

CDN Monitoring

HANDBOOK



catchpoint™

Why should you monitor your CDN?

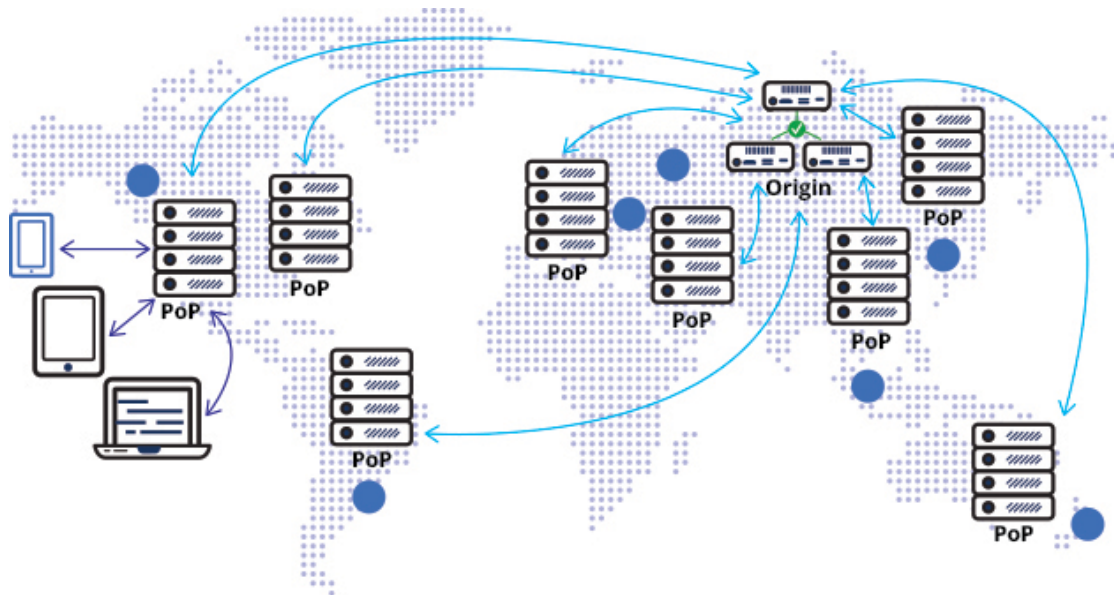
CDNs have become a critical extension of modern IT infrastructure. More than being just another IT vendor, CDN companies leverage their expertise and platforms to act as partners in infrastructure and business-related decisions. Hence, choosing a CDN platform has become a large-scale project in itself. The decision to choose any CDN partner should be the end game of a thorough, metric-driven evaluation of all potential vendors, evaluated from locations of actual end users. Baselining and benchmarking performance of the origin compared to a variety of vendors is common. However, once the decision has been made, some organizations stop monitoring the performance of the CDN, when this is only the beginning.

Once a CDN has been chosen, the onus is on the IT team to monitor if their chosen CDN partner is delivering on all the performance promises made during the evaluation. A continuous monitoring strategy that specifically targets key features and deliverables of the CDN is essential for its effective utilization. Reducing the time to detect problems and drastically improving mean time to resolution is an obvious outcome of this monitoring strategy.

We're moving into an age of multi-CDN, having a single CDN provider is not a scalable and fail-proof approach. Especially for organizations looking at a global end-user base, finding a single CDN vendor that provides the top of the line performance throughout the globe is a challenge. Hence more organizations are looking at geo-specific CDNs. This means regularly assessing performance and evaluating new CDN vendors to fill in any potential gaps.

Some companies have also moved into real-time performance-based CDN routing. In such circumstances, continuous monitoring provides two distinct by-products. The ability to benchmark your CDNs' performance variations over time helps identify performance patterns along with the strengths and weaknesses of the CDNs' product offerings. Secondly, the ability to hold the CDNs accountable for the SLAs agreed upon gives IT teams the leverage to challenge and expect the best services from their CDN partners.

What aspects of your CDN should you monitor



Implementing a CDN introduces a dynamic component to the IT infrastructure, with multiple moving parts. Each part is a potential point of failure, thereby completely neutralizing the very idea behind the CDN implementation. Hence monitoring each of these moving parts is critical for a seamless content delivery.

Last-mile network is a critical component for the optimal functioning of a CDN. Mapping of an end user to the most optimal CDN point of presence (PoP) is a science in itself, taking into consideration the ISPs, the geo locations and historical data. End users expect the same performance from any device, from anywhere, hence monitoring from multiple ISPs, geo locations, network types, and form factors is essential.

Performance optimization is another prime candidate for monitoring. Most CDNs provide standard optimization features such as caching, compression, image optimizations, redirection offloads, front end optimizations, and so on. Monitoring these features provides IT teams the ability to identify performance bottlenecks and quickly resolve performance issues.

