



How Akamai delivers your packets - the insight

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What is a Content Distribution Network?



- The RFCs and Internet Drafts define a Content Distribution Network, “CDN”, as:

Content Delivery Network or Content Distribution Network. A type of CONTENT NETWORK in which the CONTENT NETWORK ELEMENTS are arranged for more effective delivery of CONTENT to CLIENTS.

What is a Content Distribution Network - In English?



- A CDN is an overlay network, designed to deliver content from the optimal location
 - In many cases, optimal does not mean geographically closest
- CDNs are made of distinct, geographically disparate groups of servers, with each group able to serve all content on the CDN
 - Servers may be separated by type
 - E.g. One group may serve Windows Streaming Media, another group may serve HTTP
 - Servers are not typically shared between media types

What is a Content Distribution Network - In English?



- Some CDNs are network owned (Level 3, Limelight, at&t), some are not (Akamai, Mirror Image, CacheFly, Panther Express)
- Network owned CDNs have all / most of their servers in their own ASN
- Non-Network CDNs can place servers directly in other ASNs
 - This means things like NetFlow will not be useful for determining traffic to/from non-network CDNs

The Akamai System



The Akamai EdgePlatform:

85,000+
Servers

1700+
POPs

950+
Networks

660+
Cities

72+
Countries

Resulting in traffic of:

5.0 Tbps peak traffic

36 petabytes / day

790+ billion hits / day

436+ million unique clients IPs / day



How CDNs Work



- When content is requested from a CDN, the user is directed to the optimal server
 - This is usually done through the DNS, especially for non-network CDNs
 - It can be done though anycasting for network owned CDNs
- Users who query DNS-based CDNs be returned different A records for the same hostname
- This is called “mapping”
- The better the mapping, the better the CDN

