

NeuStar Ultra Services

Critical DNS Infrastructure Solutions for TLD Operators

CONFIDENTIAL

An industry leader and pioneer in Managed DNS Services

- **UltraDNS acquired by NeuStar, Inc. (NYSE: NSR) in April 2006**
 - UltraDNS technology and solutions part of NeuStar Ultra Services (NUS)
 - Thousands of customers worldwide
 - Significant penetration among Fortune 1000 and Service Provider sectors
- **Leading DNS provider to the Top-Level Domain (TLD) community**
 - Infrastructure provider for over 30 cc, s, and gTLDs
 - Manages approximately 25 million domains, over 20% of global domain market
 - Network processes in excess of 175 billion queries per month
- **NeuStar provides full service registry solutions**
 - SRS
 - Registry Gateway
 - Whois

- **Decentralized nature of DNS hierarchy vulnerable to attacks**
 - Attacks launched against critical control points (ie- root servers, TLD's) create wide-spread outages
 - If DNS does not function, users will never reach intended content
- **DNS is 'weak link' of the Internet but critical component of advanced applications**
 - VoIP / ENUM
 - RFID
 - E-commerce
- **No out of band 'command and control' in DNS**
 - Effectiveness of infrastructure can easily be interrupted by public users of the system
- **BIND software ranked as top security vulnerability on the Internet**
 - SANS Institute: <http://www.sans.org/top20/>
 - CERT advisories
- **DDoS attack patterns becoming more sophisticated and effective**
 - Internet root servers in November 2002
 - Akamai outage in July 2004
 - Distributed reflector denial of service attacks in January 2006
 - Internet root server attack in February 2007
 - Attack against Estonia in April 2007 – first cyber attack against a country

No additional hardware, software, maintenance or training costs

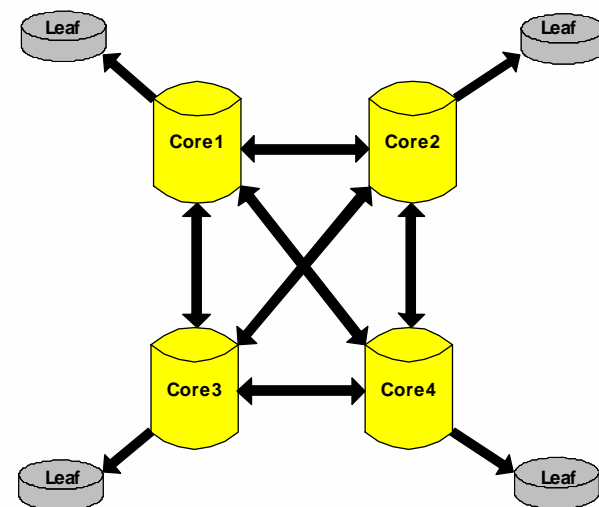
Software	Proprietary non-BIND software; provides code diversity
Service Guarantee	Includes SLA with 100% uptime network guarantee
Performance	Faster customer connections via routing to closest topological server in global network; real time replication of DNS changes
Management Tools	XML API or intuitive web-based GUI to centrally administer DNS settings using role-based security
Security	Protects from hacker attacks including DDoS Secured access to NeuStar Ultra Services nodes and name servers
Scalability	Leverages DNS infrastructure on 5 continents to scale globally
Support	24x7 proactive support

- **Pioneered IP Anycast for directory services**
 - Provides redundancy and efficiently utilizes system resources for maximum scalability
- **IP Anycast and BGP routing**
 - Failover & self-healing capabilities allows NUS to add or remove servers with no user impact
 - Queries directed and processed by the topologically closest server
- **Protects network from DDoS attacks**
 - Methodology sinks DoS attacks at source of the attack
 - Prevents customer facing issues
 - Strong relationships with upstream providers
- **Performance enhancer**
 - Mitigates delays in resolution
 - Limits number of foreign routes to traverse reducing packet loss
 - Reduces the number of query packets that are dropped and cause a DNS timeout/retry
- **Added reliability achieved by having 6 shared global IP addresses**
 - Provides additional redundancy in the face of network routing problems (e.g. black holes)

Data Propagation

Master-to-Master Replication

- **Maximum scalability and performance**
 - Two-tier replication environment
 - Numerous data triggers are designed to ensure timely cache
- **Fully redundant, scalable and fault-tolerant**
 - Utilizes a hierarchical methodology for robust replication
 - Incorporates tightly integrated code that monitors local system
 - Routing announcements immediately withdrawn upon application, server, or network failure
- **Master-to-master replication schema**
 - Replication engine interacts directly with the database
 - Maintains consistency between the information at each node in a mesh
 - Synchronized via replication over the wide area network



Current Data Centers (14)

- **North America**
 - California (3)
 - Illinois
 - Virginia (2)
 - Florida
 - Texas
- **Europe**
 - Luxembourg
 - UK
- **Australia**
 - Sydney
- **Africa**
 - South Africa
- **Asia**
 - India
 - Hong Kong