CDN infrastructures are complex. In most request-response cycles, a significant time is spent within a CDN's infrastructure. Usage of cache-hierarchies and optimized routing between their own PoPs have led to further added complexities and with them, latency. Hence, monitoring how each aspect of the CDN's own infrastructure impacts the delivery of an organization's content becomes a key aspect of any monitoring strategy.

It is also essential that the CDNs do not modify content in ways that are not configured. Application of the right configuration rules for every request and making sure the right response is served for every request is critical. Monitoring for the validation of content integrity should be part of the monitoring strategy.

Finally, if the source for all content, the origin server, introduces latency or has availability issues, this cascades through the infrastructure, impacting end users. When CDN servers have to fetch contents from these origin servers, issues with network connectivity, latency, and origin capacity all become bottlenecks. Hence the need to monitor the performance of an origin server infrastructure is essential to separate issues of CDNs from problematic origin infrastructure.

Measuring the success of a CDN

Monitor improved availability

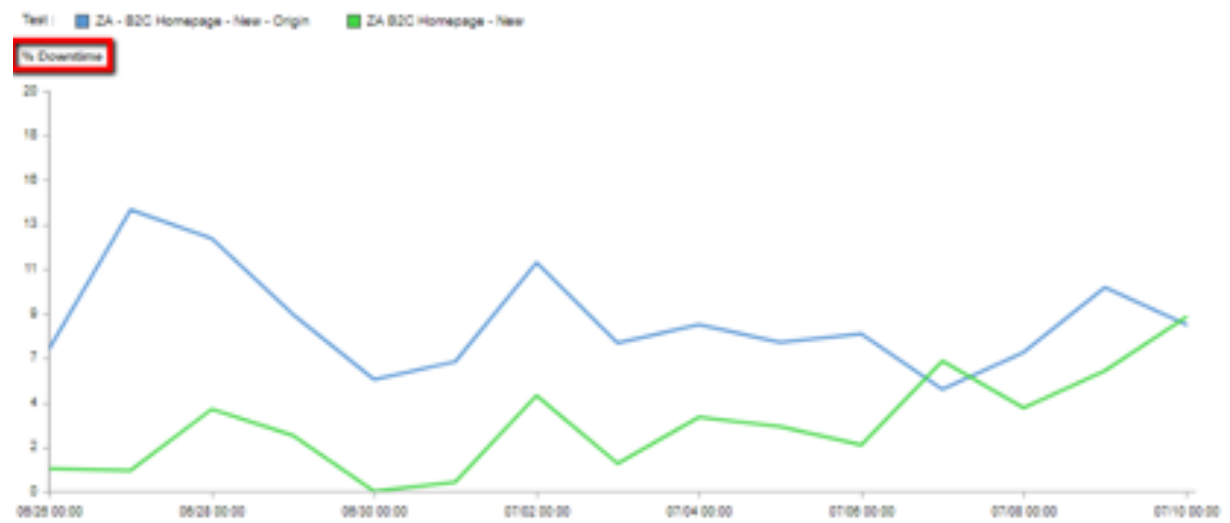
One of the fundamental use cases of a CDN implementation is to improve the availability of web assets. CDNs provide multiple ways to achieve higher availability when compared against an origin infrastructure. These CDNs do this through features such as serving cached or stale content when origin is unreachable or unavailable; long-term caching strategies ensure the need to reach the origin is reduced. Modern CDNs also provide ways to enforce failover logics at their edge servers; based on response from stipulated origin, backup, or secondary origins can be invoked.



How can Catchpoint help?

High frequency object tests that monitor the availability of CDN edge servers from locations and ISPs of actual end users is recommended. In order to isolate CDN issues from origin-associated failures it is also highly recommended to schedule similar tests directly contacting the origin server.

If origin servers are masked through security products or firewalls, Catchpoint's "Request Override" provides ways to perform DNS overrides to specific origin server or add custom headers that can authenticate requests originating from Catchpoint.



	Availability %	
	Origin	CDN
Page 1	92	100
Page 2	95	100
Page 3	99	100
Page 4	100	100
Page 5	100	100
Page 6	100	100

Here's an example of data collected during a CDN evaluation. Even during phases of origin non-availability, due to a comprehensive caching strategy, the end user was never impacted.

Network proximity

CDNs bring web content closer to the end user ("edge") through their geographically distributed network infrastructure. Leveraging a similarly distributed DNS system, CDNs also 'move' the DNS resolution process closer to the "edge." This reduces network latencies that cascades into improved response times for an end user.



How can Catchpoint Help?

