Analyzing Network Errors on SQL Server
# TABLE OF CONTENTS

BACKGROUND ........................................................................................................................................ 3  
PURPOSE OF THIS DOCUMENT ............................................................................................................ 3  
ERROR SYMPTOMS .................................................................................................................................. 3  
PROBLEM SOLVING APPROACH AND TOOLS ....................................................................................... 4  
KNOWN PROBLEM AREAS ..................................................................................................................... 6  
Virtual Machine Usage .......................................................................................................................... 6  
HP Hardware .......................................................................................................................................... 6  
Windows Server 2003 ............................................................................................................................. 6
BACKGROUND

Using an SQL Server platform to run SAP applications in a variety of usage scenarios has occasionally lead to either the applications, or SQL Server, reporting networking errors, disconnects or hanging situations. These errors can be seen as entries in SQL Server error logs, dev_w files, or Java system logs. Error conditions such as hanging client processes; a process which is doing no work and cannot be assigned, but has not reported an error in a log file, have also been observed.

SAP notes have been written as problems have arisen and solutions identified. Some SAP notes contain problem solving approaches which are not optimal, like using a different communication protocol besides TCP, to get an SAP upgrade past a critical step, but are not really a long term recommended solution. The proliferation of SAP notes, its specific purpose and age, which can be surmised by its number, must be considered when consulting SAP notes related to networking problems.

The source of networking errors is almost always not from either SQL Server or client software, but from networking failures at or below the operating system level; Network Interface Cards (NICs), routers, cables, switches, their configuration, their drivers, the firmware, or the bios. Most of the cases experienced to date have been finally resolved by alteration of one of these networking components.

PURPOSE OF THIS DOCUMENT

The primary purpose is to make the reader aware of three broad sources of networking issues which have been identified:
1) Virtual Machine Usage
2) NICs and drivers in certain HP Servers
3) Windows Server 2003 Features

If a system experiencing errors operates in one of these three environments, readers are urged to skip to the Section entitled Known Problem Areas and consult the SAP notes mentioned within the appropriate section. The reason is adjusting these environments is relatively simple and has demonstrated positive effects. Pursuing one of these known solutions is more productive then doing the detailed data gathering and analysis which must be done to address a networking problem caused by some unknown catalyst.

A secondary purpose of this document is to identify useful SAP notes which can be used as a reference. Finally, the information that is required to analyze a networking problem is defined.

ERROR SYMPTOMS

Network errors can be recorded in various logs for either SQL Server or the connecting client, or can create hanging situations. Hanging situations can be identified by noticing the following situation. In transaction SM50 there will be a work process continually accumulating elapsed time. At the same time, the transaction DBACOCKPIT -> Performance -> Database Processes with the checkbox Active Requests Only selected will show that there are not any active requests associated with the work process identified above. If SM50 and the DBACOCKPIT are not available, then note the pid of the process which is suspected of being stuck in a database activity. Using the SQL Server Management Studio, one can then consult the compatibility view sys.sysprocesses. If this view shows no spids associated with the pid which are accumulating CPU time and the last_batch column shows some period of time has gone by without a batch being submitted, then a hanging situation has happened. Subsequent refreshes of a select from sys.sysprocesses will show these two columns, CPU and last_batch, not changing. Meanwhile on the client side it will appear as if the application is waiting for a result set. Further detailed tracing of the client library can show that calls to read a socket are just sitting there, waiting for some input. For a Java client, a thread will be runnable but will be waiting on method java.net.SocketInputStream.socketRead0().

The SQL Server errors which can occur in the client logs (dev_w files for an ABAP system) are as follows:
SQL Server 0 and SQL Server 11 errors signify a disconnection between client and Server and can appear in the SQL Server Error log or in dev_w files of the client. In the dev_w files these errors will often be accompanied by the SAP error DBIF_RSQL_SQL_ERROR. The SQL Error 10054 errors put the work process in a reconnect status. On the server side, a SQL Error 11 can be caused by a networking error or other condition. See SAP Note 884809 for more information about SQL Error 11—General Network Error.

