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# Making The Move To A Cloud-Based DNS Service



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## Boost DNS Performance; Eliminate Cost, Risk, and Complexity

### Executive Summary

Every user's first interaction with your website begins with a series of DNS queries. Poor DNS performance can lead to slow page loads, dissatisfied customers, and lost business. Cloud-based DNS services extend DNS performance, resiliency, and scalability helping you ensure superior user experiences across the globe.

This white paper reviews the features and benefits of a cloud-based DNS service. You will learn:

- \* The critical role DNS plays in the user experience
- \* The difference between unicast and anycast-based DNS implementations
- \* The hidden costs, risks, and challenges of managing your own DNS infrastructure
- \* The performance, reliability, and security advantages of a cloud-based DNS service
- \* How a cloud-based DNS service can help you improve the user experience, contain costs, and free up valuable IT staff to focus on strategic business imperatives

### Introduction - DNS Overview

The **Domain Name System** (DNS) is a distributed Internet database that maps human-readable names to IP addresses, enabling users to reach the correct website when entering a URL. Every user's first interaction with your website begins with a series of **DNS lookups**.

DNS mappings are maintained in special-purpose servers known as DNS **name servers**. When a user enters your company's URL, a DNS query is routed to a DNS name server that contains the address mappings for your company's Internet domain.<sup>1</sup> DNS reliability and performance are central to the user experience.

### DNS Reliability Is Paramount

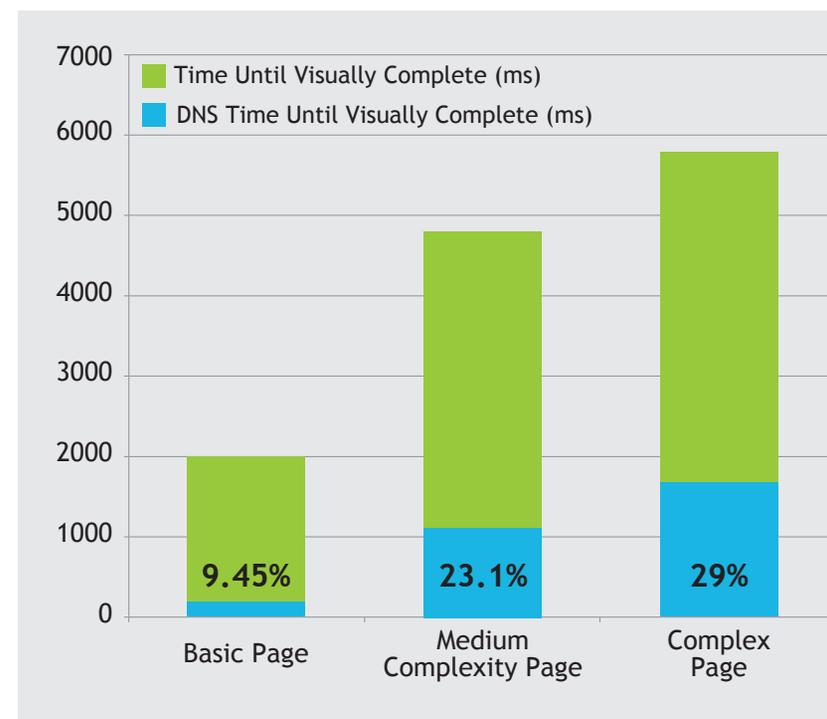
The content on your website is probably scattered across the Internet. Some of it might be hosted in your data center, some of it might be distributed across content delivery networks, and some of it might reside in the cloud. DNS is responsible for steering users to the appropriate content source. If your DNS name servers are unreachable because of hardware problems, configuration errors, or network issues, users may not be able to access the content on your site.

### DNS Performance Is Crucial

DNS queries are subject to network transmission delays and propagation delays as they make their way across the Internet and traverse intermediary routers. Network latency impairs the user experience; the greater the roundtrip latency, the slower the response to the DNS query.

To make matters worse, a **contemporary webpage** can involve dozens of DNS lookups and a page cannot load until all DNS requests are completed. For complex webpages, DNS resolution can comprise as much as 29% of initial page load time.<sup>2</sup> (See Figure 1)

FIGURE 1: Poor DNS performance – slow responses to DNS queries – can lead to slow page loads, website abandonment, and lost revenues.



<sup>1</sup> In DNS parlance this type of name server is referred to as an authoritative name server

<sup>2</sup> Based on Dyn internal testing

### Distributed Implementations Improve DNS Performance

You can extend DNS performance and resiliency by installing a network of geographically distributed name servers. By deploying multiple DNS name servers, you can eliminate single points of failure and ensure continuous service in the event of individual server problems or network outages. And by distributing DNS name servers closer to users, you can reduce network transmission delays and router propagation delays, accelerate DNS responses, and improve the end-user experience.

