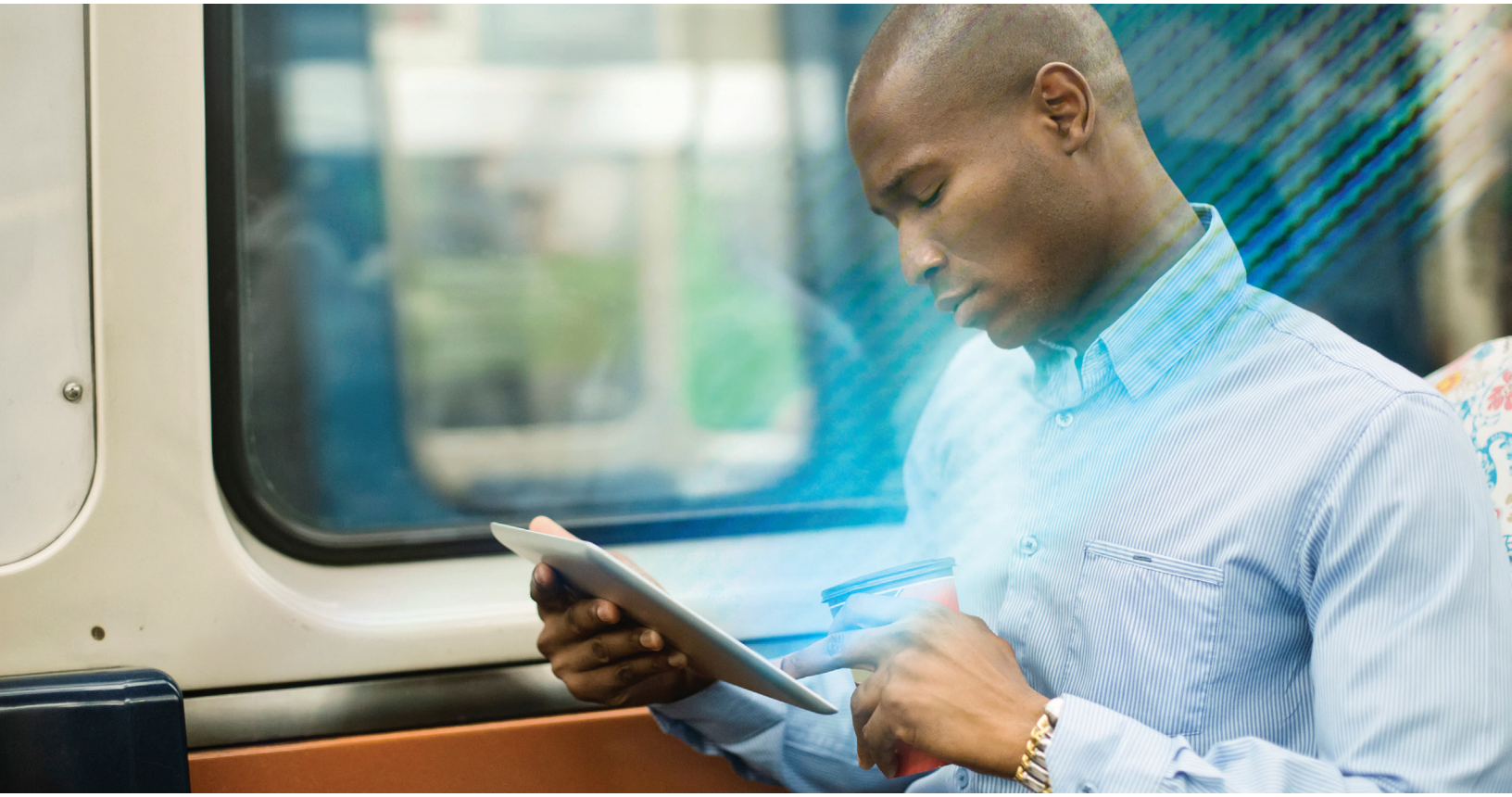


Taking Mobile Delivery to the Next Level with NetScaler® MobileStream™

Don't let poor performance and inadequate security constrain your enterprise mobility initiatives. Accelerate and protect your mobile workspaces with innovative NetScaler MobileStream™ technology from Citrix.

