WHITE PAPER

HOW TO DELIVER A GREAT QUALITY OF EXPERIENCE TO YOUR DIGITAL AUDIENCE

As businesses embrace the online world to engage their audiences, they are presented with a unique challenge—how to deliver the best possible digital experience regardless of device or location? The solution so far has been complicated—multiple services, different software, and isolated solutions combined to create a tightly bound, inflexible digital infrastructure.
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INTRODUCTION

Over the past several years, digital experiences have become larger and more immersive.

![Average Web Page Size 2010 – 2016](source: HTTP Archive)

**Figure 1:** Growth of Average Web Page Size

Not only have websites increased in size (Figure 1), but organizations have also added more interactive functionality and even cross-platform applications to enhance the efficacy of the overall experience. As that has occurred, it has become increasingly important to deliver those digital experiences—websites, software downloads, games, and applications—at the highest quality.

“Quality of Experience” (QoE) is rapidly becoming the new battle cry when delivering digital content.

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**DID YOU KNOW?**

59% of users rate “performance” of a website as the most important aspect when judging the quality of the experience.
WHAT IS QUALITY OF EXPERIENCE (QOE)?

QoE is a combination of factors that impact user perception of a digital experience.

The diagram above depicts two layers of QoE. The first represents those elements that are under direct control. For example, an organization designs their application, tailors and formats it for specific devices, selects the network through which it will be delivered, and ultimately decides what content appears in the digital experience.

The second represents those elements out of direct control. An organization, regardless of how it approaches the four inner elements, cannot determine if a user’s environment will support the experience, nor any user psychology (e.g., cognitive biases) that may impact reception of the experience.

MEASURING WEBSITE QoE

How can you measure QoE? We don’t think there is an easy way to do that, but there are a couple of metrics that can tell you what people think of your digital experiences.

Return Visitor Ratio—Measures the percentage of visitors who return to your site after an initial visit during some specific time period. If you got 4,000 visitors this month and 800 were repeat visitors, 800/4,000 = 20 percent.

Average Session Length—Measures the average amount of time a visitor spends on your site or on a particular page. If you got 4,000 visitors this month and they spent a total of 29 hours on your site, the average session length was 61.25 seconds.

Why are these two metrics important for QoE? The first tells you that people think enough of your digital experiences to keep coming back while the second tells you that they like it enough to hang around for a while.
DELIVERING A HIGH QUALITY OF EXPERIENCE

To deliver a high QoE you need to control that first layer—application, network, device, and content—which is often done through a myriad of software systems. One system might be responsible for delivering your website, another system might be responsible for video streaming, another might be responsible for providing a digital download, and a final system might be used to measure the results of everything. In most cases, none of those systems talk to one another—they are often provided by different vendors all accessed through their own management interfaces.

![Graph of Global IP Traffic Growth Projections](source: Cisco VNI, 2014)

**Figure 3: Global IP Traffic Growth Projections**

THE IMPACT OF THE INTERNET ON QoE

Unfortunately, many organizations today use the public Internet as the primary means by which to deliver their digital experiences. The public Internet was never built for the digital traffic we see today. Aging equipment—routers, switches, network interface cards, and servers—can’t keep up with the amount of digital data flowing through. And if Cisco is right (Figure 3), this data production will continue to grow at an exponential rate.

The result? Massive congestion. Using the Internet as the “network” component of the first layer in QoE may jeopardize an organization’s ability to ensure the highest level of quality. A great QoE may become a near impossibility as an organization’s digital traffic competes with the growing size of webpages, increased consumption of video, and digital downloads.
This means that even if an organization can cobble integration together, virtually any change to one may disrupt all the others, which can also prevent or hamper adoption and integration of new technologies that facilitate engagement and a higher level of QoE. In short, ensuring a high QoE becomes more complicated and difficult the more complex the overall system.

THE PLATFORM IS THE SOLUTION

It is clear that multiple, disconnected systems are not the answer to ensuring a high QoE. The complexity that grows from introducing more systems to deliver different parts of a digital experience can impact the experience by introducing latency as disparate systems attempt to work together.

