

ELM Monitoring Recommendations

Suggested metrics and default dashboards

Revision History			
Revision Number	Date	Revision Author	Description
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1 Introduction

This document outlines recommendations on the key counters and data items that should be monitored in an IBM Engineering Lifecycle Management environment. This document is implementation independent and does not provide specifics on how to gather individual metrics in specific tools.

2 Monitoring Overview

This section outlines the types of metrics typically collected and gives recommendations on thresholds for alerting team members. For simplicity thresholds will be divided in to 3 levels of increasing criticality.

1. **INFO** – Metrics passing this level should be watched to ensure that they do not further increase
2. **WARNING** – Metrics passing this level may require intervention/remediation to ensure system stability
3. **CRITICAL** – Metrics passing this level will likely require intervention to ensure system availability

2.1 OS Monitoring

Monitoring the OS hosting the ELM Application, database and proxy servers is critical in ensuring the stability, performance, and availability of your ELM environments.

2.1.1 Key Metrics

- CPU Utilization
- Disk Usage/Storage
- Physical Memory
- Swap Space

Metric	INFO	WARNING	CRITICAL
CPU Utilization	> 75%	> 85%	> 90%
Disk Usage/Storage	> 70%	> 80%	> 90%
Physical Memory	> 75%	> 80%	> 90%
Swap Space	> 60%	> 70%	> 80%

2.2 Network Monitoring

2.2.1 Key Metrics

- Network Latency
 - Client/Server Latency
 - Server/Database Latency
- Network Bandwidth/Throughput

Metric	INFO	WARNING	CRITICAL
Client/Server Latency	> 200ms	> 300ms	> 350ms
Server/Database Latency	> 3ms	> 5ms	> 7ms
Bandwidth/Throughput			

2.3 ELM Application Monitoring with MXBeans

2.4 Key Metrics

- JVM Heap
- Thread Pool Usage
- Garbage Collection
- Active Services
- SQL Metrics
 - Active Connections
 - Queue Length
 - Read Time Average
 - Write Time Average
- Diagnostics
- Resource Intensive Scenarios

Metric	INFO	WARNING	CRITICAL
JVM Heap		Used Memory/Heap > 75% over 15 min.	Used Memory/Heap > 90%
Thread Pool Usage	Active Threads > 80% of Available	Active Threads > Available Processors	

Metric	INFO	WARNING	CRITICAL
	Processors		
Garbage Collection		1. Time spent on GC > 5% 2. GC taking longer than 10s	
Active Services	1. Total Count > 75% of available processors 2. cpuRatio > 75%	1. Total Count > available processors 2. cpuRatio > 100%	
SQL Metrics	1. Active Connections / Pool size > 80%	1. Queue Length > 0 2. Active Connections / Pool Size > 90% 3. Read Avg Time > 250ms 4. Write Avg Time > 500ms	
Diagnostics			Any reported diagnostic error
Resource Intensive Scenarios	1. countOverInterval > 3	2. countOverInterval > 5 3. averageOverInterval > 120s	

