

How to Troubleshoot Black Hole Router Issues

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For a Microsoft Windows 2000 version of this article, see [159211](http://support.microsoft.com/kb/159211/EN-US/) (<http://support.microsoft.com/kb/159211/EN-US/>).

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IMPORTANT: This article contains information about modifying the registry. Before you modify the registry, make sure to back up and make sure that you understand how to restore the registry if a problem occurs. For information about how to back up, restore, and edit the registry, click the following article number to view the article in the Microsoft Knowledge Base:

[256986](http://support.microsoft.com/kb/256986/EN-US/) (<http://support.microsoft.com/kb/256986/EN-US/>) Description of the Microsoft Windows Registry

SUMMARY

This article defines the term "black hole" router, describes a method of locating black hole routers, and suggests three ways to avoid the data loss that can occur because of a black hole router.

MORE INFORMATION

On a TCP/IP-based wide area network (WAN), communication over some routes may fail if an intermediate network segment has a maximum packet size that is smaller than the maximum packet size of the communicating hosts -- and if the router does not send an appropriate Internet Control Message Protocol (ICMP) response to this condition or if a firewall on the path drops such a response. Such a router is sometimes known as a "black hole" router.

You can locate a black hole router by using the Ping utility, which is a standard utility that is installed with the Microsoft Windows TCP/IP protocol. You can then use one of three methods of fixing or working around black hole routers.

When a network router receives a packet that is larger than the size of the Maximum Transmission Unit (MTU) of the next segment of a communications network, and that packet's IP header "do not fragment" bit is flagged, the router is expected to send an ICMP "destination unreachable" message back to the sending host.

If the router does not send a message, the packet might be dropped, causing a variety of errors that vary with the program that is communicating over the unsuccessful link. (These errors do not occur if a program connects to a computer on a local subnet.) The behavior may seem intermittent, but closer examinations show that the behavior can be reproduced, for example, by having a client read a large file that is sent from a remote host.

Client-side Error

The client could not establish a connection to the remote computer. The most likely causes for this error are:

- Remote connections cannot be enabled at the remote computer.
- The maximum number of connections is exceeded at the remote computer.
- A network error occurs while establishing the connection.
 - Server-side Error: Event ID 1004
 - Source: TermService
 - Description: "The terminal server cannot issue a client license. It was unable to issue the license due to a changed (mismatched) client license, insufficient memory, or an internal error. Further details for this problem may have been reported at the client's computer."

Locating a Black Hole Router

You can use the Ping utility to locate a black hole router, by setting the `-f` and `-l` parameters when you type the `ping` command.

- The `-f` parameter causes the Ping utility to send an ICMP Echo packet that has the IP "do not fragment" bit set.
- The `-l` parameter sets the buffer, or payload, size of the ICMP Echo packet. You specify this size by typing a number after the `-l` parameter.

The largest buffer that can be sent unfragmented is equal to the smallest MTU that exists along a route, minus the IP and ICMP headers (in other words, the smallest MTU minus 28). For example, Ethernet has an MTU of 1,500 bytes, so under the best circumstances, the Ping utility can echo an unfragmented packet, plus an ICMP buffer, of 1,472 bytes (1,500 minus 28). The syntax for the `ping` command in this case is:

```
ping computer_name or IP_address -f -l 1472
```

For all local IP addresses, the expected results are as follows:

- If the MTU of every segment of a routed connection is at least 1,500, the packet is successfully returned.
- If there are intermediate segments that have smaller MTUs, and the routers return the appropriate ICMP "destination unreachable" packet, the Ping utility displays the message, "Packet needs to be fragmented but DF set."
- If there are intermediate segments that have smaller MTUs, and the routers do not return the appropriate ICMP "destination unreachable" packet, the Ping utility displays the message, "Request timed out."