How CDNs Work

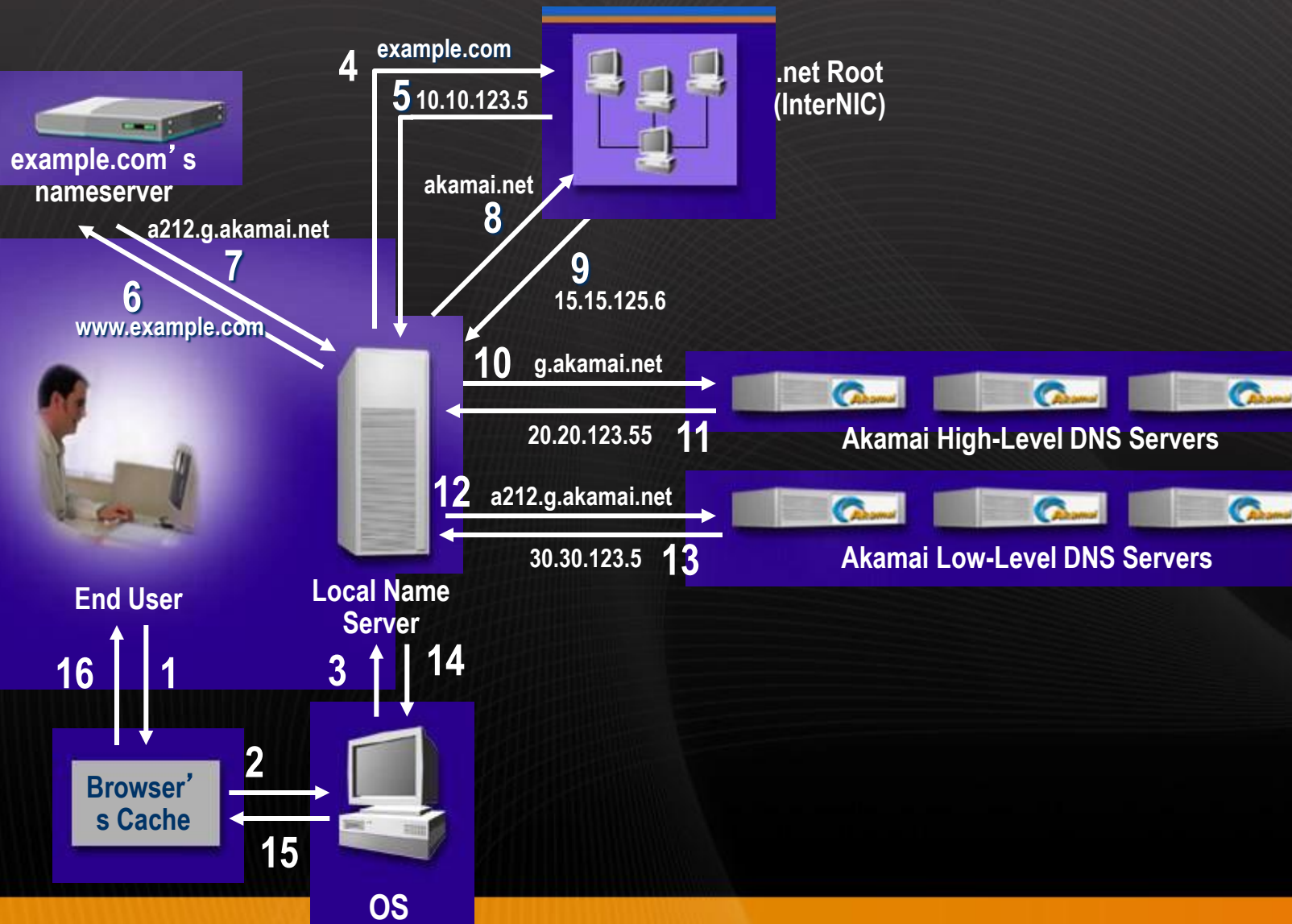


- Example of CDN mapping
 - Notice the different A records for different locations:

```
[NYC]% host www.symantec.com
www.symantec.com    CNAME    a568.d.akamai.net
a568.d.akamai.net  A        207.40.194.46
a568.d.akamai.net  A        207.40.194.49
```

```
[Boston]% host www.symantec.com
www.symantec.com    CNAME    a568.d.akamai.net
a568.d.akamai.net  A        81.23.243.152
a568.d.akamai.net  A        81.23.243.145
```

Finding the IP Address: The Akamai Way



How CDNs Work



- CDNs use multiple criteria to choose the optimal server
 - These include standard network metrics:
 - Latency
 - Throughput
 - Packet loss
 - These also include things like CPU load on the server, HD space, network utilization, etc.
- Geography still counts
 - That whole speed-of-light thing
 - Should be able to solve that with the next version of ethernet...

Object Delivery (Classic CDN)

1. Enduser types www.retailer.com into browser
2. Browser retrieves HTML from retailer's origin infrastructure
3. HTML instructs browser to get objects from Akamai
4. Browser retrieves images from optimal Akamai EdgeServer



Whole Site Delivery (for Static Sites)



1. Enduser types **www.retailer.com** into browser
2. **Browser retrieves entire site from Akamai cache at the edge**
3. HTML instructs browser to get objects from Akamai
4. Browser retrieves images from optimal Akamai EdgeServer

Origin Infrastructure



End User



Whole Site Delivery (for Dynamic Sites)



1. Enduser types **www.retailer.com** into browser
2. Browser requests HTML from optimal Akamai EdgeServer
3. **Akamai EdgeServer retrieves HTML from origin infrastructure**
4. Akamai EdgeServer sends HTML to browser
5. Browser retrieves images from optimal Akamai EdgeServer

Origin Infrastructure



End User



With Akamai:

“Just-in-time caching” of dynamic and “cold” content by Akamai Pre-fetching



- 1) Enduser types www.retailer.com into browser
- 2) Browser requests HTML from optimal Akamai EdgeServer
- 3) Akamai EdgeServer “GETs” HTML from origin infrastructure
- 4) Akamai EdgeServer parses HTML and requests uncached images from origin while delivering HTML to browser
- 5) EdgeServer delivers “Akamaized” images to browser

Origin
Infrastructure



End User



Why CDNs Peer with ISPs



- The first and foremost reason to peer is improved performance
 - Since a CDN tries to serve content as “close” to the end user as possible, peering directly with networks (over non-congested links) obviously helps
- Peering gives better throughput
 - Removing intermediate AS hops seems to give higher peak traffic for same demand profile
 - Might be due to lower latency opening TCP windows faster
 - Might be due to lower packet loss

Why CDNs Peer with ISPs



- Redundancy
 - Having more possible vectors to deliver content increases reliability
- Burstability
 - During large events, having direct connectivity to multiple networks allows for higher burstability than a single connection to a transit provider
- Burstability is important to CDNs
 - One of the reasons customers use CDNs is for burstability

