Scalability, Optimization and Tuning in B2B Sterling Integrator

Rashmi Acharya,  
Staff Software developer

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Agenda

- Performance Management
- Sterling Integrator – Quick Overview
- Performance statistics management
- Managing BP execution
- Proper Cache handling and BP optimization
- Tuning of Memory Parameters
- GC Analysis and Tuning
- Troubleshooting DB growth problem
- Managing Connection Pools
- Tuning aspects on Adapters and Perimeter services
- Tuning improvements for EDI, Translation.
- SFG tuning improvements.
- Analysing and debugging the performance problems. Thread and Heap and GC analysis
Performance Management Overview

What is Performance Engineering?

What are different Performance tuning parameters?

Performance can be related to:

- **Latency** – Amount of time required to generate a response to a request (speed)
- **Throughput** – Amount of data transferred in a specified time period (volume)
- **Scalability** – Ability of the system to grow with increased workloads (additional hardware)
- **Load** – Ability of the system to continue performance levels when the amount of work requested by the system increases.
Performance Management Overview

Tuning aspects were taken into high priority with the increase in demand and scalability which includes modifying or restructuring the entire application or code without modifying the basic functionality.

Key requirements prior to performance changes

- Understand your performance requirements
- Always plan for peaks not average
- Performance check
- An objective way of analyzing
# IBM® Sterling B2B Integration Solution

<table>
<thead>
<tr>
<th>Solution</th>
<th>Capabilities</th>
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</thead>
<tbody>
<tr>
<td>IBM Sterling B2B Integrator</td>
<td>Powers business process orchestrations, high-volume electronic message exchange, complex routing, translation, and flexible interaction with multiple internal systems and external business partners</td>
</tr>
<tr>
<td>IBM Sterling Gentran®</td>
<td>A trusted EDI and data translation solution helping you manage your B2B community</td>
</tr>
<tr>
<td>IBM Sterling e-Invoicing</td>
<td>Automates business processes and tax compliance, using global integration standards to support buyer and supplier compliance in a single solution. This is accomplished while also maintaining conformity with tax regulations for multiple countries</td>
</tr>
<tr>
<td>IBM Sterling B2B Collaboration Network</td>
<td>Provides secure connectivity and collaboration with customers and business partners. It delivers unprecedented visibility and control over the business processes shared with outside companies</td>
</tr>
<tr>
<td>IBM Sterling B2B Integration Services</td>
<td>Provides comprehensive partner On-boarding, business process management, and community support</td>
</tr>
<tr>
<td>IBM Sterling Mobile solutions</td>
<td>A variety of mobile solutions that enable your employees to conduct business easily on a wide range of mobile devices while away from the office</td>
</tr>
</tbody>
</table>
Managing Performance Statistics
Managing Perf Statistics

- Performance Statistics Report helps you identify and analyze bottlenecks in your business processes and the time taken for completion of each activity.

- Enabling this option uses lot of system resources and can cause the degradation itself. So do not enable this feature as a default option.

- The report consists of two parts:
  1: Business Process Statistics
  2: Internal System Statistics
Business Process Statistics

**Name**- Name of a business process

**Min (ms) and Max(ms)**- Minimum or Maximum time (in milliseconds) it took for a business process or activity to complete

**Invocations**: Number of invocations in the system since the report was generated.

**Pre-Service (ms)**- Total time taken by the business process engine to complete activities before a BP or service is run.

**Post-Service (ms)**- Total time taken by the business process engine to complete activities after the business process or service is run.
**Name:** Name of the system activity, including the following:

- Persist a Business Process Step to the Database
- Persist a Document to the Database
- Acquire a Database Connection
- Execute an XPath Statement
- Put a Business Process on the Queue

**Min and Max time:** Min and Max time system activity took to complete. If multiple invocations when min/max time will be taken here

**Average:** Average processing time taken for the system activity to complete.

**Invocations:** Number of times the system activity was invoked since you last generated the report.

**Total (ms):** Total time taken since report generation started.
Persist a Document/BP to Database:

The Persist a Document/BP to the Database statistics is helpful in determining database issues and slow processing issues.

If the Min (ms), Max (ms), and Average (ms) times are increasing. - Database is becoming full, or that you have a connection leak.

The number of invocations increase - your persistence level is set too high.

The number of invocations is small and the Min (ms) and Max (ms) times are increasing - Persisting large documents to the database, which can be moved to the disk to save database space.

