Enabling and Configuring DNS Traffic Control
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**Introduction**

DNS Traffic control (DTC) load balances user’s application traffic based on the Client’s location, the server’s location and the server’s availability. Through DNS Traffic Control, IT administrators can set up multiple sites and direct clients to the best available servers. DTC monitors application availability using various types of health checks to make sure the Clients are sent to servers that are available.

**Prerequisites**

The following are prerequisites for Infoblox DNS Traffic Control:

- Functional 7.3 Infoblox Grid with a Grid Master
- Active Grid with DNS license
- DNS Traffic Control license
- At least one NIOS appliance acting as an authoritative DNS Server (Primary)

**Limitations**

Following general limitations apply:

- No GSLB processing for recursive queries
- GSLB results are returned only if the query resolves to an authoritative zone to which an LBDN is explicitly linked
- No authentication support in HTTP or HTTP/S monitor
- No Automatic MaxMind updates. A single MaxMind DB per grid and only gets updated when a new version is manually uploaded
- The SIP monitor does not support SCTP transport
- The HTTP/HTTPS monitor validates the response code only. As of 7.3, it does not currently check response content
- No CSV support (import/export) for any of the existing DTC configurations

**DTC Workflow**

- A client sends a DNS request to a NIOS Grid Member where the DNS server processes it.
- The DNS server resolves the query. If the final query name belongs to a zone for which the server is authoritative and matches an LBDN linked to that zone, then DTC handles the response. Otherwise normal DNS processing occurs.
- If the cache contains a previous answer to the same request for the same client and that server is still available, it is selected. Otherwise, based on current availability and configured topology rules, the GSLB algorithm generally selects first a Pool and then a specific server from that Pool (configuration dependent).
- A DNS record is synthesized from the address of the selected server and returned to the client.
- The client contacts the server

**Best Practices**

To get the most from Infoblox DTC, Infoblox recommends the following best practices:

- A new DTC configuration should always be tested using the built-in LBDN test tool
- For web application servers http and http/s health monitors must be used to verify application level availability
- Always view the traffic management structures through the built in hierarchical map view that can be used to quickly view the overall traffic management structure of a selected DNS Traffic Control Object
- Use a naming convention for LBDN’s, and their associated Pools, Servers, and Topology rules. These naming conventions can be used for filtering and to identify a Server vs. Pool Topology rule
NIOS DTC Objects

Before implementing DTC on a NIOS appliance, an administrator must understand different objects related to the DTC feature in NIOS. The following are the NIOS DTC objects.

DTC Servers

DTC Servers are objects that are associated with synthesized A, AAA, NAPTR, and/or CNAME records. The IP addresses of these Servers are sent back in DNS query-response through DTC. The Servers can be actual physical servers, or local Server Load Balancers, or really anything with an IP address. Servers may be used by multiple Pools and topology rules. The Servers can also be disabled which affects all Pools using them. A Server may not be disabled if it is the last, non-disabled Server in any Pool that is used by an LBDN. The Servers that do not belong to any Pool or only belong to Pools that aren't used by an LBDN may be disabled. Servers cannot be deleted while in use and must first be removed from every Pool and topology rule using them.

Load Balancing Methods

The following load balancing methods are available,

Global Availability

The Global Availability Load Balancing method always returns the first available Server that is available in the list of Servers (obviously order is important). Availability is based on Health Monitor(s) used. It is a perfect load balancing method for DR. There is no weight configuration as part of this load balancing method. An example is shown in table below,

<table>
<thead>
<tr>
<th>Order</th>
<th>Weight</th>
<th>Server</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>n/a</td>
<td>1.1.1.1</td>
<td>down</td>
</tr>
<tr>
<td>2</td>
<td>n/a</td>
<td>2::2</td>
<td>up</td>
</tr>
<tr>
<td>3</td>
<td>n/a</td>
<td>3.3.3.3</td>
<td>up</td>
</tr>
<tr>
<td>4</td>
<td>n/a</td>
<td>4::4</td>
<td>down</td>
</tr>
</tbody>
</table>

With the Pool configuration shown in table above, queries for A address is going to return 3.3.3.3 and queries for AAAA record queries will return 2::2.

