backbone network provides transport that can support up to 20 channels of synchronous data replication at a data transfer rate of 10 Gbps between two metro virtual sites.

  Cisco Nexus 7000 Series offers an end-to-end solution for data center core, aggregation, and high density end-of-row and top-of-rack server connectivity in a single platform. Cisco MDS switches in the storage environment connect to Nexus switches via Fibre Channel over Ethernet.

- **Cisco IT Elastic Infrastructure Services (CITEIS):** Cisco's internal enterprise cloud, known as Cisco IT Elastic Infrastructure Services, is the UCS-based, next-generation provisioning engine for Cisco data centers. It combines compute, storage, and networking into an Infrastructure as a Service offering. CITEIS went into production in the Richardson facility in November 2009, and as of early 2011, 100 percent of the company's virtual machines have migrated to UCS, with x86 servers next on the list. This rapid success solidified the choice of CITEIS to be the default infrastructure platform for the new Allen facility. Cisco IT estimates that CITEIS should be able to serve 90 percent of the company's x86 requirements.

Figure 5. Cisco's Private Cloud Runs on Many Technologies in the Cisco Portfolio and Broader Partner Ecosystem

A NEW SHADE OF GREEN

Cisco has committed to a 25 percent reduction in its carbon footprint by 2012, and the Allen data center is a key part of the strategy for meeting that aggressive goal. Meeting U.S. Leadership in Energy and Environmental Design (LEED) certification standards, the Allen data center was built with a commitment to energy savings, water efficiency, CO2 emissions reduction, improved indoor environmental quality, stewardship of resources, and sensitivity to overall environmental impact. Environmental factors informed every decision, from non-petroleum-based transformer oil to water-efficient landscaping, and from chemical-free water treatment to ground-source heat pumps. Builders used recycled materials wherever possible and made certified wood and hardware choices. Outside air economizers (free cooling), more efficient higher voltage racks, LED lighting, and solar panels all contribute to lower energy costs.
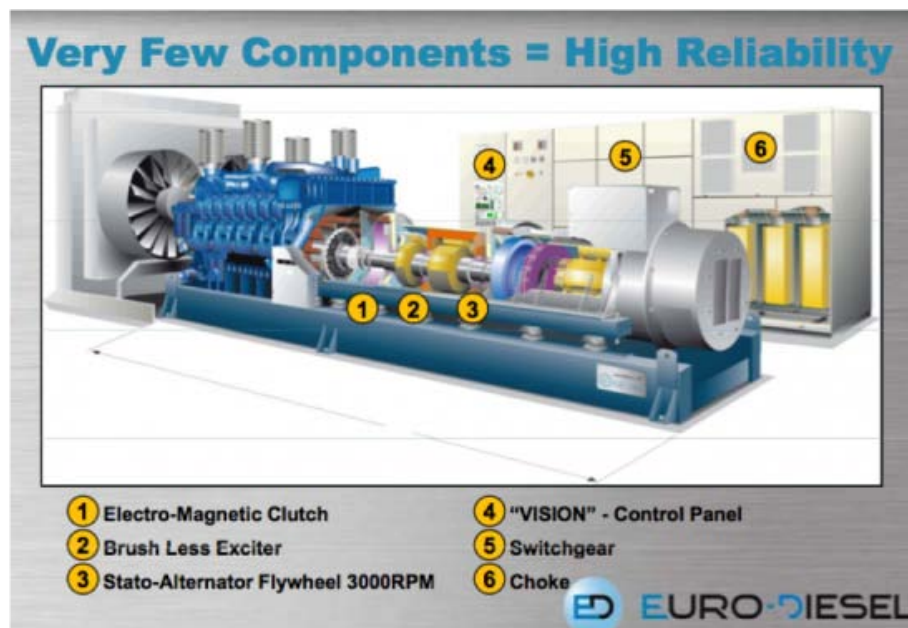
The majority of data centers today are using static UPS systems. They typically consist of banks of lead-acid batteries that store energy to provide line conditioning and backup to network equipment during power disturbances. If the disturbance progresses to an outage, diesel-fueled power generators are switched on. As the generators are rarely used, the main problems with this system are with the batteries. Even with recycling programs, the production and management of toxic battery chemicals do not benefit the environment, and the shortened life span of frequently cycled batteries result in large replacement expenditures every few years.