### Unicast Addressing vs Anycast Addressing

Distributed DNS networks can be implemented using two distinct standards-based IP addressing schemes: unicast addressing or **anycast** addressing. The unicast approach is far simpler to implement, but the anycast approach offers significant performance and resiliency advantages.

With a unicast approach each of your company's DNS name servers is assigned a unique IP address. DNS maintains a table of your domain's name servers and corresponding IP addresses, as shown in **Figure 2**. When a user enters your URL, DNS *arbitrarily* returns the IP address of one of your DNS name servers. You have no control over which name server DNS selects. A user in China could be served by a name server in North America. And a user in the U.S. could be served by a name server in Asia!

With an anycast addressing scheme, all your DNS name servers share a common IP address, as shown in **Figure 3**. When a user enters your URL, DNS returns the collective anycast address for your DNS name servers. The IP network automatically routes queries to the "closest" name server.<sup>3</sup> A user in China is automatically directed to your DNS name server in Asia. A user in the U.S. is automatically directed to your DNS name server in North America.

The anycast approach offers a variety of performance, reliability, and security advantages.

FIGURE 2: Unicast addressing delivers unpredictable results

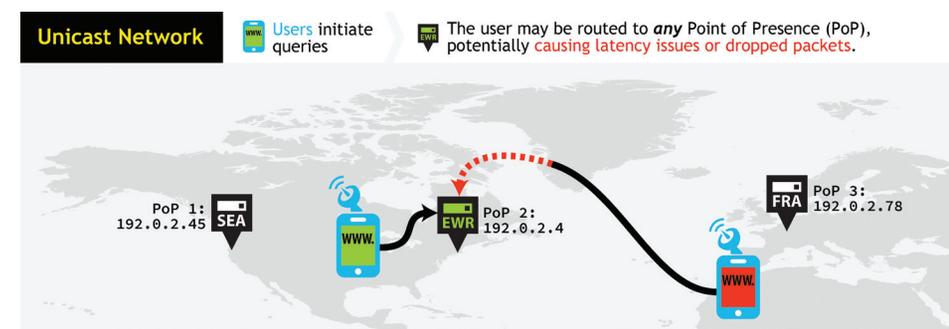
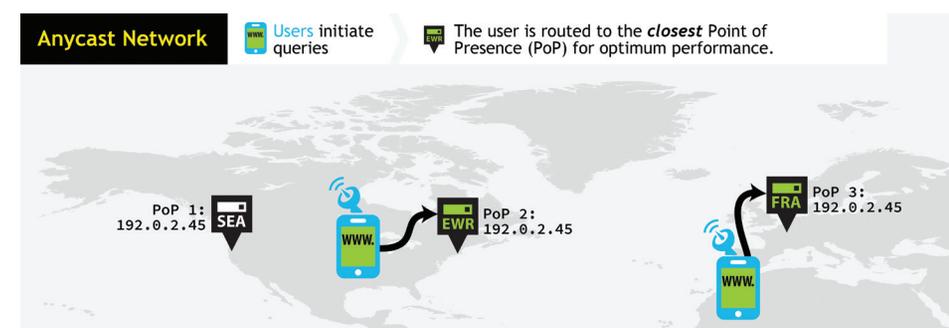


FIGURE 3: Anycast addressing optimizes DNS performance and enables consistent user experiences across the globe



<sup>3</sup> Technically speaking, the BGP routing protocol employed in the IP network directs the user to the DNS name server with the lowest "hop" count. Each router along the path constitutes a hop and introduces delay. The use of anycast accelerates DNS resolution by minimizing the number of router hops between the user and the DNS name server.

### GLOBAL DNS NETWORKS ARE COSTLY & COMPLEX

- \* **Performance** - Anycast accelerates DNS resolution by automatically directing DNS queries to the “closest” DNS name server, minimizing network transmission delays and propagation delays, and ensuring optimal user experiences across the world. Anycast also enhances the performance of your overall DNS infrastructure by load balancing queries across name servers.
- \* **Reliability** - Anycast provides predictable and more efficient failover mechanisms. With the unicast approach, when a user enters your URL, DNS randomly queries one of your name servers. (For example the North American server in Figure 2.) If the name server does not respond within a pre-defined period of time, DNS will try another name server. (For example the Europe server in Figure 2.) This unsystematic approach can introduce delay and impair the user experience. With the anycast approach, unreachable name servers are dynamically removed from IP routing tables and queries are deterministically directed to the “closest” active server.
- \* **Security** - Anycast provides fundamental security advantages over unicast. Unicast exposes the IP addresses of individual servers. Attackers can initiate targeted Denial of Service (DoS) or Distributed DoS (DDoS) attacks against specific physical servers or virtual machines. Anycast mitigates security threats by concealing the addresses of individual servers and automatically distributing attacks across collections of compute resources.

