SAP IQ 16.1 Best Practices Guide
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1 SAP IQ 16.1 Best Practices Guide

This document presents the best practices for SAP IQ 16.1. It includes recommendations for using and configuring the most important features of SAP IQ, and precautions for avoiding and troubleshooting some of its most common issues.

This document is intended to serve as a starting point for optimizing your implementation of SAP IQ 16.1. As a general purpose document, it is not intended to be a comprehensive guide for every environment; rather it is a set of guidelines, suggestions and observations on how to better use SAP IQ 16.1.

Recommended Reading

Before reading this document, be sure to read:
- Release Notes: What’s Changed in SAP IQ 16.1 (SP 01 to SP 04)
- The SAP IQ Installation and Update Guide for your platform:
  - SAP IQ Installation and Update Guide for Linux
  - SAP IQ Installation and Update Guide for Windows
  - SAP IQ Installation and Update Guide for UNIX (HP-UX, IBM-AIX, and Solaris)
- The SAP IQ Cover Letter found in your installation files.

Each of these documents contains information critical to understanding the latest features, and to achieving a successful installation of SAP IQ in your environment.
2 New Features in SAP IQ

Upgrading from an earlier version? This section highlights key new features of particular importance to you as a DBA.

Note

Only a subset of new features are described in this section.

For the definitive list of new, changed, and deleted features in SAP IQ 16.1, see Release Notes: What’s Changed in SAP IQ 16.1 (SP 01 to SP 04).

For the definitive list of new, changed, and deleted features in SAP IQ 16.0, see What’s New in SAP IQ 16.0 (SP 00 to SP 11).

In this section:

New Features in SAP IQ 16.1 [page 7]

Key features introduced in SAP IQ 16.1.

New Features in SAP IQ 16.0 [page 8]

Upgrading from an earlier release? Features introduced in 16.0 might require you to change your working habits.

2.1 New Features in SAP IQ 16.1

Key features introduced in SAP IQ 16.1.

Upgrading from an earlier release? Some new features require you to change your working habits.

Note

Only a subset of new features are described in this section. For the definitive list of new, changed, and deleted features in SAP IQ 16.1, see Release Notes: What’s Changed in SAP IQ 16.1 (SP 01 to SP 04).

Default User and Password Change

The default user and password (DBA/sq1) has been removed, and the minimum password length has changed from 3 to 6. These changes are designed to improve security in new databases. If you have databases with a DBA/sq1 user ID, then change it because this is the user login that a malicious user is likely to try when attempting to access a database.
Previously, when you created a new database, if you did not specify a DBA user for the database, a user was automatically created with user ID **DBA** and password **sql**. In 16.1, the database server requires you to supply a user ID and password. You can override the minimum password length of 6 at database creation time.

⚠️ **Caution**

If you are an experienced SAP IQ user, you may be used to a short 3-character password for the DBA user. Note that passwords now have a default length of 6 characters, and a short password will now throw an error.

### mkiqdemo Requires DBA User Name and Password

The default dba user and password are no longer set by default. When you run `mkiqdemo.sh` or `mkiqdemo.bat`, you must now specify a DBA user name and DBA password. The minimum password length is set to 6 by default.

### Sybase Control Center (SCC) was Removed

SCC is no longer supported as an administration tool in SAP IQ 16.1. Use SAP Cockpit instead.

### Related Information

- Default DBA User and Minimum Password Length (Changed)
- mkiqdemo (Changed)
- SAP Control Center (Deleted)

### 2.2 New Features in SAP IQ 16.0

Upgrading from an earlier release? Features introduced in 16.0 might require you to change your working habits.

ℹ️ **i Note**

Only a subset of the new features introduced in SAP IQ 16.0 are described in this section. For the definitive list of new, changed, and deleted features in SAP IQ 16.0, see What’s New in SAP IQ 16.0 (SP 00 to SP 11).

Important information about changes in SAP IQ 16.0 (compared to SAP IQ 15.4) is found in Read This First: Helpful Hints Before You Start Using SAP IQ 16.0.
2.2.1 Licensing Changes Introduced in SAP IQ 16.0 SP 00

Upgrading from SAP IQ 15.x? There are no new licensing options for SAP IQ 16.0.

Licensable options are the same as for SAP IQ 15.x:

- Unstructured data analytics (UDA)
- Advanced security
- Multiplex grid
- Very large database (VLDB)
- In-database analytics

The InfoPrimer option has been retired. Customers are encouraged to migrate to SAP Data Services for ETL capability into SAP IQ.

All the new features introduced in SAP IQ 16.0 are part of the base product, except for LDAP authentication, which is part of the Advanced Security Option.

2.2.1.1 The Evaluation Version vs. the Evaluation License

An Evaluation version of SAP IQ (demo version) is an installation without a license. It is not the same as an Evaluation License.

With the Evaluation version, you can select the demo version when installing SAP IQ. Once selected, the installer will not ask you to choose the PE (Product Edition) or LT (License Type). The subsequent iq.default.lmp file created will contain empty PE and LT values. For example:

- PE =
- LT =

In an Evaluation version, all standard and optional features of SAP IQ are available under installation grace. You will always see the Checked out graced license... message for each individual license. There is no limit
on the quantity of license available under grace. The only restriction is that these licenses expire after the grace period, which is 30 days from the creation date of the database. In the case where a server has started multiple databases, then it is 30 days from the creation of the oldest database. At expiry, the SAP IQ server shuts down gracefully.

**The Evaluation License**

The Evaluation License is a valid SAP IQ license.

This license is checked out like a regular license (not in grace). Also, a separate license for each optional feature is needed and must be downloaded and installed. For example, the IQ_CORE evaluation license only enables SAP IQcore functionality. If you want to evaluate the security feature, you will need to download and install the IQ_SECURITY license separately.

An evaluation license is only available by request when a potential customer needs to evaluate the product features beyond the usual 30 day grace period provided by an Evaluation Edition.

If you create a new database, you can install it with the evaluation license to obtain a 30 day grace on this new server. You cannot use the same license to start the old server.

### 2.2.1.2 SySAM2

SAP uses a utility called SySAM2 (Sybase Software Assets Manager – version 2) to install, maintain and verify SAP product licenses.

Looking for SySAM license server installation instructions? See *Installing SySAM License Server* in the *SAP IQ Installation and Update Guide* for your platform.

In this section:

- **SYSAM2 License Files** [page 11]
  SySAM2 uses the information stored in two special license files.

- **Overview of SySAM Licensing Checks** [page 11]
  SySAM performs licensing checks at various times during the SAP IQ server runtime cycle. Some licenses are checked at startup, some upon access of a feature, and some are checked at both times. Further, most licenses are checked periodically during the server’s runtime according to a heartbeat cycle.

- **Scan the Log for SySAM Errors (And Take the Appropriate Action)** [page 12]
  Because SySAM checks for license issues on a regular basis during the server’s run cycle, SySAM errors can be detected and reported at any time.

- **Troubleshooting Product Edition and License Type Errors** [page 12]
  To avoid SySAM licensing errors, make sure the information in your license manager property file (.lmp file) and your license file (.lic file) match.

- **SySAM Debugging Options** [page 13]
  Use the `lmdiag` option of the `lmuti` license manager utility, located in `$SYBASE/SYSAM-2_0/bin`, to generate an output file to assist in diagnosing license problems.
2.2.1.2.1 SYSAM2 License Files

SySAM2 uses the information stored in two special license files.

- License manager – typically referred to as the .lmp file.
- License file – commonly referred to as the .lic file.

The License Manager File

The installation process for a new SAP IQ 16.1 server creates a new, human-readable license manager property file that uses the format: <your_iq_dbname>.lmp.

Each SAP IQ database you create gets its own .lmp file.

SAP IQ uses the default license (iq.default.lmp) as a template when creating an .lmp file for a new server.

In SAP IQ 16.1, the iq.default.lmp file is located in the $SYBASE/IQ-16/SySAM directory.

The License File

You acquire a .lic license file when you purchase SAP IQ 16.1.

Create and download this license file whenever you download the SAP IQ installation software or install SAP IQ on a new machine, and place it in the $SYBASE/SYSAM-2_0 directory.

Typically, the file name includes a date and the host machine’s name. For example: BigUNIXBox_201106080415.lic.

2.2.1.2.2 Overview of SySAM Licensing Checks

SySAM performs licensing checks at various times during the SAP IQ server runtime cycle. Some licenses are checked at startup, some upon access of a feature, and some are checked at both times. Further, most licenses are checked periodically during the server’s runtime according to a heartbeat cycle.

For those licenses that are checked at startup, some are only checked after a particular feature has been added to the database. For example, SySAM only performs a VLDBMGMT licensing check after a 1 TB threshold for IQ store size has been exceeded, or after a multiplex node has been created.

The following describes when some of these checks occur:

- Always checked on startup:
  - IQ_CORE
- Checked on startup if the feature has been enabled:
  - IQ_VLDBMGMT
  - IQ_MPXNODE
2.2.1.2.3 Scan the Log for SySAM Errors (And Take the Appropriate Action)

Because SySAM checks for license issues on a regular basis during the server’s run cycle, SySAM errors can be detected and reported at any time.

When a message is issued, it is important that you take the appropriate action in a timely manner. Failure to correct these warnings or errors may result in the server shutting down or failing to boot. Therefore, it is critical that you regularly scan your IQ log for SySAM messages.

For example, creating a new DBSpace will automatically generate a graced license for the VLDBMGT option. This can occur when creating a new DBSpace that crosses the 1 TB threshold. In this case, SySAM will check-out a new VLDBMGT license for your site. Depending on your existing license allotments, this new license may be checked out as a 30-day graced license. When this occurs, a “graced license” warning will be written to the IQ log. You must resolve this issue within the 30-day grace period, otherwise the server will shut down.

In the case of a graced license, you have two choices:

1. Remove the graced license; or,
2. Purchase a new license before the grace period expires.

Tip
You should create a process to programmatically scan the IQ log for SySAM messages.

2.2.1.2.4 Troubleshooting Product Edition and License Type Errors

To avoid SySAM licensing errors, make sure the information in your license manager property file (.lmp file) and your license file (.lic file) match.

SAP IQ uses the license types specified in the configuration parameters of your .lmp file. These values are stored in two lines that start with PE= (Product Edition) and LT= (License Type).

If you have a valid license but encounter an error message in the IQ log from SySAM detecting a mismatch between your license manager file and your license file, perform the following procedure:

- Edit the .lmp file so that the PE= (Product Edition) and LT= (License Type) values match those in the VENDOR_STRING of your .lic file.
- If the vendor_string in your .lic file indicates that your license type is CPU, then LT should be equal to CP (LT=CP).
2.2.1.2.5   SySAM Debugging Options

Use the `lmdiag` option of the `lmutil` license manager utility, located in `$SYBASE/SYSAM-2_0/bin`, to generate an output file to assist in diagnosing license problems.

Use the following syntax to generate an output file:

```
$SYBASE/SYSAM-2_0/bin/lmutil lmdiag -c <license_file_name>
```

Use the following syntax to determine the status of a specific license server:

```
sysam status -a
```

Use the following syntax to determine if the license server is supporting a given license feature:

```
sysam status -f <feature_name>
```

For example the command:

```
sysam status -f IQ_CORE
```

Returns:

```
lmutil - Copyright (c) 1989-2005 Macrovision Europe Ltd. and/or Macrovision Corporation.
All Rights Reserved.
Flexible License Manager status on Thu 5/5/2011 09:51
Users of IQ_CORE: (Total of 10 licenses issued; Total of 0 licenses in use
```

2.2.2   SAP IQ Authentication Protocols

SAP IQ provides RBAC authorization, LDAP authentication, and Kerberos authentication were added in SAP IQ 16.0 SP 00.

In this section:

- RBAC Authorization [page 14]
  RBAC authorization gives full control over which system privileges and roles can be granted to each entity. It enforces the separation of duties principle by making it possible to assign disjointed sets of privileged tasks to separate autonomous entities.
- LDAP Authentication [page 14]
LDAP authentication is part of the Advanced Security Option, and can be integrated with SAP IQ to use any existing enterprise-wide directory access framework. Use LDAP for authentication using searched distinguished names.

Kerberos Authentication [page 15]
Kerberos authentication was available in SAP IQ 15.0 is still available in SAP IQ.

2.2.2.1  RBAC Authorization

RBAC authorization gives full control over which system privileges and roles can be granted to each entity. It enforces the separation of duties principle by making it possible to assign disjointed sets of privileged tasks to separate autonomous entities.

Role-based security is based on the concept of system and object-level privileges and roles. A privilege controls the ability to perform a specific task and can be granted directly to a user or to a role. Roles can then be granted to users.

Each system privilege or role has designated administrators whose responsibility it is to control which users are granted the system privilege or role, and which users can act as administrators.

2.2.2.2  LDAP Authentication

LDAP authentication is part of the Advanced Security Option, and can be integrated with SAP IQ to use any existing enterprise-wide directory access framework. Use LDAP for authentication using searched distinguished names.

To protect against a server failure, you can create a primary and a secondary LDAP server configuration object which can be used for failover and failback purposes as needed.

LDAP authentication provides an efficient and secure design for frequent, short-lived connection that can scale to multiple domains and LDAP servers. Some LDAP features include:

- Authentication using searched distinguished name (DN).
- Failover to a secondary LDAP server for high availability.
- Automatic failback to previously failed servers.
- Integration with OpenLDAP third-party libraries.
- Secure communication with LDAP servers.
- Efficient design for frequent, short-lived connections.
- Extensibility to multiple domains and multiple LDAP servers.
2.2.2.3 Kerberos Authentication

Kerberos authentication was available in SAP IQ 15.0 is still available in SAP IQ.

It is a single sign-on system for distributed environments that allows you to maintain a single user ID and password for database connections, operating system, and network logins. After initial authentication, it eliminates the need to transmit passwords over the network.

The main component of Kerberos is the Key Distribution Center which holds all the keys, authenticates users, and generates tickets for authorized users to use services in the environment.
3 Multiplex Best Practices

An SAP IQ multiplex is a group of SAP IQ servers that connects to a central store for permanent shared data. Each server maintains its own local storage for catalog metadata, and transaction logs.

An SAP IQ multiplex can have a mix of reader and writer nodes. This improves performance by allowing SAP IQ to separate the update workloads across multiple nodes. For example, if you have a system with many tables undergoing frequent data refreshes, you can create multiple writer and reader nodes. This allows SAP IQ to provide separate nodes to manage all the data changes and separate nodes to handle all the database read operations. For detailed multiplex documentation, see SAP IQ Administration: Multiplex.

Here is a depiction of the architecture:

In this section:

About the Coordinator Node [page 17]
- The coordinator node is the heart of the SAP IQ multiplex configuration. It is the only node in the multiplex with the ability to coordinate all read-write operations, including schema changes.

Sizing the Coordinator Node Correctly [page 18]
- Since the actual work is performed by the coordinator rather than the writer node where the CREATE INDEX statement was initially executed, perform some specific actions when creating indexes on fully populated tables.

Simulating Local Store Functionality When Migrating From SAP IQ 12.7 [page 18]
Since local stores were deprecated in SAP IQ 15.x, if you are migrating from an SAP IQ 12.7 configuration with local stores, transfer the data from your local stores into the SAP IQ 16.1 main shared store.

Inter-Node Communication (INC) [page 19]
Communication between the coordinator node and the secondary nodes (readers and writers) is handled by the Inter-Node Communication (INC) layer.

Multiplex Inter-Node Communication (MIPC) [page 19]
The Multiplex Inter Node Communication (MIPC) mesh is a peer-to-peer inter-node communication infrastructure that supplements the Inter Node Communication (INC) protocol, and is used for distributed query processing (DQP).

Global Transaction Resiliency [page 20]
Upgrading from SAP IQ 15.x? SAP IQ 16.1 includes resiliency improvements to the multiplex grid.

Dynamic Collision [page 20]
Dynamic collisions occur only on secondary nodes, and occur when a schema change is committed while a secondary node is querying the same object.

Logical Servers [page 21]
A logical server is a grouping of physical nodes in the multiplex.

Multiplex Recommendations [page 22]
A list of best practices for managing and using your multiplex.

Multiplex Restrictions [page 23]
Things to avoid in your multiplex.

Distributed Query Processing (DQP) and Logical Servers [page 23]
SAP IQ supports distributed query processing (DQP), which improves performance and availability in multiplex configurations by dividing queries into multiple independent pieces that are distributed across multiple nodes in a group of servers called a logical server.

3.1 About the Coordinator Node

The coordinator node is the heart of the SAP IQ multiplex configuration. It is the only node in the multiplex with the ability to coordinate all read-write operations, including schema changes.

The coordinator node:
- Manages all global read-write transactions.
- Maintains and manages the global catalog.
- Maintains the table version (TLV) log.
- Maintains metadata updates for DML and any DDL changes on SAP IQ or catalog store objects and syncs them across all nodes.
- Stores information about DDL operations.
- Communicates information about new table versions to the secondary servers (readers or writers).
- Coordinates shared SAP IQ table locking between nodes.
- Only the coordinator node has the ability to manipulate shared dbspaces (like adding dbfiles to the IQ_SHARED_TEMP dbspace), and administer logical servers for distributed query processing and workload isolation.
3.2 Sizing the Coordinator Node Correctly

Since the actual work is performed by the coordinator rather than the writer node where the `CREATE INDEX` statement was initially executed, perform some specific actions when creating indexes on fully populated tables.

It is important to note that all DDL operations are run on the SAP IQ coordinator node regardless of which node the SQL was initiated on.

Typically, this is not an issue. However, there is a potential issue when creating indexes on fully populated tables, since the actual work is performed by the coordinator rather than the writer node where the `CREATE INDEX` statement was initially executed. Consequently, when sizing the host for the SAP IQ coordinator, consider the following:

- Place the coordinator on an isolated host (where there will be no contention with other SAP IQ nodes).
- Be sure this host has the capacity to support all DBA maintenance tasks and any real-time DDL operations such as `CREATE INDEX`.
- Configure the coordinator to also play the role of writer.

3.3 Simulating Local Store Functionality When Migrating From SAP IQ 12.7

Since local stores were deprecated in SAP IQ 15.x, if you are migrating from an SAP IQ 12.7 configuration with local stores, transfer the data from your local stores into the SAP IQ 16.1 main shared store.

The `iqlaunload` utility is provided to assist with this task.

How to Simulate a Local Store in SAP IQ 16.1

This sample process simulates local store-type functionality in version 12.7 by combining login policies and dbspace management in the shared store of SAP IQ 16.1:

- Create a user dbspace.
- Apply `GRANT RESOURCE` to a specific group of users.
- Create a login policy to restrict these users from accessing any other node except the writer nodes where the storage isolation has been implemented.
- Assign this login policy to these specified users
  - Only this select group of users will be able to create tables and give select permissions
  - Only these users will be able to log in into the specified servers
- Load, inserts, deletes, updates, and selects are now restricted to a specific server.
3.4 Inter-Node Communication (INC)

Communication between the coordinator node and the secondary nodes (readers and writers) is handled by the Inter-Node Communication (INC) layer.

**Note**
SQLRemote was deprecated in SAP IQ 15.x.

The INC layer provides TCP-IP based communication between nodes with the help of remote procedure calls. This communication link consists of a heartbeat process and pooled connections.

INC communication occurs between the coordinator and secondary nodes via a dedicated connection. This dbo-owned connection is established when a secondary node starts, and it remains active for the entire time the node is active. The coordinator monitors this connection to check for the secondary nodes’ “aliveness.” This connection is only used for non-transactional communication. For transactional communication between the coordinator and the secondary nodes, INC uses a connection from the INC connection pool. Use the `MPX_MAX_CONNECTION_POOL_SIZE` Option and the `MPX_MAX_UNUSED_POOL_SIZE` Option to customize this connection.