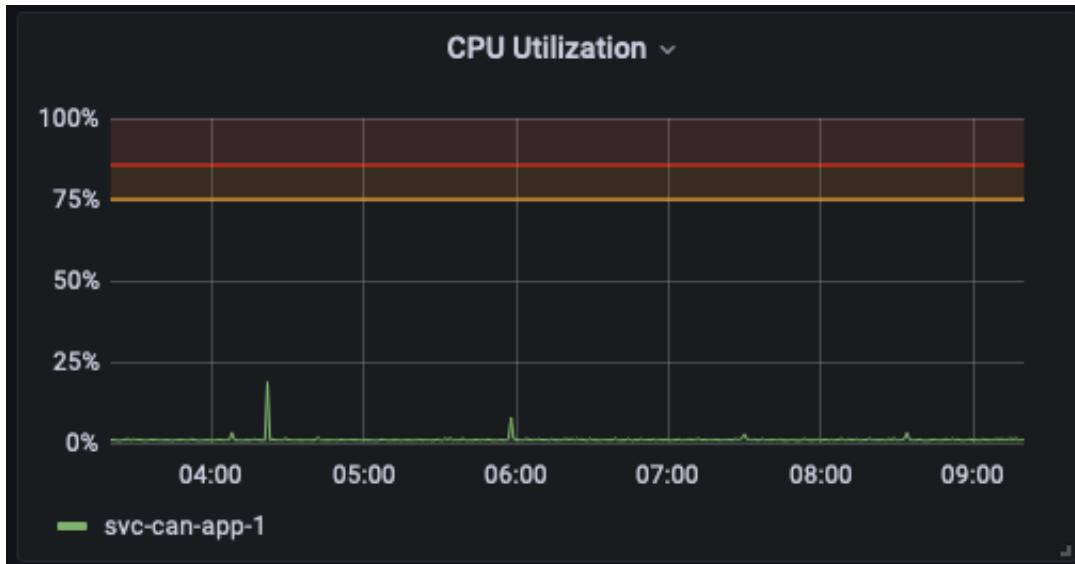
3 Database Monitoring

Metric	INFO	WARNING	CRITICAL

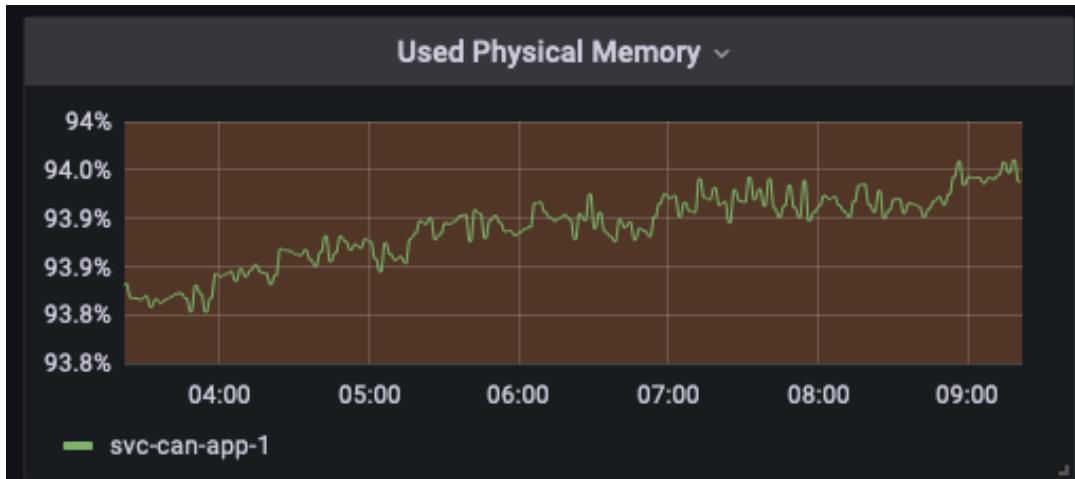
4 Suggested Dashboards

4.1 Summary Dashboard

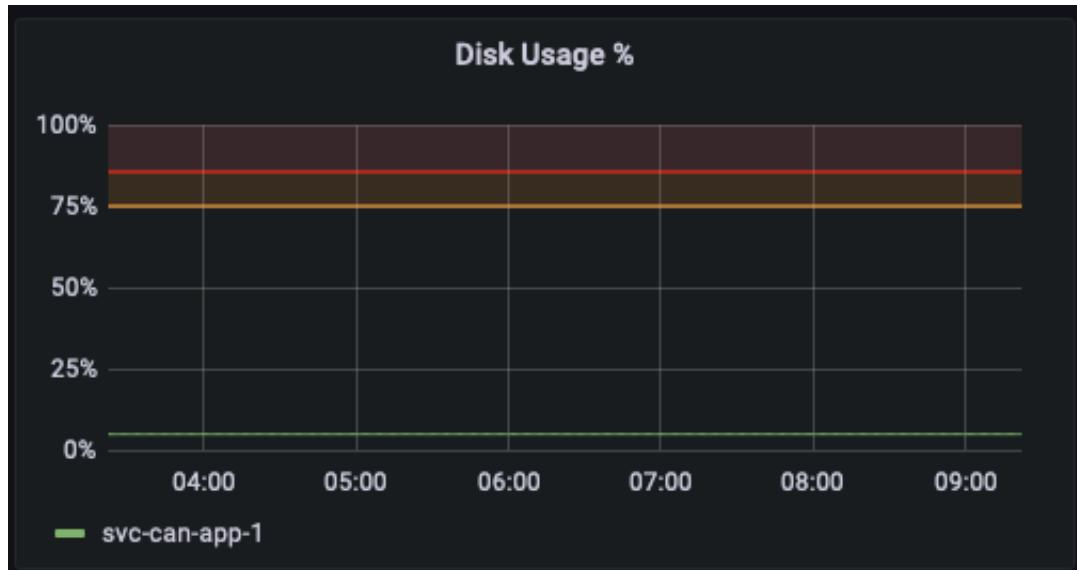
- CPU Utilization



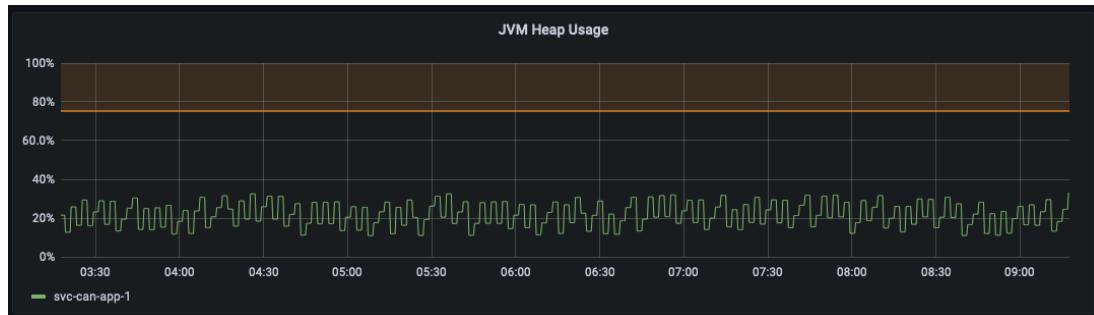
- Memory Utilization



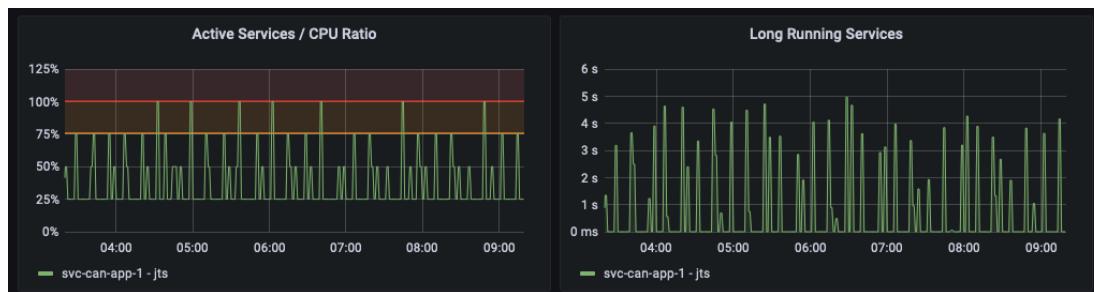
- Disk Utilization



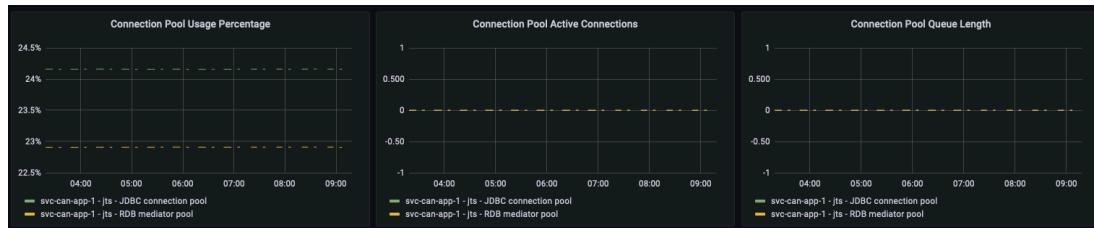
- JVM Heap Utilization



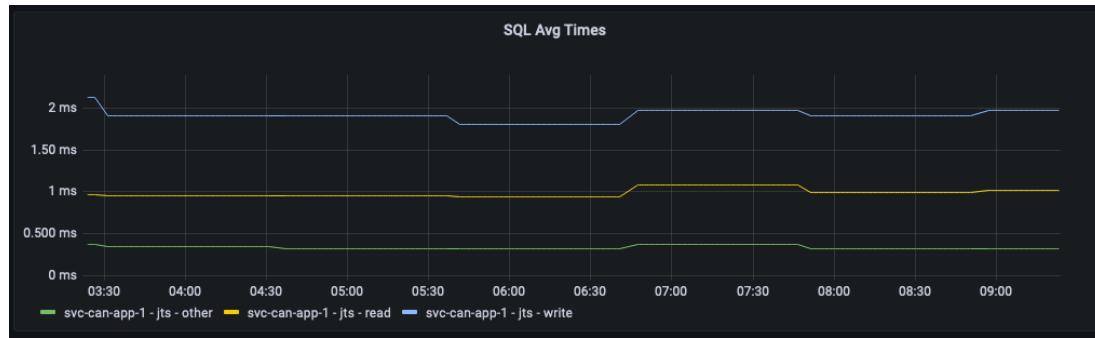
- Network Latency
- Active Services