Catchpoint has a global node coverage of over 700 nodes spread across a few hundred global cities, covering most of the world's ISPs. This becomes a critical feature requirement to monitor and identify the performance improvements your actual end users would get.

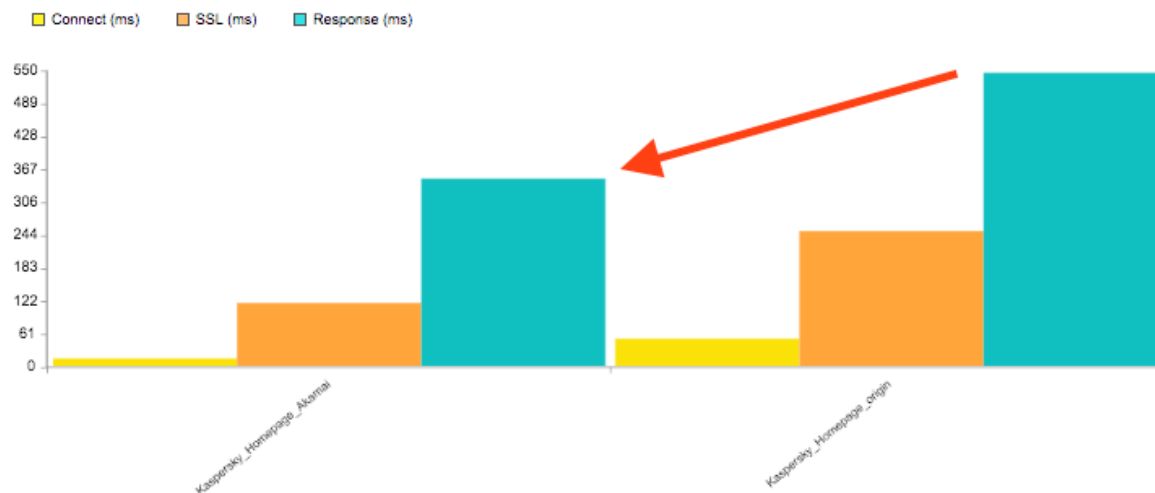
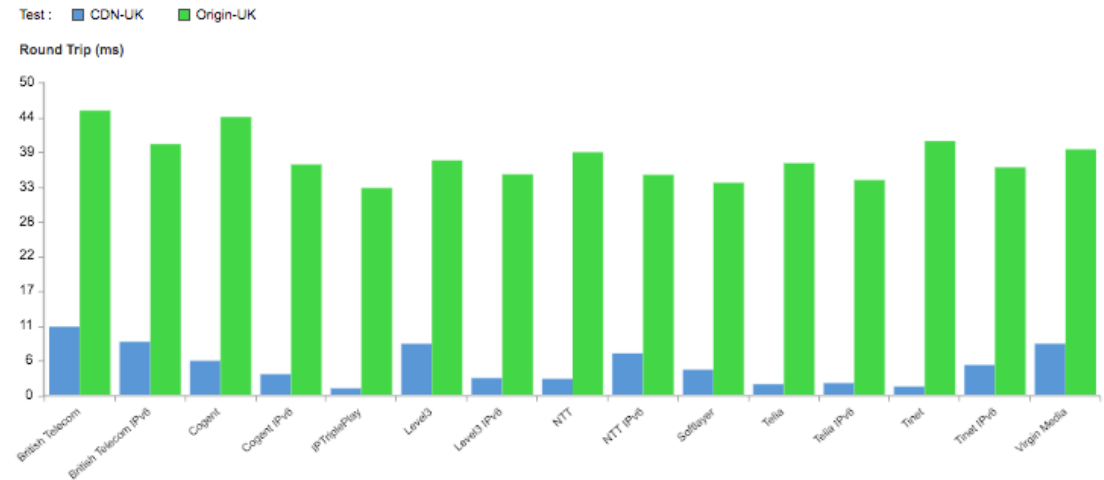
Network tests: Traceroute, Ping

Use traceroute tests to compare and contrast the network roundtrip times, the number of hops required to reach a server when using a CDN versus otherwise. The same use case is also relevant when comparing one CDN versus another.