Ratio

For the ratio method, the results’ distribution over time matches their weights but there is no expectation for sequential results. Responses are randomized, with each available option assigned a probability equal to its weight divided by the total weight of all available options. An example is shown in table below,

<table>
<thead>
<tr>
<th>Order</th>
<th>Weight</th>
<th>Server</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1.1.1.1</td>
<td>down</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2::2</td>
<td>up</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>3.3.3.3</td>
<td>up</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>4::4</td>
<td>up</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>5.5.5.5</td>
<td>up</td>
</tr>
</tbody>
</table>

With this Pool configuration and state, un-cached queries for A address is going to return 66% 3.3.3.3 and 33% 5.5.5.5 while un-cached queries for AAAA will return 50% 2::2 and 50% 4::4. Responses are going to exhibit no particular order.
Round Robin

Round robin is supported as a degenerate case of ratio with equal weights. Responses are randomized, with each available option having equal probability. The distribution over time will be even but there are no guarantees on sequencing.
Round robin ignores both weights and order. Let's look at an example configuration in the table below for Round Robin.

<table>
<thead>
<tr>
<th>Order</th>
<th>Weight</th>
<th>Server</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>1.1.1.1</td>
<td>up</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2::2</td>
<td>up</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>3.3.3.3</td>
<td>down</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>4::4</td>
<td>up</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>5.5.5.5</td>
<td>up</td>
</tr>
</tbody>
</table>

With this Pool configuration and state, each uncached query for A will return a single address in the sequence (1.1.1.1, 5.5.5.5, 1.1.1.1, 5.5.5.5, ...) while each uncached query for AAAA will return a single address from the sequence (2::2, 4::4, 2::2, 4::4, ...).

Topology

Topology load balancing method follows its own topology rule list. The lists are configured globally and can be reused. Topology rules map a source to a destination. Either a subnet or a MaxMind label may identify the source. The destination is either a server or a Pool. There are two types of topology rules, Server, and Pool. These types cannot be intermixed in the LBDN, or a Pool definition.

When GSLB processing evaluates a topology method, it logically walks the list of topology rules in order and uses the first match with an available destination. If there is none then the method falls through and either an NX domain is returned, or an obscured record is returned if it exists.

A rule with a subnet source matches if the subnet contains the client IP.

A rule with a MaxMind label source matches if running the client IP through the MaxMind DB produces a record with the corresponding label. Note that the MaxMind DB is static over the lifetime of the GSLB: there is no need to query the Maxmind DB more than once per query, regardless of the number of rules considered, and results may be cached indefinitely.

For labels, one or more of the CONTINENT, COUNTRY, or SUBDIVISION categories may be chosen along with a label from that category. Schema is not configurable.
Any source match may be inverted. e.g. Match if IP does NOT match label.

As an example, assume that the following set of custom topology rules is configured and linked to an LBDN:

<table>
<thead>
<tr>
<th>Rule</th>
<th>Source Conditions</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTINENT IS &quot;North America&quot;</td>
<td>Pool Non_US_Pool</td>
</tr>
<tr>
<td></td>
<td>COUNTRY IS_NOT &quot;United States&quot;</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>COUNTRY IS &quot;United States&quot;</td>
<td>Pool US_Pool</td>
</tr>
<tr>
<td>3</td>
<td>CONTINENT IS &quot;North America&quot;</td>
<td>Pool NA_Pool</td>
</tr>
<tr>
<td>4</td>
<td>SUBNET IS_NOT 173.194.33.0/24</td>
<td>Pool DEFAULT_Pool</td>
</tr>
</tbody>
</table>

This isn't exactly a realistic configuration but it's illustrative:
• A rule matches only if all source conditions match, so the US won't match rule #1 despite being in North America.
• Rules are matched in order, so rule #3 will never be used.
• Subnet rules ignore the GeoIP database, so any other traffic that isn't from the 173.194.33.0/24 network will be directed to the default Pool.
Falling of the end of the list invokes either the alternate LB method, if any, or returns content from DNS without GSLB otherwise.