Why CDNs Peer with ISPs



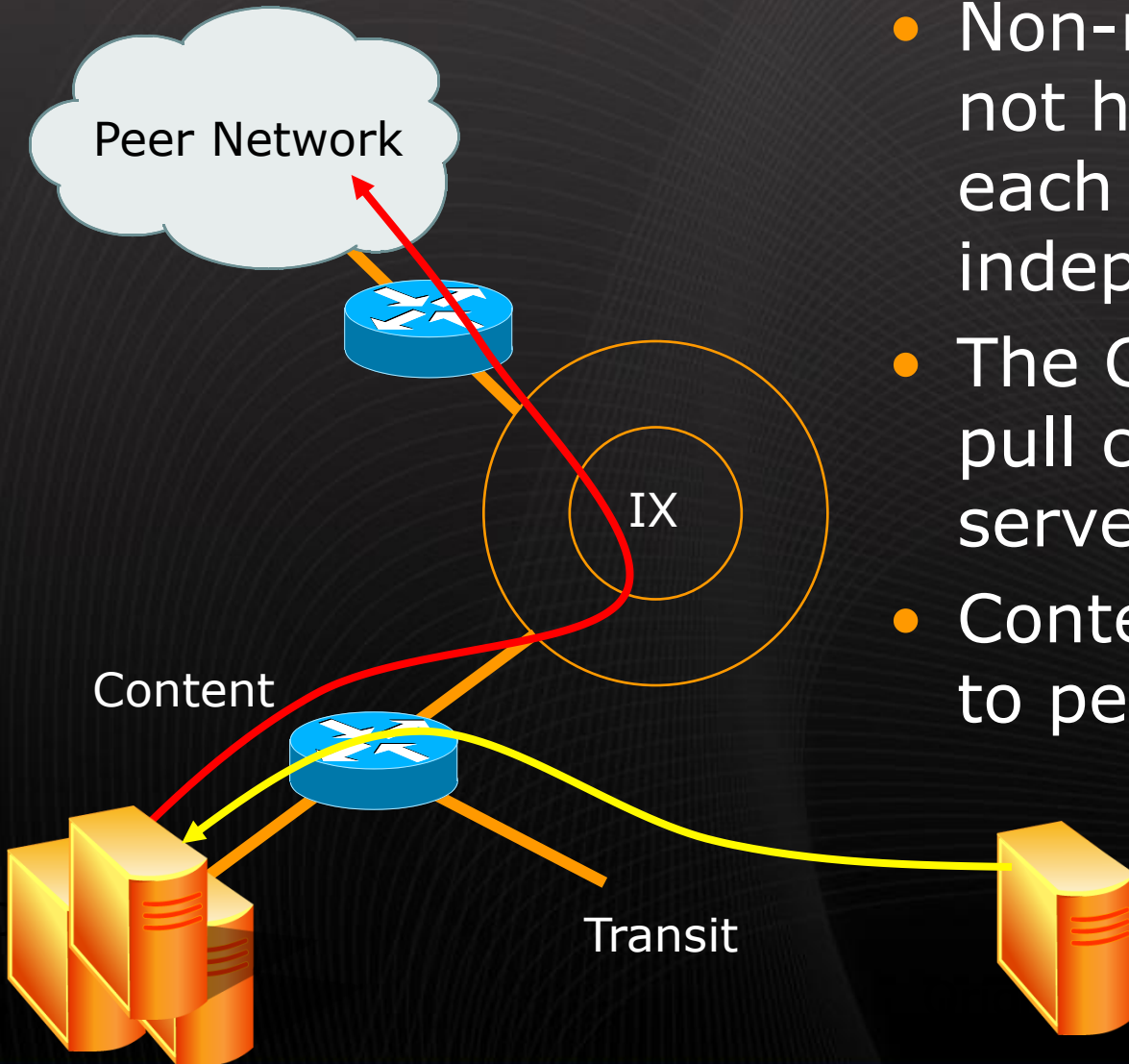
- Peering reduces costs
 - Reduces transit bill (duh)
- Network Intelligence
 - Receiving BGP directly from multiple ASes helps CDNs map the Internet
- Backup for on-net servers
 - If there are servers on-net, the IX can act as a backup during downtime and overflow
 - Allows serving different content types

Why ISPs peer with CDNs



- Performance
 - CDNs and ISPs are in the same business, just on different sides - we both want to serve end users as quickly and reliably as possible
 - You know more about your network than any CDN ever will, so working with the CDN directly can help them deliver the content more quickly and reliably
- Cost Reduction
 - Transit savings
 - Possible backbone savings

How Non-Network CDNs use IXes



- Non-network CDNs do not have a backbone, so each IX instance is independent
- The CDN uses transit to pull content into the servers
- Content is then served to peers over the IX

How CDNs use IXes



- Non-network CDNs usually do not announce large blocks of address space because no one location has a large number of servers
 - It is not uncommon to see a single /24 from a CDN at an IX
- This does not mean you will not see a lot of traffic
 - How many web servers does it take to fill a gigabit these days?

Questions?



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