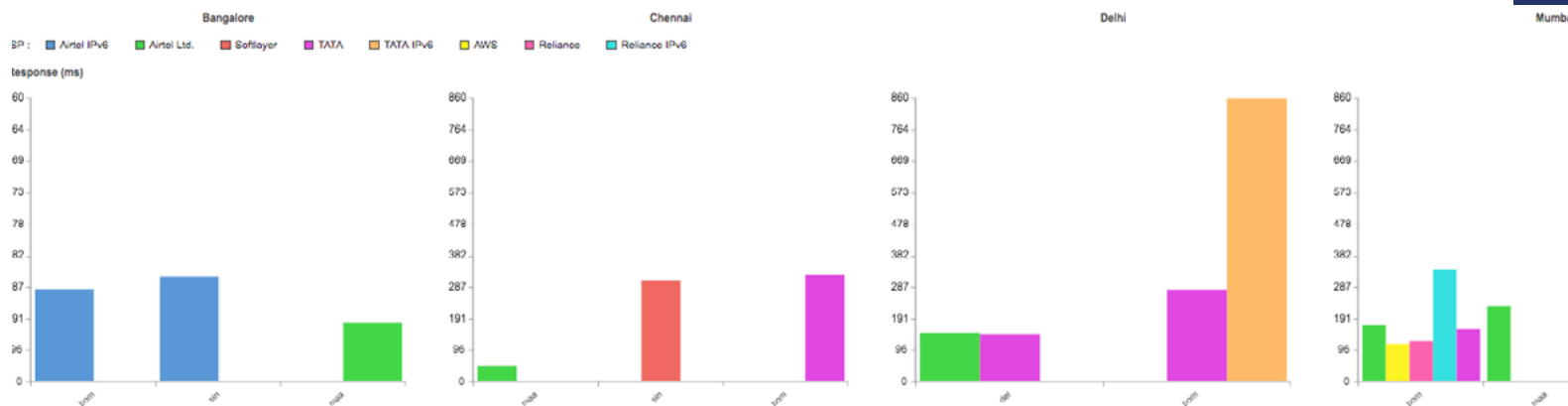
HTTP tests: Single Object, Browser (Chrome, IE)

Running a HTTP-based test in parallel shows the cumulative effect a lower round trip has on other metrics from TCP connection to SSL to overall response time.

Another key concept of any CDN is their mapping technologies. Some CDNs use proprietary mapping algorithms, while some leverage the anycast technology to map their end users to an optimal edge server. But the common idea behind any method is to identify an end user based on the connecting ISP. Leveraging Catchpoint's footprint across multiple major ISPs in major cities, you can identify mapping anomalies or even identify CDNs' peering policies when requests from different ISPs from the same city get mapped differently.



The chart to the left shows requests from within geographies being routed to different cities with a significant impact on round trips.



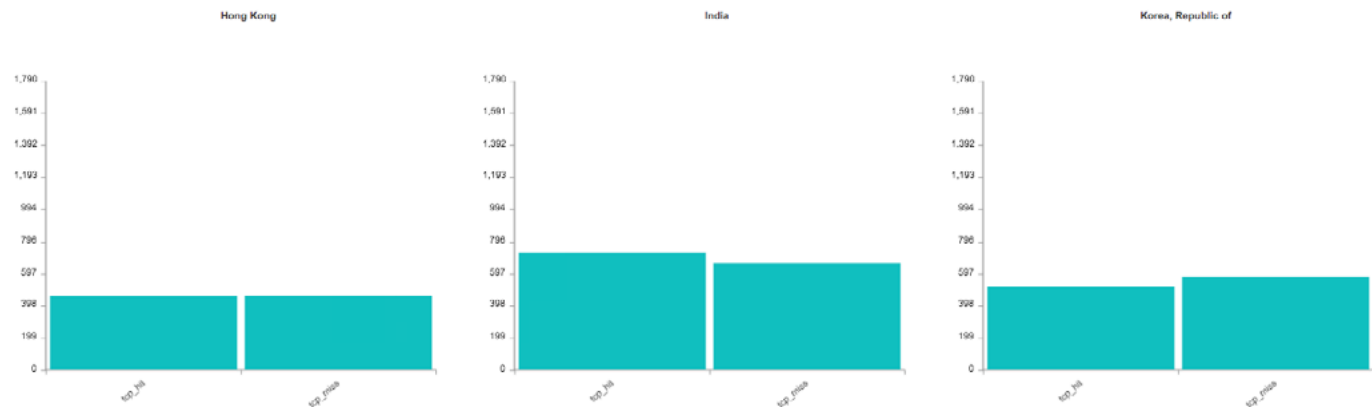
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How can Catchpoint help?