DTC Pools

DTC Pools contain one or more DTC Servers. All of the Servers in a Pool are typically in the same geographical location, but there is not a requirement. Clients are directed to a Pool using the selected Load Balancing Method. Pools may be used by multiple LBDNs. Pools can be disabled while in use and this affects all LBDNs using them. A Pool cannot be disabled if it is the last non-disabled Pool for any LBDN using it. A Pool cannot be deleted while in use. The Pools must be removed from every LBDN using them before these can be deleted. Pool in use must contain at least one enabled DTC server. The primary and alternate load-balancing methods of a Pool may not be the same, though load balancing method TOPOLOGY can be used as primary and alternate with different rulesets. Pools can be configured without health monitors.

Topology Ruleset

A topology rule maps a client IP address to a DTC Pool or Server. Topology Rulesets include Geography Rules or Subnet Rules which direct DNS clients to appropriate Pools or best available DTC Servers. Upon receiving a DNS query and after determining that the query belongs to a FQDN that is part of Load Balanced Domain Name (LBDN), the rules in the corresponding Topology Ruleset are evaluated in order and the first match with an available destination is used. The method fails if there are no matches. An LBDN can use only Topology Rulesets with Pool as the destination and a Pool can only use Topology Rulesets with Server as the destination.

DTC Load Balanced Domain Name (LBDN)

A DTC LBDN is a DTC object that is used by DNS Traffic Control to process DNS queries for load-balanced resources. Multiple LBDNs can be defined on the NIOS appliance and multiple patterns can be defined per LBDN. Permissions and extensible attributes can be configured for the LBDNs. Multiple Pools and a single load balancing method for Pools can be assigned to an LBDN. For example, two LBDNs can co-exist such as www.xyzcorp.com and ftp.xyzcorp.com and can have their own Pools and load balancing methods. So when a dns query is received by NIOS for www.xyzcorp.com or ftp.xyzcorp.com, the load balancing method for the LBDN is checked and based on the source of dns client the query is directed to appropriate Pool for the LBDN after parsing through the configured ruleset. The load balancing method for the Pool is again checked and the query is then directed to the appropriate Server based on the assigned ruleset.

DTC Health Monitors

Health monitors determine the availability of DTC servers and help route application traffic to the best available Servers. Health monitors are associated with the Pools. Every health monitor checks each Server that is associated with the Pool. NIOS supports pre-defined monitors and new custom health monitors can be created.

DTC Use Cases

The following two use cases are pretty common.

a. Load balancing DNS resources over the internet
b. Load balancing DNS resources for internal enterprise network

c. The DR use case

Load Balancing DNC resources over the Internet

In this use case the DNS resources (LBDNs) are load balanced using Geography rule with the assistance of built-in Maxmind database. The database has the information about which IP address blocks belong to which Geographical area of the world. Current built-in Maxmind Database can identify an IP address at the Continent, Country and Subdivision levels. When a DNS query comes in, the Maxmind database understands the global
location of the source of the DNS query and based on the Topology Ruleset configured for the LBDN, the query is
directed to an appropriate Pool. The Pools also use the Maxmind database and Topology Rulesets to further
direct the DNS query to appropriate DTC Servers.

For example, an Admin can configure an LBDN to use a Topology Ruleset, which directs DNS queries to either a
Europe Pool or a North America Pool. The Maxmind database is going to help in determining the origin of the
DNS query. If the DNS query originates from within Europe, it is directed to Europe Pool. For all queries
originated from North America, the destination Pool is going to be North-America Pool.

