DNS and NSLookup

Lesson Overview

Introduction

DNS entries and the NSLookup utility are used to troubleshoot SMTP related mail issues. NSLookup is available on most server based platforms and can be a great help in determining where the problem lies, often times, outside of Domino.

If you have determined that your SMTP problem is with receiving Internet mail or sending mail to a particular Internet domain, you will want to use NSLookup to evaluate DNS records. Telnet is often used after analyzing the DNS records to test connectivity.

Objectives

After completing this lesson, you will be able to…

- Explain how Domino uses DNS MX and A records to route Internet mail
- Explain the purpose of NSLookup in troubleshooting an Internet routing issue
- Use NSLookup to evaluate a particular domain for the MX record with the lowest preference
- Use NSLookup to evaluate a particular domain for the DNS A record
- Use NSLookup to list all the DNS records for a particular domain

In this Lesson

This lesson is divided into the following topics:

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</tr>
</thead>
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</tbody>
</table>

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Lesson Overview, Continued

Timing

The timing of this lesson’s components is as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Approximate Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lessons/Lesson Overview</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Exercise</td>
<td>30 minutes</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>1 hour</strong></td>
</tr>
</tbody>
</table>
Introduction to DNS and NSLookup

Overview
Improperly configured or missing DNS (Domain Name Service) records are a common cause of Internet routing issues.

NSLookup is a tool for evaluating whether DNS records are properly configured.

NSLookup
NSLookup (Name Server Lookup) is a command-line executable (NSLOOKUP.EXE) that is available on most server-based platforms, including:

- Windows NT 4.0, Windows 2000 and Windows XP
- OS/400 (iSeries) and OS/390 (zSeries)
- UNIX platforms

NSLookup.exe was not included with Windows 95 or Windows 98.

DNS
One way to define DNS is a directory that is used by SMTP servers such as Domino to:

- Convert an Internet domain name, such as acme.com, to a list of servers that can receive connections (and mail) for that name
- Find the IP address of a specific server in another Internet domain

Inbound Issues
Most often, DNS issues result in problems with receiving inbound Internet mail. As a result, NSLookup is most often used to troubleshoot inbound Internet routing issues.

NSLookup is used to troubleshoot an outbound Internet issue only when the problem is specific to sending to a particular Internet domain (or set of domains).

These points will become increasingly clear as we proceed through this lesson.
Records Found in DNS

**DNS Records**
When you use NSLookup to evaluate the DNS configuration for an Internet domain, your objective is to evaluate particular DNS records for that domain.

The DNS records that are most important to Domino for routing Internet mail are MX records and A records. These two DNS record types are explained on the next page. Additional DNS records are discussed in later pages of this lesson.

**DNS Servers: Internal versus External**
When you execute NSLookup at the command prompt, the DNS server that will be queried is taken from the Internet (TCP/IP) Properties setting on the particular machine you are using. It is not uncommon that when querying for certain DNS records, the result will vary depending on the DNS server that is queried. Often times, there will be internal DNS servers and external DNS servers for a domain. It is important to note that the internal and external DNS servers may be out of sync and may not always produce the same results.

**Determining Which Server is Being Queried**
The DNS server that is queried will be noted when you execute NSLookup. The screenshot below depicts the server that will be used to perform the queries.

Continued on next page
Records Found in DNS, Continued

Querying a Different Server

It is possible to point to a different DNS server for your queries. To do this, from within NSLookup, issue the server command along with the hostname or IP Address of the server you’d like to query. For additional options within NSLookup, enter help or ? at the command prompt.

Why Query Another Server?

Often times, during troubleshooting DNS related issues, you may need to point to different DNS server to verify the records stored there. This would be done, most frequently when Internal and External DNS servers are in use. Some servers may be routing fine and others not. By pointing to another server to verify the records, you may find that certain records are not present on one DNS server yet they are available on another.

Continued on next page
MX Records

MX (Mail eXchanger) records are used to resolve the Internet domain name, such as acme.com, to a list of servers that can receive connections (and therefore mail) for that name.