Usually when the person responsible for SAP application functionality or performance becomes aware of a networking error or hanging situation, their next step is to consult the company’s networking infrastructure team. Often times this team will come back with the pronouncement that “the network is fine. It must be an application problem.” While technically it is true that the network is fine, it is also true that the requirements the application or the operating system are placing on the network infrastructure occasionally generate a condition in which the delivery requirements of packets required by the Transmission Control Protocol (TCP) are not being met. Gathering as much data as possible about the operating conditions which exist at the time of the failure will help in tracking down a root cause.

### PROBLEM SOLVING APPROACH AND TOOLS

If the three known causes of networking errors discussed in the Known Problem Areas section have been eliminated as the source of the error, then the following general procedure should be followed, and mentioned tools used.

First it should be recorded when and where the network errors occur. The following list of questions should be answered.

- Are errors reported in the SQL Server error log or are they present on the client in dev_w files on Java logs?
- Do the errors occur at the same time every day or are they sporadic in nature?
- What is the load like on the SAP system when the errors occur? Record the general state of the system at the time of the errors; have batch jobs been started, backups, virus scanner processes occurring.
- Did the errors just start occurring and if so, what changes have occurred in the environment recently?
- Something as seemingly unrelated as the addition of another virtual machine on the same physical server could cause a loss of resources to the virtual machine hosting the SAP application server. Has the physical machine hosting the virtual machine changed?

Once all data related to the occurrence of networking error is documented the type of client software connecting to SQL Server should be documented. Record the release and version. The following possibilities exist:

<table>
<thead>
<tr>
<th>SQL Server Error</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQL Server 0</td>
<td>Represents a number of different error conditions</td>
</tr>
<tr>
<td>SQL Server 11</td>
<td>General network error</td>
</tr>
<tr>
<td>SQL Server 10054</td>
<td>TCP Provider: An existing connection has been forcible closed</td>
</tr>
<tr>
<td>SQL Server 121</td>
<td>TCP Provider: The semaphore timeout period has expired</td>
</tr>
</tbody>
</table>
Analyzing Network Errors on SQL Server

1. **SNAC ODBC driver**
   - SAP Note 1082356 - Using the ODBC based DBSL for Microsoft SQL Server
   - SAP Note 1831774 - Native ODBC driver version check

2. **JDBC driver**
   - SAP Note 1745895 - Available Microsoft JDBC drivers

3. **Linux driver**
   - SAP Note 1644499 - Database connectivity from Linux to SQL Server

A source of information which should be consulted because it exists and can be checked inexpensively is the DMV `sys.dm_os_ring_buffers` defined in SQL Server 2005 and later releases. The following query can be run to check for errors:

```sql
SELECT COUNT(*)
FROM sys.dm_os_ring_buffers
WHERE ring_buffer_type = 'RING_BUFFER_CONNECTIVITY'
```

If there are records returned, the following query can be executed:

```sql
SELECT CAST(record AS XML)
FROM sys.dm_os_ring_buffers
WHERE ring_buffer_type = 'RING_BUFFER_CONNECTIVITY'
```

An interesting link to consider when analyzing results is:


If nothing is found in the DMV then the SAP provided tool NIPING can be used for checking the health of a network. NIPING is explained in SAP Note 500235 - Network Diagnosis with NIPING. SAP Note 1109026 FAQ: Network performance gives some good information about NIPING also. It is required to run NIPING as a server process and then to run NIPING as a client process.