Insights: Gather intelligent data

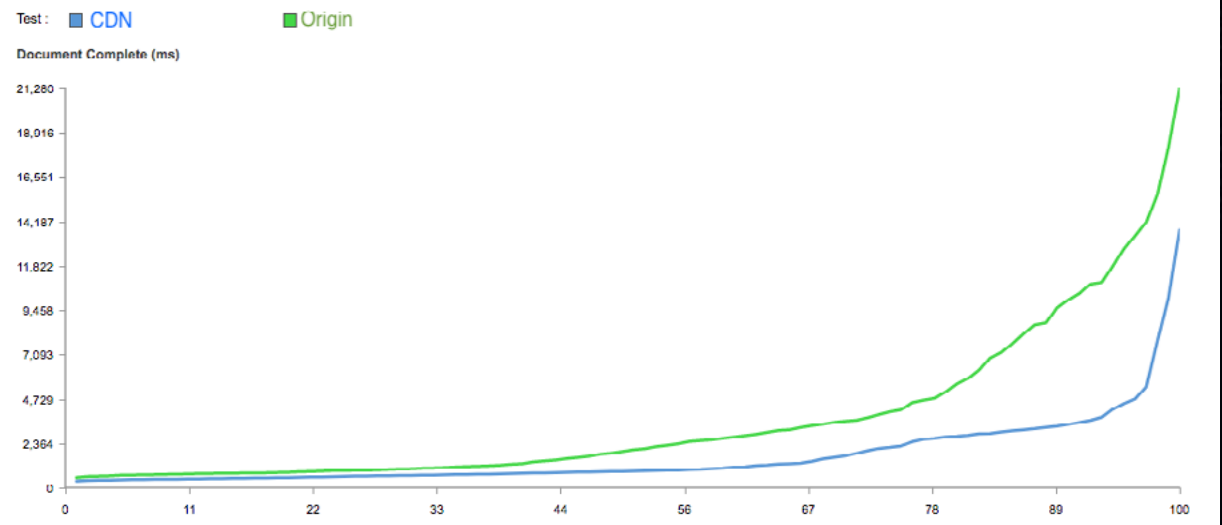
Using “Insights”, create custom metrics to capture CDN-related information. Capture details on if a request was served from an “edge” server cache, the server “think” time to serve content, gather details on whether requests were forwarded to a cache-parent etc... Insights can be used to show cache hits and cache misses from various PoPs.



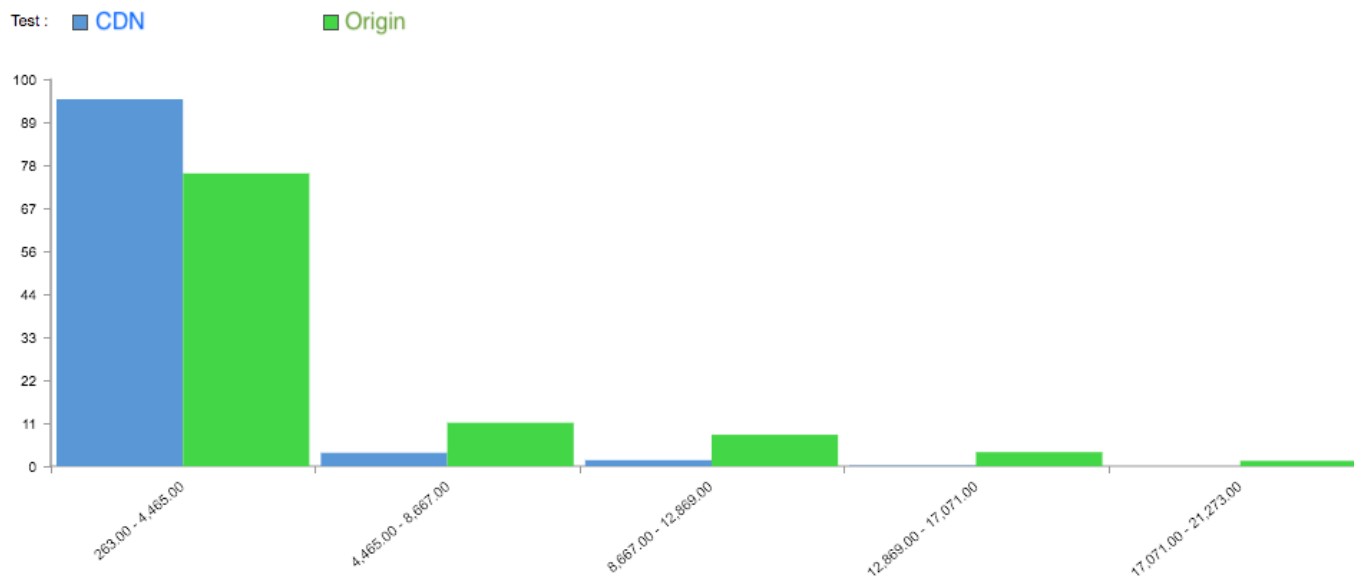
A/B Testing: Monitor scenarios

Perform A/B testing to analyze the impact of front-end optimization on page completion. Monitor specific metrics such as “Render Start” and “Document Complete” that are directly impacted by optimization features. A side-by-side comparison on this impact across all the potential end users can be efficiently analyzed using visualizations such as a cumulative distributed function (CDF) graph and histograms.