Example:

The following screenshot shows the MX Records for us.ibm.com. There are 12 servers capable for receiving inbound SMTP mail for messages addressed to users@us.ibm.com.
Records Found in DNS, Continued

MX Preference
Each server listed with an MX record has an associated MX preference. An MX preference is similar to a Notes/Domino routing cost. Servers connecting to a domain attempt to connect first to the server with the lowest MX preference. If a connection cannot be established with a lower preference MX record, the next lowest MX record will be tried.

In the case of us.ibm.com, each of the MX’d hosts have the same MX preference. Domino will attempt to connect to the one of the hostnames presented by the DNS server, until a successful connection can be established.

A Records
A (Address) Records enable the process of finding the IP address for a specific server.

Example:
The following screenshot shows the A records for ibm.com. The domain name ibm.com has 6 different hosts associated with this domain name. The domain us.ibm.com does not have any A records.

How are MX and A Records Used?
Next, we will discuss how Domino uses MX and A records to route Internet mail.
How Domino Uses MX and A Records in DNS to Route Mail

Introduction

For a Domino server to route Internet mail to a domain, Domino must find either an MX or an A record for that domain in DNS.

Process Table

The following table explains the process by which a Domino server attempts to use MX and A records to connect to a server within a particular Internet domain.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Domino looks up the Internet domain part of the recipient’s address in DNS. In an address such as <a href="mailto:John_Sample@us.ibm.com">John_Sample@us.ibm.com</a>, the Internet domain is us.ibm.com.</td>
</tr>
<tr>
<td>2</td>
<td>Through DNS, Domino looks for an MX record for the Internet domain.</td>
</tr>
</tbody>
</table>

**IF DNS finds…**  **THEN Domino…**

<table>
<thead>
<tr>
<th>IF DNS finds…</th>
<th>THEN Domino…</th>
</tr>
</thead>
<tbody>
<tr>
<td>a single MX record for the domain</td>
<td>attempts to connect to the server listed in that MX record</td>
</tr>
<tr>
<td>multiple MX records with different MX preferences</td>
<td>attempts to connect to the server that has the lowest MX preference</td>
</tr>
<tr>
<td>multiple MX records with the lowest MX preference</td>
<td>randomly selects one of those MX records and attempts to connect to the server listed in that record</td>
</tr>
<tr>
<td>no MX records for the domain</td>
<td>attempts to find an A record for that domain (go to Stage 3)</td>
</tr>
</tbody>
</table>

When an MX record is listed for an Internet domain, Domino attempts for 24 hours to connect to and route messages to the server listed in that MX record. If, after 24 hours, Domino is still unable to route the message, Domino sends a non-delivery notification to the sender.

Continued on next page
How Domino Uses MX and A Records in DNS to Route Mail, Continued

Process Table (continued)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Through DNS, Domino looks for an A record for the Internet domain.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IF DNS finds…</th>
<th>THEN Domino…</th>
</tr>
</thead>
</table>
| an A record for the domain | attempts to route the message to the IP address in the A record.  
  
  **Note:** The presence of an A record does not guarantee that a server with that IP address is listening on Port 25. |
| no A record for the domain | Can not deliver the message and sends an immediate non-delivery notification to the sender. |

Checking for an MX or A Record

When Domino is not able to send Internet mail to particular domain, an early troubleshooting step is to check whether the domain has a valid MX or A record.

The tool for evaluating these DNS records is NSLookup. Over the next few pages, we’ll learn how to use NSLookup to verify DNS records.
How to Use NSLookup to Evaluate DNS Records

Overview
In this section, we discuss the procedure to use NSLookup to query and evaluate DNS records.

Note, however, that NSLookup is not the only tool for querying DNS records. There are many third-party products available from the web as well as websites that can provide DNS query tools for you to use.