Note the following:
- INC reports messages in the `.iqmsg` file.
- The INC Connection Pool is separate from the users’ connection pool.
- All secondary nodes use INC connections for DDL commands and read-write DML operations. Whenever a user performs a DDL or read-write operation on a secondary node, an INC connection is associated with the user connection. This connection persists until the command commits or is rolled back, at which time the connection is returned to the INC connection pool.
- If SAP IQ runs out of connections from the INC connection pool, you see this error:
  "The number of connections in the connection pool have exceeded the total number of connections allowed in the connection pool. No more connections can be allocated."

3.5 Multiplex Inter-Node Communication (MIPC)

The Multiplex Inter Node Communication (MIPC) mesh is a peer-to-peer inter-node communication infrastructure that supplements the Inter Node Communication (INC) protocol, and is used for distributed query processing (DQP).

MIPC allows multiplex nodes to communicate directly with each other, and supports the more robust communication requirements of DQP. Using MIPC, SAP IQ can aggressively distribute a query across all the nodes in a multiplex.

There are both public and private configuration options for MIPC. The private option allows you to specify host-port pairs that multiplex servers will use exclusively for DQP-related communications. If no private interconnection configuration is provided, MIPC uses the host-port pairs specified for other types of communication such as external user connections and INC connections.
3.6 Global Transaction Resiliency

Upgrading from SAP IQ 15.x? SAP IQ 16.1 includes resiliency improvements to the multiplex grid.

If a communication failure with the coordinator node occurs, the secondary writers will suspend their global read-write transactions on the user connections and resume these transactions when the INC communication is restored. The suspend and resume feature is enabled in the following situations:

- INC connection failure and re-establishment
- Coordinator shutdown or crash and restart
- Coordinator shutdown or crash and failover

With global transaction resiliency in SAP IQ, DML read-write transactions on the multiplex secondary (writer) node can survive temporary communication failures between coordinator and secondary node with writer role and temporary failure of the coordinator due to coordinator server crash, shutdown or failover.

When a DML transaction is executed by a user on a secondary (Writer) node involving RW (e.g. insert/load) operations on shared database objects, a global transaction is initiated by the writer on the coordinator node. The transaction starts on an INC connection from the writer to the coordinator node.

If temporary INC connection failures such as temporary communication failures and Coordinator failures are resolved within the time-out defined specified by the `MPX_LIVENESS_TIMEOUT` Option (default 3600 secs = 1 hour), the INC connection is reestablished and global transactions will continue uninterrupted. If a failure persists longer than the `MPX_LIVENESS_TIMEOUT` value, the global transaction cannot be resumed, and is rolled back.

Global transaction status (active/suspended) can be seen using the `sp_iqconnection` Procedure on a writer node, or the `sp_iqmpxsuspendedconinfo` Procedure on the coordinator node. The `sp_iqmpxincstatistics` Procedure can be used to get a snapshot of the aggregate statistics of INC status since server startup.

3.7 Dynamic Collision

Dynamic collisions occur only on secondary nodes, and occur when a schema change is committed while a secondary node is querying the same object.

A dynamic collision results in the termination of the connection to the secondary. If such a scenario occurs, you see this message in the `.iqmsg` file:
Tip

To minimize disruptions to query operations, avoid performing schema changes when the multiplex is being heavily used.

3.8 Logical Servers

A logical server is a grouping of physical nodes in the multiplex.

The concept of logical servers was introduced in SAP IQ 15.0. When a query is executing on a machine in a logical server, only the nodes within the particular logical server participate in the query. This allows workloads to be isolated from each other for security or resource balancing purposes. Logical servers are elastic — physical machines may be added to or removed from a logical server dynamically as workload demand changes.

You can create multiple logical servers to serve different groups of applications or users. You can dynamically add and remove nodes from a logical server to accommodate the individual application resource needs. You also have flexible options for choosing which servers participate in the execution of a distributed query, or whether to turn it off entirely on a global basis or for particular queries.

When distributed query processing is enabled, SAP IQ distributes the query execution (in parallel) to those nodes that are members of the logical server.

SERVER Logical Server

On each multiplex server, the SERVER logical server has implicit membership to that server only, allowing certain privileged users to connect to any node of the multiplex and execute server-level administrative tasks without knowing which logical servers include that node.

You need the ACCESS SERVER LS system privilege to connect to a multiplex with the SERVER logical server context.

Logical Server Login Redirection

SAP IQ provides load balancing within a logical server. When you try to log into a node that is overloaded, the connection is redirected to a node with less load in the same logical server. The DBA then enables logical server policy LOGIN_REDUCTION to ‘ON’ to enable login redirection for logical servers specified by the user’s login policy. When LOGIN_REDUCTION is set to ‘OFF’ (Default: OFF), logical redirection is disabled at the logical server level, allowing external connection management.

1. Enable the logical server’s login redirection policy:
create logical server policy LRD LOGIN_REDIRECTION='ON'

2. Associate the new logical server policy with a logical server:
alter logical server LS policy LRD

Logins are only redirected if LOGIN_REDIRECTION is enabled and:

- The initial connection node is not a member of the target logical server.
- The initial connection node is a member of the target logical server, but has a role other than that requested.
- The initial node is a member of the target logical server and has the requested role, but has reached the limit of maximum connections on the current logical server member node.

### 3.9 Multiplex Recommendations

A list of best practices for managing and using your multiplex.

- All multiplex nodes must be at the same patch level, and be running the same operating system. SAP IQ does not support mixed versions in a multiplex.
- SAP IQ multiplex does not support DIRECT IO; only raw devices for shared SAP IQ stores.
- For optimal performance, keep the SAP IQ logs (such as .db, transaction.log, and iqmsg) on local disk.
- For performance reasons, secondary writers should only run large loads, and not a high volume of sub-minute read-write transactions. These small transactions entail proportionately more communication overhead with the coordinator. The coordinator may run large loads, as long as it is running on a machine with enough resources. Treat the coordinator as a first class node that is capable of handling workloads equal to any other node in the multiplex. That is, run large loads on the coordinator as long as:
  - Operations on other nodes do not slow down; or
  - You do not exhaust resources on the coordinator and need more CPU or RAM to load
- Keep the catalog as small as possible by not placing user tables in this space. Catalog size has a negative impact on synchronization.
- Only the coordinator node can perform modifications to the IQ main store dbspace files.
- Database backups can only be executed on the coordinator of a multiplex configuration.
- Prior to adding or altering a dbfile in the IQ_SYSTEM_MAIN dbspace, you must shut down all secondary nodes. Once the dbfile modifications are completed, the secondary node must be synchronized.
- Prior to performing a failover procedure, you must shut down the current coordinator server to avoid corrupting the multiplex.
- Make sure there are no active connections to a logical server before dropping a member of a logical server or the logical server itself. Use the `sp_iqconnection Procedure` to examine the logical server context of active connections. See Distributed Query Processing (DQP) and Logical Servers [page 23].
- You may execute CREATE/ALTER/DROP MULTIPLEX SERVER statements from any server in the multiplex as long as the coordinator is running. Before adding any secondary server to the multiplex, make sure it has access to the shared dbspaces, since SAP IQ does not verify this when you run your statements. Since an object’s transaction management data is stored on the IQ_SYSTEM_MAIN dbspace, it is very important that this dbspace be adequately sized.
3.10 Multiplex Restrictions

Things to avoid in your multiplex.

- Never start a secondary node in single-node mode. If this occurs when a good coordinator is present, the multiplex will think you are promoting the secondary node to the role of a coordinator. Having two coordinators in a multiplex setup is not supported, and could lead to data corruption.
- Do not run excessive amounts of global DDL commands on secondary nodes. Use local temporary tables wherever possible, as DDL on local temporary tables does not have the INC overhead.
- Do not exclude a designated failover server from the multiplex unless it is the last un-excluded server in the multiplex.

3.11 Distributed Query Processing (DQP) and Logical Servers

SAP IQ supports distributed query processing (DQP), which improves performance and availability in multiplex configurations by dividing queries into multiple independent pieces that are distributed across multiple nodes in a group of servers called a logical server.

Distributed query processing comes as part of the Multiplex Grid option for SAP IQ, and is enabled by default. In general, any query that qualifies for parallel processing also qualifies for DQP.

See SAP IQ Administration: Multiplex.

In this section:

Sizing the Shared Temporary Dbspace [page 23]

Distributed Query Processing (DQP) requires temporary storage that all multiplex nodes can share in order to assign work, and to store and transmit intermediate results.

3.11.1 Sizing the Shared Temporary Dbspace

Distributed Query Processing (DQP) requires temporary storage that all multiplex nodes can share in order to assign work, and to store and transmit intermediate results.

Sizing the shared temporary dbspace depends on the distributed query processing workload. In a worst case scenario, you will need an amount equal to the sum of all local temporary dbspaces. As a starting point, it is
best to create a temporary storage dbspace that is equal to half the size of the peak local temporary storage usage for each node.

To calculate the peak local temporary storage usage, run the `sp_iqstatus Procedure` during a typical query workload on a pre-DQP server.

To track shared temporary store usage on an ongoing basis, you can execute the `sp_iqspaceused Procedure` on a regular basis.
We recommend that you migrate to the latest version of SAP IQ whenever possible. The latest version gives you access to the newest features and fixes in the product.

This section contains recommendations for avoiding some of the more common migration and upgrade issues.

In this section:

- **Review the SAP IQ Options Every Time You Upgrade** [page 26]
  Verify both internal options and public options every time you upgrade SAP IQ, regardless of whether you are upgrading to a patch release, minor release version, or major release version.

- **Back Up Before an Upgrade or Migration** [page 26]
  Back up your entire SAP IQ database before performing a migration or upgrade. Without an entire database backup, recovering from upgrade issues becomes very difficult.

- **Back Up After an Upgrade or Migration** [page 27]
  Although optional, you should back up your entire database after a successful migration or upgrade.

- **Establish a Performance Baseline for your New Installation** [page 27]
  You should establish a pre-migration baseline of query performance and query results for all your applications.

- **Test your New Installation** [page 28]

- **Run sp_iqcheckoptions Before and After an Upgrade** [page 28]
  Run sp_iqcheckoptions before and after an upgrade to verify that your post-upgrade option values are correct.

- **Verify Database Consistency Before and After a Migration** [page 28]
  You should verify the consistency of your databases both before and after you migrate to a new version of SAP IQ.

- **Migrating from SAP IQ 15.x to SAP IQ 16.1 Using ALTER DATABASE UPGRADE** [page 29]
  The changes in SAP SQL Anywhere between IQ 15.x and IQ 16.1 do not require an unload/reload of the IQ catalog store.

- **Migrating from SAP IQ 12.7 to SAP IQ 16.1** [page 29]
  Updating a 12.7 catalog to SAP IQ 16.1 requires a database file migration, not a simple database upgrade.

- **Resolving the Parse Stack Overflow Issue** [page 31]
  During SAP IQ testing, you may receive an error message.

- **Use the -iqro Switch When Performing the Alter Database Upgrade Command** [page 33]
  You must use the -iqro switch to start your server in read-only mode before running the ALTER DATABASE UPGRADE command to avoid serious recovery issues if you encounter problems with the database migration.

- **Rebuilding FP Indexes for Enhanced Compression** [page 34]
Upgrading from SAP IQ 12.x or 15.x? A number of enhancements to compression techniques were introduced. The new compression techniques are automatically applied to all new data.

### 4.1 Review the SAP IQ Options Every Time You Upgrade

Verify both internal options and public options every time you upgrade SAP IQ, regardless of whether you are upgrading to a patch release, minor release version, or major release version.

When opening cases with SAP Support, you may be asked to use some undocumented, internal options as a workaround for an issue. Make sure to review these internal options with every version change to SAP IQ. These options are used to implement various code execution paths, and their behavior can change from release to release.

Failure to review these internal options at upgrade time exposes you to risk – a behavior change can result in serious performance degradation. If option behavior has changed, you may need to set the internal option back to its default setting to maximize performance. Leaving your SAP IQ 15.x or 16.0 internal option settings unchanged after you upgrade to 16.1 can result in serious performance problems.

The most critical internal options to watch are those that begin with these phrases:

- `ddl_options`
- `mpx_options`
- `dqp_options`
- `core_options`
- `dml_options`

Use the upgrade time to review the public options that you’ve set as part of your normal setup. While the current options that you’ve set will be fine, going back through your public options and reviewing guarantees optimal performance.

> **Tip**

To reset an option to its default setting, use this command:

```
set option PUBLIC.<OPTION_NAME>=;
```

The semi-colon (;) instructs SAP IQ to reset the value to default. Simply replace `<OPTION_NAME>` with the actual name of the option that you wish to reset for the PUBLIC group. To reset options to other groups of users, replace PUBLIC with the user or group name.

### 4.2 Back Up Before an Upgrade or Migration

Back up your entire SAP IQ database before performing a migration or upgrade. Without an entire database backup, recovering from upgrade issues becomes very difficult.

Include the following files in your backup (and record the lengths of these files):
- The IQ_SYSTEM_TEMP dbspace file, typically named dbname.iqtmp.
- All SYSTEM dbspace files (such as the IQ Catalog Store), that are typically named dbname.db.
- All user dbspaces, typically named dbname.iq.
- The transaction log file (required for system recovery), typically named dbname.log.
- Files belonging to any additional dbspaces that have been added to the IQ main store.
- Files belonging to any additional dbspaces in the catalog store. These are listed in the SYSDBSPACE system view.

Record the lengths of the following files:
- The IQ_SYSTEM_TEMP dbspace file, typically named dbname.iqtmp.
- Additional files that have been added to IQ_SYSTEM_TEMP.
- The files or raw devices used to hold temporary dbspaces.

You should also back up the following optional ASCII message files, which may be useful in troubleshooting:
- dbname.iqmsg
- $IQDIR15/logfiles/*.srvlog
- $IQDIR15/logfiles/*.stderr

If IQ message log wrapping is enabled, back up the complete set of .iqmsg log files. If problems occur during a restore, the .iqmsg file contains information that proves that the database was shut down before the backup started.

For more details on backup files, see SAP IQ Administration: Backup, Restore, and Data Recovery.

### 4.3  Back Up After an Upgrade or Migration

Although optional, you should back up your entire database after a successful migration or upgrade.

### 4.4  Establish a Performance Baseline for your New Installation

You should establish a pre-migration baseline of query performance and query results for all your applications.

You can use this baseline to evaluate post-migration performance and query results. Without this baseline, troubleshooting post-migration performance and data-related issues becomes very difficult.
4.5 **Test your New Installation**

⚠️ Caution
You must **thoroughly test** your applications before moving a new version of SAP IQ into production.

4.6 **Run sp_iqcheckoptions Before and After an Upgrade**

Run `sp_iqcheckoptions` before and after an upgrade to verify that your post-upgrade option values are correct.

⚠️ Caution
Running the `sp_iqcheckoptions` Procedure is critical, since options are sometimes reset to their default values as a result of the upgrade process. Therefore, you will want to identify any such options and return them to their desired values.

4.7 **Verify Database Consistency Before and After a Migration**

You should verify the consistency of your databases both before and after you migrate to a new version of SAP IQ.

You verify database consistency by running `sp_iqcheckdb` so that you can properly diagnose and resolve any consistency issues that might occur.

For example, to verify a database, do the following:

1. Issue a **CHECKPOINT** command. See [CHECKPOINT Statement](#).
2. Run the `sp_iqcheckdb` Procedure in verify mode:
   ```sql
   sp_iqcheckdb 'verify database'
   ```
3. If you run the `sp_iqcheckdb` procedure from Interactive SQL, redirect output to a file by typing the following:
   ```sql
   sp_iqcheckdb 'verify database' <filename>
   ```
4. Issue a **COMMIT** statement. See [COMMIT Statement](#).

For detailed information on interpreting the `sp_iqcheckdb` results and corrective action, see SAP IQ Administration: Backup, Restore, and Data Recovery.
4.8 Migrating from SAP IQ 15.x to SAP IQ 16.1 Using ALTER DATABASE UPGRADE

The changes in SAP SQL Anywhere between IQ 15.x and IQ 16.1 do not require an unload/reload of the IQ catalog store.

All migration paths assume you are migrating from SAP IQ 15.4 at minimum.

See SAP IQ 15.4.x Upgrades in SAP IQ Installation and Configuration Guide for your platform for a detailed migration workflow.

4.9 Migrating from SAP IQ 12.7 to SAP IQ 16.1

Updating a 12.7 catalog to SAP IQ 16.1 requires a database file migration, not a simple database upgrade.

All migration paths assume that you are migrating from SAP IQ 12.7 ESD #5 as a minimum.

See SAP IQ 12.7 Upgrade and Database Migration in the SAP IQ Installation and Configuration Guide for your platform for a detailed migration workflow.

In this section:

Tips for the iqunload Utility [page 29]

Recommendations for using the iqunload utility to migrate an SAP IQ 12.7 database to an SAP IQ 16.1 database.

Known Issues for the iqunload Utility [page 30]

There are several known issues that you may encounter when using iqunload. Although uncommon, you should be aware of them.

4.9.1 Tips for the iqunload Utility

Recommendations for using the iqunload utility to migrate an SAP IQ 12.7 database to an SAP IQ 16.1 database.

Use Schema Unload Mode Before Performing the Load

Before performing the actual unload, you should first run iqunload for SAP IQ 12.7 Database Migration in schema unload mode. Do this by using the syntax:

```
iqunload -n
```

Running the iqunload utility in schema unload mode lets you connect to an existing SAP IQ 12.7 server and generate a reload.sql script that contains the entire schema for your 12.7 database. You can also run this
script against a new SAP IQ 16.1 database to recreate the schema of the legacy database. Running `iqunload` in the schema unload mode provides two major benefits:

- Allows you to verify the correctness of the schema by applying it to a new SAP IQ database.
- Provides an estimate of the time the migration process will require.

**Use the `-iqro` Switch when Performing an Unload/Reload of the Catalog**

The `start_iq -iqro` Database Server Option opens the server’s dbspaces in read-only mode.

⚠️ **Caution**

It is critical that you use the `-iqro` switch to start SAP IQ in read-only mode during several steps of the unload/reload process. Failure to do so can result in serious recovery issues, should a problem occur.

4.9.2 Known Issues for the `iqunload` Utility

There are several known issues that you may encounter when using `iqunload`. Although uncommon, you should be aware of them.

**Drop the Global Temporary Tables**

If you have created a GLOBAL TEMPORARY TABLE, drop it before running `iqunload -au`. Otherwise, the `iqunload for SAP IQ 12.7 Database Migration` utility may fail with an error. You can then recreate this table after the migration.

**Reset the `DATE_FORMAT` and `DATE_ORDER`**

If you have changed the default values for the `DATE_FORMAT` or `DATE_ORDER` database options, reset them before running `iqunload`. You can do this using the syntax:

```sql
SET option DATE_FORMAT = ;
```

and

```sql
SET option DATE_ORDER = ;
```

Setting these options back to their default values permits `iqunload -au` to succeed. Otherwise, you may encounter an error such as:

```
Reload of SYSIQINFO failed due to the following errors:
```
The reloaded table "SYS.SYSIQINFO" contains a row with key column(s) "create_time" values: ( 2011-12-27 11:44:12.557 ) which has unexpected values or column mismatches with original table "SYS.SYSIQINFO" with key column(s) "create_time" values( 2007-04-25 16:26:33.754 ): Reloaded Table "commit_txn_id" column value: ( 0 ), Original Table "commit_txn_id" column value: ( 2883768 ).