Both the Europe and North America Pools can be configured to further direct queries to the appropriate Server
based on the Client’s location. For example, if the query originated from the UK, the DTC configuration can direct
it to the UK Datacenter Server and if it originated from any European country other than UK it is directed to the
Paris Datacenter server. It boils down to what a user wants to achieve in terms of load balancing a DNS resource.

Load Balancing DNS resources for internal enterprise network

The enterprises can load balance application traffic using Infoblox DTC feature based on the subnet of origination
for a DNS query. Instead of using Geography rules in Topology Ruleset, the subnet rules are used. The
enterprise use case generally is for internally routable IP addresses; hence there is no need to get MaxMind
database involved. A single Grid can be used to deploy all DTC use cases. Though if you have a custom
MaxMind database, you could have both external, and RFC1918 addresses

A simple example of this use case is two subnet rules as follows,

Subnet Rule-1 if the DNS query is originated from subnet1, it is directed to Pool1. Then Pool1 directs dns query
to respective DTC servers based on load balancing method configured (Ratio, Round Robin or Global Availability)

Subnet Rule-2 if the dns query is originated from subnet2, it is directed to Pool2. Then Pool2 directs dns query
to respective DTC servers based on load balancing method configured (Ratio, Round Robin or Global Availability)

The DR Use case

This use case is for Disaster Recovery. In case the Primary Datacenter goes down, the application traffic can be
directed to the Backup Datacenter. The load balancing method used in this use case is Global Availability. The
idea is to have all traffic go to the Primary Datacenter as long as it is available. If the Primary Datacenter ever
goes down, then all traffic will be directed to the Backup Datacenter. When the Primary Datacenter comes back
online, all traffic will again be directed to the Primary Datacenter.

Deploying DTC

We are going to use “Load balancing DNS resources over the internet” as an example. In this use case there are
four Data Center Servers

• London
• Paris
• New York
• San Francisco

The two DTC Servers London and Paris are going to be part of Europe Pool and New York and San Francisco
DTC Servers are going to be part of North-America Pool.

The LBDN is going to be configured for FQDN www.xyzcorp.com

The following steps are required to bring up this DTC use case;

• Configure DTC Servers
• Configure Server Topology Rulesets for DTC Pools
• Configure DTC Pools
Configure Pool Topology Ruleset for LBDN
Configure LBDN

Configure DTC Servers
In our example we are going to add four DTC Servers with the following names and IP addresses
Paris Datacenter – 10.60.31.7
London Datacenter – 10.60.31.8
New-York Datacenter – 10.60.31.9
SFO Datacenter – 10.60.31.10
To add and configure DTC Servers go to

1. Go to Data Management > Traffic Management > Traffic Management

2. From Toolbar, Click Add > DTC Server

3. In DTC Server Wizard, fill the fields as follows,
   Name - Paris Datacenter
   Host – 10.60.31.7

4. Click Save & Close
Repeat steps 2 to 4 to add the remaining three DTC Servers in our example. Once all servers are added the Traffic Management tab is going to show all four servers as shown below,

Configure Server ruleset for DTC Pools

In our example we are going to configure two Server Topology Rulesets, one for North-America Pool and the other for Europe Pool. The Topology Rulesets are named North-America-Ruleset and Europe-Ruleset.