Before You Begin
Before using the NSLookup procedure below, consider the following:

- This procedure is written for Windows 2000 and Windows NT 4.0
- NSLookup requires the TCP/IP protocol
- NSLookup is case-sensitive; no uppercase characters are accepted

Using NSLookup to Evaluate DNS
To evaluate DNS records using NSlookup, follow the steps in the table below.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From the <strong>Windows</strong> task bar, select <strong>Start, Run</strong>.</td>
</tr>
<tr>
<td>2</td>
<td>In the command line, type <strong>nslookup</strong> and press ENTER.</td>
</tr>
</tbody>
</table>

Result: The default server and its address display. (The default server is the server that is listed as the primary DNS server on your TCP stack.)

![Command Prompt - nslookup](image)

**Note:** The NSlookup executable (NSLOOKUP.EXE) can be launched a number of ways. If you prefer, you can launch NSlookup from a DOS prompt or configure a shortcut from the Windows desktop.

Continued on next page
## How to Use NSLookup to Evaluate DNS Records, Continued

### Using NSLookup to Evaluate DNS (continued)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
</table>
| 3    | Type **set type=<command>** and press ENTER.  
**Example:** To evaluate MX records, type **set type=mx** and press ENTER.  
**Result:** The cursor moves to the next line, as shown in the following screenshot:  
![NSLookupScreenshot](image)
| 4    | Type the domain you wish to query and press ENTER.  
**Example:** Type **us.ibm.com** and press ENTER.  
**Result:** The MX records for the specified domain (us.ibm.com) display, as shown in the following screenshot:  
![NSLookupScreenshot](image)

**Note:** If no MX records exist for a particular domain, the response shown in NSLookup depends on the platform. Details are provided further below.

*Continued on next page*
Using NSLookup to Evaluate DNS (continued)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Repeat steps 3 and 4 to evaluate other DNS records for either the same domain or a new domain.</td>
</tr>
<tr>
<td></td>
<td>Example: To evaluate the A record for us.ibm.com:</td>
</tr>
<tr>
<td></td>
<td>Type <code>set type=a</code> and press ENTER</td>
</tr>
<tr>
<td></td>
<td>Type <code>us.ibm.com</code> and press ENTER</td>
</tr>
<tr>
<td></td>
<td>Result: Notice there is no A record for the specified domain (us.ibm.com) displayed.</td>
</tr>
<tr>
<td></td>
<td>Note: When no A record exists for a particular domain, no Address line displays.</td>
</tr>
<tr>
<td>6</td>
<td>To exit NSLookup, type <code>quit</code> and press ENTER.</td>
</tr>
</tbody>
</table>

**Note:** To display all the commands that can be used in NSLookup, load the Help.

To load Help, type either `help` or `?` (the question mark) and then press ENTER.

---

No MX Records Found

As mentioned in Step 4, if no MX records are found for the specified domain, the results returned by NSLookup will depend on the platform. Some systems will report that the host can not be found or non-existent domain message.

*Continued on next page*
How to Use NSLookup to Evaluate DNS Records, Continued

DNS is Unavailable

While improperly configured DNS records are the most likely cause of DNS issues, another possible cause is that DNS itself is unavailable.

The following screenshot illustrates the results Administrators may see when they attempt to launch NSLookup, from within their own domain, when DNS is unavailable:

![NSLookup Screenshot](image)

Evaluating the Results of NSLookup

After evaluating DNS records using NSLookup, your next step depends on your findings. The following table lists the most common findings and appropriate next steps.