Drop Any Java Classes or Java Procedures

If you have any Java stored procedures or Java Classes, drop them before running the iqunload utility iqunload -au. If you do not do so, then your iqunload may fail with an error similar to the following:

***** SQL error: External environment could not be started, 'main thread' could not be found. This file contains the statement that caused the schema reload failure. To complete the schema reload, you need to modify your database to avoid generating the statement below. Once you have modified your database appropriately, re-run the schema reload process. NOTE: You may want to generate the schema only for the database being reloaded, and load this schema into an empty database to check for SQL errors. INSTALL JAVA FROM @byte_code.

Failing to Start the SAP IQ Server in Read-Only Mode may Result in Errors

Failing to start your SAP IQ write server (with its migrated database) in read-only (-iqro) mode prior to performing the load verification step may result in a corrupted migration. See -iqro Database Server Option.

4.10 Resolving the Parse Stack Overflow Issue

During SAP IQ testing, you may receive an error message.

The error message is similar to:

Syntax error near 'parse stack overflow' on line 25SQLCODE=-131, ODBC 3 State='42000'

Typically, this error indicates that SAP IQ has encountered a SQL statement that is too long. This happens when a program generates a lengthy SQL command.

This error message is generated at the SAP SQL Anywhere level, where the SQL Anywhere server manages connections and parses commands before the query is passed to SAP IQ. In SAP IQ 16.1, the structures generated in parsing commands consume a bit more memory than in SAP IQ 12.7. Therefore, a long command...
that ran successfully in SAP IQ 12.7 (but was close to overflow), now crosses the line into overflow in SAP IQ 16.1.

Consider these options to avoid this overflow error:

- Break the query into smaller pieces.
- Use a larger IQ catalog page size. In this case, go to the next larger page size. The default page size for SAP IQ is 4096; and, the permissible page sizes are 4096, 8192, 16384, and 32768 bytes.

**i Note**
The IQ catalog page size is distinct from the IQ database page size.

### Fix the Stack Overflow Error by Increasing the Catalog Page Size

If you choose to increase your catalog page size, and you are already in the process of running the iqunload utility as part of an SAP IQ 16.1 migration, you should use the iqunload utility to rebuild your server with a larger page size. For this option, consider the following procedures:

- Add the -ap option to enable the catalog database to be created with a larger page size. For example:

  ```
iqunload -au -ap 8192 -c [connection parameters]
  ```

- Also, add the -gp database server option parameter to your SAP IQ 16.1 server configuration file (.cfg) using the same value as in the iqunload -ap command (such as -gp 8192) to keep your SAP IQ configuration file and the startup messages written to your .iqmsg log in sync with your catalog database configuration.

- Increase the size of your catalog cache. For example, if you increase your catalog page size from 4 KB to 8 KB, you must double the amount of catalog cache specified in your -c or -cl, and -ch startup configuration parameters. Otherwise, the catalog cache will only accommodate half the number of 8 KB pages as it did 4 KB pages. Increase your cache size if you use larger page sizes. A cache of the same size will accommodate only a fraction of the number of the larger pages, leaving less flexibility in arranging the space.

### Other Solution Options

If you cannot rebuild the SAP IQ 16.1 server by rerunning iqunload; perform the following:

- Use the IQ data extraction facility to offload the database.
- Re-create the database with the larger catalog page size.
- Load the database from the extracts.

Note the following:

- You cannot use SAP IQ backup and restore to change the catalog page size.
- Using the -gp database server option without rebuilding the database may seem to offer an easier solution than rebuilding the database. But, by itself, it does not. When starting SAP IQ, the -gp value sets the size of catalog pages in memory for the SAP IQ server. For example, -gp 8192 results in an 8 KB catalog page.
size in memory. If the database was built with a 4096 catalog page size, then at startup, the 4 KB pages are loaded into 8 KB page frames and the other 4 KB per memory page is wasted. In this situation, the following boot-time messages appear in the .srvlog file:

```
E. 07/29 09:13:13. Note: database page size is smaller than the cache page size, resulting in inefficient use of memory.
I. 07/29 09:13:16. Using a maximum page size of 8192 bytes
I. 07/29 09:13:38. Performance warning: Database "iqdemo" has a page size of 4096 that does Not match maximum of 8192 set for server, causing inefficient use of cache ...
```

\textbf{Note}

The \texttt{-gp} parameter has somewhat different usage in a standalone SAP SQL Anywhere database implementation, but in SAP IQ, its effect is as described.

### 4.11 Use the \texttt{-iqro} Switch When Performing the Alter Database Upgrade Command

You must use the \texttt{-iqro} switch to start your server in read-only mode before running the \texttt{ALTER DATABASE UPGRADE} command to avoid serious recovery issues if you encounter problems with the database migration.

\textbf{The Max Connections Error}

When using \texttt{-gm 1} (max connections = 1) with the \texttt{ALTER DATABASE UPGRADE} statement, the upgrade command will fail with this error:

\texttt{Not allowed while 'DBA' is using the database}

\textbf{Resolving the Max Connections Error}

There are several ways to resolve this max connection issue:

\textbf{Method 1:}

Drop the extraneous connection to the SAP Control Center server:

- Run the \texttt{sp_iqconnection} procedure to view the connections.
- Drop the extra connection. For example: \texttt{drop connection 2}
**Method 2:**

Start SAP IQ with startup flags for two or more connections and read-only mode.

For example: `-gm 2 -iqro 1`

**Method 3:**

Temporarily start SAP IQ on a different port using the `–x` switch:

- The `–x` switch controls the port that SAP IQ uses when you start the server. Starting the server on a port that is unknown to any other process will hide the server from these other automated processes.
- On a simplex server, use the `–x` switch to specify a new port number. For example:

  ```
  start_iq @yourserver.cfg yourdb.db -x 'tcpip{port=<new_port>}'
  ```

- On a multiplex server, use both the `–x` and `–iqmpx` override switch to specify a new port number. For example:

  ```
  start_iq @yourserver.cfg yourdb.db -iqmpx_ov 1 –x 'tcpip{port=<new_port>}'
  ```

**i Note**

You can use this procedure any time you are performing maintenance operations and you want to hide your SAP IQ server from other users or processes.

---

**Related Information**

- `-gm` database server option
- `ALTER DATABASE` Statement

---

### 4.12 Rebuilding FP Indexes for Enhanced Compression

Upgrading from SAP IQ 12.x or 15.x? A number of enhancements to compression techniques were introduced. The new compression techniques are automatically applied to all new data.

New compression techniques are not automatically applied to existing (pre-SAP IQ 16.0) data.
Therefore, in order to compress pre-SAP IQ 16.0 data using the enhanced compression algorithm, you must do one of the following:

- Rebuild the FP indexes using the \texttt{sp_iqrebuildindex} Procedure.

\begin{leftmargin}{\labelwidth}{\labelsep}
\begin{minipage}{\linewidth}
\textbf{Note}
Currently, this cannot be used with varchar and varbinary columns wider than 255 bytes.
\end{minipage}
\end{leftmargin}

- Move the data to another dbspace using the \texttt{ALTER TABLE ... MOVE} statement.

\textbf{Related Information}

\texttt{ALTER TABLE} Statement
5 Operational Management Best Practices

Use administration tools to manage, monitor and administer SAP IQ.

- SAP IQ Cockpit
- SAP IQ stored procedures
- OS-level commands and utilities

In high volume environments, several of these methods may be necessary to effectively monitor and administer SAP IQ.

In this section:

- Stored Procedures for SAP IQ Management [page 36]
  You can execute stored procedures like `sp_iqstatus`, `sa_procedure_profile`, `sp_iqsysmon`, and `sp_iqworkmon` either individually or in a script that runs periodically or when triggered by events.

- OS-Level Tools for SAP IQ Management [page 37]
  OS-level tools such as `vmstat` provide useful information on memory and CPU use and disk activity.

- Troubleshooting AIX Multi-Processor Issues [page 37]
  If SAP IQ is installed on a multi-processor AIX box, you might see the following discrepancy in reporting of processors.

- Best Practices for Interactive SQL and Open Client Utilities [page 37]
  The Interactive SQL utility (`dbisql`), and open client utilities like `dsedit`, are installed with SAP IQ.

5.1 Stored Procedures for SAP IQ Management

You can execute stored procedures like `sp_iqstatus`, `sa_procedure_profile`, `sp_iqsysmon`, and `sp_iqworkmon` either individually or in a script that runs periodically or when triggered by events.

You can also use SAP IQ utilities to monitor buffer cache and other statistics.

For stored procedure reference information, see SAP IQ SQL Reference.

For utility reference, see the SAP IQ Utility Reference.

Related Information

- `sa_procedure_profile` System Procedure
- `sp_iqsysmon` Procedure
- `sp_iqworkmon` Procedure
- `sp_iqstatus` Procedure
5.2 OS-Level Tools for SAP IQ Management

OS-level tools such as `vmstat` provide useful information on memory and CPU use and disk activity. See Collecting Diagnostic Data [page 78] section of this guide for information on OS tools that could assist in debugging issues.

5.3 Troubleshooting AIX Multi-Processor Issues

If SAP IQ is installed on a multi-processor AIX box, you might see the following discrepancy in reporting of processors.

From `iqdemo.001.srvlog`:

```
I. 05/01 10:31:51.
I. 05/01 10:31:51. 14 physical processor(s) detected.
I. 05/01 10:31:51. Running AIX 5 3 on PPC
I. 05/01 10:31:51. Server built for PPC processor architecture
```

From `iqdemo.iqmsg`:

```
I. 05/01 10:31:53. 0000000000 Using licenses from: /testhost/iq15/
SYSAM2_0/licenses:/testhost/iq15/IQ-15_0/demo
I. 05/01 10:31:55. 0000000000 Checked out license for 7 IQ_CORE
(2010.11150/15-nov-2010/13E7 0944 F517 63F0) will expire Tue Nov 16 00:00:00 2010.
I. 05/01 10:31:55. 0000000000 WARNING: Sybase IQ functionality that requires the
IQ_CORE license will be disabled on Tue Nov 16 00:00:00 2010, unless a suitable
IQ_CORE license is obtained before that date.
```

*Note*

In the output, the difference between the number of CPUs (14) and the number of cores (7) occurs because the reporting is on the physical CPUs instead of the logical CPUs on AIX. This is a reporting issue only. There is no problem with SySAM detecting and checking-out the correct number of licenses.

5.4 Best Practices for Interactive SQL and Open Client Utilities

The Interactive SQL utility (`dbisql`), and open client utilities like `dsedit`, are installed with SAP IQ.

In this section:

- Open Client Utilities [page 38]
  - In SAP IQ 16.1, four Open Client utilities are installed.
- `isql` [page 38]
isql is a command-line Interactive SQL utility that uses the SAP Adaptive Server Enterprise Open Client API.

Interactive SQL (DBISQL) [page 38]
Interactive SQL (DBISQL) is the SAP IQ interactive SQL utility. It enables you to execute SQL statements, build scripts, and display database data.

DBISQL-C, DBISQL-Classic, and Interactive ISQL-Classic are Deprecated [page 39]
The C-based editions of DBISQL (including the DBISQL-C, DBISQL-Classic, and Interactive SQL Classic versions of DBISQL) are deprecated.

Graphical and Command Line Versions of DBISQL-Java [page 40]
A brief overview of the graphical version and command line version of DBISQL-Java.

Returning Multiple Result Sets in DBISQL [page 40]
By default, Interactive SQL shows the first result set of the most recently executed statement.

Do Not Mix SQL Dialects in DBISQL [page 41]
Do not mix Watcom-SQL and Transact-SQL dialects when executing batch scripts.

Import Restrictions in DBISQL [page 41]
Do not use the Import option in the Interactive SQL Data menu.

5.4.1 Open Client Utilities

In SAP IQ 16.1, four Open Client utilities are installed.

- isql
- dsedit
- dscp (UNIX only)
- ocsfg (Windows only)

5.4.2 isql

isql is a command-line Interactive SQL utility that uses the SAP Adaptive Server Enterprise Open Client API.

For syntax and parameters, see the SAP Adaptive Server Enterprise Utility Guide.

isql doesn’t permit you to create user-defined database options. If you need to add your own database options, use the DBISQL Interactive SQL utility instead. See the SAP IQ Interactive SQL Guide.

5.4.3 Interactive SQL (DBISQL)

Interactive SQL (DBISQL) is the SAP IQ interactive SQL utility. It enables you to execute SQL statements, build scripts, and display database data.

DBISQL has two different interface modes:
• A graphical interface that is sometimes referred to as Interactive SQL Java.
• A command-line interface that is sometimes referred to as DBISQL.

Comparing DBISQL-Java and DBISQL-C

Within SAP IQ, there are two editions of the DBISQL utilities. Each is based on a different programming platform:

DBISQL-C:
This is the first edition of DBISQL and it was built on C. It is considered the legacy version of DBISQL. This version is sometimes referred to as DBISQL-C, DBISQL-Classic, or Interactive DBISQL-Classic.

DBISQL-Java:
This is the current version of DBISQL and it was built on Java. This version was designed to replace the C-based version of DBISQL (DBISQL-C).

5.4.4 DBISQL-C, DBISQL-Classic, and Interactive ISQL-Classic are Deprecated

The C-based editions of DBISQL (including the DBISQL-C, DBISQL-Classic, and Interactive SQL Classic versions of DBISQL) are deprecated.

However, there are no plans to remove this C-based edition. Interactive SQL Classic is provided for backwards compatibility for running SQL scripts and as a lightweight tool for deployment.

i Note
The C-based edition does not provide the same functionality as that Java version of DBISQL provides, and it does not support all the features available in the current version of SAP IQ.

DBISQL-Java is the New Standard

As the C-based version of DBISQL has been deprecated and does not support the latest features of SAP IQ, we strongly recommend you use the Java edition of the DBISQL utility, rather than DBISQL-C, or ISQL, unless instructed otherwise, or unless the deprecated utility is required for a specific task.

Support for the C-based version of DBISQL is only provided for backwards compatibility with existing applications and scripts.
5.4.5 Graphical and Command Line Versions of DBISQL-Java

A brief overview of the graphical version and command line version of DBISQL-Java.

Interactive SQL Java (Graphical)

Interactive SQL Java is the graphical version of the SAP IQ DBISQL utility.

To start Interactive SQL, see Starting Interactive SQL from the Windows Start Menu.

You can install the Windows client version of this utility in several ways:
- Install as part of the Windows SAP IQ server installation.
- Install as part of the SAP IQ client installation.
- Install using the Open Client SDK.

You can also run Interactive SQL Java using an xterm window on UNIX and Linux systems. To do this, enter the following within your SAP IQ environment on UNIX:

xterm -sb

DBISQL-Java (Command Line)

On UNIX, you can run the DBISQL utility as a command line interface.

For instructions on starting DBISQL from the Windows or UNIX command prompt, see Starting Interactive SQL from a Command Prompt.

The following example starts DBISQL in a UNIX environment:

```
dbisql -c "uid=<DBA>;pwd=<sql>; eng=<my_server>; dbn=<my_db>; links=tcpi(port=<2638>);" -nogui
```

5.4.6 Returning Multiple Result Sets in DBISQL

By default, Interactive SQL shows the first result set of the most recently executed statement.

For instructions, see Showing Multiple Result Sets (UNIX) and Showing Multiple Result Sets (Windows).
5.4.7 Do Not Mix SQL Dialects in DBISQL

Do not mix Watcom-SQL and Transact-SQL dialects when executing batch scripts. Mixing SQL dialects can result in errors like:

```
Syntax error near 'PROCEDURE' on line 6
SQLCODE=-131, ODBC 3 State="42000"
```

5.4.8 Import Restrictions in DBISQL

Do not use the **Import** option in the Interactive SQL **Data** menu.

The **Import** option is not supported for use with SAP IQ databases. Use the **LOAD TABLE Statement** or the **INSERT Statement** to load data into SAP IQ tables.

**i Note**

If using the deprecated DBISQL-C utility, do not use the **Command | Options | Input Format** menu.
6  Best Practices for Network Connectivity

Information about data access APIs, connectivity tips, ODBC driver manager information, and tips on increasing network throughput.

In this section:

Set the Max Number of User Connections (-gm and -gn Options) [page 42]
For high-volume servers (in either simplex or multiplex implementations), the default setting for the maximum number of user connections may not be sufficient.

Client Access APIs [page 43]
Client access APIs make it easier to build and deploy database applications in multiple programming environments.

Open Client Connections Versus ODBC Connections [page 43]
Most Open Client applications expect an SAP Adaptive Server Enterprise server and T-SQL behavior, as opposed to ANSI-SQL.

Samples and Source Code [page 44]
Find code samples for Perl, Python, PHP, ADO.NET, and OLEDB.

ODBC Driver Manager on UNIX [page 44]
The unixODBC driver manager needs to be version 2.2.14 or higher.

Optimizing Network Connectivity [page 44]
Suggestions for increasing network throughput when accessing an SAP IQ database.

6.1  Set the Max Number of User Connections (-gm and -gn Options)

For high-volume servers (in either simplex or multiplex implementations), the default setting for the maximum number of user connections may not be sufficient.

The default setting for the maximum number of user connections may not be enough if there are many user connections performing concurrent DDL or read-write operations, or if user transactions are very large (for example if many users are performing concurrent data loads or updates without a commit). In this case, you must increase the setting for max user connections for the secondary server. To do this, use the -gm database server option and the -gn Database Server Option.

Follow these general sizing guidelines:

- Set -gn to 1.5 the value of -gm:
  - If -gm is less than 100, set -gn = -gm + 50.
  - If -gm is greater than or equal to 100, set -gn = -gm * 1.5
- On a multiplex coordinator node, set -gn to (-gm + 50 + number_of_IQ_nodes)
- On a multiplex coordinator node, high user concurrency is not needed for external connections, set -gm to relatively low.
For more details on setting the `-gm` and `-gn` options, see the [SAP IQ Hardware Sizing Guide](#).

You should also set the `MPX_MAX_CONNECTION_POOL_SIZE Option` to a reasonable value. Making this number too large can result in too many INC connections to the coordinator.

For high-volume servers, you may also want to consider reducing the DDL or read/write workload on the secondary node by performing some of these operations directly on the coordinator.

To optimize INC connection performance, you should carefully assess the expected concurrent read/write and DDL workload for your applications, and to monitor this workload on an ongoing basis.

### 6.2 Client Access APIs

Client access APIs make it easier to build and deploy database applications in multiple programming environments.

Pre-15.x versions of SAP IQ offered JConnect, ODBC, and Open Client data access APIs. The latest data access APIs include:

- ADO.NET
- Perl (provided by the SQL Anywhere Perl DBD::SQLAnywhere DBI module)
- Python (provided by the sqlanydb interface)
- PHP (provided by the SQL Anywhere PHP module)
- OLE DB
- Native Ruby Driver
- Ruby/DBI Driver
- Linux32(x86) platforms

### 6.3 Open Client Connections Versus ODBC Connections

Most Open Client applications expect an SAP Adaptive Server Enterprise server and T-SQL behavior, as opposed to ANSI-SQL.