Assign from an XPath Statement:

Determine how well-structured XPath statements in your business processes.

The Min (ms), Max (ms), and Average (ms) times are increasing. This indicates that the XPath statement is not written efficiently, and may slow down your process time.

Good practice to write /PurchaseOrder/location/source () instead of //source() , entire process data will be traversed.
Acquire a Database Connection:

- Helps to figure out database issues, resource leaks, or whether you have to increase the number of database pools.
- The number of invocations are increasing. This indicates that your persistence level is set too high, causing too much data to be stored in the database, or your cache levels are not tuned correctly, causing the data to be stored and retrieved from the database instead of from the cache.
- The number of invocations are low and not increasing. This indicates that either you have a resource leak that is not releasing previously used database connections to be used by other threads, or you do not have enough database pools.

Put a Business Process on the Queue:

- This is helpful in determining if you are using a queue instead of your cache during processing. When you compare this information with your benchmarks, verify if you notice increasing invocation times. If yes, it indicates that you are not using your cache efficiently.
Managing BP Execution
Symptoms and causes of poor BP execution

Increase of business process execution time is because of:

- The database is full or is receiving too many requests
- Improperly designed business processes.
- Improperly Tuned Performance Properties.
- Disabled few must do service causing Indexing, archiving, or purging activities may not occur.

There are some system cleaning processes should be running to keep the system healthy.

Disabling few of these processes can also cause the problem.

- ScheduleIndexBusinessProcess
- ScheduleBackupService
- SchedulePurgeService
- ScheduleAssociateBPsToDoc
- ScheduleRecoveryBusinessProcess
- ScheduleAutoTerminateService
- Schedule_BPLinkagePurgeService
Improperly designed BP can be because of:

- Improperly tuned cache properties.
- Improperly written XPath statements.
- Business process persistence levels are set too high
- Unnecessary service invocations.
- Using older services and adapters instead of newer and more efficient ones.
- Unnecessary loops, inside the business process.
- Usage of bad query inside the BP to perform database fetch operation
- A full database or DB maintainance issues.
- Usage of larger lifespan for documents or BPs unless your business demands for it.
- Wrong setting for the Document storage type.
How to determine the cause of poor execution

- Review the **wf.log** file inside the install_dir/logs folder for time and date information showing increase in the execution time.

- Review the **performance statistics report** for number of invocations and processing time.

- Review the BP activity step which takes more execution time to check for improper BP **design, mode, Xpath** etc. Check for any replacement for the activity to perform any better solution.

- Check for any **halted, waiting or interrupted BPs**.

- Check the **document storage** type for the BPs.

- **Persistence** level set

- **Lifespan set** for the document or BPs.
Persistence level change

Sterling B2B Integrator can persist either all the data or only a small amount of data for each activity that is processed. The default value for Sterling B2B Integrator is Full persistence. There are three levels which you can set persistence:

**Global** – property can be changed in `/install_dir/properties/noapp.properties_gis_ext.in` file. Values are SYSTEM DEFAULT, PERSISTENCE_WF_NONE, PERSISTENCE_ERROR_ONLY.
The parameter `#persistence_level=<value>` can set to
PERSISTENCE_FULL
PERSISTENCE_MINIMAL
PERSISTENCE_NONE

**Business Process** – Change the persistence level during the check-in process. The business process persistence level overrides the global persistence level.

**Activity Level** – Change the persistence level in the service or adapter. The activity persistence level overrides the business process persistence level and the global persistence level.
Best Practices

- Document storage type

Choosing the right document storage type:
- **Database**: Store documents in the database. Use this option for small documents or when clustering without a clustered file system.
- **File System**: Store documents in the file system. Use this option for large volume processing, such as documents that are over 10 MB in size, or when working with a large number of documents within a single business process (including any sub-processes it invokes).

- Persistence level

We recommend to run the business processes (BP) with minimal persistence required to complete. Do not use full persistence unless your business needs require it, as this consumes more system resources.

- Document and BP lifespan

Do not use larger lifespan for documents or business processes unless your business needs require it. If large lifespan is not the requirement, it is very important to set the lifespan for BP and document accordingly.
Troubleshooting Cache
Types of Cache Memory

Sterling Integrator uses below types of Caches to execute processes.

**Soft Reference Cache:**
- When objects are removed from the memory cache in order to keep the memory cache size constant, they are moved to a soft reference cache.
- It can grow or shrink based on the available memory.