In response to financial and environmental costs, new technologies like fuel cell and lithium-ion are being developed. Dynamic UPS, also known as Diesel Rotary UPS (DRUPS), uses the same basic flywheel technology first used in the Paleolithic potter's wheel, and was then updated during the industrial age for use in energy storage. Powered by the utility, the flywheel spins up to speed. When power quality drops, the inertia of the flywheel keeps it spinning and providing power to the system for up to 10 to 20 seconds, covering that 98.7 percent of all problems.

Figure 6.   Rotary Uninterrupted Power Supply (UPS) systems in Allen, Texas Data Center

Cisco's existing production data center in Texas has 1,920 batteries (weighing 450 pounds each) protecting IT loads in the event of a utility power failure. The Allen, Texas Data Center does not require batteries as a result of using flywheel technology. With the use of rotary UPS systems in Allen, Texas data center the power protection will yield several important benefits for Cisco IT. It will reduce our real estate and carbon footprints. It requires less space, doesn't have the toxic chemicals, and doesn't require the same cooling conditions that batteries do. With reduced cooling demands and flexible humidity variances, DRUPS supports the use of evaporative cooling versus traditional chillers. While DRUPS generally has a higher initial investment cost, the longer lifespan of the equipment will result in a long-term cost reduction. Furthermore, DRUPS requires minimal maintenance performed only 3 times a year within 10 years before overhaul is required.

Figure 7. Rotary Uninterrupted Power Supply (UPS) components

If you would like to hear more about dynamic UPS and are curious about the those deployed in the Allen, Texas facility, visit our Cisco Data Center 2011-Texas chronicle and view the Flywheels for Power Backup video for a walkthrough of the system.

Air economizers, which draw fresh air from outside to cool the data center, account for further savings of US$600,000 per year.

"Our Allen data center will be the first Cisco data center to gain Gold LEED certification," says Manville. "We're taking this opportunity to set new benchmarks for energy efficiency and to serve as a model for social responsibility."

RESULTS

Cisco IT is three years into a six-year vision for consolidation, virtualization, cloud computing, and all new approaches to power and cooling—and so, far decision makers are very pleased with the outcome. The Global Data Center Strategy has produced measurable results at the outset and positioned Cisco IT as a strategic partner within the business. For example, the Allen data center is equipped to achieve:
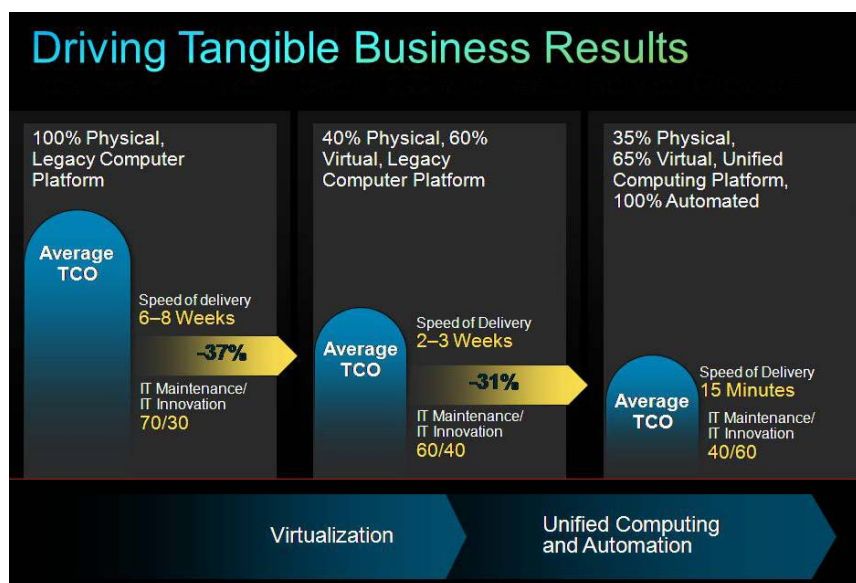
- **Faster deployment of services:** Before the Allen data center came online, an application owner who needed a new service waited six to eight weeks from the time of request to deployment in the data center. Today, Cisco IT can deploy that new service in under an hour, with a Service Level Agreement (SLA) of 2-days. The key to this rapid-fire provisioning is the ability to create service profiles using UCS Manager.
- **Lower total cost of ownership:** Compared to existing data centers, the Allen facility runs on fewer infrastructure components, which