So perhaps the opposite is the answer—a single platform with integrated services that address an organization’s need to publish and deliver digital experiences with the highest QoE. The ideal platform would need to have an expected set of characteristics and functions.
PLATFORM CHARACTERISTICS

What must a platform have in order to meet those needs? We’ve identified six characteristics that we think the ideal platform must have:

**Integration/Openness**—The platform must not only integrate services that are connected to it, but it must provide a framework that enables organizations to extend the platform to other systems. It must be flexible in design.

**Manageability**—The platform and services that are connected to it must include elements of management (i.e., through API or GUI) that enable an organization to control access (i.e., security), distribution of content, etc.

**High Performance**—The platform must include technologies and features that actively work to increase the speed and performance of delivery to the end user.

**Resiliency**—The platform must not only respond favorably to outside pressures (e.g., a DDoS attack), but the individual components must work independently enough that a problem with one does not bring down the entire platform (e.g., loose coupling).

**Elasticity**—The platform must be able to scale up or down and geographically based on demand. For example, storage should increase naturally to accommodate increased numbers of digital assets or reduce as those assets are removed.

**Analytics**—The platform should output data from the various components to provide detailed insight into what is happening with digital assets as they pass in, out of, and through the system.

THE NEED FOR AUTOMATION

An ideal platform to publish and deliver a digital experience should also provide automation. The digital world is simply moving too quickly to rely entirely on manual processes regardless of how efficient they are. Ideally, automation has two aspects:

**Policy**—These are business rules set by the organization. For example, an organization might set a policy that when files are uploaded to a certain directory in the storage capabilities of the platform, they are automatically transformed (i.e., transcoding videos) and moved to specific folders.

**Feedback**—This is intelligence within the network that continually receives data from different platform components and uses that data to adjust policies or recommend new policies. For example, the network may begin to recognize that there are no users requesting a specific video format from a specific region. The rule for automatically converting videos could then be adjusted automatically to prevent copying the unrequested format to that region, thereby saving on storage costs.

WHAT DOES POLICY REALLY MEAN?

Policy enables automation. In an ideal platform, integrated services collectively load their content into a single data warehouse. Employing a policy engine, platform users can automate basic activities. For example, implementing a policy that delivered specific content to a user depending upon keywords in their engagement via social media, or recommended specific videos based on how much time was spent watching a similar one, would provide a better Quality of Experience than just delivering the same content or experience to every user.

Understanding and connecting information regarding user behavior with information about available content from all the previously discussed functions allows organizations to combine data, apply analytics to create information, monitor the information flow, create rules that trigger based on observation, and then take action—automated and/or manual.
Why is automation so important? For two reasons. First, automation requires data. A policy engine integrated into the platform could pull data into a centralized repository. For example, content data could mingle with delivery data providing a more holistic view without requiring integration work. Second, the policy component of automation can ensure the highest level of personalization by applying rules to shape the digital experience with relevant content. Over time, automation develops a level of intelligence into your digital experience, which hopefully ensures the best rate of conversion and engagement.

THE LIMELIGHT ORCHESTRATE PLATFORM

Envisioned and created to address those trends in the functional buckets of an ideal platform, the Limelight Orchestrate platform represents a way to publish and deliver your digital experience to ensure the highest QoE. This equates to long-term business value as well as tangible bottom-line performance.

Orchestrate is a platform for building and managing the end to end workflows, processes, and activities that organizations need to ensure that their digital experiences are fast, responsive, secure, and always available.

Wiping Away That Complexity with Integrated Cloud Goodness

How does the Limelight Orchestrate platform do it? By integrating those fundamental systems into a single cloud-based offering to mitigate the complexities organizations face today. In doing so, organizations can react in real time as well as improve engagement with their online audiences regardless of device or geography, thereby providing a much higher QoE.
THE LIMELIGHT ORCHESTRATE PLATFORM ARCHITECTURE

In order to deliver on the platform vision, Limelight Networks has created a holistic architecture for the management and delivery of the content that comprises an organization’s digital experience, ensuring the highest levels of QoE, and with the flexibility to support third-party systems. Rather than cobbling individual components and services together, the Orchestrate platform architecture provides a common framework for delivering the objects that comprise digital experiences (web content, rich media, advertising, social, third-party and other digital content material and interactions) from various sources to any device or set of devices, anywhere, securely, with high availability and high performance.