**Memory Cache:**

Uses the amount of memory necessary to hold the objects in memory at all times. You can configure this in the noapp.properties file.

**Disk Cache:**
- Objects can be read more quickly from the disk than from the database. When objects are no longer in the soft reference cache because they have been garbage collected,
- The disk cache provides a faster access mechanism than object retrieval from the database.
- Based on the memory allocated to Sterling B2B Integrator and the number of CPUs, The Integrator tuning wizard will allocate disk cache and in-memory cache

- **Shadow Cache**

  - When the thread is available for the BP to run, the object is retrieved from the memory instead of the disk.

- **Distribution Cache**

  - Distribution Cache Maximum Determines the maximum number of business processes in queue on node2. If the number of business processes on node2 queue exceeds this number, node1 will not transfer any more business processes to node2.
The number of business processes that ran without being cached and the number that are currently in cache.

Cache location is also specified so that you can determine the number of business processes that were found in the soft reference cache, in the disk cache, and in the memory cache.

Statistics which shows
- Soft reference Cache
- Memory cache
- Disk cache

Total Number of BPs in Cache: 1206
Total Number of BPs not Cached: 15714
Cache Usage Monitoring

➢ From the Administration menu, select Operations > System > Troubleshooter. > cache usage

➢ The Cache Usage report displays the following information for each cache type:

Cache name – Name of the cache

Count  Number of objects in the cache

Requests  Number of times an object was requested from the cache, irrespective of whether it was found or not.

Hits  Number of times an object was requested from the cache, and was found successfully.

➢ The Cache loader sizes can be changed in the CacheManager.properties file. The cache operation uses expiry feature, LRU based algorithm for the better performance of it.
Symptoms and reasons of inefficient Cache Usage

- **Symptoms:**
  - Slow-running business processes
  - Longer completion time for business processes
  - Increased cache hits reported in the Cache Usage Report.
  - No Cache hit percentage

- **Reasons:**
  - Improper tuning of performance properties.
  - High cache usage for less frequent large objects.
  - Low cache usage for high frequent small objects.

- **Resolving the inefficient Cache Usage:**
  - Properly Tune Cache Performance Properties.
  - Low Cache size Allocation for Less Frequently Used Large Objects
  - High Cache Allocation for More Frequently Used Small Objects
  - Compress Cache Contents
Memory Parameters Tuning
- Performance Tuning Utility to edit the performance configuration using the settings based on few internal calculations.

- It is stored in the tuning.properties.

- From the Administration menu, select Operations > System > Performance > Tuning. After the change, run the setupfiles.sh and then start the instance.

- Description of the properties

  - **Physical memory to Platform:** Amount of memory allocated for use in processing operations. Amount of memory allocated depends on your OS and JDK selected. If 64bit jdk selected, then we can assign to a size of more than 4GB memory into the SI system.

  - **Number of Server Nodes:** The number of server nodes installed. NUM_ASI_NODES in the tuning.properties file.
**Number of Container Nodes:**
The number of container nodes installed. NUM_CONTAINER_NODE in the property file.

- **Allocate memory for Active MQ:**
  Memory allocated to active MQ messaging Service from the physical memory allocated to SI. If it is true. Default of 512MB will be allocated. If false memory from physical memory will not be allotted. IS_DEDUCT_MEM_ACTIVEMQ in the property file.

- **locate memory for SAP Adapter:**
  Allocate memory for SAP Adapter from the physical memory allocated to SI. If the value is set to true. Default value allocated is 256MB.

- **Allocate memory for Command Line Adapter:**
  Default of 128MB is allocated if we set the property to true.

- **Physical Memory Allocated to Server (MB)**
  This value is not same as ‘physical memory allocated to platform’. It is calculated as (((Physical memory allocated to Platform - (Number of server nodes * Minimum memory allocated to the server nodes)) - (Number of server nodes * Maximum permanent generation size allocated to server nodes)) - (Number of container nodes * Maximum permanent generation size allocated to container nodes)) – Memory allocated to the ops server))

  Here 4096 - (1*0)-(1*384) – (0*0)-128 =3584.
- **Initial Heap Size (MB):**
  Controls the initial size of a Java heap allocated to each server JVM.
  it can reduce the overhead associated with garbage collection by improving the server response time and throughput. If a large number of minor garbage collections are happening, try to increase the value of it. It can be done with –Xms parameter

  Example: Linux 64-bit: =if (MEMORY_ASI >= 2036, MEMORY_ASI, if (MEMORY_ASI <= 1024, 512, round(0.5 * MEMORY_ASI)))

- **Maximum Heap Size (MB):**
  Controls the maximum size of a Java heap allocated to each server JVM. It can be done with Xmx parameter.