By increasing the `-l` parameter on successive pings, you can identify how large an unfragmented packet can travel a specific route. The smallest MTU that is in general use is 576 bytes, so you can safely start with an ICMP buffer of 548 and then work up from there. For example, if the command `ping computer_name or IP_address -f -l 972` returns packets but `ping computer_name or IP_address -f -l 973` does not return packets, the largest MTU on that route is 1,000 (972 plus 28). The default MTU of common network media are described in the following article in the Microsoft Knowledge Base:

[314496](http://support.microsoft.com/kb/314496/EN-US/) (<http://support.microsoft.com/kb/314496/EN-US/>) Default MTU Size for Different Network Topology

Fixing or Working Around a Black Hole Router

WARNING: If you use Registry Editor incorrectly, you may cause serious problems that may require you to reinstall your operating system. Microsoft cannot guarantee that you can solve problems that result from using Registry Editor incorrectly. Use Registry Editor at your own risk.

The following three methods are ways to either fix or work around a black hole router.

Method 1

Enable PMTU Black Hole Detection on the Windows-based host that will be communicating over a WAN connection. Follow these steps:

1. Start Registry Editor (Regedit.exe).

2. Locate the following key in the registry:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\tcpip\parameters
```

3. On the `Edit` menu, click `Add Value`, and then add the following registry value:

ValueName: EnablePMTUBHDetect
 DataType: REG_DWORD
 Value: 1

4. Quit Registry Editor, and then restart the computer.

Method2

Configure intermediate router to send ICMP Type 3 Code 4 messages ("destination unreachable, don't fragment (DF) bits sent and fragmentation required"). This might require rear router software or firmware upgrade, router reconfiguration, or router replacement.

Method3

Set the MTU of the host interface to be the largest size that the black hole router can handle, to guarantee that the largest possible packets size is sent over that connection. However, note that local traffic then uses smaller packets than necessary, as will traffic that uses the routed connections without problems.

This work around assumes that you have identified the MTU and the state of all possible links that the host might use. After you identify the largest MTU size that is supported, manually set the MTU. Follow these steps:

1. Click **Start**, and then click **Control Panel**.
2. Double-click **Network and Internet Connections**, and then click to open the **Network Connections** folder.
3. If more than one network connection is listed, for each connection, double-click the connection and then click the **Support tab** of the **Status** interface that opens. The connection that shows a **Default Gateway** entry is probably the network connection that is used to connect to the Internet. Note the name of the connection (for example, "Local Area Connection2").
4. Start Registry Editor (Regedit.exe).
5. Under the **HKEY_LOCAL_MACHINE** tree, go to the following key:
`SYSTEM\CurrentControlSet\Control\Network\{4D36E972-E325-11CE-BFC1-08002BE10318}\`
6. Under that key are one or more keys that have numeric identifiers. Each of these keys has a **Connection** subkey. Examine each of the keys that look like this:
`ID_for_Adapter\Connection`
 The **Name** value in the **Connection** subkey provides the network connection name that is used in the **Network Connections** folder. When you find the one that matches the name that you found in step 3, make a note of the **ID_for_Adapter** that the network connection name is under.
7. Return to **HKEY_LOCAL_MACHINE**, and then locate the following key
`SYSTEM\CurrentControlSet\Services\Tcpip\Parameters\Interfaces\ID_for_Adapter`
 where **ID_for_Adapter** is the number that you noted in step 6. When you highlight this key, several values appear on the right side of the screen, including **DefaultGateway** and **EnableDHCP**.
8. Right-click the right side of the screen, click **New**, and then click **DWORD Value**. Name the value **MTU**.
9. Double-click the value so that you can edit the value, change **Base** to **Decimal**, and then enter the largest acceptable MTU size, which is the size that you identified by using the Ping tests.
10. Quit Registry Editor.

Note that if you still encounter problems with some servers, you might need to set the MTU lower than the Ping tests indicate because of other routers in that specific path. Repeatedly lower the MTU by 10 until access to those sites is successful.

For additional information manually setting the MTU, click the article number below to view the article in the Microsoft Knowledge Base:

[314053](http://support.microsoft.com/kb/314053/EN-US/) (<http://support.microsoft.com/kb/314053/EN-US/>) TCP/IP and NBT Configuration Parameters for Windows XP

For additional information, see Internet RFC 1191 and RFC 1435, which are available from the following Internic Website:

<http://www.internic.net/> (<http://www.internic.net/>)

APPLI ESTO

- Microsoft Windows XP Home Edition
- Microsoft Windows XP Professional

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