Therefore, when writing stored procedures, make sure you consider the type of client connections will execute your code. Some language options use different default values depending on whether you are using an Open Client connection versus an ODBC connection. These options include:

- `ALLOW_NULLS_BY_DEFAULT Option [TSQL]`
- `STRING_RTRUNCATION Option [TSQL]`
- `ANSINULL Option [TSQL]`
- `CHAINED Option [TSQL]`

When using an ODBC driver, it is a good idea to set AutoPreCommit to `YES`. With this setting, user queries will obtain the latest version of a database object. You can set this at the connection level or as a server option.
An ODBC connection will set the following temporary options upon connection:

- `SET TEMPORARY OPTION Time_format = 'hh:nn:ss';`
- `SET TEMPORARY OPTION Timestamp_format = 'yyyy-mm-dd hh:nn:ss.ssssss';`
- `SET TEMPORARY OPTION Date_format = 'yyyy-mm-dd';`
- `SET TEMPORARY OPTION Date_order = 'ymd';`

In order to override these settings for your ODBC connection, you must set the desired values in the `InitString` of the ODBC DSN.

### 6.4 Samples and Source Code

Find code samples for Perl, Python, PHP, ADO.NET, and OLEDB.

Source code, sample projects, and OS-specific binaries for Perl, Python, and PHP are installed in the `%IQDIR16%\ SDK` directory on Windows and the `$IQDIR16/sdk` directory on UNIX.

ADO.NET and OLEDB code samples are in the appropriate folder within `%ALLUSERSPROFILE%\SybaseIQ\samples\SQLAnywhere`.

### 6.5 ODBC Driver Manager on UNIX

The unixODBC driver manager needs to be version 2.2.14 or higher.

See [The unixODBC driver manager](#).

SAP IQ provides the SQL Anywhere `libdbodxx` shared object, which in SAP IQ is called `libdbodbc16`. Use this on all supported UNIX platforms as an ODBC driver manager.

### 6.6 Optimizing Network Connectivity

Suggestions for increasing network throughput when accessing an SAP IQ database.

**Network**

Data retrieval depends on the speed of the network. The faster the network cards and LAN, the better concurrency you can achieve.

**Packet Sizes**

Use the `-p database server option` to set the appropriate packet size. A larger packet size allows a larger data set to be transmitted in each packet.

The default packet size without `-p` is 7300 bytes.
7  Data Modeling Recommendations

Guidance on tuning your database schema for SAP IQ.

In this section:

Sizing Data Types [page 45]
Use the smallest data types possible for data.

IQ Unique Option [page 46]
Use the IQ UNIQUE option to force a specific cardinality on a column.

Null Values [page 46]
Specifying NULL or NOT NULL for a column allows the optimizer to better guess the join criteria.

Unsigned Data Types [page 47]
Use unsigned data types wherever possible.

LONG VARCHAR and LONG BINARY [page 47]
The only indexes allowed on VARCHAR() data wider than 255 bytes are WD, TEXT and CMP. The TEXT index is the only supported index for LONG BINARY columns.

Large Object Storage [page 47]
As a separately licensed option, SAP IQ supports character large object (CLOB) data with a length ranging from zero (0) to 512 TB (terabytes) for an SAP IQ page size of 128 KB, or 2 PB (petabytes) for a page size of 512 KB.

Comparing VARCHAR and CHAR [page 48]
SAP IQ supports variable storage for VARCHAR and VARBINARY.

When to Use Indexes [page 48]
Follow these tips to use the appropriate index for particular situations.

Temporary Tables [page 48]
If you use ON COMMIT PRESERVE ROWS on temporary tables, then rows remain in the table after the transaction has been committed.

Cursors [page 49]
Using cursors generally means row-based processing, which is not optimal in SAP IQ. SAP IQ is designed for set-based processing.

7.1  Sizing Data Types

Use the smallest data types possible for data.

For example, if time information is not necessary, use a DATE data type instead of the DATETIME data type.

If data can fit in TINYINT (1-byte) or SMALLINT (2-byte), use it instead of INTEGER (4-byte) or BIGINT (8-byte).

Avoid overallocating storage when defining NUMERIC() or DECIMAL().
Don’t specify CHAR() or VARCHAR() values larger than the expected maximum length of data.

7.2  IQ Unique Option

Use the IQ UNIQUE option to force a specific cardinality on a column.

In all new SAP IQ 16.0 and 16.1 databases, FP_SBITLE IQ15_COMPATIBILITY=’Off’ is the default. MINIMIZE_STORAGE is ignored.

Using IQ UNIQUE(0) will disable all FP or NBit optimizations and force usage of a flat FP. Do not use this setting.

The following recommendations apply only when FP_SBITLE IQ15_COMPATIBILITY=’ON’ (you want to maintain FP(1), FP(2), and FP(3) indexing instead of adopting new NBit dictionary compression):

- Setting the MINIMIZE_STORAGE option to ON before table creation allows SAP IQ to optimize the FP indexes for each column.
- Using the IQ UNIQUE option forces a specific cardinality on a column.
- Using the MINIMIZE_STORAGE option places an IQ UNIQUE(255) on every column for every table created and removes the need to use IQ UNIQUE.
- MINIMIZE_STORAGE slows down data loads slightly, but drastically improves query speeds.

Related Information

Effect of IQ UNIQUE
MINIMIZE_STORAGE Option
FP_SBITLE IQ15_COMPATIBILITY Option

7.3  Null Values

Specifying NULL or NOT NULL for a column allows the optimizer to better guess the join criteria.

Unlike SAP Adaptive Server Enterprise, NULL data does not save space on the database page.

Always use NULL or NOT NULL for columns in stored procedures, including temporary tables, if you use Tabular Data Stream (TDS) and Command Sequence (CmdSeq) to create those stored procedures.
7.4 Unsigned Data Types

Use unsigned data types wherever possible.
Comparisons of unsigned data are faster than signed data.

7.5 LONG VARCHAR and LONG BINARY

The only indexes allowed on VARCHAR() data wider than 255 bytes are WD, TEXT and CMP. The TEXT index is the only supported index for LONG BINARY columns.

Storage for these data types are allocated in 256-byte chunks.

**i Note**

The LONG VARCHAR and LONG BINARY data types require the Unstructured Data Analytics Option license.

Maximum width of VARCHAR is 32 KB -1 (64 KB -1 ASCII hex for VARBINARY).
The maximum width of LONG VARCHAR is 2 GB.
The WORD index is the only index that allows VARCHAR() data wider than 255 bytes.

Some SAP IQ functions, such as (REVERSE Function [String], SUSER_NAME Function [System], UCASE Function [String]), return LONG VARCHAR. If you use these functions with a SELECT INTO statement, and you don’t have the Unstructured Data Analytics Option license, use the CAST Function [Data Type Conversion] to convert the return value of the function to the correct data type and size.

7.6 Large Object Storage

As a separately licensed option, SAP IQ supports character large object (CLOB) data with a length ranging from zero (0) to 512 TB (terabytes) for an SAP IQ page size of 128 KB, or 2 PB (petabytes) for a page size of 512 KB.

The maximum length is equal to 4 GB multiplied by the database page size.

You can store large objects in binary or text-based objects.

This option extends LONG BINARY data type from a maximum size of 2 GB to an unlimited size.

The only indexes you can use on LOB are FP, WD, and TEXT.

Some useful functions include BYTE_LENGTH64 (returns size of an object) or BYTE_SUBSTR64 (returns portions of the object).
7.7 Comparing VARCHAR and CHAR

SAP IQ supports variable storage for VARCHAR and VARBINARY.

- VARCHAR types add a slight storage overhead. For example, a VARCHAR(100) with just 25 bytes in use will require 26 bytes of storage; 25 bytes for the variable data, and 1 byte for the size of data.
- CHAR data is blank padded; VARCHAR is not.
- Unlike with earlier versions of SAP IQ use VARCHAR whenever possible.

7.8 When to Use Indexes

Follow these tips to use the appropriate index for particular situations.

- If you have JOIN columns, then you should have HG indexes.
- All searchable columns should either have HG or LF indexes.
- Aggregation columns should have HNG indexes.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUM(A*B) will use an FP instead of an HNG.</td>
</tr>
</tbody>
</table>

- DATE, TIME and DATETIME columns should have DATE, TIME or DTTM indexes. If uncertain, place an LF or HG index on the column, depending on cardinality.
- Where appropriate, use primary key, unique constraint or UNIQUE HG index where appropriate.
- If DATE, TIME, or DATETIME columns have an HNG index, replace them with DATE, TIME or DTTM index.
- If a column is used for word searching, then place a WD index on it.
- If a column is used for full text searching, then place a TEXT index on it.
- GROUP BY clauses can take advantage of multi-column indexes as long as the index completely matches the column and order.
- HG inserts are the most expensive in SAP IQ with respect to the other indexes.
- It is preferable to have join columns on integer data types (unsigned, if possible), because integer comparisons are quicker than character comparisons.
- Keep data types as narrow as possible to improve performance by reducing disk I/O and memory requirements.
- Multi-column primary keys should have an additional LF or HG index placed on each individual column.

7.9 Temporary Tables

If you use ON COMMIT PRESERVE ROWS on temporary tables, then rows remain in the table after the transaction has been committed.

Temporary tables are available at the current level (parent) and all of its children.

A parent cannot see a child’s temporary table.
Global temporary tables are static across connections and restarts.

**Related Information**

Preserving Rows
CREATE TABLE Statement

## 7.10 Cursors

Using cursors generally means row-based processing, which is not optimal in SAP IQ. SAP IQ is designed for set-based processing.

If you do use cursors, make sure to use NO SCROLL cursors.

OPEN WITH HOLD means the cursor remains open across transactions. If they are not used, the cursor is closed when a commit is issued.

**Related Information**

Hold Cursors
OPEN Statement [ESQL] [SP]
8 Database Maintenance Recommendations

Recommendations for database maintenance, monitoring, auditing, database connections, and more.

In this section:

Manage Message Log Size with -iqmsgsz and -iqmsgnum [page 50]
Use the message log management parameters -iqmsgsz and -iqmsgnum.

Custom Stored Procedures for Main Dbspace and Temporary Dbspace Management [page 51]
It may be convenient to develop events and custom stored procedures to monitor IQ_SYSTEM_MAIN and IQ_SYSTEM_TEMP dbspace use, and to drop connections that consume too many resources.

Monitor Catalog Disk Space [page 57]
When you create new objects in SAP IQ, their definitions are stored in the IQ catalog. Over time, the catalog file (.DB) and the catalog log files (.LOG) grow in size.

Monitor Free Space Using the sa_disk_free_space Stored Procedure [page 57]
The system stored procedure sa_disk_free_space was introduced in SAP IQ 15.x.

Collecting Daily Auditing Data [page 58]
Activate the SAP IQ auditing feature to collect auditing data on a daily basis.

Manage Locations of Temporary Files [page 59]
Specify the locations of temporary files created by SAP IQ.

Scan the Log for SySAM Messages [page 59]
Create a process to programmatically scan the SAP IQ log at regular intervals for SySAM messages and take appropriate action.

Check for DQP Configuration Problems [page 59]
SAP IQ is capable of distributed query processing (DQP).

Scan IQMSG for Out of Space Messages [page 60]
To avoid dbspace out-of-space messages from getting buried in a large .iqmsg file, consider writing a script to scan the file for such messages.

8.1 Manage Message Log Size with -iqmsgsz and -iqmsgnum

Use the message log management parameters -iqmsgsz and -iqmsgnum.

Use the -iqmsgsz Database Server Option and the -iqmsgnun Database Server Option to control the size of the message log file, and to control the number of archives to be saved.
Tip

Use the -iqmsgsz Database Server Option and the -iqmsgnum Database Server Option to prevent the message log file from growing indefinitely.

8.2 Custom Stored Procedures for Main Dbspace and Temporary Dbspace Management

It may be convenient to develop events and custom stored procedures to monitor IQ_SYSTEM_MAIN and IQ_SYSTEM_TEMP dbspace use, and to drop connections that consume too many resources.

Tasks in this section show you how to create the sp_dropConnOnMainUsed and sp_dropConnOnTempUsed stored procedures.

⚠️ Caution

It is important to note that these are custom stored procedures that you use at your own risk – sp_dropConnOnMainUsed and sp_dropConnOnTempUsed are not SAP IQ system stored procedures, and therefore they are not officially supported, and are not documented with the system stored procedures.

Once the free space within the IQ_SYSTEM_MAIN or IQ_SYSTEM_TEMP falls below a specified threshold value, the sp_dropConnOnMainUsed stored procedure identifies the connection consuming the most space, and the sp_dropConnOnTempUsed stored procedure drops this connection.

ℹ️ Note

sp_dropConnOnMainUsed does not drop DBA connections for IQ_SYSTEM_MAIN.
sp_dropConnOnTempUsed, however, drops any connection (including DBA connections) that is using too much space in IQ_SYSTEM_TEMP.

Whenever a connection is dropped, these stored procedures write to their respective log files: dropConnOnMainUsed.log and dropConnOnTempUsed.log.

Unless you pass explicit path names to these stored procedures, the default location for their logs is the same directory where the database (*.db) file is located.

In this section:

Creating the sp_dropConnOnMainUsed Stored Procedure [page 52]

If IQ_SYSTEM_MAIN usage reaches a specified threshold, the sp_dropConnOnMainUsed custom stored procedure instructs the SAP IQ server to disconnect the connection consuming the most IQ_SYSTEM_MAIN space. DBA connections are the exception – the procedure does not drop DBA connections.

Creating the sp_dropConnOnTempUsed Stored Procedure [page 54]

If IQ_SYSTEM_TEMP usage reaches a specified threshold, the sp_dropConnOnTempUsed custom stored procedure instructs the SAP IQ server to disconnect the connection consuming the most IQ_SYSTEM_TEMP space. This procedure can prevent the SAP IQ server from running out of
Unlike `sp_dropConnOnMainUsed`, `sp_dropConnOnTempUsed` does drop DBA connections.

Implementing `sp_dropConnOnMainUsed` and `sp_dropConnOnTempUsed` [page 56]
Follow this workflow to implement dbspace monitoring and connection dropping capability.

8.2.1 Creating the `sp_dropConnOnMainUsed` Stored Procedure

If IQ_SYSTEM_MAIN usage reaches a specified threshold, the `sp_dropConnOnMainUsed` custom stored procedure instructs the SAP IQ server to disconnect the connection consuming the most IQ_SYSTEM_MAIN space. DBA connections are the exception – the procedure does not drop DBA connections.

Context

If IQ_SYSTEM_MAIN usage reaches a specified threshold, the procedure instructs the SAP IQ server to disconnect the connection consuming the most IQ_SYSTEM_MAIN DBA connections, which it does not drop. This procedure can prevent the SAP IQ server from running out of IQ_SYSTEM_MAIN space.

**Note**

Create, use, and modify `sp_dropConnOnMainUsed` at your own risk. `sp_dropConnOnMainUsed` is not an SAP IQ system stored procedure, and therefore is not supported.

Procedure

From a DBA connection, create this stored procedure in your database. Use this code as a template:

```sql
create procedure
begin
declare maintotal unsigned bigint;
declare mainused unsigned bigint;
```
DECLARE TEMPUSED UNSIGNED BIGINT;
DECLARE DATABasename VARCHAR(30);
DECLARE VERSIONsize VARCHAR(255);
DECLARE SERVERname VARCHAR(30);
DECLARE COnnname VARCHAR(30);
DECLARE TempKB UNSIGNED BIGINT;
DECLARE COnnuserid VARCHAR(30);
DECLARE CurrTime VARCHAR(30);
DECLARE MsgText VARCHAR(255);
DECLARE connid INTEGER;
DECLARE blocksizeX2 UNSIGNED BIGINT;
DECLARE local temporary table m_iq_txn_table(
    TxnID UNSIGNED BIGINT NULL,
    CmtID UNSIGNED BIGINT NULL,
    VersionID UNSIGNED BIGINT NULL,
    State CHAR(12) NULL,
    TxnCreateTime CHAR(26) NULL,
    ConnHandle UNSIGNED BIGINT NULL,
    IQConnID UNSIGNED BIGINT NULL,
    Dbremote BIT NOT NULL,
    CursorCount UNSIGNED BIGINT NULL,
    SpCount UNSIGNED BIGINT NULL,
    SpNumber UNSIGNED BIGINT NULL,
    MainTableKBCreated UNSIGNED BIGINT NULL,
    MainTableKBdropped UNSIGNED BIGINT NULL,
    TempTableKBCreated UNSIGNED BIGINT NULL,
    TempTableKBdropped UNSIGNED BIGINT NULL,
    MainWorkSpaceKB UNSIGNED BIGINT NULL,
) IN SYSTEM ON commit preserve rows;
DECLARE local temporary table iq_status_main(
    Name VARCHAR(40) NULL,
    Value VARCHAR(128) NULL,
) IN SYSTEM ON commit preserve rows;
SET CurrTime = 'left'(CONVERT(VARCHAR(30), GETDATE(*), 115), 16);
EXECUTE IMMEDIATE 'iq utilities main INTO iq_status_main status';
SELECT SUBSTRING(Value, CAST(LOCATE(Value, '=') AS TINYINT) + 1, LENGTH(Value)) INTO VERSIONsize
FROM iq_status_main WHERE name LIKE '%Other%' ORDER BY Name ASC;
SELECT Value INTO VERSIONsize FROM iq_status_main WHERE name = 'Other Versions:';
CALL sp_iqspaceused(maintotal, mainused, temptotal, tempused);
SET Databasename = DB_NAME(*);
SET servername = @@servername;
-- IQ main store free space > FreeMainSpace then return. If it is < FreeMainSpace
-- then drop the connection which is taking maximum main space.
IF CAST(100 - (mainused * 100 / maintotal) AS INTEGER) > FreeMainSpace THEN
    DROP TABLE m_iq_txn_table;
    DROP TABLE iq_status_main;
RETURN;
END IF;
SELECT TOP 1 ConnHandle,
    connection_property('Name', ConnHandle) AS Name,
    connection_property('Userid', ConnHandle) AS Userid,
    MAX(cast(MainTableKBCreated * blocksizeX2 / 2 AS UNSIGNED BIGINT) +
        cast(MainTableKBdropped * blocksizeX2 / 2 AS UNSIGNED BIGINT)) AS MainWorkSpaceKB INTO connid,
    connname, connuserid,
    TempKB FROM m_iq_txn_table WHERE
    MainTableKBCreated > 0 AND
    Userid <> 'DBA' AND
    MainTableKBCreated > MainTableKBdropped
GROUP BY ConnHandle ORDER BY MainWorkSpaceKB DESC;
if connid is not null then
execute immediate 'drop connection ' || connid;
set MsgText='echo ' || CurrTime || ' IQ Main free space of: ' ||
cast(cast(100-(mainused*100/maintotal) as numeric(5,2)) as varchar(10)) || '%' ||
'>> ' || LogFile;
call xp_cmdshell(MsgText);
set MsgText='echo ' || CurrTime || ' IQ Temp free space of: ' ||
cast(cast(100-(tempused*100/temptotal) as numeric(5,2)) as varchar(10)) || '%' ||
'>> ' || LogFile;
call xp_cmdshell(MsgText);
set MsgText='echo ' || CurrTime || ' IQ Versioning Size : ' || cast(versionsize as varchar(30)) || '>> ' || LogFile;
call xp_cmdshell(MsgText);

8.2.2 Creating the sp_dropConnOnTempUsed Stored Procedure

If IQ_SYSTEM_TEMP usage reaches a specified threshold, the sp_dropConnOnTempUsed custom stored procedure instructs the SAP IQ server to disconnect the connection consuming the most IQ_SYSTEM_TEMP space. This procedure can prevent the SAP IQ server from running out of IQ_SYSTEM_TEMP space. Unlike sp_dropConnOnMainUsed, sp_dropConnOnTempUsed does drop DBA connections.