The North-America-Ruleset is going to have two rules as follows,

- Rule 1: If the source DNS query is from USA, then the destination is New York Datacenter
- Rule 2: If the source DNS query is from North America and not from USA, then the destination is SFO Datacenter

The Europe-Ruleset is going to have two rules as follows,

- Rule 1: If the source DNS query is from United Kingdom, then the destination is London Datacenter
- Rule 2: If the source DNS query is from Europe and not from United Kingdom, then the destination is Paris Datacenter

To configure the Topology Rulesets for DTC Pools, follow the steps below,

5. Go to Data Management > Traffic Management > Topology

6. From Toolbar, Click Add > Add Ruleset
7. In Ruleset Wizard fill the fields as follows

   Name – North-America-Ruleset

   Destination Type – Server

8. Click + drop down menu > Geography Rule

9. Under Rules Section, Select Continent as North America and Country as United States

10. Click Select for Destination

11. This will bring up DTC Server Selector window

12. Select New-York Datacenter from the list of DTC Servers

13. Click Add
14. Now we are going to add Rule-2
15. Click \+ drop down menu > Geography Rule

16. Under Rules Section, Select Continent as North America
17. Click Select for Destination

18. This will bring up DTC Server Selector window

19. Select SFO Datacenter from the list of DTC Servers
20. Click Add

21. Click Save & Close

By following steps 6 to 22, we add Europe-Ruleset so that it is configuration looks like the one shown below,
Configure DTC Pools

In our example, we are going to configure two DTC Pools named North-America-Pool and Europe-Pool. North-America-Pool is going to use Topology load balancing method and North-America-Ruleset for rules. It is going to have DTC Servers New-York Datacenter and SFO Datacenter as its Pool members.

Europe-Pool is also going to use Topology load balancing method and Europe-Ruleset for rules. It is going to have DTC Servers London Datacenter and Paris Datacenter as its Pool members.

To configure DTC Pools,

Go to Data Management > Traffic Management > Traffic management

From Toolbar, Click Add > DTC Pool

In DTC Pool Wizard type North-America-Pool in the Name field.
Click Next

Select icmp, http and snmp from Available section and move them to Active section as health monitors

Select All under Availability Requirements

Click Next

Select Preferred Load Balancing Method as Topology

Select North-America-Ruleset under Topology-Ruleset

Click Next

Click + drop down menu to add New-York Datacenter and SFO Datacenter as Pool Members from the list under DTC Servers Selector

Click Save & Close

Similarly we are going to add second DTC Pool Europe-Pool.

From Toolbar, Click Add > DTC Pool
In DTC Pool Wizard type Europe-Pool in the Name field.

Click Next

Select icmp, http and snmp from Available section and move them to Active section as health monitors

Select All under Availability Requirements

Click Next

Select Preferred Load Balancing Method as Topology

Select Europe-Ruleset under Topology-Ruleset

Click Next

Click + drop down menu to add Paris Datacenter and London Datacenter as Pool Members from the list under DTC Servers Selector
Configure Pool Topology Ruleset for LBDN

In our example we are going to configure a ruleset for the LBDN named Global-Ruleset with destination as Pool.

The ruleset is going to have two rules as follows,

- Rule 1: If the source DNS query is from North America, then the destination is North-America-Pool
- Rule 2: If the source DNS query is from Europe, then the destination is Europe-Pool

To configure the Topology ruleset for LBDN follow the steps below,

Go to Data Management > Traffic Management > Topology

From Toolbar, Click Add > Add Ruleset

In Ruleset Wizard fill the fields as follows

Name – Global-Ruleset

Destination Type – Pool

To add rule 1, Click + drop down menu > Geography Rule
Under Rules Section, Select Continent as **North America**

Click **Select** for Destination

This will bring up **DTC Pool Selector** window

Select **New-America-Pool** from the list of DTC Pools

Click **Add**

Now we are going to add **Rule-2**

Click **+ drop down menu > Geography Rule**

Under Rules Section, Select Continent as **North America**

Click **Select** for Destination

This will bring up **DTC Pool Selector** window
Select **Europe-Pool** from the list of DTC Pools

Click **Add**

Configure LBDN

In our example we are going to create a Load balanced domain name [www.xyzcorp.com-LBDN](http://www.xyzcorp.com-LBDN). This LBDN is going to load balance DNS queries that match pattern `*.xyzcorp.com` for authoritative zone [xyzcorp.com](http://xyzcorp.com). The Topology Ruleset used is [Global-Ruleset](http://Global-Ruleset) and the associated Pools are **Europe-Pool** and **North-America-Pool**.