CITRIX®

Initially deployed for purposes of convenience and to boost employee productivity, mobile solutions have become a strategic component of today's businesses. Being able to perform one's job and conduct personal affairs from anywhere at any time has made the transition from novelty and exception to universal expectation and, for many, a way of life. As a result, no longer is it sufficient for enterprises to deliver mobile services where poor performance results in a user experience that is merely acceptable. Neither is it appropriate to "get by" using a patchwork of ill-fitting and incomplete security capabilities to protect your mobile infrastructure and related information resources.

NetScaler MobileStream™ technology from Citrix enables enterprises to do more than simply get by when it comes to the performance and security of mobile workspaces. Building on the gains derived from the core set of NetScaler functionality, NetScaler MobileStream combines a suite of multi-layer optimizations purpose-built to accelerate mobile service delivery with an essential collection of secure access and threat protection capabilities for mobile computing. The result is a unified solution that not only provides the peace of mind IT needs but also delivers the exceptional mobile experience your employees, customers and partners deserve.

Put another way, the result with NetScaler MobileStream is a dramatic improvement in mobile service performance and protection that makes Citrix NetScaler® the world's fastest and most secure delivery platform for mobile workspaces.

The Mobile Delivery Challenge

Today's IT managers must consider not only that mobile computing has become strategic, but also that it is very different from previous technologies and therefore requires a different approach.

Mobile is strategic. The days of mobile computing being a corner case where you only need to support a handful of employees accessing a couple of applications here and there are rapidly diminishing. For better or worse, being able to work, collaborate and conduct business from anywhere at any time has become an expectation of our modern society. In response, businesses are spending millions of dollars on the creation of native mobile applications, the conversion of existing apps to mobile-friendly versions, or otherwise finding ways to make legacy apps accessible to mobile users. Many have shifted from viewing mobile as a necessity—as something they must support to keep pace—to thinking of it as a strategic option that can be used to get ahead of their competition.

Because the accessibility and availability that mobile computing brings is a larger and more strategic piece of today's businesses, this

elevates the need to ensure the accessibility and availability of mobile services. No longer can enterprises afford performance and security to be bottlenecks to their mobile initiatives. Instead, steps must be taken to transform what is too often a merely acceptable—or worse, barely tolerable—user experience into one that is excellent. Investments are similarly needed to better protect the mobile environment, not only to mitigate the risk of security breaches and potential loss of sensitive data, but also to ensure that mobile services are able to remain online in the face of ever-present threats.

Mobile is different. Many aspects of mobile computing are different from those involved with supporting branch office employees, telecommuters or even traditional road warriors. Most notable among these are the devices themselves (smartphones and tablets vs. desktops and laptops) and the network connectivity they employ (3G/4G and WiFi vs. broadband Internet and corporate WAN links). As a result, it should come as no surprise that the mechanisms and approaches used to accelerate performance for these older, more familiar use cases are not sufficient for the mobile scenario. Although many traditional optimization techniques do, in fact, boost mobile performance, the gain is often only minimal and is incomplete. To raise further the bar for mobile user experience, IT managers need to employ optimization solutions specifically designed to account for the unique characteristics, limitations and opportunities of the mobile workspace.

Security, too, differs for mobile computing. The most significant challenge is the growing adoption of the bring-your-own-device (BYOD) approach to mobile computing. According to the 2014 Cyberthreat Defense Report, nearly 80% of organizations expect to have BYOD policies in place by 2016. Along with this strategy comes a reduction to the amount of control IT has over client devices. This situation inherently forces security teams to place greater emphasis on secure access and threat protection. In other words, they need to tightly control which mobile users and devices can access corporate resources in the first place, and defend the corporate network against devices that are compromised or otherwise being misused.

Introducing NetScaler MobileStream

NetScaler is an all-in-one web application delivery controller that makes applications run five times better, reduces web application ownership costs, and ensures application availability. Already recognized as the industry's most advanced cloud networking platform, NetScaler is deployed in thousands of networks around the world to optimize, secure and control the delivery of all enterprise and cloud services while maximizing the end-user experience. Now, with the introduction of NetScaler MobileStream, it also becomes the world's fastest and most secure platform for mobile service delivery.