Planned Expansion

- China • Canada • South America

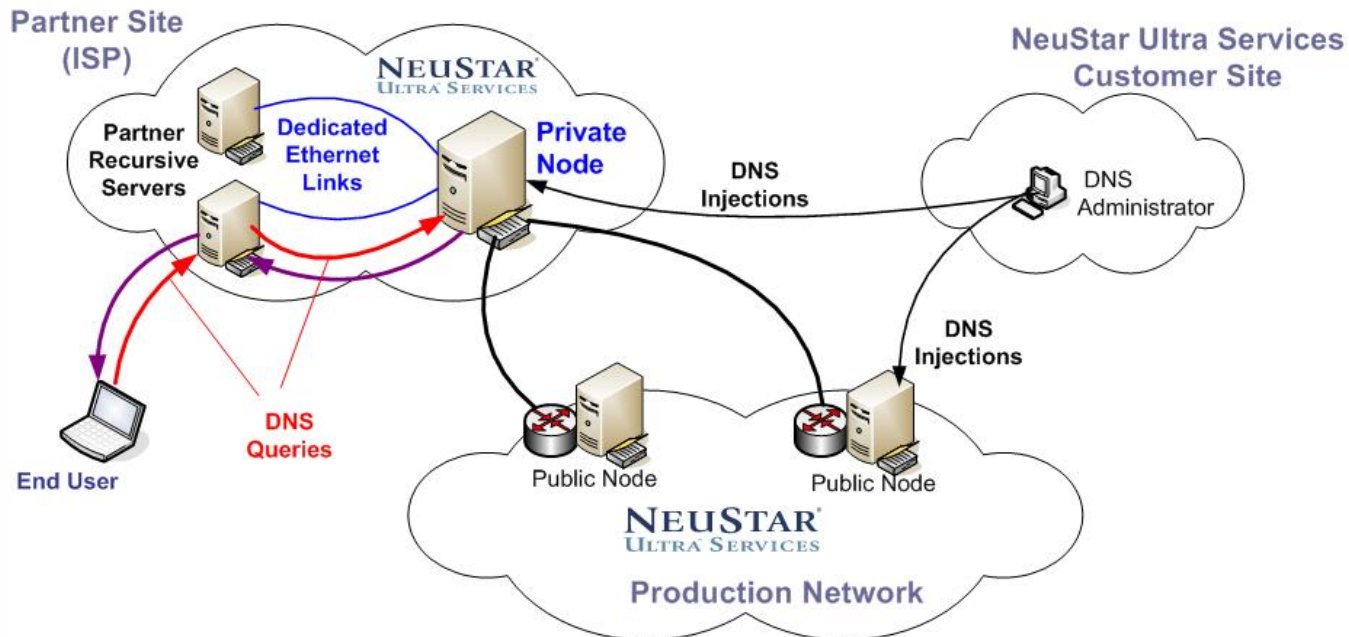
DNS Shield created to mitigate DDoS attacks launched against DNS infrastructure

- **Focus on top 20 Global ISP/network providers**
 - AOL, EarthLink, Cablevision, Qwest, Yahoo!
 - Significant ISP and network provider demand
 - Targeting to cover 75% of end users
- **Private Nodes deployed within Major ISPs/Network Providers**
 - Inaccessible to public
 - Accessible only to “trusted” recursive servers
- **Providers create and maintain Access Control Lists (ACLs)**
 - Restricts access to Ultra Service Nodes and provider’s recursive name servers
 - Forms a protected environment for DNS query and response traffic
- **Each partner deploys two or more authoritative private nodes**
 - Functionally identical to NUS Public Nodes
 - Utilizes Anycast IP addressing via BGP
 - Connected privately to Ultra Services Replication System



- A constellation of private nodes with secure links to the Ultra Services global network forms a trusted DNS infrastructure

DNS Shield Network Architecture



- **DNS Shield leverages the Service Provider's existing infrastructure**
 - No changes necessary in recursive server query lookup
- **Reduces Customer Support costs associated with effects of DDoS against DNS**
 - Without DNS Shield implementation, Service Providers must burden support costs associated with end users that cannot reach intended destination due to DNS disruption
- **DNS Shield provides increased DNS resolution performance for end users**
 - Authoritative server proximity to end users allows query response times of less than 5 milliseconds
- **Service Provider's zones are cross-pollinated within each others infrastructure**
 - Enables DNS to function even while under a severe DDoS attack
 - End user recursive queries are completed in an isolated and trusted environment
- **Ultra Services provides code diversity and global footprint that augments existing Service Provider's infrastructure**

- **Advanced services viewed as critical by TLD administrators**
 - **DNS Shield Protection**
 - TLD's get benefit of DDoS protection on both the public and private infrastructure
 - Provides significant performance improvements in DNS resolution to each end user community even if the public infrastructure is under DDoS attack
 - **DNSSEC**
 - TLD's looking towards DNSSEC as a critical security layer for protecting end user community
 - DNSSEC test-bed available to TLD customers
 - **IPv6 Support**
 - Network is deployed with IPv6 native connectivity to all nodes
 - Supports AAAA records
 - **IDN Support**
 - Network is compliant with both ASCII and Punycode
 - Single lookup supports both 8-bit and Punycode server side characters
 - **ENUM**
 - Ultra Services infrastructure and API compliant with NAPTR record administration key for ENUM routing
 - Production environment available to facilitate TLD adoption of ENUM services

- **TLD's can utilize NeuStar for either Primary or Secondary DNS**
 - **Over 25 node locations to serve DNS on both the public and DNS Shield networks**
 - **DNS managed via XML API or AXFR/IXFR**
 - Changes propagated globally in 2 minutes or less
 - **TLD traffic managed on separate network from enterprise customers**
 - TLD network customized for processing high query volumes
 - Injection methodology designed for scale
 - Isolate effects of attack traffic from enterprise network
 - Dual GigE connections at each node, Juniper M120 carrier class routers
 - **Detailed domain/query reporting and traffic logging for all TLD customers**
 - Segmented by time of day and network location
 - **Custom infrastructure solutions available where NUS can anycast TLD controlled IP addresses**
 - Disaster Recovery solution
 - Real-time enablement of the NUS infrastructure to process queries during high volume periods

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