    If this parameter is tuned correctly, it can:
    - Reduce the overhead associated with the garbage collection and the risk of encountering an Out-Of-Memory (OOM) condition
    - Improve the server response time and throughput

- **Initial Size of New (Nursery) Heap (MB)**
  Controls the initial size of the new heap area allocated to each server JVM.
  It is used with the throughput/parallel collector instead of the JVM built-in tuning the parameter provides. Default value is 256MB for Linux. It can be done with –Xns parameter

- **Maximum Size of New (Nursery) Heap (MB)**
  Controls the maximum size of the new heap area allocated to each server JVM.
  Linux 64-bit: Linux-64.MAX_AGE=512
- **Maximum Permanent Generation Size (MB):**
  Controls the maximum size of the permanent generation heap allocated to the server JVM. It stores all the class code and class-like data. The value of the parameter should be large enough to fit all the classes that are concurrently loaded. Property value is operating system].MAX_PERM_SIZE=384 Mb for Linux system.

- **Thread Stack Size (KB):**
  Controls the maximum Java stack size for any thread. This can be determined with –Xss parameter. Each time a method is invoked, a stack frame is created and pushed into the thread stack. At a minimum, a stack frame contains a method’s local variables and arguments. If a thread's actual stack size reaches beyond this limit, you will get a java.lang.StackOverflowError exception.

- **Enable VerboseGC:**
  JVM Verbose garbage collection (GC) statistics are critical. Select True from the drop-down list if you want to generate verbose garbage collection data for server JVM. GC logs will be present in noapp.logs for analysis.

- **JVM Arguments Prefix:**
  Determines the arguments set as JVM parameters before other JVM flags are set for server JVM. It can be used to specify the GC ratio, tenured, nursery area sie ratio etc. Example: turning on the compaction – XXfullCompaction or -XXkeepAreaRatio:10 etc.

- **JVM Arguments Suffix:**
  Determines the arguments set as JVM parameters after other JVM flags are set for server JVM. For example, -Xnoclassgc parameter disables dynamic class unloading.
Garbage Collection analysis and Tuning
• Collecting and analyzing GC statistics help size the different sections of a heap correctly.

• **GCViewer** or VisualGC are few tools where GC statistics can be analyzed for memory leaks, Objects allocation and deallocation stats, Different heap statistics

• **-verbose:gc** to get the GC output to noapp.log file.

• In th HP JVM or in SUN JVM we can specify:
  ```
  java -XX:+PrintGCDetails -XX:+PrintGCTimeStamps -Xloggc:<gcfilename> -verbose:<gc>
  ```

**Layout of Generation heap**

- New objects are allocated in the **Eden**. When the Eden fills up, the JVM issues a scavenge GC or minor collection to move the surviving objects into one of the two survivor or semi spaces.

- **The scavenge GC’s** efficiency depends on the amount of referenced objects it has to move to the survivor space, and not on the size of the Eden.

- When the old heap fills up, the JVM issues a Full GC or major collection. In a **Full GC**, the JVM has to first identify all the referenced objects. When that is done, the JVM sweeps the entire heap to reclaim all free memory.
GC performance improvement

- Few Parameters which may improve the performance w.r.t. GC
  - `-XX:+DisableExplicitGC`
  - `-XX:NewSize` -- controls the minimum young generation size in a heap.
  - `-Xmn<Size>` -- sets the size of the young generation heap.
  - `-XX:MaxPermSize` -- Stores all classes. This value of the parameter should be large enough to fit all the classes that are concurrently loaded.
  - If GC is not able to clear number of live objects from the heap for a long time, then there might be a memory leak which can cause OOM in the future.
  - In a Full GC, the JVM has to first identify all the referenced objects. When that is done, the JVM sweeps the entire heap to reclaim all free memory. If you see multiple full GC cycles, the increase the overall heap size.
  - If you see increased number of small GC cycles, then try to increase the newSize with `-Xmn <size>`
  - `-XX:NewSize = (0.33333 * value of –Xms)`
  - `-Xmn = (0.33333 * value of -Xmx)`
Understanding of memory parameters in the SI system