<table>
<thead>
<tr>
<th>IF you determine that an Internet domain...</th>
<th>THEN...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a valid MX record</td>
<td>Consider using Telnet to attempt connecting (on port 25) to the server with the lowest MX preference and send a test message.</td>
</tr>
<tr>
<td>Does not have a valid MX record exists, but does have an A record</td>
<td>Consider using Telnet to connect to the server at the IP address listed in the A record and send a test message.</td>
</tr>
<tr>
<td>Has neither a valid MX or A record OR is not available in DNS</td>
<td>Explain to the customer that there is a DNS issue that must be resolved before Domino can route Internet mail to that domain.</td>
</tr>
</tbody>
</table>

Note: Telnet is covered in a separate lesson.
Additional DNS Records and NSLookup Commands

Introduction
Although MX and A records are the DNS records you most often need to evaluate with NSLookup, there are circumstances in which you need to evaluate additional DNS records, including:

- NS records
- CName records
- PTR records
- All the DNS records available for a domain

NS Records
An NS (Name Server) record defines the DNS servers for a domain.

The set type command for NS records is `set type=ns`.

When to Check for NS Records
Consider checking the name servers when some of your SMTP servers within your internet domain are able to send mail to the Internet while other SMTP servers cannot. It may be that the SMTP servers are referring to different DNS servers. One of the DNS servers may have different (incorrect) DNS records.

After identifying the DNS servers (via type=NS), compare the records for the two servers to see if they are different.

Example:
The following screenshot shows that the ibm.com domain has 4 name servers. There are no NS records found for the domain name us.ibm.com, just for ibm.com.

```
> set type=ns
> ibm.com
Server: ns.watson.ibm.com
Address: 129.34.20.80
ibm.com nameserver = ns.almaden.ibm.com
ibm.com nameserver = internet-server.zurich.ibm.com
ibm.com nameserver = ns.austin.ibm.com
ibm.com nameserver = ns.watson.ibm.com
ns.austin.ibm.com internet address = 192.35.232.34
ns.watson.ibm.com internet address = 129.34.20.80
ns.almaden.ibm.com internet address = 190.4.83.35
internet-server.zurich.ibm.com internet address = 195.196.20.204
```

Continued on next page
### CNAME Records

A CNAME (Canonical NAME) record is an optional DNS record. A CNAME record is essentially an alias.

The set type command for CNAME records is: `set type=cname`

Many domains lack a CNAME. For example, if you query us.ibm.com for a CNAME, you will see the following response:

```plaintext
***No canonical name (CNAME) records available for us.ibm.com
```

### When to Check for CNAME Records

Check for a CNAME if you find that a particular domain does not have any MX records and the A record lists a different domain name than the one you originally entered.

### PTR Records

A PTR (PoinTeR) record is an optional record that maps an IP address to a host name.

The set type command for PTR records is: `set type=ptr`

PTR records are necessary when one domain must send mail on behalf of another. A common scenario is a business partner who sends mail on behalf of another company. Without a PTR record, mail sent by the business partner on behalf that other company will be rejected by servers that perform a “reverse lookup.”

A reverse lookup is a step taken by a remote host (the receiving host) to confirm that the host name and the IP address of the sending host match each other. Many servers perform reverse lookups as a way to eliminate SPAM.

### When to Check for PTR Records

Check for a PTR record when a customer is unable to send mail to a particular domain (or set of domains). Confirm the customer’s Internet domain has a valid PTR record so that their mail is not rejected as a result of a reverse lookup.

To check for Pointer records, set type=PTR. Be aware that most domains do not have PTR records and this is often the cause of many outbound mail failures. Adding a PTR records solves many reverse lookup failures.

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*Continued on next page*
All DNS Records for a Domain

To review all the DNS records for a particular domain at once, use the following NSlookup command:

```
set type=all  (or set type=any).
```

Example:

```
us.ibm.com NS preference = 10, mail exchanger = e33.co.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e34.co.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e35.co.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e36.co.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e1.ny.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e2.ny.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e3.ny.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e4.ny.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e5.ny.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e6.ny.us.ibm.com
us.ibm.com NS preference = 10, mail exchanger = e7.ny.us.ibm.com
```

Displaying Help

Remember, to display all the commands that can be used in NSlookup, either:

- Type `help` and press ENTER or
- Type `?` and press ENTER
Exercise: Using NSLookup to Evaluate DNS

Introduction
This exercise is designed to reinforce your understanding of DNS and NSLookup.