Notice, CDNs may not necessarily improve the performance of your best-performing end users at the 5th percentile. But as the end users move away from the 30th or 40th percentile, we notice the significant differences in the page completion metrics. These are the customers who will see the most value from a CDN.



Similarly, histograms provide a view into how the percentage of your end users seeing a positive shift in performance increases considerably while using a CDN.



Catchpoint's "Request Override" feature allows Catchpoint users to run "what if" scenarios without having to deploy a new version of their website or applications to test use cases like a new CDN, impact of specific third-party contents and so on. On a recent webinar, Priceline discussed how they take advantage of Request Overrides for many test scenarios including to send pages to their origin and CDN in parallel. This enables them to compare any metric across both the CDN and the origin.

This feature provides the flexibility for users to perform the following actions:

Apply to	Field	
www.example.com	(Request Override) ▼	cdn.example.com
static.example.com	(DNS Override) ▼	172.54.23.12
<input doubleclick.\""="" type="text" value=".\"/>	(Request Block) ▼	
static.example.com	(DNS-Resolver Override) ▼	8.8.8.8

Request Override: Rewrites the request URL (use cases include forward origin changes)

Request Block: Prevents the request from being made (blocking problematic tags, requests)

Request Delay: Delays the "wait" time of a request by a specified time in milliseconds

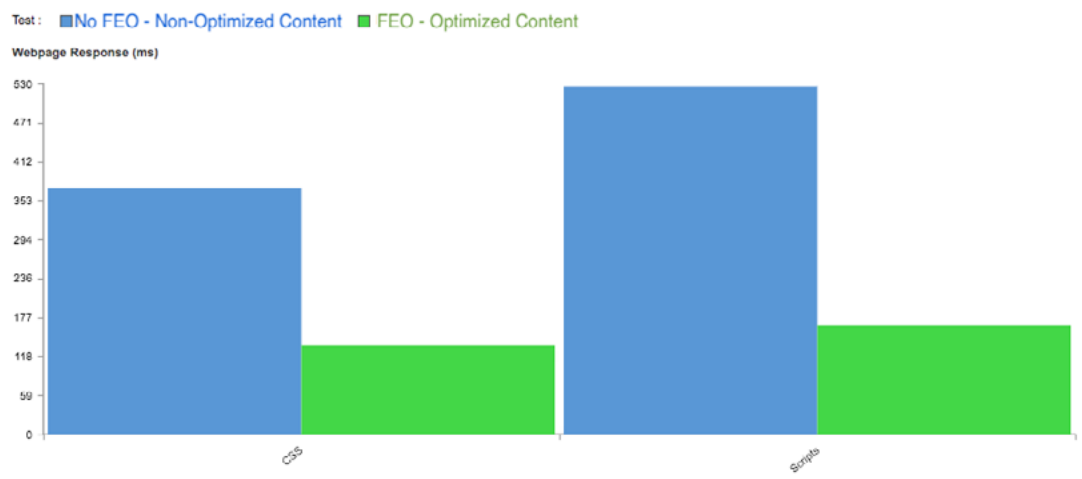
DNS Override: Specifies the IP address or host name to use for DNS resolution of a request

DNS Resolver Override: Forces the agent to use a different DNS resolver

Zones: Aggregate and analyze

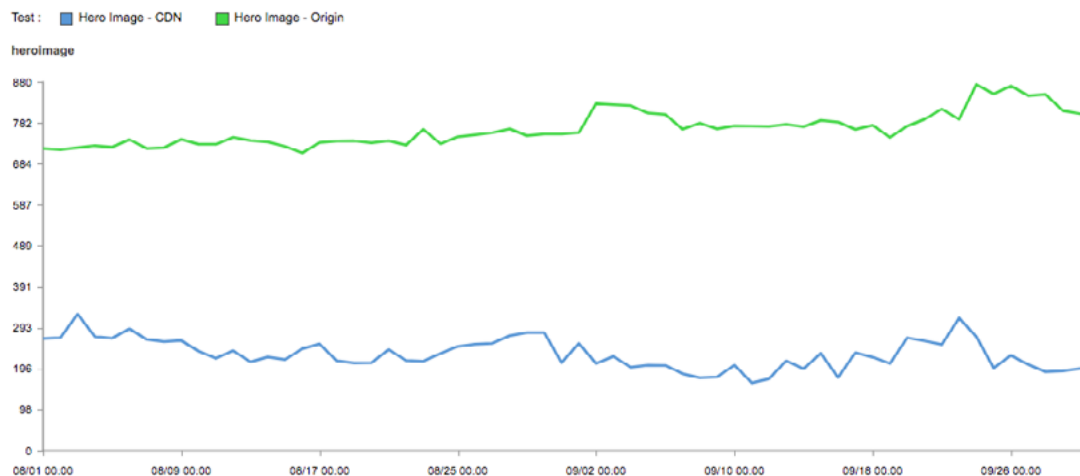
Group specific domains or contents based on content types in to “zones”. Examples of this can be grouping all first-party content and third-party content and monitor specifically the impact of first-party content being accelerated by a CDN service. Isolating noisy performance data from third-party content helps set up the right alert thresholds and leads to effective evaluations.