If the tmp.sh in the /install/bin folder is configured with these memory parameters
install\jdk\bin\java -XX:MaxPermSize=128m -Xss256k -Xms1024m -Xmx3072m --
    XX:MaxNewSize=1024m -Xmn512m -XX:SurvivorRatio=4 -XX:+DisableExplicitGC.
    -XX:MaxPermSize=128m , which stores all class objects and toString() done on the class
    object will be stored here.
    -Xss256k specifies the thread stack memory
    -Xms1024m is the min heap size
    -Xmx3072m is the maximum heap size , it again depends on the physical memory set in the
    machine.
    -XX:MaxNewSize=1024m is the maximum size of the young generation heap
    -Xmn512m is the size of the eden space i.e new generation heap value..
    -XX:NewRatio=2 is the default which is talking about the ratio of new/old generation heap
    -XX:SurvivorRatio=4 ratio between eden/survivor space ratio.
    -XX:+DisableExplicitGC, i.e application invoked system.gc() will not be entertained.
You can change the size of the database pools to allow more connections to the database.

Increasing the pool size can solve the following issues:

- Increased volume levels
- Data bursts
- Connection or cursor leaks.

**Default Document Storage:**

**FS** - Stores the document data on the local file system

**DB** - (Default) Stores the document data in the database

defaultDocumentStorageType in jdbc.properties

**JDBC Monitor** Page analysis

**Types of Connection pool**

- UI, Archive, Default, Non-transactional, Local.
Symptoms that can cause a Database growth

- **Indexing business process** is not working properly, causing no data to be flagged for archival or purging.
- **Persistence levels** set to high globally or in BP or on activity causing DB to grow.
- **Size of the database** is not optimized for your processing requirements
- **Schedule_BPRecovery** business process is either not running or failing causing BP to remain in DB in interrupted state.
- **AssociateDocsToBP** business process is either not running or failing, causing expired documents to not be associated for being purged from the system.

Resolving the DB issues:

- Monitor the Database Usage Report in Sterling B2B Integrator to determine the levels of database usage to tune them according to the processing need.
- Complete the **indexing and purging** activities regularly.
- Optimizing the **document lifespan** period in the system
- **Document Persistence** has to be set properly such as FS when dealing with large tables like TRANS_DATA or DATA_TABLE which maintains the BLOB_DATA.
- Running the cleanup activities and regular DB maintenance cycle to make sure of rebuild, shrunk operations on databases.
- Rapid growth tables like DOCUMENT, CORRELATION_SET, TRANS_DATA, DATA_TABLE can be moved to a **separate segments or tablespace** to improve the performance.
Managing the Connection Pool

- Determines the initial number of connections to be reserved in the database connection pool. It can be set using the initial size in tuning wizard.

- It is a good practice to set the **min connection size to 1** instead of setting to large value.

- Periodically check the JDBC connection tracker or connection pool report to check whether it is matching the need. It is recommended to set the **maximum value of 256** in the system for all connection pools.

- **Keep proper buffer size** value for the future demand during high processing load. Once all the connections are used (maxsize + buffersize), and a new request for a connection comes in, the new request is denied and an error is written stating that a connection cannot be created and that the connection pool has been exhausted.
DB – Cleanup Processes

- ScheduleIndexBusinessProcess
- ScheduleBackupService
- SchedulePurgeService
- ScheduleAssociateBPsToDoc
- ScheduleRecoveryBusinessProcess
- ScheduleAutoTerminateService
- Schedule_BPLinkagePurgeService
**ScheduleIndexBusinessProcess**

- Runs on completed processes
- Picks the Bps with ARCHIVE_INFO with ARCHIVE_FLAG = -1
- Sets ARCHIVE_DATE to greatest of:
  - Lifespan set in workflow definition
  - Any Documents associated with process. not doc creation.
- Sets ARCHIVE_FLAG to:
  - 0 Archive for archiving the documents
  - 2 Purge for purging them

**max_business_processes:** Default 5000

**ScheduleBackupService**

- Runs on processes with ARCHIVE_FLAG = 0
- Makes backup in filesystem.
- Sets ARCHIVE_FLAG = 1
- Does not change ARCHIVE_DATE
- Starts with oldest process set to archive
SchedulePurgeService

- Runs on processes that have:
  - ARCHIVE_FLAG in (1, 2).
  - ARCHIVE_DATE < now.