Allen Data Center Technologies
- Backbone Core Network
- Desktop Network
- DMZ Network
- Structured Cable Plant that supports 40 GB throughput
- MVDC Dark Fibre
- 10 UCS B-Series Seed Clusters
- Nexus 2000, Nexus 5000, Nexus 7000
- ACE
- EMC VMAX Seed Data Storage
- MDS Storage Networks
- Quantum Tape Library
- AVAMAR Storage Devices
- CSPO Systems

means fewer elements to manage. Due to the significantly lower cabling requirements inherent in the UCS design, the Allen data center uses 60 percent fewer cables than what would have been required on other compute platforms. Solar power, optimized cooling, and efficient lighting all keep energy costs as low as possible. Overall, virtualization has reduced the cost from US$3700 per server image per quarter to about US$2000 per server image per quarter, and Cisco estimates that a further reduction to US$600 per server image per quarter is possible as the company achieves a fully virtualized model.

Figure 8.   Cisco Has Reduced the TCO within Its Data Centers, while Speeding up Application Delivery from Weeks to Minutes

- **Increased scalability:** In the Allen data center, Cisco IT has gained flexibility to add software and services without increasing cooling, power, space, or cabling costs. A centralized network configuration means Cisco can install any type of device on any tile of the data center floor.
- **Increased business resiliency:** With its Metro Virtual Data Center strategy, Cisco IT can ensure zero downtime for critical business processes in case of a disaster.

NEXT STEPS

Above all, data center automation has freed up resources to design next-generation services and continue the journey to the cloud. It's a journey that began with centralizing disparate resources into consolidated, virtualized, and automated centers of efficient IT resources. Now, it is about designing and managing those resources in cloud-based models that further increase both IT efficiency and business agility.

Looking ahead, Cisco IT is well positioned to enable the company to move into new markets, try new business models, expand globally, and provide a seamless user experience throughout the company and across the supply chain.

"We're responding real-time to the needs of the business," says Manville. "And this has changed the perception of Cisco IT from a roadblock to a business enabler and now trusted advisor."

> **Allen Data Center Timeline**
> - January 2009: Planning began
> - August 2009: Broke ground
> - January 2010: Equipment installed
> - July 2010: Started testing building systems
> - December 2010: Hand-off to Cisco IT
> - April 2011: Go live

LESSONS LEARNED

- Cisco's cloud initiative allowed IT to gain credibility within business units and lines of business. Being able to deploy a service and have the agility of a cloud-based program allows Cisco to meet and exceed business requirements, and by leveraging this, we have embedded Cisco IT personnel within our application development teams to drive new innovation and services across our business units. This has enabled Cisco IT to migrate from a provider of services to a trusted advisor and business enabler.

- Deploying a unified data center fabric, fiber channel over Ethernet, has allowed Cisco to develop new data center cable plant architectures that will enable the cable plant to last the lifetime of the data center.

- Cisco was able to reduce Op-ex in the data center in three ways. First with virtualization, second is automation, and third in aligning the organization and business processes to take advantage of the virtualization and automation characteristics that were built into the data center.

- Creating pre-defined UCS service profiles was vital in meeting reduced service level agreements.

- The decision to move away from raised floors in the data halls in the Allen facility saved significant costs and provided an opportunity to solve air distribution in a more efficient manner.

- Using three types of cooling systems to maintain temperatures throughout the facility proved optimal. Office space is cooled using geothermal wells and ground-source heat pumps, the eight rotary UPS's are cooled using evaporative cooling, and the data halls are cooled with three 1000-ton and two 500-ton chillers with variable speed motors. In addition, fresh air economizers enable outside air to be used when the temperature drops below 77 degrees. The economizer system will use outside air 50 to 60 percent of the time.

- Using chimney rack hot air isolation improved efficient separation of hot and cool air based on Computational Fluid Dynamics (CFD) modeling.

FOR MORE INFORMATION

To find out more about the Cisco Allen Data Center, go to: http://www.cisco.com/go/dc2011

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