Context

⚠️ Caution
Create, use, and modify sp_dropConnOnTempUsed at your own risk. The sp_dropConnOnTempUsed custom stored procedure is not an SAP IQ system stored procedure, and therefore is not supported.

Procedure

From a DBA connection, create this stored procedure in your database. Use this code as a template:

```sql
create procedure dba.sp_dropConnOnTempUsed(LogFile varchar(50),FreeTempSpace integer)
begin
declare maintotal unsigned bigint;
declare mainused unsigned bigint;
declare temptotal unsigned bigint;
declare tempused unsigned bigint;
declare databasename varchar(30);
declare versionsize varchar(255);
declare servername varchar(30);
declare conname varchar(30);
declare TempKB unsigned bigint;
declare connuserid varchar(30);
```
declare CurrTime varchar(30);
declare MsgText varchar(255);
declare connid integer;
declare blocksizeX2 unsigned bigint;
declare local temporary table t_iq_txn_table(
    TxnID unsigned bigint null,
    CmtID unsigned bigint null,
    VersionID unsigned bigint null,
    State char(12) null,
    TxnCreateTime char(26) null,
    ConnHandle unsigned bigint null,
    IQConnID unsigned bigint null,
    Dbremote bit not null,
    CursorCount unsigned bigint null,
    SpCount unsigned bigint null,
    SpNumber unsigned bigint null,
    MainTableKBCreated unsigned bigint null,
    MainTableKBDropped unsigned bigint null,
    TempTableKBCreated unsigned bigint null,
    TempTableKBDropped unsigned bigint null,
    TempWorkSpaceKB unsigned bigint null,
) in SYSTEM on commit preserve rows;
declare local temporary table iq_status_temp(
    Name varchar(40) null,
    Value varchar(128) null,
) in SYSTEM on commit preserve rows;
set CurrTime="left"(convert(varchar(30)'getdate(*)'115)'16);
execute immediate 'iq utilities main into iq_status_temp status';
select substring(Value'cast(locate(Value''=') as tinyint)+1'length(Value)) into
    versionsize
from iq_status_temp where name like '%Other%' order by Name asc;
select Value into versionsize from iq_status_temp where name = 'Other Versions:';
call sp_iqspaceused(maintotal,mainused,temptotal,tempused);
set databasename=db_name(*);
set servername=@@servername;
// IQ temp store free space > FreeTempSpace then return. If it is < FreeTempSpace
// then drop the connection which is taking maximum temp space.
if cast(100-(tempused*100/temptotal) as integer) > FreeTempSpace then
    return
end if;
set MsgText='echo ' || CurrTime || ' IQ Main free space of: ' ||
    cast(cast(100-(mainused*100/maintotal) as numeric(5'2)) as varchar(10)) ||
    '%%' || '>
' || LogFile;
call xp_cmdshell(MsgText);
set MsgText='echo ' || CurrTime || ' IQ Temp free space of: ' ||
    cast(100-(tempused*100/temptotal) as numeric(5,2)) as varchar(10))
|| '%%' || '>
' || LogFile;
call xp_cmdshell(MsgText);
set MsgText='echo ' || CurrTime || ' IQ Versioning Size : ' ||
cast(versionsize as varchar(30)) || '>
' || LogFile;
call xp_cmdshell(MsgText);
select first block_size/512 into blocksizeX2 from SYSIQINFO;
execute immediate 'iq utilities main into t_iq_txn_table command statistics
10000';
select top 1 ConnHandle,
    connection_property('Name',connHandle) as Name,
    connection_property('Userid',connHandle) as Userid,
    max(cast(TempWorkSpaceKB*blocksizeX2/2 as unsigned bigint)
        +cast(TempTableKBCreated*blo
        cksizeX2/2 as unsigned bigint)+cast(TempTableKBDropped*blocksizeX2/2 as unsigned bigint))
    as TempWorkSpaceKB into connid,
    connname,connuserid,
8.2.3 Implementing sp_dropConnOnMainUsed and sp_dropConnOnTempUsed

Follow this workflow to implement dbspace monitoring and connection dropping capability.

Prerequisites

- You have created the sp_dropConnOnMainUsed custom stored procedure.
- You have created the sp_dropConnOnTempUsed custom stored procedure.

Procedure

1. From a DBA connection, execute the following CREATE_EVENT statements using the following configurations:
   
   **Start time** - set your preferred start time. In this example, it is 04:00.
   
   **Threshold value** - this is the Free Space percentage, not Used Space. In this example it is 90%.

   ```sql
   CREATE EVENT "dropConnOnMainUsed"
   SCHEDULE "dropConnOnMainUsed"
   START TIME '04:00' EVERY 300 SECONDS
   HANDLER BEGIN
   call sp_dropConnOnMainUsed('dropConnOnMainUsed.log', 90)
   END;
   CREATE EVENT "dropConnOnTempUsed"
   SCHEDULE "dropConnOnTempUsed"
   START TIME '04:00' EVERY 300 SECONDS
   HANDLER BEGIN
   call sp_dropConnOnTempUsed('dropConnOnTempUsed.log', 90)
   END;
   ```
2. Configure parameters for the events.

3. For multiplex environments, make sure that the events are only executed from a writer node.

```
declare srvType char(1);
select ServerType into srvType from sp_iqmpxversioninfo();
//Return immediately if Reader Node.
if srvType='Q'
then
    return ;
end if ;
```

## 8.3 Monitor Catalog Disk Space

When you create new objects in SAP IQ, their definitions are stored in the IQ catalog. Over time, the catalog file (.DB) and the catalog log files (.LOG) grow in size.

> **Tip**
>
> Make a habit of monitoring the size of .DB and .LOG files.
>
> Always monitor the OS-level disk space where your .DB and .LOG files reside. To avoid interruptions in SAP IQ availability, ensure that there is sufficient space to accommodate these files.

## 8.4 Monitor Free Space Using the `sa_disk_free_space` Stored Procedure

The system stored procedure `sa_disk_free_space` was introduced in SAP IQ 15.x.

Use the `sa_disk_free_space` system procedure to monitor the free space for system dbspaces. The procedure returns the system dbspace name, the free disk size, and the total disk size.

The system dbspace names you can use in `sa_disk_free_space` system procedure syntax are:

- SYSTEM
- TRANSLOG
- TRANSLOGMIRROR
- TEMPORARY or TEMP

> **Tip**
>
> Run the `sa_disk_free_space` system procedure at regular intervals throughout the day.
>
> Run it either manually, by scheduling its execution in a CREATE EVENT Statement, or in a UNIX script to monitor free space. For example:

```
call sa_disk_free_space (system);  Returns disk information for the system dbspace (.DB).
```
8.5 Collecting Daily Auditing Data

Activate the SAP IQ auditing feature to collect auditing data on a daily basis.

Prerequisites

You are logged in as DBA.

Context

Auditing saves additional information to the transaction log:

- All login attempts (successful and failed), including the terminal ID.
- Accurate timestamps of all events (to a resolution of milliseconds).
- All permissions checks (successful and failed), including the object on which the permission was checked (if applicable).
- All actions that require DBA authority.

For details on all the auditing types, see: sa_enable_auditing_type system procedure.

Procedure

1. Turn on auditing by calling the sa_enable_auditing_type system procedure:

   ```sql
   SET OPTION auditing = 'On';
   CALL sa_enable_auditing_type( 'all' );
   ```

2. Combine auditing with truncating the transaction log (for example, each day at 12:00 midnight); this enables you to collect the audit data on a per-day basis.
8.6 Manage Locations of Temporary Files

Specify the locations of temporary files created by SAP IQ.

Procedure

1. On UNIX/Linux platforms, point the IQTMP16 variable to the desired directory (with the desired permissions) where temporary files are created by SAP IQ.
2. You can also use the -dt database server option to specify the location of a temporary file. If this option is not specified, then the database server checks SAP IQ environment variables in this order:
   ○ IQTMP16 (or the SATMP environment variable for SAP SQL Anywhere temporary files)
   ○ TMP
   ○ TMPDIR
   ○ TEMP

8.7 Scan the Log for SySAM Messages

Create a process to programmatically scan the SAP IQ log at regular intervals for SySAM messages and take appropriate action.

These messages can occur at any time and are due to a wide range of issues ranging from software installation to increasing the size of dbspaces.

⚠️ Caution

Failure to correct SySAM warnings or errors in a timely manner may result in the server shutting down or failing to start.

8.8 Check for DQP Configuration Problems

SAP IQ is capable of distributed query processing (DQP).

DQP requires a shared temporary store (dbspace). An empty dbspace will be created for you called IQ_SHARED_TEMP. Add disk space (raw device) to this dbspace using the command ALTER DBSPACE ADD FILE or use Cockpit to add the disk space. You can use the stored procedure sp_iqmpxcheckdpconfig to diagnose DQP configuration issues.
Related Information

ALTER DBSPACE Statement
sp_iqmpxcheckdqpconfig Procedure

8.9 Scan IQMSG for Out of Space Messages

To avoid dbspace out-of-space messages from getting buried in a large .iqmsg file, consider writing a script to scan the file for such messages.

SAP Support has a template for such a script for UNIX platforms, which you modify for your particular environment.

⚠️ Caution

Use such a script at your own risk.
9  Best Practices for Backup and Recovery

Tips for diagnosing database backup and recovery problems, and best practices for SAP IQ backup and recovery.

For backup and recovery administration procedures, see SAP IQ Administration: Backup, Restore, and Data Recovery.

In this section:

- Backup and Recovery Recommendations [page 61]
  Recommendations for SAP IQ backup and recovery to help you avoid problems.

- Understanding SAP IQ Backup Methods [page 64]
  The SAP IQ server provides several types of backups.

- Backup Utilities [page 64]
  Use backup utilities to display detailed information about the backup and restore activities performed against an SAP IQ database.

9.1  Backup and Recovery Recommendations

Recommendations for SAP IQ backup and recovery to help you avoid problems.

Keep a Soft Copy of Schema

Have your database schema in a file format in case you cannot restore a database and need to rebuild the server. Any major changes in schema should be followed by DDL soft copy record-keeping.

Keep Backup Copies

Back up the database when there are major changes in the database as well as at regular intervals. Backups are extremely important for continued operations in case of unforeseen events.

Keep copies of the valid database in safe location(s). SAP IQ allows you to verify the database dumps. Verification will inform you of any issues, so you can take corrective action in a timely manner.

Always keep a good copy of the catalog .db file. In a multiplex environment, also have a good copy of the coordinator’s catalog .db file.
Consider Virtual Backups

To reduce the time for a backup, investigate the virtual backup option provided with SAP IQ. Virtual backups allow you to do more frequent full backups, since they don’t take as long as a regular backup.

You can back up and restore the whole database in seconds or minutes, minimizing downtime. SAN technologies provide the capability of creating multiple mirrored copies of SAP IQ dbfile devices. These copies make it possible to offload maintenance tasks, such as consistency checks, on the mirrored copies. You can use the sp_iqfile Procedure to create a backup list of files that comprise the database.

Manage Log File Size

Keep monitoring the .log file size. If it grows too big, then take appropriate actions to truncate the .log file. An extremely large .log file can have an adverse impact on database performance.

The latest versions of SAP IQ have configurable options (the -iqmsgsz Database Server Option and the -iqmsgnum Database Server Option switches) for keeping the message file size constrained, and making copies of previous versions of the file.

Use a Test Environment

Your test environment should be as similar as possible to the production environment. Test any modifications in the test environment for correctness and desired performance before implementing them in the production environment.

Understand Multiplex Restrictions

Backup and restore commands may only be executed on the coordinator in a multiplex environment.

Ask for Help

To avoid major problems, promptly contact SAP Support before you take any drastic action when you encounter any SAP IQ-related error.

Monitor Available Disk Space

Create events in the SAP IQ server that monitor OS space availability. Use the sa_disk_free_space system procedure to get this information.
Monitoring the available disk space for SAP IQ critical operational files is important to maintain SAP IQ availability. This includes the SAP IQ .log and .db files, along with the .iqmsg file and several other files. Make sure you have sufficient space to accommodate these files to avoid interruptions in SAP IQ service.

On UNIX platforms, the /tmp file system is often used for temporary work. This directory also needs sufficient space. Before starting an SAP IQ server, set the IQTMP environment variable to point to a different temporary location.

**Copy PARAMS.CFG, SYSDBFILE, and SYSDBSPACE**

The IQ temporary store and params.cfg file are not backed up, but information needed to recreate the IQ temporary store and metadata is backed up. The DBA should make a copy of the params.cfg file and save the contents of the SYSDBFILE system view and SYSDBSPACE system view.

**Use Logical Links when Creating Dbfiles**

A dbspace is composed of a set of dbfiles. When creating dbfiles, use logical links to make it easier to move the underlying physical devices as needed.

**Restricting Backups to Read-Write Files**

Dbspaces and dbfiles can be read-only (RO), read-write (RW), and online or offline. You may restrict full, incremental since-full or incremental backup to just the set of read-write files in the IQ main store. All read-write files will be backed up. An SAP IQ backup may back up a subset of read-only dbspaces and/or read-only dbfiles in the IQ main store.

**Freelist and Backups**

In SAP IQ, 20 percent of IQ_SYSTEM_MAIN is reserved for the freelist. The freelist is used to track the blocks used by dbspaces. The freelist is considered part of the catalog information. Used blocks for the freelist are backed up, but reserved blocks are not since they can be easily reconstructed without a backup of the information.

**Restoring a Multiplex**

During a restore, if the directory structure and dbfile names are the same in both the DR environment and the production environment, there is no need to drop the secondary servers from the multiplex.
Understand the RESTORE Command VERIFY Option

The RESTORE DATABASE statement provides a VERIFY option to validate the database backup archives. This option only reads the blocks and does not perform a restore. See RESTORE DATABASE Statement.

File Location Restrictions During Restore

In a restore operation, the IQ main store files (.iq), catalog database (.db file) and transaction log (.log file) cannot exist in the location to which the database is being restored. If any of these files exist, move them to a different location before starting the full restore.

9.2 Understanding SAP IQ Backup Methods

The SAP IQ server provides several types of backups.

- **Full backup** - is the default backup type. It performs a full backup of catalog stores and all used blocks.
- **Incremental backup** - performs a full backup of the catalog store and all blocks that have changed since the last backup of any kind are backed up.
- **Incremental-since-full-backup** - performs a full backup of the catalog store and all blocks that have changed since the last full backup.

**Note**

The INCREDENTIAL clause is not supported with read-only dbspaces.

- **Virtual backup** - performs a full backup of the catalog store and selected SAP IQ metadata. The information specific to the freelist, the backup, and the checkpoint, is backed up.
- **Virtual decoupled** - performs a virtual backup, where all dbspaces are copied after the decoupled backup finishes, followed by a non-virtual incremental backup.
- **Virtual encapsulated** - a virtual encapsulated shell command allows the shell command to be executed as part of the backup. The shell command performs system-level backup of the IQ store. A non-zero status returned from the shell command indicates a backup failure and the virtual backup returns an error.

See BACKUP DATABASE Statement.

9.3 Backup Utilities

Use backup utilities to display detailed information about the backup and restore activities performed against an SAP IQ database.

- **db_backupheader** - reads the backup archive and displays the dbspaces and dbfiles that existed when the backup was done. See db_backupheader Database Administration Utility.
**sp_iqbackupsummary** - shows all the dbfiles included in a particular backup. See [sp_iqbackupsummary Procedure](#).

**sp_iqbackupdetails** - summarizes the backup operations performed by a particular backup. See [sp_iqbackupdetails Procedure](#).

**sp_iqrestoreaction** - lists the restore actions needed to bring a database to a consistent state for a given date. See [sp_iqrestoreaction Procedure](#).

For more information on using these utilities, see [Queries, Utilities, and Procedures](#) in *SAP IQ Administration: Backup, Restore, and Data Recovery*. 
10 Best Practices for User-Defined Functions

User-defined functions (UDFs) are user-written procedures that return a value to the calling environment for use in a SQL query or statement. UDFs provide a mechanism for extending the functionality of a database server by allowing users to create their own custom functions that can be called from within a SQL statement.

UDFs can run either within or external to the SAP IQ server. SAP IQ provides three types of UDFs:

<table>
<thead>
<tr>
<th>UDF</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>External C/C++ UDFs</td>
<td>Run within the SAP IQ server and provide the highest level of performance. These require the IQ_UDF license (for partner certified libraries), or the IQ_IDA license (for user-written libraries).</td>
</tr>
<tr>
<td>External Language UDFs</td>
<td>Run outside of SAP IQ and are written in languages such as Java, PERL, or client-side embedded C/C++. These do not require a special license.</td>
</tr>
<tr>
<td>Interactive SQL UDFs</td>
<td>Run within SAP IQ (limited to the functionality provided by the SQL languages supported by SAP IQ, and may lack the performance of external C/C++ UDFs). These do not require a special license.</td>
</tr>
</tbody>
</table>

In this section:

- External C/C++ UDF Recommendations [page 66]
  Best practices for external C/C++ UDF development.
- External C/C++ UDF Restrictions [page 68]
  Practices to avoid when developing external C/C++ UDFs.
- Table UDF Performance and Tuning Tips [page 68]
  Best practices for developing high-performance table UDFs.
- UDF Debugging Tips [page 69]
  Tips to help you debug SAP IQ UDFs.

10.1 External C/C++ UDF Recommendations

Best practices for external C/C++ UDF development.

Read SAP IQ Administration: User-Defined Functions for practices to avoid, such as performing complex, or memory-intensive operations repeated at every UDF invocation.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modifying at runtime</td>
<td>If a UDF needs to be modified at runtime, SAP recommends following a set of procedures for safely unloading the old UDF library and reloading the new library. See SAP IQ Administration: User-Defined Functions for more information.</td>
</tr>
<tr>
<td>Recommendation</td>
<td>Details</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Single library</td>
<td>The C/C++ code for UDFs is compiled into one or more external libraries that are subsequently loaded into the SAP IQ server process space when needed. For simplicity of managing the UDF installation, SAP recommends that UDF developers package multiple UDF functions within a single library.</td>
</tr>
<tr>
<td>Upgrade to the v4 API</td>
<td>Although you can still use the v3 UDF API (requires either the IQ_UDF or IQ_IDA license) SAP recommends that you upgrade to the v4 API. The v4 version allows you to distribute queries incorporating UDFs across a multiplex. Also, TPFs (table parameterized functions) in v4 allow you to define a partitioning schema that breaks the data set into row set partitions that execute in parallel across the multiplex.</td>
</tr>
<tr>
<td>Understand licensing</td>
<td>Execution of UDFs on a simplex server or on a multiplex writer node remains restricted to SAP Certified Partners and requires the purchase of another license – the IQ_UDF license. UDFs which run under the IQ_IDA option are restricted to reader nodes only. When running IQ_IDA UDFs, you must ensure that your failover logic never results in a reader node being promoted to a writer, or a coordinator node. This promotion will cause all subsequent UDFs to fail.</td>
</tr>
<tr>
<td>Memory management</td>
<td>UDF developers must be careful with memory management and the use of the pointer. Be sure to manage memory and temporary results as defined by the API. In addition, be sure to implement robust error handling. Write UDFs so that they track whether a query has been canceled by the user, and clean up and exit properly. Check the return status of all callback functions, and return the correct status of success or failure from the UDF.</td>
</tr>
<tr>
<td>Debugging</td>
<td>Use log and console messages sparingly while debugging the C/C++ or external language code. All debugging output should be removed or disabled when compiling the final production UDF library or jar, leaving only log or console messages which report error conditions.</td>
</tr>
<tr>
<td>Thread-safe UDFs</td>
<td>Write all UDFs in a thread-safe manner that allows them to be called simultaneously by different users. If a UDF accesses a global or shared data structure, implement the appropriate locking around its accesses to that data.</td>
</tr>
<tr>
<td>Deploy UDFs with caution</td>
<td>Certified SAP partners who deploy their UDFs on a writer node need to do so with great caution. Use the -sf database server option with each server to enable or disable the execution of UDFs. In general, you should install and execute UDFs only on read-only multiplex nodes.</td>
</tr>
</tbody>
</table>
10.2 External C/C++ UDF Restrictions

Practices to avoid when developing external C/C++ UDFs.