- **Server process**: `niping -s -1 0`
- **Client Process**: `niping -c -H <nipingsvr> -B 20 -D 12000 -L 1200 with smaller buffer size`
- **Client Process**: `niping -c -H <nipingsvr> -B 10000 -D 12000 -L 1200`

Further information about niping can be found here:


If NIPING reveals nothing then a general check of the health of the server returning the errors can be performed. Windows provides a monitoring tool called performance monitor, or Perfmon. Perfmon logs can be created for the objects memory, physical disk, process and processor, select all instances. These logs can give an overview of general system health and if disk or CPU load might be heavy enough to introduce a resource constraint which would impact network connectivity. Perfmon can be run sampling every 15 seconds during the time the error occurs. A good system administrator will be familiar with Perfmon and will have log files which demonstrate system resource utilization for times which are classified as good performance. These log files can be considered a baseline to measure against.

If no clues yet exist as to the cause of the error, then a decision regarding the next steps needs to be made. Following the steps outlined in SAP Note 1593183 TPC/IP Networking Parameters for SQL Server, the keep alive parameters for both the client and server can be raised. This simple change has proven to help many customers avoid sporadic and hard to pinpoint network errors. If this simple problem avoidance solution isn’t implemented, then more detailed tracing techniques described below can be implemented. Even if the time and effort to do the tracing is implemented, there is no guarantee the root cause of the error will be identified, or that the identification of the root cause will result in an actionable activity that will resolve the problem.

Continuing on with the analysis process requires that client side tracing be utilized. The clients mentioned above offer various tracing tools which may or may not be invasive. In addition to the possible performance hit, client tracing produces large amounts of data which is cumbersome to move around and takes time to analyze and decipher. For the SNAC ODBC client there is the possibility to switch from TCP to a different protocol for temporary elimination of the TCP error. However, this will result in reduced performance in normal operation. See SAP Note 98678 SQL Server Connection Issues.
A JDBC driver offers logging possibilities through setting classes in the standard logging.properties file of the associated J2EE running the application. This log files can quit large and the logging is invasive. SAP support personnel working a customer case would direct this logging activity.


As a last resort, there are network monitoring tools which can be invoked at the operating system level; wireshark and netmon. These tools produce extremely large output logs and going through these logs can be tedious and time consuming work, especially when only sporadic errors are encountered. A filter should be defined screening for the IP address of the DB server and the port number the involved SQL Server uses. Additionally the IP address of the client machine can be included as a filter. Since it is usually only the TCP protocol involved in the error, adding the condition to the filter of protocol equal TCP could help. Also, as a first attempt filtering for TCP Resets will reduce the output. The network monitoring tool can be run on both the client and db server.

The filter would look something like this:  
"tcp.port eq <SQLPORT> && tcp.flags.reset==1"

where <SQLPORT> is the port the SQL Server uses for connections, usually 1433.

**KNOWN PROBLEM AREAS**

**Virtual Machine Usage**

SAP Note 1593183 TPC/IP Networking Parameters for SQL Server discusses how to set TCP/IP parameters in an environment where virtual machines are used, either as the client or server, or both. Please read this SAP note and adjust keep alive settings on both client and server machines.

There have also been occasions where a physical machine hosting multiple virtual machines has been overcommitted either in memory usage or CPU capability. Vendors may claim this is not possible, but it has been observed in the field. The tool mentioned in SAP Note 1593183, RAMMAP, which is referred to in the following blog can be used to check for memory overcommitment.


**HP Hardware**

SAP Note 1794178 Network issues suspected on SQL Server Systems should be consulted if HP hardware is in use. Also SAP Note 1721482 Hanging disp+work process on HP Proliant should be consulted. Check out the SAP notes and make sure your driver is newer then the version called out in the SAP note if you are using an HP model that is listed.

**Windows Server 2003**

SAP Note 1794178 Network issues suspected on SQL Server Systems should be consulted if Windows Server 2003 is in use. Also SAP Note 392892 DBIF_RSQL_SQL_ERROR (SQL error 0 or 11) points 6 through 9 can be consulted. Basically Windows Server 2003 should be upgraded as soon as possible and any “networking enhancements” should be avoided in Windows Server 2003. This means turning off settings such as receive side scaling, TCP IP chimney offloading, and single root I/O virtualization.