ARCHITECTURE DETAILS

![Orchestrate Platform Architecture Diagram]

**Figure 6:** The Orchestrate Platform Architecture

The Orchestrate platform embodies this architecture, delivering it to Limelight customers as a cloud-based service, offering the ability to monitor change, respond in real time to threats and opportunities, create truly personalized relationships and engage more deeply and effectively with constituent audiences, at lower cost, and with far less effort and error than was possible with disconnected systems, thereby providing a much higher level of QoE.

PART OF A FABRIC

The Orchestrate platform is deeply integrated with the Limelight network. This enables organizations to capitalize not only on the economies of scale for bandwidth and infrastructure but also on the relationships Limelight’s network has with other access networks around the globe. Organizations can maximize the opportunity for the highest Quality of Experience when exploiting connections worldwide.
The architecture is a combination of infrastructure, software, and services. Through this architecture organizations can choose to build a flexible, unique digital experience delivery and publishing workflow or employ out-of-the-box functionality to solve immediate challenges. Via a robust API library, organizations can harness core technologies within the platform (e.g., content delivery services) in any manner that fits their requirements.

The Orchestrate platform architecture is comprised of four layers:

- Network
- Software
- Services
- Management

**NETWORK**

Powered by leased-wavelength and a single, global Autonomous System Number, the Limelight network is one of the world’s largest, private networks for delivering digital content. Spanning the globe with over 80 points-of-presence (POPs), this network has successfully delivered some of the world’s biggest Internet events to TVs, PCs, game consoles, tablets, and smartphones without using the public Internet. With over 11 Tbps of egress capacity, the network is built to handle spikes and user volatility, ensuring that your digital experiences are delivered with the best Quality of Experience possible.

**SOFTWARE**

Integrated deeply into the infrastructure is a library of software that provides advanced functionality to the integrated services. This software includes:

**EdgePrism**—This is the platform’s advanced caching proxy software. It is designed to handle events of massive scale with the lowest latency, best reliability, and highest origin offload with any size website or file library. Advanced acceleration and optimization features ensure both cacheable and uncacheable content can be delivered with the lowest response times.

**EdgeQuery**—This is the platform’s integrated reporting and data analytics software that provides real-time behavioral information about digital content consumption. This data is available within the Control web portal or accessible via API.

**SmartPurge**—This is the platform’s digital asset control and management software providing near real-time removal of content (through URL or content patterns rather than just regular expression) from cache. Content that is removed from cache becomes globally inaccessible even as objects are being deleted. This ensures objects are unavailable to audiences during the purge process.
SERVICES

The Orchestrate platform comes with a number of integrated services to provide organizations an easier end to end solution for publishing and delivering their digital experiences without having to worry about finding third-party providers. The table below provides a brief overview of each of the available services.

<table>
<thead>
<tr>
<th>Services</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Delivery</td>
<td>A suite of cloud-based services to manage, publish, and stream VOD and Live video to any device</td>
</tr>
<tr>
<td>Web Acceleration</td>
<td>Core technologies integrated into the network that provide acceleration of both the website presentation layer as well as dynamic scripts and small objects</td>
</tr>
<tr>
<td>Content Delivery</td>
<td>Network-based software to facilitate the delivery of web content, rich media, and other digital assets employing globally-distributed points-of-presence that leverage a dense-server architecture for HTTP and specialized media delivery</td>
</tr>
<tr>
<td>Cloud Storage</td>
<td>An elastic system of storage leveraging the content delivery infrastructure providing petabytes of replicable capacity</td>
</tr>
<tr>
<td>Cloud Security</td>
<td>A variety of content protection services such as DRM, geo-restriction, URL tokenization, DDoS attack protection, and Web Application Firewall</td>
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</tbody>
</table>

MANAGEMENT

Organizations can engage with the platform and integrated services through both a powerful web-based management tool (Control) and a suite of REST-based APIs.