<table>
<thead>
<tr>
<th>Restriction</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard-coded library paths</td>
<td>Do not hard-code library paths in SQL registration scripts. This practice makes it difficult to provide flexibility to the user to install the UDFs into the same directory as SAP IQ.</td>
</tr>
<tr>
<td>Ambiguous code</td>
<td>Do not write ambiguous code, or constructs that can unexpectedly loop forever, without providing a mechanism for the user to cancel the UDF invocation. See the function get_is_cancelled External Procedure Context Method.</td>
</tr>
<tr>
<td>Repeated memory-intensive</td>
<td>Do not perform complex, or memory-intensive operations that are repeated every invocation. When a UDF call is made against a table that contains many thousands of rows, efficient execution becomes paramount. Allocate blocks of memory for a one to several thousand rows at a time, rather than on a row-by-row basis.</td>
</tr>
<tr>
<td>Database operations from</td>
<td>Do not open a database connection, or perform database operations from within a UDF. All parameters and data required for UDF execution must be passed as parameters to the UDF.</td>
</tr>
<tr>
<td>within the UDF</td>
<td></td>
</tr>
<tr>
<td>Reserved words in named</td>
<td>Do not use reserved words when naming your UDFs.</td>
</tr>
<tr>
<td>UDFs</td>
<td></td>
</tr>
<tr>
<td>Excessive information in logs</td>
<td>Do not log excessive, detailed information to the iqmsg file (C/C++ UDFs) or console (external language UDFs), especially within loops or other segments of code which execute frequently, as this dramatically affects the performance of the UDF.</td>
</tr>
</tbody>
</table>

10.3 Table UDF Performance and Tuning Tips

Best practices for developing high-performance table UDFs.

<table>
<thead>
<tr>
<th>Performance tip</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid data copies</td>
<td>Avoid data copies by using fetch_block instead of fetch_into.</td>
</tr>
<tr>
<td>Optimize row block structure</td>
<td>The size of a row block structure can have an impact on performance. The number of rows in a row block is configurable using the TABLE_UDF_ROW_BLOCK_CHUNK_SIZE_KB Option. This option fixes the memory usage for the server constructed row block. If a row block is too small, the UDF will need to be invoked many times to return all the data. The number of rows in the row block will be chunk_size / row_width. (The row_width is the size in bytes for each column in a row). The default value is 128K bytes.</td>
</tr>
</tbody>
</table>

DEFAULT_TABLE_UDF_ROW _COUNT option (Java table UDFs)
Performance tip | Details
--- | ---
Set the temporary `DEFAULT_TABLE_UDF_ROW_COUNT` Option to the number of rows you expect your UDF to produce. This affects how much space SAP IQ thinks it needs to process the query, and will affect the type of join preference that SAP IQ chooses. The default value for `DEFAULT_TABLE_UDF_ROW_COUNT` is 200 000 rows.

Disallow server-side request | (Java UDFs)
Keep the default setting to disallow `ALLOW SERVER SIDE REQUESTS`. If they are allowed, Java UDFs then execute via functional compensation, which degrades performance.

Turn off console log messages | (Java UDFs)
Improve performance by turning off any console log messages (commenting out Java `sys.println(...)` statements) used while debugging the Java code.

### 10.4 UDF Debugging Tips

Tips to help you debug SAP IQ UDFs.

<table>
<thead>
<tr>
<th>Debugging Tip</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set <code>EXTERNAL_UDF_EXECUTION MODE</code></td>
<td>Use the <code>EXTERNAL_UDF_EXECUTION MODE</code> database option to control the amount of error checking and call tracing that SAP IQ performs automatically when statements are evaluated. See Controlling Error Checking and Call Tracing.</td>
</tr>
<tr>
<td>Remove debugging messages</td>
<td>SAP IQ captures errors from the operating system to the <code>.stdout</code> (Windows and UNIX) and <code>.stderr</code> (UNIX only) files located in the same directory as the database file.</td>
</tr>
</tbody>
</table>

**iNote**

Logging messages to the `.iqmsg` or console negatively affects performance, so you should remove all debug messages prior to final compilation and deployment to a production environment.

| Log custom information | The UDF APIs also provide callback functions enabling the UDF to write to the `.iqmsg` message file, so you can log your own information as appropriate. |
| Use Microsoft Visual Studio Debugger | Microsoft Visual Studio 2008 developers can use the Microsoft Visual Studio Debugger to step through the user-defined function code. |
11  Best Practices for Database Options

Database options provide a method for controlling many aspects of SAP IQ behavior.

Unlike SAP ASE, SAP IQ provides hundreds of database options that enable you to customize server behavior to meet your application needs. Most database options are available to all users and are dynamic. However, some options set permanent server-wide behavior and are static. For these options, DBA authority is usually required, and a server restart is needed for these changes to go into effect.

Since SAP IQ contains only one database, changing a single database option can affect the entire server. Depending on how you qualify an option, the scope of these changes ranges from temporarily affecting an individual user, to permanently affecting all users on the server – making them an important and powerful feature of SAP IQ.

Understand database options fully before using them, and implement them with caution. Further, some database options should only be used under explicit instructions from SAP Support.

In this section:

- SAP IQ Behavior Controlled by Database Options [page 71]
  - Database options control SAP IQ behavior in several areas.

- How to Set a Database Option [page 71]
  - To set an option, use the `SET OPTION` statement.

- Reset or Delete a Database Option [page 71]
  - To reset or delete a database option, use the `SET OPTION` statement without specifying `<option-value>`. This returns the option to its original or default value, depending how the option was originally set.

- Database Option Scope, Duration, and Precedence [page 72]
  - Given the range and degree of control that database options exercise, you need to control these options with precision, through the use of `SET OPTION` statement syntax that limits the scope, duration and precedence of its effects.

- Tips on Setting Database Options [page 73]
  - Choose the correct option scope and option duration for your needs.

- Using SP_IQCHECKOPTIONS to Display Database Options [page 74]
  - The `sp_iqcheckoptions` procedure lists the current and default values for database options that have been changed from the default.

- Database Options that Impact Performance [page 75]
  - Options you should turn ON or OFF to improve SAP IQ performance.

- Database Options for Collecting Query Performance Data [page 76]
  - Set query plan options to collect query plan information.
11.1 SAP IQ Behavior Controlled by Database Options

Database options control SAP IQ behavior in several areas.

<table>
<thead>
<tr>
<th>Area</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility</td>
<td>Controls the extent to which SAP IQ behaves like SAP Adaptive Server Enterprise, and whether errors are generated when SQL does not conform to SQL92.</td>
</tr>
<tr>
<td>Error handling</td>
<td>Controls what happens when a specified error occurs, such as dividing by zero.</td>
</tr>
<tr>
<td>Concurrency transactions</td>
<td>Controls the degree of concurrency and the details of COMMIT behavior.</td>
</tr>
<tr>
<td>Performance and optimizer behavior</td>
<td>Controls performance features such as index usage and optimizer tips.</td>
</tr>
<tr>
<td>Query behavior</td>
<td>Enables or disables specific features and the forcing of specific query behavior.</td>
</tr>
<tr>
<td>Resource usage</td>
<td>Controls resource usage such as cache, and execution time.</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>Controls the creation and configuration of troubleshooting and performance diagnostics.</td>
</tr>
</tbody>
</table>

11.2 How to Set a Database Option

To set an option, use the SET OPTION statement.

For command syntax, usage notes, and command examples, see SET OPTION Statement.

11.3 Reset or Delete a Database Option

To reset or delete a database option, use the SET OPTION statement without specifying <option-value>. This returns the option to its original or default value, depending how the option was originally set.

Resetting Database Option Values

The following table shows the behavior change of the option settings when you set them without a value:

<table>
<thead>
<tr>
<th>Option Value</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>A personal option setting</td>
<td>The value reverts back to the PUBLIC setting</td>
</tr>
<tr>
<td>A TEMPORARY option</td>
<td>The setting reverts back to a PERMANENT setting</td>
</tr>
</tbody>
</table>
### Examples

- `SET temporary option Query_Plan_As_HTML = ;`
- `SET option DBA.Query_Plan = ;`
- `SET option PUBLIC. Query_Plan = ;`

### 11.4 Database Option Scope, Duration, and Precedence

Given the range and degree of control that database options exercise, you need to control these options with precision, through the use of `SET OPTION` statement syntax that limits the scope, duration and precedence of its effects.

<table>
<thead>
<tr>
<th>Option Scope</th>
<th>Option Duration</th>
<th>Precedence</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>USER</td>
<td>This setting only affects the user ID named in the option.</td>
<td>USER takes precedence over PUBLIC.</td>
<td>If you do not specify USER or PUBLIC, by default, your option applies only to the user issuing the command.</td>
</tr>
<tr>
<td>PUBLIC</td>
<td>This setting affects all users.</td>
<td></td>
<td>You must have DBA privileges to use the PUBLIC option.</td>
</tr>
<tr>
<td>TEMPORARY (without PUBLIC)</td>
<td>This setting remains in effect for the duration of the user connection that set the option.</td>
<td>TEMPORARY takes precedence over USER and PUBLIC settings.</td>
<td>If you do not specify USER or PUBLIC, by default, your option applies only to the user issuing the command.</td>
</tr>
<tr>
<td>TEMPORARY PUBLIC</td>
<td>This setting remains in effect until you restart SAP IQ. Is effective immediately and persists until you restart SAP IQ. Upon restart, the option reverts to its previous permanent setting.</td>
<td>TEMPORARY takes precedence over USER and PUBLIC settings.</td>
<td>Requires DBA authority to set.</td>
</tr>
<tr>
<td>PERMANENT (Implied)</td>
<td>Do not set this option explicitly. It is set indirectly by specifying an option without the TEMPORARY qualifier.</td>
<td></td>
<td>Applies to the user or group that sets it. If set by the DBA, it applies to all user.</td>
</tr>
</tbody>
</table>
When Options Take Effect

Options that affect the entire server may require you to restart the server for the to take effect.

Options that affect only the current connection generally take effect immediately. In many cases, you can change these option settings in the middle of a transaction.

→ Tip

Do not change options when a cursor is open since this can lead to unreliable results.

Related Information

SET OPTION Statement

11.5 Tips on Setting Database Options

Choose the correct option scope and option duration for your needs.

Set USER

To set an option for a particular user or group, specify the user name or group name. For example:

```
SET option USER1.Query_Plan = 'ON' ;
```

To set an option for current user, specify the option without specifying a user name or group name. For example:

```
SET option Query_Plan = 'ON' ;
```

Set PUBLIC

To set an option for every user, use the PUBLIC keyword. For example:

```
SET option PUBLIC.mpx_autoexclude_timeout = '0' ;
```

↓ Note

The use of the PUBLIC option requires DBA privileges.
Set TEMPORARY (Without PUBLIC Option)

To set an option for the duration of the current user’s connection only, set the option using the TEMPORARY keyword, without specifying PUBLIC or group. For example:

```
SET temporary option Query_Plan = 'ON' ;
```

Set PUBLIC. TEMPORARY

If an option is set to TEMPORARY for the PUBLIC group, it remains in effect for as long as the database is running and reverts back to the permanent value when the server is restarted. For example:

```
SET PUBLIC. temporary option Query_Plan = 'ON' ;
```

Set Permanent (Implied)

The permanent setting is implied, and not set explicitly. That is, there is no `SET PERMANENT` command for database options. To make an option setting permanent, set the option without using the TEMPORARY keyword. This permanently sets the option value for the user or group issuing the statement. For example:

```
SET option Query_Plan = 'ON' ;
```

11.6 Using SP_IQCHECKOPTIONS to Display Database Options

The `sp_iqcheckoptions` procedure lists the current and default values for database options that have been changed from the default.

The behavior of `sp_iqcheckoptions` differs based on who it is run by:

- **Run as DBA** - it lists all options set on a permanent basis for all groups.
- **Run as user** - it lists temporary options set for DBA and those temporary options set by the current user.

All users see non-default server start-up options.

Sample output for `sp_iqcheckoptions`:

```
User_name  Option_name  Current_value  Default_value  Option_type
----------  -----------  -----------  -------------  -----------
'DBA'     'Query_Plan_As_HTML' 'On' 'Off' 'Permanent'
'DBA'     'Query_Plan_Text_Access' 'On' 'Off' 'Temporary'
'DBA'     'Query_Plan_Text_Access' 'On' 'Off' 'Permanent'
```
Tip

Run `sp_iqcheckoptions` before and after an upgrade to verify option settings. In case the upgrade process reset some options to their default values, running `sp_iqcheckoptions` allows you to identify and correct their settings.

Related Information

`sp_iqcheckoptions` Procedure

11.7 Database Options that Impact Performance

Options you should turn ON or OFF to improve SAP IQ performance.

<table>
<thead>
<tr>
<th>Option</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUERY_PLAN option</td>
<td>In general, keep the <code>QUERY_PLAN Option</code> turned OFF; keeping this option ON grows the <code>.iqmsg</code> file size at a rapid rate. Turn the <code>QUERY_PLAN option</code> ON only when you need to collect query and load plans for analysis.</td>
</tr>
<tr>
<td>FORCE_NO_SCROLL_CURSORS option</td>
<td>Make sure to turn the <code>FORCE_NO_SCROLL_CURSORS Option</code> ON. Turn this option OFF only where you need backwards scrolling cursors.</td>
</tr>
<tr>
<td>DEFAULT_DISK_STRIPING option</td>
<td>Improve performance by turning the <code>DEFAULT_DISK_STRIPING Option</code> ON so that SAP IQ can write to all available disk stripes during a write operation.</td>
</tr>
<tr>
<td>XP_CMDSHELL option</td>
<td>Avoid using the use of <code>XP_CMDSHELL</code> calls within SAP IQ because these calls can be expensive.</td>
</tr>
<tr>
<td>INSERT...LOCATION PACKETSIZE option</td>
<td>For better performance when executing an <code>INSERT...LOCATION</code> operation, increase the communication packet size to 4 KB if the data volume is large (the default is 512 bytes on most platforms). For example:</td>
</tr>
<tr>
<td></td>
<td><code>INSERT LOCATION PACKETSIZE 4096</code></td>
</tr>
<tr>
<td>Disable scrollable cursor</td>
<td>By default, all query results are buffered in Temp Cache to permit scrolling back and forth through all result rows. Because this may seriously degrade performance if the result set has millions of rows, you should disable this option (by setting it 'ON'). For example:</td>
</tr>
<tr>
<td></td>
<td><code>SET OPTION public.Force_No_Scroll_Cursors='on'</code>;</td>
</tr>
</tbody>
</table>
### Option Details

This option may be set OFF for those users that require this functionality.

**Query temp space**

If set to a non-zero value, it specifies the number of megabytes that each query can use. A query will fail to execute with the error `Query rejected because it exceeds total space resource limit if the temp space estimate exceeds this value. For example:

```sql
SET OPTION public.Query_temp_Space_Limit='0';
```

**Compatibility settings**

When writing stored procedures or embedded application code, be sure to explicitly specify settings for compatibility, as these options get set to different values for Open Client versus ODBC connections.

**Disable referential integrity checking**

When loading data from SAP Adaptive Server Enterprise or other sources, disable referential integrity checking by turning this option ‘ON’.

**Tune parallelism**

To help manage the additional memory requirements of parallelism, SAP IQ provides several database options that allow you to either allocate more memory or to reduce parallelism to match the resources of your particular machine. Therefore, in addition to the existing startup settings that specify the size of main cache and temporary cache (`-iqmc` and `-iqtc`), SAP IQ has several options for tuning parallelism. These include:

- **MAX_QUERY_PARALLELISM** - the `MAX_QUERY_PARALLELISM` Option sets an upper bound that limits the level of parallelization that the optimizer will permit query operators – such as joins, GROUP BY, and ORDER BY – to be. This value should be greater than or equal to the number of cores.

- **MAX_IQ_THREADS_PER_TEAM** - the `MAX_IQ_THREADS_PER_TEAM` Option controls the number of threads allocated to perform a single operation. It should be at least twice the number of cores, or the default of 144, whichever is larger.

- **MAX_IQ_THREADS_PER_CONNECTION** - the `MAX_IQ_THREADS_PER_CONNECTION` Option controls the number of threads for each connection. It should be at least twice the value for `MAX_IQ_THREADS_PER_TEAM` or the default of 144, whichever is larger.

### 11.8 Database Options for Collecting Query Performance Data

Set query plan options to collect query plan information.

```sql
SET temporary option DDL_Information = 'ON' ;
SET temporary option DML_Options10 = 'ON';
```
SET temporary option Index_Advisor = 'ON';
SET temporary option Query_Plan_After_Run = 'ON';
SET temporary option Query_Detail = 'ON';
SET temporary option Query_Name = 'query name here';
SET temporary option Query_Plan = 'ON';
SET temporary option Query_Plan_As_HTML = 'ON';
SET temporary option Query_Plan_As_Html_Directory = 'directory/path';
SET temporary option QUERY_PLAN_TEXT_ACCESS = 'ON';
SET temporary option Query_Timing = 'ON';
SET temporary option QUERY_PLAN_MIN_TIME Option = <num milliseconds>

**Note**

If `Query_Plan='ON'` is set globally, the IQ MSG file will grow quickly. To reduce output size, set `Query_Plan_As_HTML` without setting `Query_Plan`. 
12 Collecting Diagnostic Data

Whenever you encounter issues in SAP IQ, collect diagnostic information before contacting SAP Support.

Collect Basic Diagnostic Information

Regardless of the symptoms of your problem, collect the following basic diagnostic information for SAP IQ problems.

<table>
<thead>
<tr>
<th>Diagnostic Information</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem descriptions and error messages</td>
<td>Provide a clear description of the problem, as well as the exact error message. For example, is this a simplex (single node) or multiplex (multiple node) implementation? If a multiplex, which nodes are the coordinator, reader(s) or writer(s) nodes? When, or what time did this problem occur? Can you reproduce the problem? Is it a non-fatal stack trace, a hung server, or a server crash situation?</td>
</tr>
</tbody>
</table>

Recent changes Have there been any recent changes to your SAP IQ server or the OS?

Test or production? Is this problem occurring on a test server, or on a production server?

Log files Collect and supply these files from the last clean start sequence:

- .iqmsg - usually located in the same directory where the .db file resides.
- .srvlog - located in IQ installs > logfiles
- .stderr - located in IQ installs > logfiles
- –zo - the output file after setting -zr all or -zr sql
- .cfg - provide the .cfg configuration file

System information Provide the OS version and patch level, total memory, and number of CPUs and cores.

OS error logs Provide operating system error logs. For example, /var/adm/messages or errpt output based on the operating system where SAP IQ is installed.

SAP IQ version information Provide the complete SAP IQ version output, by executing start_iq -v2.

Version information for tools Provide the version of any other tool involved in the problem, such as dbisql, OCS, JDBC, SCC, ODBC, jConnect, and any logs pertaining to these tools.