Designing, installing, & managing a large-scale DNS network takes time, money, & resources.

#### Upfront Expenses

- Architect the network
- Identify colocation facilities for areas outside corporate data centers
- Establish peering & transit relationships with network service providers
- Hire incremental staff with DNS & security expertise
- Purchase and install server hardware
- Procure & configure DNS software
- Acquire & implement security solutions

#### Recurring Operational Expenditures

- Ongoing network administration & management
- Recurring rack space, power, & equipment maintenance costs

### Managing Your Own DNS Infrastructure Is Costly And Risky

Businesses that manage their own DNS infrastructure typically install one or more name servers in each corporate data center. Most employ unicast addressing schemes<sup>4</sup> and rely on a relatively small number of name servers (2-3 servers).

You can optimize DNS performance and resiliency by implementing a global anycast network. But engineering, deploying, and operating a large-scale DNS implementation is a resource-intensive and time-consuming proposition, beyond the financial means of most corporate IT organizations. (See sidebar)



<sup>4</sup> In a 2014 emedia survey, fewer than 30% of organizations managing their own DNS infrastructure indicated they use anycast addressing.

### Implementing a global anycast network is also fraught with challenges and risks:

- Enabling anycast across public networks can be difficult or impossible - most network service providers do not support anycast addressing for commercial customers
- Deploying DNS name servers in your corporate data centers is inherently risky; if your corporate data network goes down, you lose DNS services as well
- You will need to implement new security solutions to mitigate DoS/DDoS threats and you may need to hire security experts to help
- Designing, building, and managing a global DNS network steals resources from other business-critical IT projects

#### LEARN MORE

Watch our **DNS Build vs. Buy** webinar.

### Cloud-Based Services Optimize DNS Performance; Eliminate Expense And Complexity

You can improve results, contain costs, and make better use of valuable IT personnel by leveraging a cloud-based DNS service. Best-of-breed managed DNS service providers have the global DNS infrastructure and deep DNS expertise to ensure your success.

- \* **Global Performance and Scalability** - DNS service providers operate large-scale anycast networks with multiple points-of-presence (PoP) across the globe. They accelerate DNS resolution by automatically steering queries to the closest PoP, ensuring consistent user experiences around the world.
- \* **High Availability** - DNS service providers run highly resilient networks with no single point of failure. They operate out of geographically distributed, high-availability data centers on separate power grids, flood plains, and fault lines. And they deploy fully redundant server configurations and install redundant connections to multiple ISPs to ensure uninterrupted service in the event of equipment failures or network outages.
- \* **Strong Security** - DNS service providers take a multilayered approach to security, employing a variety of measures to establish trust and defend against threats. They retain dedicated security experts who closely monitor industry trends and proactively update security systems and practices to thwart malicious attacks and mitigate risks.
- \* **Easy-to-Use APIs** - Most DNS service providers offer development tools and APIs to help you streamline integration with external applications and automate routine DNS configuration tasks.

## WHITEPAPER

- \* **Expertise and Support** - DNS service providers employ full-time DNS and network security experts, and offer 24x7x365 technical support to help you keep your website running smoothly around the clock.

### Conclusion - Make The Move To The Cloud

Creating a highly scalable, reliable, and efficient DNS infrastructure takes time, money, and expertise. You can accelerate your success and contain costs with a cloud-based service.

You'll gain a variety of functional and financial benefits, including:

- \* **Increased DNS performance and reliability** - enjoy all the scalability and resiliency advantages of a global anycast network
- \* **Better business results** - greater DNS performance translates directly to better user experiences, improved customer satisfaction, and greater revenues
- \* **No ramp-up or build-out costs** - avoid all the expenses and risks associated with designing and deploying a worldwide DNS network - DNS expertise is hard to find
- \* **No network management expenses** - minimize ongoing operational expenditures; the provider manages the DNS infrastructure

A cloud-based DNS service can help you deliver superior user experiences while keeping expenses in check. You can improve business results while freeing up valuable IT resources to focus on innovation.

### About Dyn

Dyn is a cloud-based Internet Performance company. Dyn helps companies monitor, control, and optimize online infrastructure for an exceptional end-user experience. Through a world-class network and unrivaled, objective intelligence into Internet conditions, Dyn ensures traffic gets delivered faster, safer, and more reliably than ever.

 **Contact Dyn today to learn how you can maximize DNS performance, improve user satisfaction, and contain costs with a cloud-based service.**