- JDBC/RDB Pool Usage

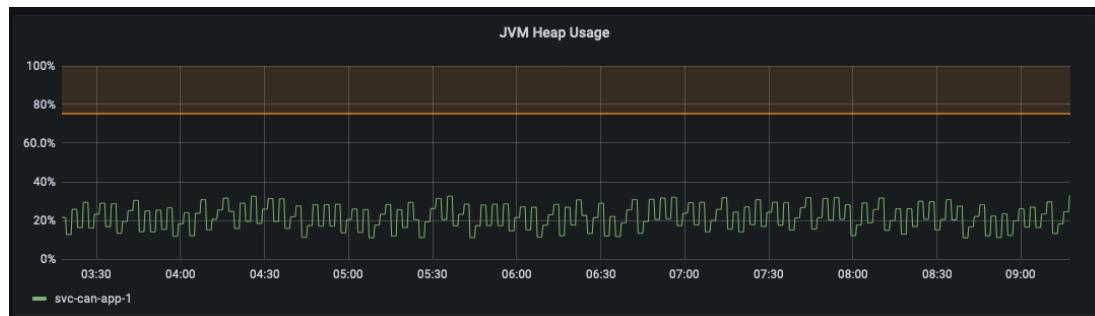


- SQL Read/Write Performance



4.2 ELM-JVM Dashboard

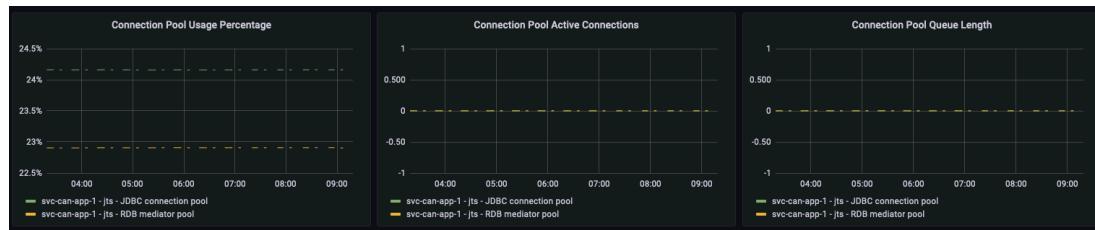
- JVM Heap Utilization



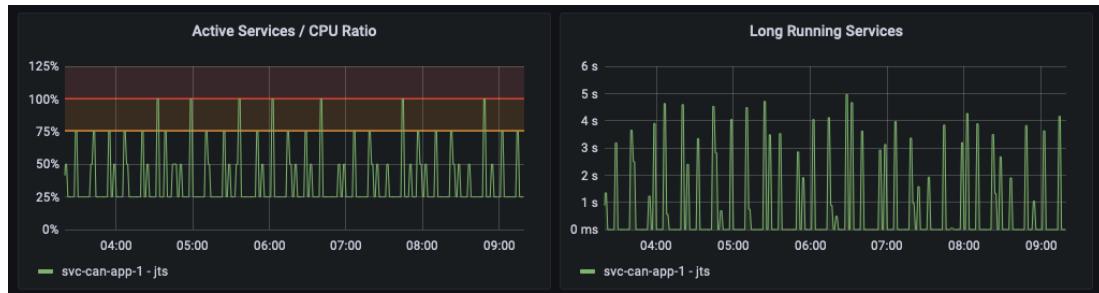
- Garbage Collection



- Thread pool Usage



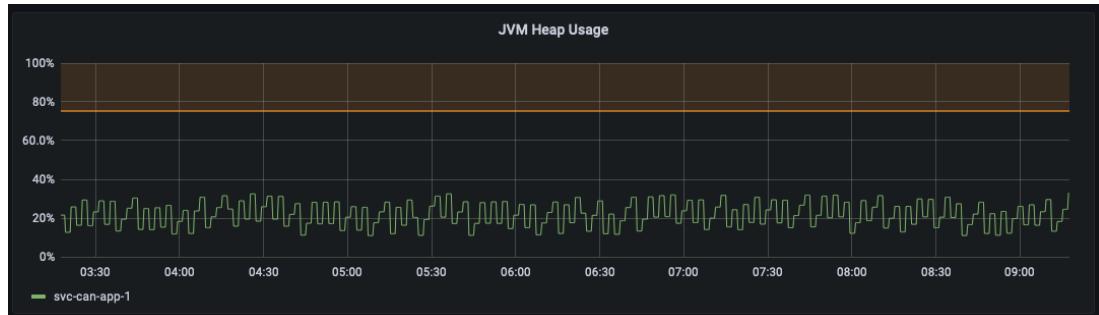
- Active Services



- Diagnostics

4.3 LQE/LDX Dashboard

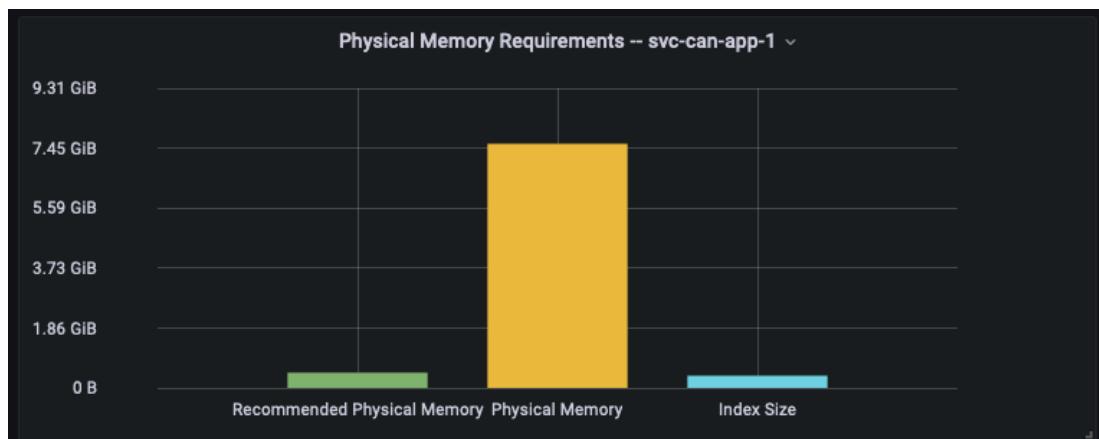
- JVM Heap



- Garbage Collections



- Index Size/JVM Heap/Physical Memory ratio



- TRS Fetch Times



- Change Log
- Partition Monitoring

4.4 DOORS Next Generation Dashboard

- Rogue Query Summary

4.5 EWM Dashboard

- Build Queue Information

5 Detailed Metrics Collection

5.1 OS Metrics

5.2 ELM MXBeans

Metric Type	MXBean	Attributes
Thread Pool Usage	WebSphere:type=ThreadPoolStats,name=Default Executor	<ul style="list-style-type: none">• PoolSize• ActiveThreads
	java.lang:type=OperatingSystem	<ul style="list-style-type: none">• AvailableProcessors
Garbage Collection	java.lang:type=GarbageCollector,name=<global scavenge>	<ul style="list-style-type: none">• CollectionCount• CollectionTime
Memory Usage	java.lang:type=OperatingSystem	<ul style="list-style-type: none">• FreePhysicalMemorySize• TotalPhysicalMemorySize• FreeSwapSpaceSize• TotalSwapSpaceSize
	WebSphere:type=JvmStats	<ul style="list-style-type: none">• Heap• UsedMemory
Active Services	com.ibm.team.foundation.activeservices:type=activeServicesSummaryMetrics	<ul style="list-style-type: none">• longestDuration• totalCount• countExceedingThresholdDuration• cpuRatio