In this section:

Slow Server Performance Diagnostics [page 79]

If you are experiencing slow server performance, collect the following diagnostic data to accompany the basic diagnostic information you gathered.
Slow Query Performance Diagnostics [page 81]  
Collect additional diagnostics if you are experiencing slow query performance.

Non-Fatal Stack Trace Diagnostics [page 82]  
Collect additional diagnostics if you are experiencing a non-fatal error with a stack trace.

Crash or Fatal Stack Trace Diagnostics [page 82]  
Collect additional diagnostics if you are experiencing a crash or fatal stack trace.

Hung Server Diagnostics [page 83]  
Collect additional diagnostics if you are experiencing an SAP IQ server hang.

Connection Diagnostics [page 83]  
Collect additional diagnostics if you are experiencing an SAP IQ connection issue.

Backup and Restore Diagnostics [page 83]  
Collect additional diagnostics if you are experiencing an SAP IQ backup issue.

SySAM Diagnostics [page 84]  
Collect additional diagnostics if you are experiencing SAP IQ SySAM issues.

12.1 Slow Server Performance Diagnostics

If you are experiencing slow server performance, collect the following diagnostic data to accompany the basic diagnostic information you gathered.

Server-Level Diagnostics for Slow Server Performance

Collect server-level information, in the following order, to accompany the normal diagnostic data you gathered in Collecting Diagnostic Data [page 78]:

1. The .cfg file used to start the SAP IQ server.
2. The following IQ log files, which you collect from the last clean start sequence:
   ○ .iqmsg
   ○ .srvlog
   ○ .stderr
   ○ -zo output file after setting -zr all or -zr sql
3. The exact command used to start the SAP IQ server.
4. Output from the following, which you obtain using dbisql or isql:
   ○ sp_iqstatus
   ○ select * from sysfile
   ○ select * from syssqdbfile
   ○ select * from sysoptions order by 2,1
   ○ Monitoring output, obtained from running the following script in isql:

```sql
create table iqmontable (c1 int)
go
```
Operating System Diagnostics for Slow Server Performance

Collect the output from the following UNIX commands, in the following order, to accompany the normal diagnostic data you gathered:

1. The statistics by protocol: `netstat -s`  
2. Memory statistics for the networking code: `netstat -m`  
3. The stack trace for each process: `pstack <process_id>`
   For simplex a server or coordinator and/or secondary node(s) showing problems, gather at least three or four `pstack` outputs that are at least three to five minutes apart. The `pstack` utility may differ based on the operating system that SAP IQ is running on. For example, the tool on AIX is `procstack`, and `pstack` on Solaris, Linux, and HP-UX.
4. Memory map, which you obtain with the following command:
   - (Most UNIX systems) `pmap <PID>`
   - (AIX) `svmon -rP`
5. CPU and IO statistics: `iostat -cdDex 10`
6. Virtual memory statistics: `vmstat -S 5`
7. Processor-related statistics: `mpstat 180 10`
8. Tracing output.

⚠️ Caution

Use these tracing tools with caution and only as a last resort as they can severely impact performance.

<table>
<thead>
<tr>
<th>Tracing Tool</th>
<th>Platform</th>
<th>Command</th>
</tr>
</thead>
</table>
| truss        | (AIX, Solaris etc.) | Execute the `truss` command for at least 40 seconds:  
|              |          | `truss -afv all -Dd -<output_file_name> -p <PID>` |
| dtrace       | (Solaris 10+, preferred tracing option) | |
12.2 Slow Query Performance Diagnostics

Collect additional diagnostics if you are experiencing slow query performance.

Obtain the information for these questions to accompany the basic diagnostic data you gathered in Collecting Diagnostic Data [page 78]:

- Which client tool are you using to execute the query? For example DBISQL, or isql.
- Which operating system is the client tool running on?
- What protocol are you using?
- Was the query scripted (that is, was the stored procedure written and tested earlier), generated, or an ad-hoc query?
- What is the SQL for the query?
- What is the DDL definition for all the objects involved in the query? Objects include:
  - Tables
  - Views
  - Indexes
  - User-defined data types

Perform the following tasks to obtain additional information:

- Collect output from the sp_iqindexmetadata Procedure.
- Generate HTML Query and Load plans for good and bad performance periods by setting the following options just prior to executing the query:

```sql
set temporary option Query_Plan = 'ON';
set temporary option Query_Plan_After_Run = 'ON';
set temporary option Query_Detail = 'ON';
set temporary option Query_Timing = 'ON';
set temporary option Query_Plan_As_HTML = 'ON';
set temporary option Index_Advisor = 'ON';
set temporary option Query_Name = '<Query_name>';
set temporary option DML_Options10 = 'ON';
set temporary option Query_Plan_As_HTML Directory = '<html_plans_directory>';
set temporary option index_advisor='on'';
```

If you do not set Query_Plan_As_HTML_Directory, then by default the HTML plans are generated in the same location where the .iqmsg file is created.
12.3 Non-Fatal Stack Trace Diagnostics

Collect additional diagnostics if you are experiencing a non-fatal error with a stack trace.

Obtain the information for these questions to accompany the basic diagnostic data you gathered in Collecting Diagnostic Data [page 78]:

- The SQL or application that caused the stack trace.
- Did the SQL or application work without problems before?
- Can you reproduce the problem on other servers?
- Can you reproduce the issue consistently?
- Is there anything unique occurring when the issue happens?
- Is there any particular sequence that needs to be followed to reproduce the problem?
- Is there any dependency on the data used during the stack trace?

In addition, if you can reproduce this problem, you can send SQL, table DDL and possibly sample data to SAP Support for further diagnosis.

12.4 Crash or Fatal Stack Trace Diagnostics

Collect additional diagnostics if you are experiencing a crash or fatal stack trace.

Obtain the information for these questions to accompany the basic diagnostic data you gathered in Collecting Diagnostic Data [page 78]:

- Can you reproduce the issue in a simpler reproduction?
- Can you restart the server normally after the crash?
- Does this issue result in data corruption?
- Provide the stack trace file: stktrc*.iq

Perform the following tasks to obtain additional information:

- If there is corruption, execute the *sp_iqcheckdb Procedure* on the objects involved. For example:

  ```sql
  sp_iqcheckdb 'verify database/table/index'
  ```

- In the case of a crash, SAP Support may need the complete core file in some situations. Since SAP IQ truncates the core file to 32 KB by default, get the complete core file by setting this environment variable before starting SAP IQ:

  ```shell
  export IQ_UNLIMIT_CORE="YES"
  ```

Some operating systems may require you to set some operating system parameters to write the complete core at the desired directory.
12.5 Hung Server Diagnostics

Collect additional diagnostics if you are experiencing an SAP IQ server hang.

Obtain additional information to accompany the basic diagnostic data you gathered in Collecting Diagnostic Data [page 78]:

- Check to see if any of the dbspaces ran out of space.
- Collect at least three or four pstack output(s) against the SAP IQ server at least three to five minutes apart:
  - On Solaris, Linux and HP_UX the utility is: pstack
  - On AIX the utility is: procstack

12.6 Connection Diagnostics

Collect additional diagnostics if you are experiencing an SAP IQ connection issue.

Obtain the information for these questions to accompany the basic diagnostic data you gathered in Collecting Diagnostic Data [page 78].

- Can you ping the server using dbping or the TCP/IP ping utility?
- Are the connectivity problems specific to a particular client tool?
- Ensure the server name cache info has the correct server information. Locate the sasrv.ini file. This file contains server information, including server name, protocol, and address. The default location of sasrv.ini is %ALLUSERSPROFILE%\Application Data\SQLAnywhere 11 on Windows and ~/.sqlanywhere11 on UNIX.

Perform the following tasks to obtain additional information:

- Collect the client application logs:
  - ODBC client – turn on ODBC trace.
  - Open Client – perform a ping using dsedit. Set up RIBO and trace.
- Run a network trace, such as tcpdump.

12.7 Backup and Restore Diagnostics

Collect additional diagnostics if you are experiencing an SAP IQ backup issue.

Perform the following tasks to obtain backup and restore-related information:

- Execute the restore utility using the verify option to verify that the backup is valid.
- Check to see whether any of the dump file is missing or whether the restore sequence differs from the dump sequence.
12.8 SySAM Diagnostics

Collect additional diagnostics if you are experiencing SAP IQ SySAM issues.

Perform the following tasks to obtain information, to accompany the normal diagnostic data you gathered in Collecting Diagnostic Data [page 78]:

- Collect the output of the `sp_iqimconfig` Procedure.
- Collect the `.lic` file if this is an unserved license.
- Verify that the directory for this `.lic` file is correctly identified in the search path written to the `.iqmsg` log. For example:

  I. 04/12 12:30:18. 0000000000 Using licenses from:
  C:\IQ\SYSAM-2_0\licenses\SybaseIQ.lic;C:\Documents and Settings\All Users\SybaseIQ\demo\*.lic

- (Served license only) Provide the SySAM server log. Check the SySAM documentation on troubleshooting tips.
- Obtain additional hardware and processor information by running the following command for your platform:
  - (AIX) `lscfg` or `lsconf`
  - (HP-UX) `machinfo`
  - (Linux) `more /proc/cpuinfo > cpuinfo_output`
  - (Solaris) `/usr/sbin/prtdiag` or `/usr/sbin/psrinfo`
- Collect the `dbname>.lmp` file, located in the same directory as the `.db` files.
13 Understanding Error Messages and Alerts

Error and status messages that indicate conditions of potential concern to SAP IQ database operations can appear in several different IQ log files.

- The IQ message file (the .iqmsg log)
- The server log (the .srvlog)
- The standard error log (the .stderr log)
- The Request Log (the zrzo log or SQL log)

You should monitor all four message sources to catch all conditions of potential interest to a database administrator (DBA). There is no single means that a system generating DBA alerts can use to detect all error messages. This section examines the various types of SAP IQ messages and how they can be detected.

In this section:

Standardized Messages in the .iqmsg Log [page 85]
Learn about the evolution of error messages in the IQ message file.

Severity Codes [page 87]
Severity codes indicate the degree and source of the SAP IQ error.

Other Types of Messages in the .iqmsg Log [page 89]
In addition to standardized error messages classified by SQLCode, other types of messages can appear in the SAP IQ .iqmsg log.

.srvlog Messages [page 94]
Startup messages tracking the SAP IQ server startup process are written to the .srvlog.

.stderr Messages [page 96]
The .stderr log shows useful information from SAP IQ server start time about resources configured for the server.

Request Log Messages [page 96]
User-level error messages are logged in the request log, along with all command activity.

When There are No Messages [page 97]
Sometimes a problem with the SAP IQ server can occur without leaving messages in the .iqmsg log.

13.1 Standardized Messages in the .iqmsg Log

Learn about the evolution of error messages in the IQ message file.

Error messages appearing in the IQ message file used to be identified mainly by source code module and line number within the module, along with message text. SQLCode and SQLState were added in SAP IQ 12.6, and a new SAP IQ Error Messages Reference was published, to locate SQLCode and SQLState error messages found in the .iqmsg log. The internal message number – such as [20539] in the example that follows – was also
prefixed to the message text for code module exception messages. Previously this number was only shown for non-exception reporting.

Previous to SAP IQ version 12.6, a sample message would have looked like this:

```
Exception Thrown from opt_GroupNode.cxx:549, Err# 0, tid 69 origtid 69
O/S Err#: 0, ErrID: 9216 (df_Exception)
Feature, ROLLUP or CUBE in a subquery, is not supported.
-- (opt_GroupNode.cxx 549)
```

The same message now looks like this:

```
Exception Thrown from opt_GroupNode.cxx:549, Err# 0, tid 69 origtid 69
O/S Err#: 0, ErrID: 9216 (df_Exception); SQLCode: -1001030, SQLState: 'QFA2A',
Severity: 14
(20539): Feature, ROLLUP or CUBE in a subquery, is not supported.
-- (opt_GroupNode.cxx 549)
```

This standardized SAP IQ error message reports and made them more useful. Prior to these changes, SQLCode and SQLState were reported to the client only, along with the error message text. These changes in SAP IQ 12.6 made it possible to correlate what the client received with the server-oriented error information logged in the IQ message file.

The ErrID field – above 9216 – is not a unique identifier for an error condition, but an internal SAP IQ identifier for the component reporting the error. This is why different messages can appear with the same “ErrID”: one component may detect multiple errors. These internal codes are not returned to the client. The other internal information including the OS error code as displayed in the example above is likewise not returned to the client.

SAP IQ error messages have not been reorganized to be like SAP Adaptive Server Enterprise messages for several reasons. SAP IQ error messages are generated from both SAP SQL Anywhere engine and the SAP IQ engine – different parts of the product. Also, IQ is written largely in C++ while SAP Adaptive Server Enterprise is written mostly in C, so so that error messages are generated in different ways.

Error messages in the .iqmsg log are generally represented as shown above - an exception message generated by a code module that includes SQLCode, SQLState, Severity, internal message number and message text. The SQLCode is typically used as the primary identifier for referencing error message documentation or searching a knowledge base.

The SAP IQ Error Messages Reference includes several versions of reference tables for errors messages, sorted by SQLCode, SQLState, or Sybase error code. This allows you to look up the example error message by SQLCode -1001030, SQLState QFA2A, or Sybase error code 20539. The latter is what was previously called internal error code:

```
Exception Thrown from opt_GroupNode.cxx:549, Err# 0, tid 69 origtid 69
O/S Err#: 0, ErrID: 9216 (df_Exception); SQLCode: -1001030, SQLState: 'QFA2A',
Severity: 14
(20539): Feature, ROLLUP or CUBE in a subquery, is not supported.
-- (opt_GroupNode.cxx 549)
```

Negative SQLCode values denote errors; positive values are warnings.

SQLState is a system of codes defined by the ANSI SQL/92 standard. Each value is a five-character string consisting of a two-character class and a three-character subclass. For more details including a table of class code definitions, see the SAP IQ Error Messages Reference.

Sybase error codes, the values in square brackets, may not always be unique. In such cases, the SQLCode value provides differentiation. None of these codes by themselves may be convenient for generating DBA
alerts, since values are individualized. However, the severity code could provide a starting point for detecting issues of concern for a DBA, since it applies to ranges of SQLCodes. Additionally, you could use individual SQLCodes or Sybase error codes to flag issues of specific concern. Operations DBAs looking for server-wide issues will likely be interested in different conditions than applications DBAs monitoring errors in business processing functions.

13.2 Severity Codes

Severity codes indicate the degree and source of the SAP IQ error.

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Comment.</td>
</tr>
<tr>
<td>1</td>
<td>Information.</td>
</tr>
<tr>
<td>10</td>
<td>Status information; warning.</td>
</tr>
<tr>
<td>11</td>
<td>Specified database object not found.</td>
</tr>
<tr>
<td>12</td>
<td>Wrong data type encountered.</td>
</tr>
<tr>
<td>13</td>
<td>User transaction syntax error.</td>
</tr>
<tr>
<td>14</td>
<td>Insufficient permission to execute command.</td>
</tr>
<tr>
<td>15</td>
<td>Syntax error in SQL statement.</td>
</tr>
<tr>
<td>16</td>
<td>Miscellaneous user error (non-fatal).</td>
</tr>
<tr>
<td>17</td>
<td>Insufficient resources.</td>
</tr>
<tr>
<td>18</td>
<td>Non-fatal internal error detected.</td>
</tr>
<tr>
<td>19</td>
<td>Fatal error in resource.</td>
</tr>
<tr>
<td>20</td>
<td>Fatal error in current process.</td>
</tr>
<tr>
<td>21</td>
<td>Fatal error in database processes.</td>
</tr>
<tr>
<td>22</td>
<td>Fatal error: table integrity suspect.</td>
</tr>
<tr>
<td>23</td>
<td>Hardware error or system table corruption.</td>
</tr>
<tr>
<td>24</td>
<td>Hardware error or system table corruption.</td>
</tr>
</tbody>
</table>

The severity code can generally indicate how critical a problem may be so that it can be further examined. However, additional qualification may be required to make decisions on actions to be taken. The following two examples are different kinds of issues, both classified as Severity 14.

This message represents a serious server-level situation that may require quick DBA intervention:

```
Exception Thrown from hos_mem.cxx:370, Err# 1, tid 1503 origtid 1503 O/S Err#: 0, ErrID: 517 (hos_memexception); SQLCode: -1006042, SQLState: 'QBA42', Severity: 14 [20280]: All available virtual memory has been used; allocation cancelled: [Extra info: 8392703] -- (hos_mem.cxx 370)
```

This message, on the other hand, is a completely different type of issue that may or may not require any intervention:

```
Exception Thrown from db_iqutility.cxx:1929, Err# 105, tid 1194 origtid 1194
```
Differentiation of conditions can be a fine line. Consider these two very similar error messages for table not found:

```
Exception Thrown from db_iqutility.cxx:1929, Err# 105, tid 1194 origtid 1194
O/S Err#: 0, ErrID: 4098 (db_sqlexception); SQLCode: -1009141, SQLState: 'QCA51',
Severity: 14
[21061]: Table 'ReCreator' cannot be found in the IQ store.
  -- (db_iqutility.cxx 1929)
```

```
Exception Thrown from db_iqutility.cxx:7212, Err# 7, tid 1188 origtid 1188
O/S Err#: 0, ErrID: 1034 (db_dbccexception); SQLCode: -1000266, SQLState: 'QDB09',
Severity: 23
[21079]: Table 'dbo.ix_staff_query_index' not found.
  -- (db_iqutility.cxx 7212)
```

The probable cause of SQLCode -1009141 is defined in the SAP IQ Error Messages Reference as:
The stored procedure sp_iqtablesize cannot find the table. This stored procedure is for IQ tables only. It cannot be run against system tables or ASA tables.

The probably cause of SQLCode -1000266, on the other hand, is defined in the SAP IQ Error Messages Reference as:
The specified table could not be opened. Either the table does not exist or the name format is incorrect. The table name must follow the format [OWNER.]TABLE

Note the difference in severity codes: -1009141 is 14, whereas -1000266 is 23.

As a DBA, defining an alert for such errors probably requires a combination of measures, including perhaps severity and a list of specific error message code values known to represent issues of concern.

**Severity Zero Messages with Unspecified Error Codes**

You may encounter .iqmsgException Thrown from hos_mem.cxx:370, Err# 1, tid 1503 origtid 1503 error messages with unspecified codes, such as the following example, which shows the entire connection session:

```
Collation ISO_BINENG, Case Respect, Blank Padding On, Comparisons are Binary
Txn 354435661 0 354435661
Connect: SA connHandle: 14856 SA connID: 31 IQ connID: 0000015137 User: ctxna_write
InserT Started:
CtxnOrder
Exception Thrown from db_sqlins.cxx:15769, Err# 31, tid 1058 origtid 1058
O/S Err#: 0, ErrID: 4098 (db_sqlexception); SQLCode: 0, SQLState: '?????',
Severity: 0
[-157]:
Exception Thrown from db_sqlins.cxx:15769, Err# 31, tid 1058 origtid 1058
O/S Err#: 0, ErrID: 4098 (db_sqlexception); SQLCode: 0, SQLState: '?????',
Severity: 0
[-157]:
Rbck
PostRbck
Disconnect: SA connHandle: 14856 SA connID: 31 IQ connID: 0000015137 User: ctxna_write
```
This example was from a software bug in SAP IQ 12.0, later fixed in 15.0. You should report any such messages with unspecified codes to SAP Support for further analysis and correction.

13.3 Other Types of Messages in the .iqmsg Log

In addition to standardized error messages classified by SQLCode, other types of messages can appear in the SAP IQ .iqmsg log.