- Deletes data from tables based on GROUP_ID
- Deletes from ARCHIVE_INFO
- query.purge_archiveInfoRowLimit.database_name=2000 (default)
- Multi-threaded Purge

ScheduleAssociateBPsToDoc

- Finds documents that have:
  - -1 WORKFLOW_ID.
  - lifespan in the past.

- Documents delete when run of AssociateBPsToDocs purge.
  - Based on Lifespan considerations.
ScheduleRecoveryBusinessProcess

- Abnormal process termination due to hardstop or JVM crash makes the database not in synchronized state.
- There are BPs in indefinite state like active, halting or waiting_on_io. Which are not safe or final states in the system.
- The BPRecover attempts to address the problem of how to synchronize the database and the WorkFlowEngine so as to not impact an newly executing BPs.
- BPReportService obtains the list of ACTIVE, HALTING or WAITING_ON_IO from the database. This set is then compared to the list of threads, messages in the queues and ActivityData entries (objects in memory that can be associated with an in-flight process). This is done 3 times with a 10 sec sleep in between each. If a candidate makes it through all 3 checks, then it is considered active hung.
ScheduleAutoTerminateService

- The Auto Terminate service is pre-configured and, by default, is scheduled to run each day at 4:00 A.M.
- The service checks for business processes that have been in a specified state for a specified length of time and then terminates them.
- By default, the Auto Terminate service checks for and terminates business processes that have been in a halted state for over 14 days. You can adjust these settings to suit your specific business needs.

- Overriding the bprecovery.properties Settings in customer.overrides file:

  ```
  auto_terminate_days=14
  num_states=1
  auto_terminate_state1=halted
  auto_terminate_batch=1000
  ```

- In BPML `<assign to="AUTO_TERM_DAYS" >new_value</assign>`
Reorganize, Rebuild, Stats, Shrink on Databases

These are few important steps in the database maintenance cycle

- **Reorganize**
  
  This function enables a user to clean up the database indexes and other details in order to make the database function more efficiently. It does a re-ordering of index not re-creating them again, does not collect stats, uses fewer server resources.

- **Rebuild**
  
  Reduce fragmentation issues caused by frequent insert and purge operation on databases, rebuild of indexes are very important. Creates a re-ordered copy of the index, and replaces the original with it, collects stats on the index,

- **Stats**
  
  Collects the statistics on the objects of databases. Helps to create a explain plan for each objects and keeps them in memory.

- **Shrink**
  
  Releases un-used space in the object back to the OS
Few Important SI tables

The following table lists some of the tables defined in Sterling B2B Integrator experience substantial input, output, and rapid growth.

These tables are candidates for moving to a tablespace or segment that is separate from the rest of the database.

<table>
<thead>
<tr>
<th>Table Name</th>
<th>Table Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA_TABLE and TRANS_TABLE</td>
<td>These tables hold the binary payload of documents used for processing within Sterling B2B Integrator.</td>
</tr>
<tr>
<td>DOCUMENT, CORRELATION_SET</td>
<td>Contains document metadata used for searchability and enablement of various document processing tasks.</td>
</tr>
<tr>
<td>WORKFLOW_CONTEXT</td>
<td>Contains step status and business process flow information.</td>
</tr>
<tr>
<td>ARCHIVE_INFO</td>
<td>Holds lifespan information pertaining to all business processes and document storage in the system.</td>
</tr>
</tbody>
</table>
Tuning on the Adapter Configurations

**HTTP Server Adapter:**
- The HTTP Server adapter enables you to specify the threads range in the http.properties file. It includes a **Min Thread value** and **Max Thread value**.
- If the Max Thread value is reached, any additional connection requests fail.
- The http.properties file is located in the properties folder under your application installation directory.
- Minimum and Maximum number of **Jetty threads** can be tuned for the better performance of the HTTP server.