Management—Limelight Orchestrate Control is a powerful web-based interface for managing all aspects of publishing and delivering digital experiences. Through our self-service tool, organizations can quickly create new configurations and update existing configurations; delete configurations; access and rollback to previous versions; and even clone or copy configurations. In addition to self-service, Control provides access to detailed reports, the ability to turn-up and manage video streams, and access to support resources. With Control at their fingertips, organizations get the tools to maintain the highest Quality of Experience for their digital audiences.

APIs—From video to storage to the CDN, our APIs enable organizations flexible control over all aspects of their digital experience.

- **Storage**—Through JSON RPC and other access means, these APIs support both single file and multipart file uploads as well as methods for file and directory upload, listing, copying, renaming, and deleting.

- **Reporting**—Via REST API, organizations can access all the traffic, content, and IP connect reports available via the Orchestrate Control management portal. Data is returned in either JSON or XML format for easy integration with enterprise reporting, IT monitoring, and other systems.

- **Video**—Through the extensive REST API library, developers can enable applications to perform actions programmatically that are normally carried out within the Orchestrate Video web-interface enabling complete workflow integration to existing systems.
TAKING THE PLATFORM TO MARKET

Orchestrate has a multi-faceted approach to the market based on its modular architecture.

**AS A PLATFORM**

Orchestrate is presented to the market as the ideal digital delivery platform. Organizations seeking an end to end, cloud-based workflow solution for building and delivering digital experiences with the highest possible QoE will find this approach appealing, enabling them to tackle many challenges immediately.

**AS A SOLUTION**

In some cases, Orchestrate will be tailored to tackle the specific challenges posed to different use cases, industries, and organizations. Limelight’s solutions for Media and Broadcasters, Software and Device Manufacturers, or Gaming, offer finely tuned solutions optimized for specific uses, including specialized knowledge gained from previous successful implementations in those areas.

**AS INDIVIDUAL SERVICES**

There will be organizations that want the benefit of a platform but may not require all of the available service modules currently offered through the Orchestrate platform. In these cases, organizations can selectively choose the individual service modules they wish to deploy while still reaping the benefits of the Orchestrate platform as a whole.
CONCLUSION

Today’s demanding digital audiences have created a situation where organizations must provide digital experiences with the highest level of quality (QoE) or risk losing attention and opportunities to engage which can, in turn, impact the bottom line and overall success of the organization.

Unfortunately, many organizations have approached QoE using a myriad of disparate systems. Disconnected from each other, these systems present significant challenges in providing the highest levels of QoE by introducing latency and other problems.

The Limelight Orchestrate platform offers a solution, providing a unified and integrated set of systems, tools, and processes that help organizations reliably publish and deliver digital experiences with a consistently high QoE. Through a flexible and modular architecture, Orchestrate enables organizations to solve critical challenges via out-of-the-box functionality or enhance workflows with powerful APIs.

ABOUT THE ORCHESTRATE PLATFORM

The Limelight Orchestrate Platform is built upon a global, private backbone network with the speed, capacity, and availability to deliver the experiences today’s audiences demand. This industry-leading Platform includes integrated content delivery, web acceleration, origin storage, video management, cloud security, and support services. The unique combination of global private infrastructure, advanced software, and expert services surpasses other CDNs, to enable today’s and tomorrow’s workflows and put audience experience first.

ABOUT LIMELIGHT NETWORKS

Limelight Networks Inc., (NASDAQ: LLNW), a global leader in digital content delivery, empowers customers to better engage online audiences by enabling them to securely manage and globally deliver digital content, on any device. The company’s award winning Limelight Orchestrate™ platform includes an integrated suite of content delivery technology and services that helps organizations secure digital content, deliver exceptional multi-screen experiences, improve brand awareness, drive revenue, and enhance customer relationships — all while reducing costs. For more information, please visit www.limelight.com, read our blog, follow us on Twitter, Facebook and LinkedIn and be sure to visit Limelight Connect.

1 http://httparchive.org
3 Based on a similar illustration of QoE as defined by Andrew Perkis at http://spie.org/x92222.xml.
6 As of February 2015.