Metric Type	MXBean	Attributes
	java.lang:type=OperatingSystem	<ul style="list-style-type: none"> • AvailableProcessors
SQL Metrics	com.ibm.team.foundation.counters:type=counterMetrics,group=resource usage,facet=queue length,counterName=JDBC connection pool	<ul style="list-style-type: none"> • value
	com.ibm.team.foundation.counters:type=counterMetrics,group=resource usage,facet=queue length,counterName=RDB mediator pool	<ul style="list-style-type: none"> • value
	com.ibm.team.foundation.counters:type=counterMetrics,group=resource usage,facet=usage percentage,counterName=JDBC connection pool	<ul style="list-style-type: none"> • averageOverInterval
	com.ibm.team.foundation.counters:type=counterMetrics,group=resource usage,facet=usage percentage,counterName=RDB mediator pool	<ul style="list-style-type: none"> • averageOverInterval
	com.ibm.team.foundation.sqlactivity:type=sqlActivitySummaryMetrics,sqlStmtType=read	<ul style="list-style-type: none"> • sqlAverageTime
	com.ibm.team.foundation.sqlactivity:type=sqlActivitySummaryMetrics,sqlStmtType=write	<ul style="list-style-type: none"> • sqlAverageTime
	com.ibm.team.foundation.sqlactivity:type=sqlActivitySummaryMetrics,sqlStmtType=other	<ul style="list-style-type: none"> • sqlAverageTime
ELM Diagnostics	com.ibm.team.foundation.diagnostic:type=diagnosticMetrics,testId=*	<ul style="list-style-type: none"> • status
Diagnostics	com.ibm.team.foundation.diagnostic:type=diagnosticMetrics,testId=*	<ul style="list-style-type: none"> • status

Metric Type	MXBean	Attributes
LQE Performance	com.ibm.team.integration.lqe:type=IndexingAgentMetrics, url=<TRS_URL>,node=<NODE_NAME>	<ul style="list-style-type: none">• ChangeLogMetrics<ul style="list-style-type: none">◦ errorCount◦ errorInfo◦ status◦ skippedCount◦ failedPatchCount◦ fetchTimeAvg◦ recoveredCount◦ trsFetchTimeAvg• ValidationMetrics<ul style="list-style-type: none">◦ errorCount◦ missingResourcesCount◦ outdatedResourcesCount◦ skippedCount◦ status

Metric Type	MXBean	Attributes
LQE Partition Monitoring	com.ibm.team.jis.lqe:type=TdbDataset,name=<name>	<ul style="list-style-type: none"> • DatasetMetrics <ul style="list-style-type: none"> ◦ graphProcessingTimeAvg ◦ luceneWriteTimeAvg ◦ queryTimeAvg ◦ queryWaitTimeAvg ◦ readTimeAvg ◦ readWaitTimeAvg ◦ tdbSyncTimeAvg ◦ writeTimeAvg ◦ writeWaitTimeAvg • LastQueryLoadSummary <ul style="list-style-type: none"> ◦ status • QueryLoadMetrics <ul style="list-style-type: none"> ◦ queryLoad
LQE Maintenance	com.ibm.team.jis.lqe:type=MaintenanceActivity	<ul style="list-style-type: none"> • PreviousBackupMetrics <ul style="list-style-type: none"> ◦ status • PreviousCompactionMetrics <ul style="list-style-type: none"> ◦ Status
Resource Intensive Scenarios	com.ibm.team.foundation.counters:name=<<contextRoot>>,type=counterMetrics,group=scenarios,facet=elapsed time in millisecs,counterNameAndId=summary_*	<ul style="list-style-type: none"> • averageOverInterval • countOverInterval

Metric Type	MXBean	Attributes
Rogue Query Summary	com.ibm.rdm.metric:name=RogueQuerySummary, type=query	<ul style="list-style-type: none">• contextRoot• average• min• median• max• queryCount

6 More Info

More information and recommendations can be found at:

- <https://jazz.net/wiki/bin/view/Deployment/JMXMBEANS>
- <https://jazz.net/library/article/91590>
- <https://jazz.net/wiki/bin/view/Deployment/DeploymentMonitoring>
- <https://jazz.net/library/article/91971>
- <https://jazz.net/library/article/90785>
- <https://jazz.net/wiki/bin/view/Deployment/LifecycleQueryEngineBestPractices>

7 Appendix A – Using jconsole to browse current mbeans

This section provides guidance on how to run jconsole and use it to connect to a running ELM Server (Liberty) instance. This will provide a way to actively browser the currently published mbeans and assist with debugging your other monitoring tools.

7.1 Prerequisites

The following prerequisites must be present to use jconsole to attach to your ELM server.

- 1) Full java 1.8 JDK that includes **jconsole.jar** and **tools.jar**
- 2) The **monitor-1.0** and **restConnector-2.0** features enabled in the liberty server configuration
 - [Monitoring with monitor-1.0](#)
 - [Admin REST Connector 2.0](#)
- 3) The **restConnectory.jar** file from <install-dir>/server/liberty/wlp/clients/restConnector.jar
- 4) The SSL keystore used by the Liberty server. By default these are located in <install-dir>/server/liberty/servers/clm/resources/security.
- 5) The REST connector address. This can be found in <install-dir>/server/logs/state/com.ibm.ws.jmx.rest.address.