NetScaler MobileStream addresses the mounting challenges of mobile service delivery like no solution before it. Customers benefit first from the core NetScaler functionality, including intelligent Layer 4 to 7 load distribution, global server load balancing for site-level high availability and failover, numerous server offload capabilities, full application visibility and control, and incomparable scalability. In addition to this robust foundation, NetScaler MobileStream is designed with the mobile computing scenario in mind and adds an unparalleled suite of technologies designed specifically for mobile operations. These include:

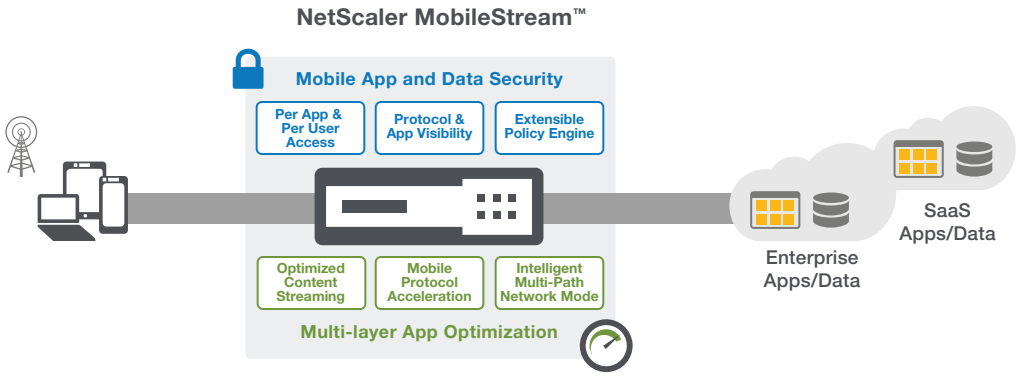
- Optimized content streaming for faster download and rendering
- Mobile protocol acceleration for enhanced performance over lossy, high latency links
- Intelligent multipath-network mode to seamlessly leverage wireless and cellular connectivity
- Per application and user access management for secure end-to-end delivery
- An extensible policy engine for mobile threat and malware protection
- Built-in protocol and application visibility for compliance

The net result is a uniquely capable, unified solution for accelerating and protecting the increasingly strategic portfolio of mobile services being deployed by today's enterprises.

Optimized Content Streaming

From a performance perspective, the design of many web applications is less than ideal. For example, web pages are often laden with tens or even hundreds of individual objects, use inefficient image formats, and fail to leverage client-side cache technology. These and other similar shortcomings can affect all consumers of web application on mobile devices. While the impact of these deficiencies is generally not an issue for those users working from fixed locations on a PC or laptop, it is far more noticeable for mobile users that can be seen with slow page rendering and a diminished user experience. The poorer performance for mobile users is a product of reduced processing capacity and other client-side constraints in conjunction with the latency, bandwidth, and packet loss characteristics of mobile network connections.

NetScaler MobileStream consists of multiple dynamic, content-streaming optimizations that improve the efficiency of the device and the network leading to a much faster performance. These optimizations are broken into four categories corresponding to the main stages of web page delivery: connection setup, image preparation and download, embedded-object download, and page rendering.



Mobile Performance Optimization Powered by NetScaler MobileStream

NetScaler MobileStream incorporates a suite of multi-layer optimizations purpose built to account for the unique conditions and capabilities characteristic of the mobile scenario and, therefore, maximize the mobile user experience.

Connection-layer Optimization. The leading capability in this category is domain sharding. By default, browsers restrict the number of parallel connections that can be open to any one domain. Typically, fewer than ten are allowed. For complex web applications with hundreds of embedded images, scripts and other objects per page, this limitation can create a significant bottleneck resulting in excessive load times. With domain sharding, NetScaler MobileStream modifies administrator-selected URLs by breaking them into sub-domains to allow client web browsers to open multiple groups of parallel connections. As a result, object-heavy pages are downloaded and can be rendered up to 10 times faster. Also included in this category is cache extension, a capability that leverages advanced browser settings and NetScaler AppCache functionality to further improve performance by maximizing the practice of locally caching static content.