In the example to the right, content is based on content types, “Scripts” and “CSS” are our custom-defined Zones. We’re comparing the performance differences in these groups of content with and without using a CDN. The same comparisons can also be made across multiple-evaluating CDNs.



Custom Metrics: Hero image load

Certain users prefer to use metrics apart from the standard page completion metrics. Examples of these metrics include hero image load times, scrolling stickiness, time to load a specific element on the page etc... Using Catchpoint's ability to create custom metrics and perform benchmarking and evaluation provides IT teams more flexibility and a tailor-made monitoring strategy for CDNs. This also helps the teams monitor the impact of CDNs from an end user's perception.



Benchmark emerging technology

Very often, CDNs work as an extended arm of a company's infrastructure. So, for any emerging technologies or protocols to be implemented in a scalable way, it's imperative for CDNs to support these technologies. A good example of this would be the implementation of HTTP/2 protocol. The successful adoption of this was solely due to the CDNs supporting this protocol.

An advantage of CDNs supporting emerging technologies is the reduction in capital expenditure and a reduction in IT operations. The CDNs offload this implementation over to their platform, hence providing customers simple switches to turn on these technologies for their customers.



How can Catchpoint help?

HTTP/2 and IPv6

Catchpoint provides its customers an infrastructure that's up-to-date on emerging technologies and protocols. Good examples have been the support of SPDY protocol, upgrading that to HTTP/2 once the new protocol was released.

Using Catchpoint, IT teams can evaluate the performance impact of implementing newer technologies by performing A/B testing for these new features. Business and operational decisions can be made based on the outcome of these tests.

Similarly, Catchpoint also has a dedicated set of nodes that support IPv6 for those interested in evaluating and benchmarking the performance impacts of using newer protocols.



Evaluate market expansion

Another major advantage of implementing a CDN is easier penetration into emerging or non-primary markets without significant capital expenditure. A significant use-case of this is China. China represents a tremendous opportunity for online companies who can deliver a superior experience behind the "Great Firewall." Ecommerce sales in China are expected to reach \$1 trillion by 2020 and the \$17.8 billion spent on Single's Day in 2016 dwarfs the \$3.45 billion spent on the US equivalent, Cyber Monday.

Apart from different geographies, CDNs also provide performance acceleration to demographics that include a range of network conditions. Users using 2G or 3G networks or users with networks having high packet losses are going to be an essential demographic for optimizations.



How can Catchpoint help?

Catchpoint node infrastructure

Catchpoint has over 700 nodes distributed over hundreds of different ISPs and spread across 150+ cities worldwide. These nodes are classified into network types, based on the type of connection to the internet.

- **Backbone nodes:** Connected to the major ISPs using dedicated networks. Application/web performance baselining across the Internet without last mile variations.
- **Last mile nodes:** Local performance monitoring as observed from a user location, building or city block. Performance measurements include the impact of local traffic and network "noise" issues.
- **Wireless nodes:** These are nodes connected to wireless carriers. They provide an accurate performance benchmark for those interested in monitoring from a mobile-centric approach.

Backbone	Boston
8	3 6 0
NOT TARGETED	
Boston - AT&T	
Boston - AT&T IPv6	
Boston - Cogent	
Boston - Cogent IPv6	
Boston - XO	
Boston - XO IPv6	
Boston - Zayo	
Boston - Zayo IPv6	

LastMile	Boston
8	3 6 0
TARGETED	
LM - Boston, MA - VZN FIOS	
NOT TARGETED	
LM - Boston, MA - Comcast	
LM - Boston, MA - RCN	

Wireless	Boston
8	3 6 0
NOT TARGETED	
Boston - AT&T 3G	
Boston - AT&T 4G	
Boston - Sprint 4G	
Boston - Tmobile 4G	
Boston - VZN 3G	
Boston - VZN 4G	