The following is a sample address:

service:jmx:rest://sampleserver.ibm.com:9443/IBMJMXConnectorREST

- 6) User ID and password that has “administrator-role” as defined in the liberty server configuration. This is typically defined in the liberty server.xml file (<install-dir>/server/liberty/servers/clm/server.xml). In the example below the user **ADMIN** and the **JazzAdmins** group have this role.

```
<administrator-role>
  <user>ADMIN</user>
  <group>JazzAdmins</group>
</administrator-role>
```

7.2 Starting jconsole

Once all the prerequisites have collected the jconsole application is started by running the following commands:

```
export JAVA_HOME=<path to Java JDK>
jconsole \
-J-Djava.class.path=$JAVA_HOME/lib/jconsole.jar:$JAVA_HOME/lib/tools.jar:./restConnector.jar \
-J-Djavax.net.ssl.trustStore=<ssl-certs-file>
-J-Djavax.net.ssl.trustStoreType=<ssl-certs-file-type> \
-J-Djavax.net.ssl.trustStorePassword=<ssl-certs-file-password>
```

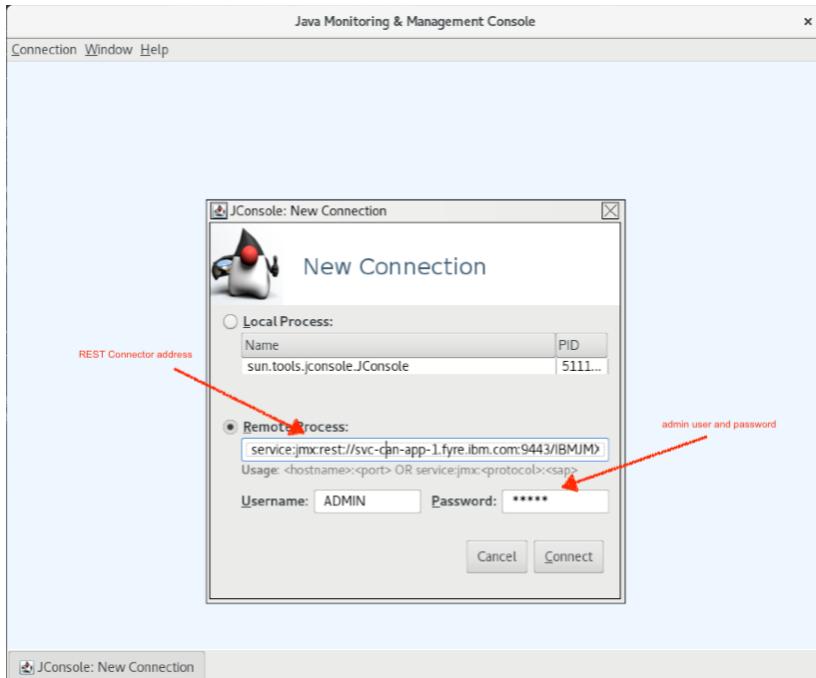
Sample:

```
export JAVA_HOME=/usr/lib/jvm/java-1.8.0
jconsole \
-J-Djava.class.path=$JAVA_HOME/lib/jconsole.jar:$JAVA_HOME/lib/tools.jar:./restConnector.jar \
-J-Djavax.net.ssl.trustStore=./elm_certs.p12 \
-J-Djavax.net.ssl.trustStoreType=PKCS12 \
-J-Djavax.net.ssl.trustStorePassword=elm_cert
```

Note: It is advisable to wrap these commands in a script. Additionally, these commands do not need to be run on the server, they can be run on any host (Unix, Mac, Windows) that has network and firewall access to the server you will be connecting to using jconsole