**FTP Server Adapter:**
- FTP Server performance can be tuned by changing **Min and Max threads** configuration. Default value is 3 and 6. If the number of requests increases, then this property value can be changed.
- **Transfer Buffer Size** which specifies the size of the buffer for transfer operation, this can be changed to improve the transfer rate. It depends on the perimeter transfer buffer window size set.
- **Document Storage** indicates the location where body of the request document must be stored. FS will improve the performance if it is used as an option instead of DB.
Tuning on the Adapter Configurations

- **SFTP Server Adapter**
  - SFTP Server adapter to enable external SFTP clients to *put* files into a Mailbox or *get* files from a Mailbox.
  - Minimum and Maximum number of *threads* can be tuned to improve the performance. These threads are used by the perimeter server to improve the performance.
  - **Transfer Thread Pool Size**: Tuning parameter that indicates the number of permanent transfer threads the server begins with. Once a socket has either been accepted or connected, the socket is registered with a transfer thread. This thread asynchronously performs all the input and output for the socket. Increasing the value from default of 2 to higher number will improve the throughput in the system.
  - **Channels per Transfer Thread**: A tuning parameter that indicates the number of channels available for each transfer thread.
  - **Document Storage Type**: Select where documents will be stored, it can be DB or FS. FS will always high performant than DB.
  - **Key Exchange value set to false** to avoid the exchange of key during multiple get operations.
Tuning on the Adapter Configurations

- **Perimeter Server**

  A perimeter server is communication management software installed in a DMZ that manages communication flows between a perimeter network and Sterling B2B Integrator TCP-based transport adapters. Perimeter servers help reduce network congestion issues and enhance security and scalability for high-volume environments.

  Memory utilization, the amount of data in these buffers can be managed by setting the **high and low water mark** settings for both **inbound** and **outbound** traffic.

  - **gmm.shedExecutionTime** is the time in ms that perimeter services will wait for memory to be released, when the GMM memory limit specified by **gmm.maxAllocation** is reached, before closing one or more connections.

  - **gmm.maxAllocation** Maximum amount of memory to use for all buffering inside perimeter services and associated adapters. The default value is 384M.

  - **socket.receiveBufferSize** This value is used for socket I/O.
Filegateway tuning

- Property: **fgRouteConcurrentSessionLimit**: Number of File Gateway services that can be run concurrently. Maximum value can be 64.

- If you have a high volume of PGP traffic, you can improve your performance by specifying a group for the file gateway. `pgpCmdline2svcname=PGPCmdlineService`. The name Command Line Adapter to be used for PGP packing and unpacking

- If you are processing very large files, increase the probe values to avoid timeout conditions.
  - `bpCompletionProbes.1=120`
  - `bpCompletionSleepMsec.1=100`

- If you have very large files that will be processed by PGP, then increase the `fgRoutePGPCmdLineSocketTimeout` value from the default value of 4min.

- If you have high volumes of FTP traffic, then specify them as a group, like `ftpClientAdapterName=FTPClientAdapter`

- Suppress Duplicate Messages by `mailbox.disallowDuplicateMessages=true`

- Increase the number of steps a business process must complete prior to returning to the queue. Property: `noapp.AE_ExecuteCycle.#` where # is the queue number. Higher values will accelerate individual business process where lower number provides smooth multitasking capability. Batch processing requires a higher number where as interactive favors a lower number

- Increase the number of concurrent threads. Property: `noapp.MaxThreads`

- Set storage type. As filesystem. Property: `filegateway_ui.storagetype=file`
Performance tuning on EDI, Translation

- Enveloping Service can be improved by changing these parameters in the system:

- In the enveloping.property file:
  - `unpersistedStorageType=DB`
  - `TRACKING_LEVEL=none`
  - `useLocalInMemoryControlNumbers=true`

- In the translator.properties.in

  If you are translating very large files (5GB or larger) or files that contain many levels of looping, you can get better translation performance by tuning the following parameters:
  - `maxKeyFileSize`.
  - `OptimizeXPathHelper` property is used for optimize common XPath operations by explicitly retrieving the data from the DOM.
  - Use “useTracking=false” in the jdbc.properties file
  - Check whether the Cache size are set to optimal level.
  - Check your Heap and memory settings are supported to
Analyzing the performance problems through different tools

- There are several tools available for analysing the performance problems.
  - JVM Thread monitoring tool to monitor
    - Thread contention issues
    - Slowness issues
    - Application hangs issues
    - dead locks etc
    - State of the system etc.
  - Heap Analysis tool: to analyze the
    - OutOfMemoryError Exceptions
    - Memory Leaks.
    - The Application Hangs issues
  - GC analysis tool to analyze
    - GC statistics for proper heap settings
    - Application pause time during garbage collection
    - Memory leaks issue
  - AWR report for
    - Database performance issue analysis in Oracle DB
    - Low performant sqls in oracle db
    - DB server performance improvement
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