To configure LBDN named [www.xyzcorp.com-LBDN](http://www.xyzcorp.com-LBDN),

Go to **Data Management > Traffic Management > Traffic Management**

From Toolbar, Click **Add > DTC LBDN**

In **DTC LBDN** wizard fill the field as follows,

- **Display Name** – [www.xyzcorp.com-LBDN](http://www.xyzcorp.com-LBDN)
- Click **+** to add Pattern `*.xyzcorp.com`
- Select **Topology** as **Load Balancing Method**
- Select **Global-Ruleset** as the **Topology Ruleset**
Click Next

Leave default selection of A and AAAA checked under Return these record types for the associated zones:

Click + to add xyzcorp.com as Associated Zones from Zone Selector window by clicking on xyzcorp.com from the list

Click Next

Click + to add Pools Europe-Pool and North-America-Pool from DTC Pool Selector window

Click Save & Close

**DTC LBDN Visualization**

Since pictures speak louder than words, Infoblox NIOS provides a status function where an administrator can visualize the hierarchy of DTC objects along with the configuration status.

In our example, we are going to see the Traffic Management structure of our configured DTC LBDN named www.xyzcorp.com-LBDN by clicking on the gear icon next to the DTC LBDN and selecting LBDN Visualization > www.xyzcorp.com-LBDN
This takes us to a page with graphical representation of the selected DTC LBDN.

The Legend shows colors that provide the status of the DTC LBDN, for example Green means everything is running. The traffic management structure is an inverted tree representation with its root at DTC LBDN. In our example, the root is branching out to two DTC Pools named Europe-Pool and North-America-Pool, which are further, branched out to their respective DTC Server members. We can click on any of the DTC objects to view the next DTC objects under it. For example, we can click on North-America-Pool to view DTC objects under it as shown below,

To get out of the Traffic Management Structure view we can click x on right hand corner.

**Test DTC LBDN**

Infoblox NIOS provides a testing function to test the DTC response for the respective LBDN. This way the configuration of the DTC LBDN is validated. Only Infoblox LBDNs can be tested using this option.

To test an LBDN,

Go to Data Management > Traffic Management > Traffic Management tab

Select the LBDN object to test. In our example it is **www.xyzcorp.com-LBDN**. Click Test DTC LBDN option in Toolbar.
As an administrator we know that the expected result of our DTC configuration is as follows:

- If DNS query source is United Kingdom then DTC Server London Datacenter is returned in DNS query response
- If DNS query source is USA then DTC Server New-York Datacenter is returned in DNS query response
- If DNS query source is Europe, but, not United Kingdom, then DTC Server Paris Datacenter is returned in DNS query response
- If DNS query source is North America, but, not USA, then DTC Server SFO Datacenter is returned in DNS query response

In our example, the DTC feature is running on a member with hostname `ns1.contoso1.com`. In the Test DTC LBDN dialog box, complete the following to simulate DNS query source from United Kingdom,

Query Source – 5.2.96.10
Query Name – www.xyzcorp.com
Member – ns1.contoso1.com
Record Type – A

Click Start

The result shows the DNS Query response returns the IP address (10.60.31.8) of London Datacenter. This validates the configuration where anything originating from United Kingdom is directed to London Datacenter.

Similarly, we can validate the rest of the configuration by simulating DNS query source from USA, North America (not USA) and Europe (not United Kingdom).

We can use Clear button to clear the results of DTC test.

**Obscured Records**

If you have a DNS record that matches an LBDN, it is termed as an obscured record. It will be returned if the DNS Server queried does not have DTC configured/enabled, or it will be returned if there is no Server or Pool topology match. This can be used as a record of last resort.