Image Optimization. Embedded images often represent more than 50 percent of the content on today's web pages. By dynamically re-sizing these images and converting GIF files into the more efficient PNG format, NetScaler MobileStream effectively reduces the size of web pages by up to five times. This reduces bandwidth consumption and, from a user perspective, substantially improves page download and render time.

Object-download Optimization. Scripts and cascading style sheets (CSS files) are the next largest components of most web pages. Features in this category work to optimize these elements. By, for example, dynamically:

- Performing "minification" to remove all unnecessary characters and whitespace (e.g., new lines, comments and block delimiters) from JavaScript and CSS files, thereby shrinking their size by as much as 30 percent
- Inserting the content from embedded JavaScript and CSS files)that would otherwise need to be downloaded individually) in line with HTML
- Similarly in-lining small images in CSS files to reduce further the demand for parallel connections between client and server
- Combining related CSS files to reduce object count

The net result is not only quicker downloads but also simpler and faster page processing at the client end.

Page-rendering Optimization. Page rendering can be adversely affected by the organization of its content. For example, a JavaScript file at the head of a page must be downloaded, parsed and executed before the rest of the page can be processed. But the associated action-oriented logic—such as a "submit" or "download" function—isn't needed until after the page is entirely rendered and the user is prepared to act. In these type of situations the user experience is enhanced if JavaScript files are located toward the end of the page. The reverse is true for CSS files, which benefit from being grouped together at the start of a page. NetScaler MobileStream dynamically adjusts the order of JavaScript and CSS files accordingly to minimize page rendering times.

Mobile Protocol Acceleration

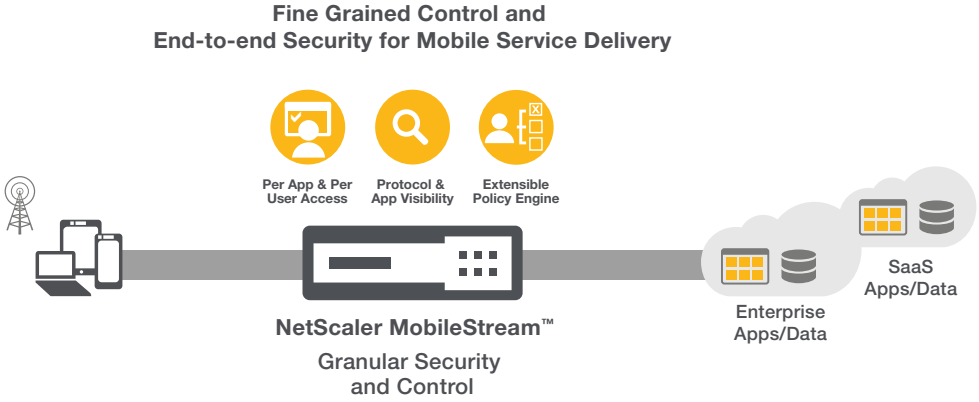
All efforts at optimizing performance at higher layers of the computing stack run the risk of being negated if poor network performance is allowed to eclipse related gains. NetScaler MobileStream ensures that will not happen by incorporating mobile-specific protocol accelerations for optimizing network performance.

SPDY Support. An open networking protocol, SPDY reduces web page retrieval time by prioritizing and multiplexing the transfer of web page resources so that only one connection is needed per client. By requiring the use of SSL/TLS encryption, it also improves web security. With NetScaler MobileStream, NetScaler acts as a SPDY gateway. This approach allows existing server-side applications to immediately benefit from SPDY without having to be modified in any way. On the client side, support for SPDY is included in many of the latest mobile device web browsers.

Advanced Congestion Control. Ordinary congestion control algorithms included with the standard TCP stack are a poor fit for mobile traffic. This is because they operate under the assumption that packet loss occurs as a result of congestion on the network. With wireless services, however, packet loss can also be the product of other, softer-impact events such as signal interference or attenuation. For these latter cases, the standard algorithms are simply too aggressive. They cause the data flow to be cut back far more than is necessary for the actual conditions on the network. NetScaler MobileStream corrects this situation by allowing administrators to select from a set of mobile-specific congestion algorithms that operate as extensions to the NetScaler TCP stack, including TCP Westwood, TCP Westwood+, BIC TCP, and CUBIC TCP. Each alternative uses a different mechanism, but the net outcome is the same: less aggressive scale-back and a quicker return to full-throttle transmission, resulting in more effective use of available bandwidth and a better overall user experience.