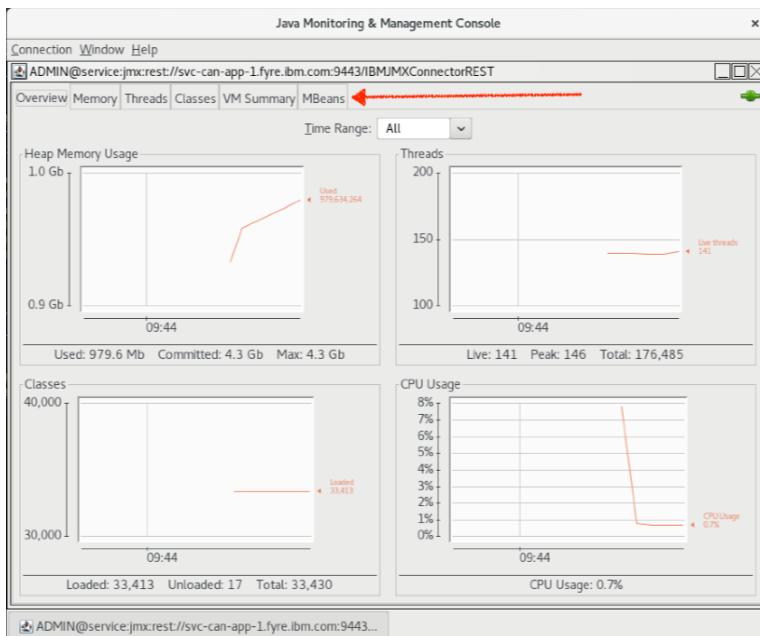
7.3 Connecting and Browsing mbeans

Run the commands/script from above



Enter in the REST address and Admin ID and password then click “Connect”

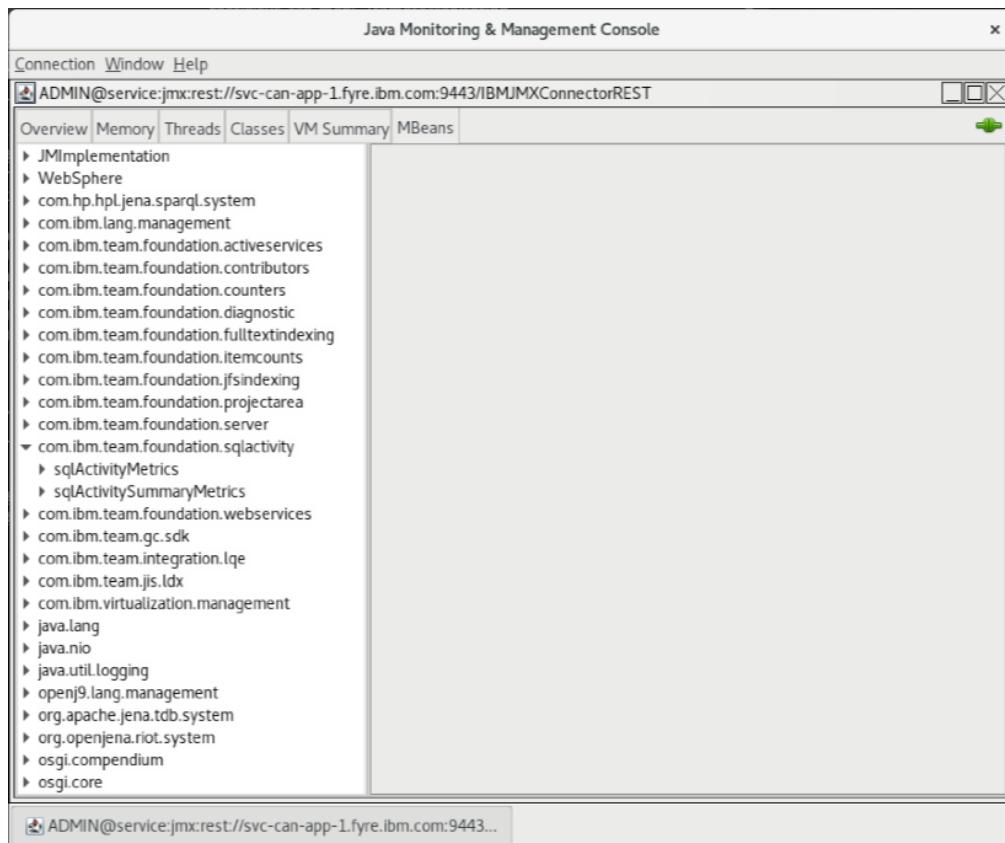
If you can connect successfully, you will see a Overview page similar to below



To browse the currently available mbeans, click on the MBeans tab

ELM Monitoring Recommendations

Suggested metrics and default dashboards



Browse the tree on the left to examine the available mbeans and their current values.

To get the full mbean object name, simply navigate to the mbean you are interested in and view the Object name in the info screen on the right.