These messages include:
- Abort (crash)
- Non-fatal error with stack trace
- Read (bufman) error
- Out-of-space error
- Interrupts
- SySAM licensing

In this section:

Abort Messages [page 90]
Abort messages typically mean the SAP IQ server has crashed.

Non-Fatal Error with a Stack Trace [page 90]
Certain SAP IQ errors trigger additional diagnostics beyond a SQLCode type of message. These are logged in the .iqmsg log with a stack trace, and are labeled as non-fatal to distinguish them from aborts.

Read Error (bufman) [page 91]
Non-fatal SAP IQ errors containing the keyword bufman indicate the buffer manager had a problem reading a page into memory. The contents of the page are dumped into the log. Log output is lengthy; parts have been omitted from this example for brevity.

Out of Space Error [page 93]
If there is not enough SAP IQ temporary or main dbspace available for a buffer or dbspace allocation request, then the statement making the request rolls back.

Interrupt Messages [page 93]
SAP IQ interrupt messages occur when a user at a terminal enters Ctrl + C, or an application issues a cancel on a connection.

SySAM Licensing [page 94]
SySAM messages may appear in the .iqmsg log when the database is closed. The database is closed and reopened at server startup, so one set of SySAM messages should appear near the start of the .iqmsg log.
13.3.1 Abort Messages

Abort messages typically mean the SAP IQ server has crashed.

Restart the system and report the incident to SAP Support. As a DBA, the keyword to look for in the error message is *Abort*: any codes or text in the messages that follow this keyword is meaningful only for SAP Support analysis. The content of the stack trace is usually the most important part for identifying the nature of the crash.

Here is an example of abort messages appearing in the `.iqmsg` log:

```
**************************************************
***   SAP IQ Abort:                                  
***      From:  stctxlib/st_server.cxx:1960          
***      PID: 234024                                 
***      Message: caught signal 11, program abort    
***      Thread: 140142576420608  (TID: 30)          
**************************************************
**  Error from IQ connection:  SA connHandle: 405147  SA connID: 56  IQ connID: 0000607164  User: dbamaint  
**  Time of error:  2018-10-25 06:31:26              
**  IQ Version:  SAP IQ/16.0.110/11355/P/sp11.20    
**  OS info:  IQ built on: Enterprise Linux64 - x86_64 - 2.6.18-194.el5, Executed on: Linux/dc2nix2q180/2.99.0-693.17.1.e17.x86_64/#1 SMP Sun Jan 14 10:36:03 EST 2018/x86_64  
**  Command status when error occured:  COMMAND ACTIVE  
**  Command text:  IQDEV8.GSRpt.spGSRpt_Standard_Order_2_LIST  
**  Dump all thread stacks at hos_throw.cxx:311 for PID: 28656  
**  ********** This is the STACKTRACE **********
```

On rare occasions, an abort can be interrupted by a second abort, resulting in the server continuing to execute, though in an uncertain state.

⚠️ Caution

If the server has halted it needs to be restarted, but if an abort has occurred and it is still running, contact SAP Support to discuss whether the server should be stopped and restarted.

13.3.2 Non-Fatal Error with a Stack Trace

Certain SAP IQ errors trigger additional diagnostics beyond a SQLCode type of message. These are logged in the `.iqmsg` log with a stack trace, and are labeled as *non-fatal* to distinguish them from aborts.

Here is an example:

```
Large Delete Failed for Index mincost.Transactions_2011Q4.ASIQ_IDX_T1984_I14_HG: 1381  
5403 Rows Deleted. Expected 13815419.  
**************************************************
**  Non-Fatal IQ Internal Error Detected  
**  at s_ohcIter.cxx:809 on thread 2028837184 (TID 1479)  
**  Please report this to SAP IQ support  
```
** with the following diagnostic information, 
* and, if possible, with the user’s command. 
** Error from IQ connection: SA connHandle: 207245 SA connID: 55 IQ connID: 0000205176
User: MCD_DBA
** IQ Version: SAP IQ/12.7.0/090824/P/ESD 7
** OS info: IQ built on: Enterprise Linux64 - amd64,Opteron64,X86_64/2.4.21-27.0.1.ELsmp, 
Executed on: Linux/lx-chsybp208/2.6.18-238.19.1.el5/#1 SMP Sun Jul 10 08:43:41 EDT 2011/
x86_64
** Command status when error occurred: CURSOR ACTIVE
** Command text: 
delete mincost.Transactions_2011Q4 where HoldDate='20111108'

***************** This is the STACKTRACE **********************
...
******************* End of STACKTRACE ******************
** End of stack trace from Non-Fatal IQ Internal Error s_ohcIter.cxx:809
**
********************************************************
Exception Thrown from s_ohcIter.cxx:809, Err# 15, tid 1479 origtid 1479
O/S Err#: 0, ErrID: 2068 (hs_idxexception); SQLCode: -1006003, SQLState: 'QBA03', Severity: 23
[20241]: IQ Internal error. Please report this to Sybase IQ support. mincost.
Transactions_2011Q4.ASIQ_IDX_T1984_I14_HG 9 ???
-- (s_ohcIter.cxx 809)
...
Exception Thrown from s_ohcIter.cxx:809, Err# 15, tid 1479 origtid 1479
O/S Err#: 0, ErrID: 2068 (hs_idxexception); SQLCode: -1006003, SQLState: 'QBA03', Severity: 23
[20241]: IQ Internal error. Please report this to SAP IQ support. mincost.
Transactions_2011Q4.ASIQ_IDX_T1984_I14_HG 9 ???
-- (s_ohcIter.cxx 809)

An alert for this type of error could trigger on the text Non-Fatal IQ Internal Error Detected or on Severity code 23 and SQLCode value -1006003 in the trailing messages.

### 13.3.3 Read Error (bufman)

Non-fatal SAP IQ errors containing the keyword `bufman` indicate the buffer manager had a problem reading a page into memory. The contents of the page are dumped into the log. Log output is lengthy; parts have been omitted from this example for brevity:

************
** Non-Fatal IQ Internal Error Detected **
at s_buf.cxx:1121 on thread 2130811200 (TID 1413)
**
** Please report this to SAP IQ support 
** with the following diagnostic information, 
** and, if possible, with the user’s command. 
**
** Error from IQ connection: 
** Time of error: 2011-06-20 03:52:09
** IQ Version: SAP IQ/12.7.0/080707/P/ESD 5
** OS info: IQ built on: Enterprise Linux64 - amd64,Opteron64,X86_64/2.4.21-27.0.1.ELsmp, 
Executed on: Linux/lx-chsybp161/2.6.18-164.2.1.el5/#1 SMP Mon Sep 21 04:37:42 EDT 2009/
** Command status when error occurred: NO COMMAND OR CURSOR ACTIVE

*************** This is the STACKTRACE ***************

----- Thread Number 213081200 -----  

pc: 0x0 ()  
pc: 0x2aaadb6ecf1b pcstkwalk(stk_trace*, int, db_log*, hos_fd*)+0x10b()  
pc: 0x2aaadb6eb96 ucstkgentrace(int, int)+0xb6()  
pc: 0x2aaadb6ed36d StackTraceForThisThread(char const*, int, char const*, char const*)+0x22d()  
pc: 0x2aaadb81e8be s_bufman_exception::s_bufman_exception[in-charge](char const*, int, s_bufman const*, s_buf const*, short, unsigned long long, unsigned, s_diskblockheader const*, int)+0x5ce()  
pc: 0x2aaadb812767 s_buf::ReadBufAndVerify(s_diskblockheader*, unsigned long long, unsigned, unsigned, int)+0x213()  
pc: 0x2aaadb812918 s_buf::Read(unsigned long long, unsigned, int, short, unsigned long long, unsigned, int, short, unsigned long, unsigned)+0x140()  
...

******************** End of STACKTRACE ***************

** End of stack trace from Non-Fatal IQ Internal Error s_buf.cxx:1121  

Exception Thrown from s_buf.cxx:1121, Err# 12, tid 1413 origtid 1413  
O/S Err#: 0, ErrID: 2055 (s_bufman_exception); SQLCode: -1009039, SQLState: 'QSA39', Severity: 14  

[20060]: temp Bufman: Incorrect page header read;  
buffer={btype=10,nlb=16,blk=1578,pbn=33478464,npb=5,uid=1156293683,txn=0,sp=0,flgs=0xc10}  
page={btype=10,nlb=16,npb=4,ctr=136,cta=134,txn=0,sp=0,ver=1,pb=97,pus=48654}.  
-- (s_buf.cxx 1121)  
Page dump for sbuf @ 0x2ab2ad3fe3a0  
_dskBlk @ 0x2ab2ad3fe3a0  
Physical block #: 33478464 (0x1fed740)  
Blocks read: 5  
Expected Pad1: 51 (0x33), Pad2: 1578 (0x062a)  
File #9 (catid 16419): /sybiqdb/IQPBO1R/./Temp/TEMP9R  
Starting Block: 33470464 (0x1f41)  
File Physical Block Number: 8001 (0x1f41)  
File size: 2097148 blocks, 34359672832 bytes.  
...

End of page dump.

There was an s_buf::Read() error during s_bufman::FindForPrefetch().

Exception Thrown from s_buf.cxx:1121, Err# 12, tid 1413 origtid 1413  
O/S Err#: 0, ErrID: 2055 (s_bufman_exception); SQLCode: -1009039, SQLState: 'QSA39', Severity: 14  

[20060]: temp Bufman: Incorrect page header read;  
buffer={btype=10,nlb=16,blk=1578,pbn=33478464,npb=5,uid=1156293683,txn=0,sp=0,flgs=0xc10}  
page={btype=10,nlb=16,npb=4,ctr=136,cta=134,txn=0,sp=0,ver=1,pb=97,pus=48654).
The portion of the stack trace shown is typical. As a DBA, you could create an alert to trigger on Bufman: Incorrect page header read (could be "temp" as here, or "main") or the SQLCode value. Notice that the severity code is only Severity: 14. There are other SQLCode values for similar errors - for example SQLCode -1009046 - so given those two circumstances, it might be useful to specify a range of SQLCode values to trigger an alert.

13.3.4 Out of Space Error

If there is not enough SAP IQ temporary or main dbspace available for a buffer or dbspace allocation request, then the statement making the request rolls back.

Messages in the .iqmsg log look like this:

```
Exception Thrown from s_blockmap.cxx:3699, Err# 0, tid 318 origtid 318
O/S Err#: 0, ErrID: 2095 (s_nodbspaceexception); SQLCode: -1009170, SQLState: 'QSB66',
Severity: 14
[20223]: You have run out of space in IQ_SYSTEM_MAIN DBSpace.
```

As a DBA, to define an alert monitoring for this condition, look for the SQLCode value -1009170 or the text You have run out of space.

13.3.5 Interrupt Messages

SAP IQ interrupt messages occur when a user at a terminal enters \[Ctrl\] + \[C\] or an application issues a cancel on a connection.

In the .iqmsg log, interrupt messages can look like this:

```
Exception Thrown from s_run.cxx:752, Err# 0, tid 1859 origtid 1859
O/S Err#: 0, ErrID: 519 (hos_attnexception); SQLCode: -299, SQLState: '57014',
Severity: 16
[2188]: Statement interrupted by user
```

Interrupt messages can also look like this (note the different error ID):

```
Exception Thrown from st_command.cxx:618, Err# 0, tid 388 origtid 388
O/S Err#: 0, ErrID: 5125 (st_commandException); SQLCode: -299, SQLState: '57014', Severity: 16
[2188]: Statement interrupted by user
```

This related message may be nearby in the .iqmsg log:

```
Cancellation request received: SA connHandle: 563454 SA connID: 24 IQ connID: 0000860607
User: tu_rdr
```
The Cancellation request received message appears in the .iqmsg log as a result of an interruption. If a code module further on in the sequence of execution has interrupt handling installed, the interruption is caught and an exception message logged, as shown above.

Usually you will not want to pick up interrupt messages as part of your alerts monitoring, but the examples above show what they look like in the .iqmsg log.

### 13.3.6 SySAM Licensing

SySAM messages may appear in the .iqmsg log when the database is closed. The database is closed and reopened at server startup, so one set of SySAM messages should appear near the start of the .iqmsg log.

Messages indicating a problem can look like the following:

```
DB: Versn: 16.0.110.2422/10448/P/sp11.07/Enterprise Linux64 - x86_64 -
  2.6.18-194.e15/64bit/2017-03-14 03:53:48
Using licenses from: /APP/IP1/BINARY/SYSAM-2_0/licenses/sybase.lic:/APP/IP1/
  CATALOG/DB/*.lic
Failed to obtain license(s) for IQ_CORE feature from license file(s) or
server(s).
No such feature exists. Verify that a license containing the feature name
IQ_CORE is available or generate and
deploy the license from the SAP Support Portal.
License feature name:  IQ_CORE
License search path:   /APP/IP1/BINARY/SYSAM-2_0/licenses/sybase.lic:/APP/IP1/
  CATALOG/DB/*.lic:
FlexNet Licensing error:-5,414   (KT: No such feature exists)
Exception Thrown from oslib/hos_sysam.cxx:908, Err# 0, tid 4 origtid 4
O/S Err#: 0, ErrID: 549 (hos_sysamException); SQLCode: -1006269, SQLState: 'QBC69', Severity: 14
No SYSAM License Available
```

### 13.4 .srvlog Messages

Startup messages tracking the SAP IQ server startup process are written to the .srvlog.

After startup, .srvlog mainly records informational messages about inserts and deletes and for connections terminating abnormally, such as when a user program terminates a connection without proper exit steps.

Here is an example of an error occurring at startup:

```
I. 01/11 08:14:50. Finished checkpoint of "pkns" (pkns.db) at Fri Jan 11 2018
  08:14
E. 01/11 08:14:52. Error: No SYSAM License Available
E. 01/11 08:14:52. No SYSAM License Available
I. 01/11 08:14:52. Database server shutdown due to startup error
```

Other serious conditions that can be reported in .srvlog include memory exhaustion errors, and assertion errors.

In this section:
Fatal Error: Memory Exhausted [page 95]
Certain queries can consume SAP SQL Anywhere catalog cache memory, and memory consumption can increase if the SAP IQ configuration allows it, and if available RAM exists on the server host machine.

Assertion Failure [page 95]
On rare occasions, a non-viable code path is followed and an assertion error gets logged in the SAP IQ .srvlog.

13.4.1 Fatal Error: Memory Exhausted

Certain queries can consume SAP SQL Anywhere catalog cache memory, and memory consumption can increase if the SAP IQ configuration allows it, and if available RAM exists on the server host machine.

Messages like this will be logged in the .srvlog file as SAP SQL Anywhere catalog cache memory is increased to meet demands:

- 02/18 23:57:46. Cache size adjusted to 261536K
- 02/18 23:57:46. Cache size adjusted to 261796K

If these continue to the point where all available RAM is consumed, the database server terminates, with the following error:

- 02/18 23:57:46. Cache size adjusted to 262060K
- 02/18 23:57:46. Fatal error: no free pages available in cache

There is no error number for this condition. As a DBA, you should configure your alerts to pick up any message text in the .srvlog that includes the string Fatal error.

13.4.2 Assertion Failure

On rare occasions, a non-viable code path is followed and an assertion error gets logged in the SAP IQ .srvlog.

Here are two examples:

- 02/18 08:45:01. *** ERROR *** Assertion failed: 102801 (12.7.0.2074)
- 02/18 08:45:01. Unable to find table definition when creating/altering a column

- 07/06 12:26:41. *** ERROR *** Assertion failed: 102300 (12.7.0.2056)
- 07/06 12:26:41. File associated with given page id is invalid or not open

The assertion failure usually terminates the server; often when this occurs, there are no other error messages in any other log. The SAP SQL Anywhere engine suddenly shuts down, halting SAP IQ.
13.5 .stderr Messages

The .stderr log shows useful information from SAP IQ server start time about resources configured for the server.

Anything from the server process directed to stdout can also appear here. In the event of an abort, the .stderr log shows a minimal set of messages indicating that an abort occurred. This is part of the complete set of abort diagnostic messages in the .iqmsg log.

Detailed SySAM messages are written to this log file as well as the .iqmsg log. Here is an example showing a problem:

```
Using licenses from: /opt/sybase/SYSAM/licenses/license.dat:/opt/sybase/
SYSAM-2_0/licenses/SYBASE.lic:/opt/sybase/SYSAM-2_0/licenses/examplea.com.lic:/opt/
sybase/SYSAM-2_0/licenses/examplea.com.lic:/opt/catalog/EX_PD_HFBF1/*.lic
Failed to obtain license(s) for IQ_CORE feature from license file(s) or server(s).
No such feature exists. Verify that a license containing the feature name IQ_CORE is available or generate and deploy the license from the Sybase Product Download Center.
License feature name: IQ_CORE
License search path: /opt/sybase/SYSAM/licenses/license.dat:/opt/sybase/
SYSAM-2_0/licenses/SYBASE.lic:/opt/sybase/SYSAM-2_0/licenses/examplea.com.lic:/opt/
sybase/SYSAM-2_0/licenses/examplea.com.lic:/opt/catalog/EX_PD_HFBF1/*.lic:
FLEXnet Licensing error:-5,414
DBSPAWN ERROR: -82
Unable to start specified database: autostarting database failed
```

Being the destination for stdout sometimes results in network-related error messages getting written to .stderr log. For example:

```
MIPC Failed to update connectivity status for server id : 2
MIPC Failed to update connectivity status for server id : 2
MIPC Failed to update connectivity status for server id : 2
```

These messages indicate a problem with network communications between nodes in a multiplex installation, and may be due to network problems.

13.6 Request Log Messages

User-level error messages are logged in the request log, along with all command activity.

Common errors are logged in the request log, as follows:

```
code: -1000266 "Table 'dbo.ReCreator' not found. -- (db_iqutility.cxx 7212)"
code: -131 "Syntax error near '(end of line)' on line 1"
```
The code values are SQLCodes. Besides the SAP IQ Error Messages Reference, another source of information about these message codes is the SQL Anywhere Errors guide. See the topic SQL Anywhere error messages sorted by SQLCODE.

Less common errors are logged in a similar fashion. Here is what the request log shows for the non-fatal internal error used as an example in Non-Fatal Error with a Stack Trace [page 90]:

```
code: -1006003 "IQ Internal error. Please report this to SAP IQ support. mincost. Transactions_2011Q4.ASIQ_IDX_T1984_I14_HG 9 ???. -- (s_ohcIter.cxx 809)"
```

Note that an out of connections condition is logged only in the request log, not the .iqmsg log or .srvlog. Connections are managed by SAP SQL Anywhere and, like the .srvlog, the request log belongs to the SAP SQL Anywhere engine. Messages look like this:

```
** ERROR conn: 1078055 code: -102 "Database server connection limit exceeded"
** DONE conn: 1078055 CONNECT
** ERROR conn: 1078056 code: -102 "Database server connection limit exceeded"
** DONE conn: 1078056 CONNECT
```

The -gm database server option sets this connection limit.

### 13.7 When There are No Messages

Sometimes a problem with the SAP IQ server can occur without leaving messages in the .iqmsg log.

In such circumstances, inspect the other SAP IQ logs. If the server has halted, look in the .srvlog and the .stderr log. You might see an assertion failed message at the end of the .srvlog, as described in Assertion Failure [page 95].

When SAP IQ terminates with no messages, the cause is often in the SAP SQL Anywhere engine. Check the request log to see the last command executed. An enormous command, such as can be submitted by code generators, can exceed stack space and cause the SAP SQL Anywhere engine to stop, bringing down SAP IQ.
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