Intelligent Multipath-Network Mode

Another innovative technology delivered with NetScaler MobileStream is Multipath TCP (MPTCP) which enables client devices to simultaneously take advantage of multiple network paths. For example, this capability allows a single application session to utilize both the device's WiFi and cellular network connections at the same time. The user experience is improved not only by having greater aggregate throughput and quicker download times, but also by encountering fewer service disruptions (as individual links are seamlessly added and dropped whenever the user moves in and out of network coverage areas).



Fine-grained Security and Control Powered by NetScaler MobileStream

While accelerated performance delivers the exceptional mobile experience your employees, customers and partners deserve, it takes robust mobile security to provide IT and business managers with the peace of mind they need

before elevating mobile computing to the status of strategic asset. NetScaler MobileStream fulfills this requirement with a comprehensive set of capabilities that securely enable access for mobile users, thoroughly protecting the corporate network and applications from compromised and misused devices. NetScaler MobileStream also provides the in-depth visibility required to maintenance and compliance with applicable regulations.

Application and User – Centric Access Management

NetScaler MobileStream compensates for the reduced management control IT departments have over mobile devices by providing them with the technology needed to tightly regulate which mobile users and devices can actually gain access, and to which specific resources.

Identity-based Access Control. NetScaler serves as an authentication and authorization proxy for mobile and non-mobile users alike. In this capacity, it effectively blocks all inbound application requests until the user's identity is validated. It then restricts access to only those resources for which the given user is authorized. Coverage is provided for a wide variety of authentication mechanisms, including local authentication, RADIUS, LDAP, TACACS, certificates, NTLM, SAML2 and Kerberos constrained delegation. In addition, the proxy approach not only provides a separate front-end security layer for an organization's applications, but also enables single sign-on (SSO) and a consistent user experience through the standardization of authentication mechanisms and policies.

MicroVPN and Classic SSL VPN. With the MicroVPN feature, mobile users are provided with application-specific access to an organization's internal network. The secure tunnel that is set up only works for the single, designated application, each application gets its own tunnel. When access to a broader set of resources is allowed, administrators can instead employ the accompanying full-featured SSL VPN. Fine-grained access control can be achieved by leveraging an exhaustive array of attributes, including user role, location, strength of authentication, and ownership and security posture of the mobile device.

ActiveSync Proxy. With this capability, NetScaler serves as a termination and policy enforcement point for all inbound ActiveSync connections, this is used to enable native email services for mobile clients. The proxy provides an important layer of protection for back-end Exchange servers and allows administrators to control email access based on a wide variety of parameters, such as whether the associated device is jailbroken, in an undesirable geographic area, or out of compliance in some other way. The ability to leverage client-side certificates further enhances security by eliminating the need to cache Active Directory credentials on each mobile device requiring native email access.

Comprehensive Threat Protection for Mobile

Robust threat protection is an essential complement to tightly controlled network access. Preventing threats that work by exploiting allowed application sessions and network connections is clearly one objective. With a significant portion of an organization's user population now mobile, it is also imperative to establish better defenses against threats designed to disrupt external access to the internal computing services that drive the business.

NetScaler Application Firewall. An ICSA-certified web application security solution, NetScaler Application Firewall blocks known and unknown attacks against

web applications being accessed by mobile users. The Application Firewall's hybrid security model permits only correct application behavior while efficiently scanning for, and protecting against, known application vulnerabilities. It analyzes all bi-directional traffic, including SSL-encrypted sessions, to defend against a broad range of threats without any modification to the applications being protected. Additionally, protection for web services applications is provided by an integral set of XML-specific security features, including schema validation for SOAP messages and XML payloads, and prevention of XPath injection attacks, malicious XML attachments, and recursive expansion attacks.