Timing
The timing for this exercise is as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Approximate Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>1 minute</td>
</tr>
<tr>
<td>Exercise</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Recap</td>
<td>9 minutes</td>
</tr>
<tr>
<td>Total:</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>

Intended Outcome
In completing this exercise, you will demonstrate your ability to…

- Explain how Domino uses DNS MX and A records to route Internet mail
- Explain the purpose of NSLookup in troubleshooting an Internet routing issue
- Use NSLookup to evaluate a particular domain for the MX record with the lowest preference
- Use NSLookup to evaluate a particular domain for the DNS A record
- Use NSLookup to list all the DNS records for a particular domain

Requirements
To complete this exercise, you need the following:

- NSLookup
- The procedure: How to Use NSLookup to Evaluate DNS Records
- A domain name ________________ (pick any internet domain name you will to search on)
- A pen

Instructions
There are two parts to this exercise.

- In Part 1, you will read a scenario and then use NSLookup to evaluate the DNS records for a particular domain.
- In Part 2, you will answer a set of questions about DNS and NSLookup.

Continued on next page
Exercise: Using NSLookup to Evaluate DNS, Continued

Scenario for Part 1

You have just received a call from your help desk who announces that “mail isn’t routing properly.” By asking the initial troubleshooting questions, you determine the following:

1. Internal: All internal NRPC mail routing is working fine.
2. External:
   - Outbound Internet mail is working fine.
   - Inbound Internet mail is not working at all.
3. Scope: The scope is at the level of the Internet domain. (No Internet messages are received.)
4. Errors: Apparently, some external people are getting non-delivery notification (NDN) errors when sending mail to the customer’s company, but the customer doesn’t know the syntax of the errors.
5. Versions: The Domino Servers are running Windows 2000, Domino version 6.5.4, and all clients are Notes 6.5.4.
6. Did it ever work: All mail used to route properly but inbound Internet mail suddenly began to fail yesterday.

You have also confirmed that the SMTP listener task is enabled. You realize that something may have changed with DNS. You decide to use NSLookup to evaluate the DNS records for your internet domain.

---

Table for Part 1

Use NSLookup to answer the following questions for the customer’s domain.

<table>
<thead>
<tr>
<th>#</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What are the MX records for your domain? Which has the lowest preference?</td>
</tr>
<tr>
<td>2</td>
<td>What is the A record for your domain?</td>
</tr>
<tr>
<td>3</td>
<td>Does your domain include a PTR record? If so, what is it?</td>
</tr>
</tbody>
</table>

Continued on next page
Exercise: Using NSLookup to Evaluate DNS, Continued

Table for Part 1 (continued)

<table>
<thead>
<tr>
<th>#</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Does your domain include a CNAME record? If so, what is it?</td>
</tr>
<tr>
<td>5</td>
<td>What are the NS records for your domain?</td>
</tr>
<tr>
<td>6</td>
<td>What other DNS records do you see for your domain when you use the set type=all command?</td>
</tr>
</tbody>
</table>

Part 2
Answer the following general questions on NSLookup and DNS.

Question 1
What is the value of NSLookup in troubleshooting a routing issue?

Answer

Question 2
How does Domino use MX and A records to route mail to an Internet domain?

Answer

Question 3
How do MX preferences influence which server Domino attempts to connect to?

Answer

Continued on next page
Exercise: Using NSLookup to Evaluate DNS, Continued

**Question 4**
What happens when Domino, in attempting to send a message to an Internet domain, doesn’t find through DNS either an MX or an A record for that domain?

**Answer**

**Results**
You have demonstrated your ability to...

- Explain how Domino uses DNS MX and A records to route Internet mail
- Explain the value of NSLookup in troubleshooting an Internet routing issue
- Use NSLookup to evaluate a particular domain for the MX record with the lowest preference
- Use NSLookup to evaluate a particular domain for the DNS A record
- Use NSLookup to list all the DNS records for a particular domain