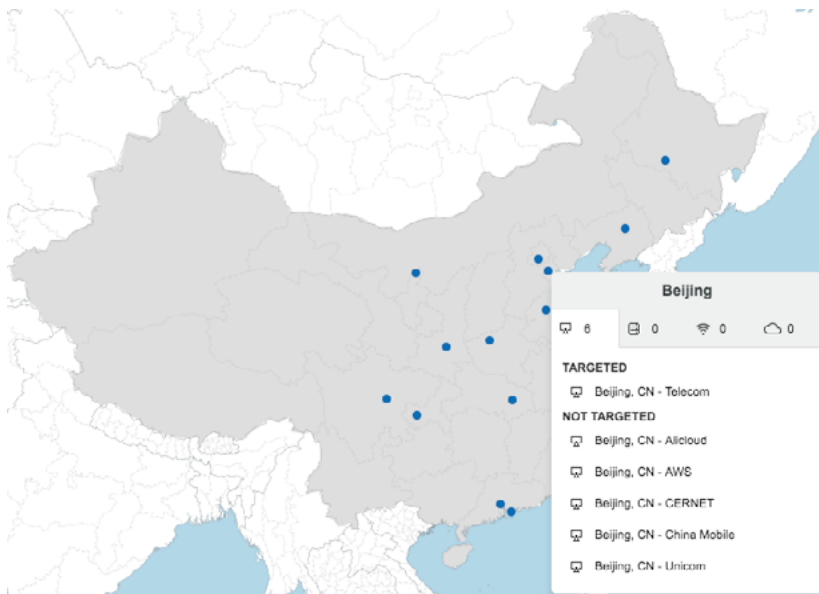
Each node type addresses specific aspects of CDN monitoring, including but not limited to benchmarking performance, SLA management, CDN functionality, mapping troubleshooting, and so on.

China CDN delivery

Delivery of content for Chinese end users from servers within China is a complicated process. Considerations have to be made based on technology and type of content. Content owners have to obtain an ICP license to serve content from within China. The latency between serving content from within China versus from serving content from the rim (Hong Kong, Tokyo, Seoul) is significant.

Here's a snapshot of performance difference between serving the same website from within China versus from outside China for Chinese end users. As it can be observed, the TCP connection time due to the Firewall of China is very high for requests being served from outside, cascading into higher response times.

Catchpoint provides over 50 nodes in China, located on all the major ISPs like Unicom, Telecom, China Mobile, and Cernet. Nodes are present in all major cities, thereby providing complete coverage of the entire country.

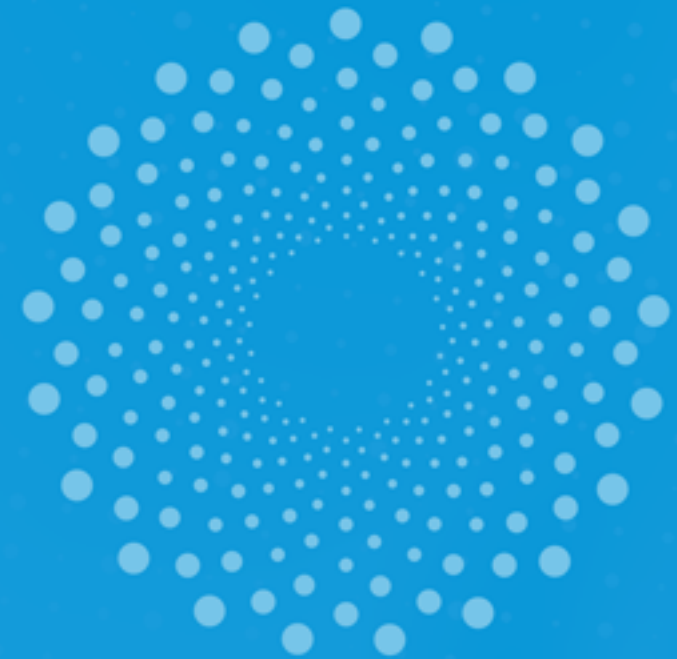


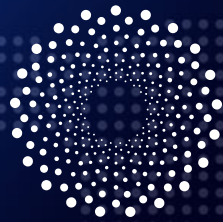
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To further understand the problems and strategies for China delivery and how to monitor from within China, refer to [this ebook](#).

Conclusion

CDNs offer a variety of benefits to applications including increasing site availability, reducing latency, optimizing content, and ensuring performance expectations are met when expanding to new markets. Organizations can rely on Catchpoint to monitor the performance of CDNs from the evaluation phase through to deployment to ensure that content is being delivered efficiently and SLAs are being met.





catchpoint™

Catchpoint empowers a new kind of IT — customer centric IT — that's optimized to deliver amazing digital experiences and drive business success.

Catchpoint is revolutionizing end-user experience monitoring to help companies deliver amazing digital experiences. Our platform provides complete visibility into your users' experiences from anywhere – and real-time intelligence into your applications and services to detect and fix issues faster. We are proud to partner with digital innovators like Google, L'Oréal, Verizon, Oracle, LinkedIn, Honeywell, Priceline, and Qualtrics, who trust Catchpoint to improve their brand experience and drive their business success.

18 Smart Monitors

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