Multi-Layer DDoS Protection. Distributed denial of service (DDoS) attacks designed to take down an enterprise's external-facing services —and thereby impede mobile users —are a constant and growing threat. NetScaler defenses in this area include:

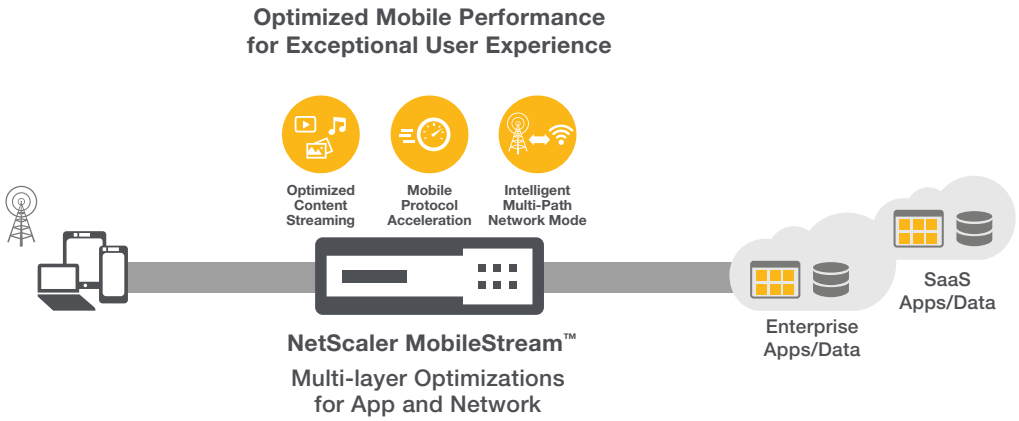
- an integral API call-out mechanism that can be used to automatically trigger external DDoS protection services based on real-time traffic conditions
- a high-performance architecture and extensive set of mechanisms for mitigating flood-oriented attacks targeting common network and connection layer services
- numerous features for countering more insidious low-bandwidth, application-layer variants, without impacting legitimate transactions

To learn more about these capabilities, please refer to: "Citrix NetScaler: A powerful defense against denial of service attacks."

Extensible Threat and Malware Protection. Another substantial layer of threat protection is delivered by the NetScaler SDX service delivery networking platform. Featuring an advanced virtualized architecture, NetScaler SDX is a multi-services platform that enables consolidated operation of multiple independent instances of key services, including NetScaler application delivery services and third-party applications. Its open and extensible design results in a future-proof approach for delivering a wide range of traditional and advanced threat protection technologies, both now and into the future as new solutions continue to emerge. One compelling example is the ability to run the Palo Alto Networks VM-Series on NetScaler SDX and thereby supplement the extensive security capabilities of NetScaler MobileStream with the power of a next-generation enterprise security platform capable of stopping advanced malware and targeted attacks.

Built-in Protocol and Application Visibility

A next-generation application visibility solution from Citrix, NetScaler Insight Center overcomes the limitations of traditional monitoring solutions to provide today's enterprises with end-to-end visibility into application sessions, including those for mobile users. Featuring an approach that leverages an organization's existing NetScaler devices, NetScaler Insight Center combines zero-impact, network-based instrumentation—that is both network and application aware—with an efficient and powerful management system capable of transforming raw data into actionable information and comprehensive usage reports. The result is a solution administrators can use to closely track mobile user activity, quickly identify and remediate end user experience issues, and highlight potential compliance issues such as application access by unauthorized users.



Taking Mobile Delivery to the Next Level

The investments enterprises are making in mobile computing are rapidly transforming it into a strategic business asset. To match and facilitate this transformation, IT managers must ensure a positive mobile user experience while protecting related infrastructure and information resources from all-too-common threats and the loss of sensitive data.

NetScaler MobileStream technology from Citrix uniquely addresses these requirements. While other solutions continue to rely solely on conventional delivery mechanisms, NetScaler MobileStream adds an extensive portfolio of multi-layer optimizations purpose-built to account for the unique conditions, limitations and opportunities characteristic of mobile devices and the networks over which they operate. Enterprises also obtain a comprehensive set of mobile-centric security capabilities for tightly controlling mobile access to corporate-hosted resources and protecting them from related threats. The net result is that MobileStream makes NetScaler the world's fastest and most secure delivery platform for mobile workspaces.

For more information visit citrix.com/netscaler.

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