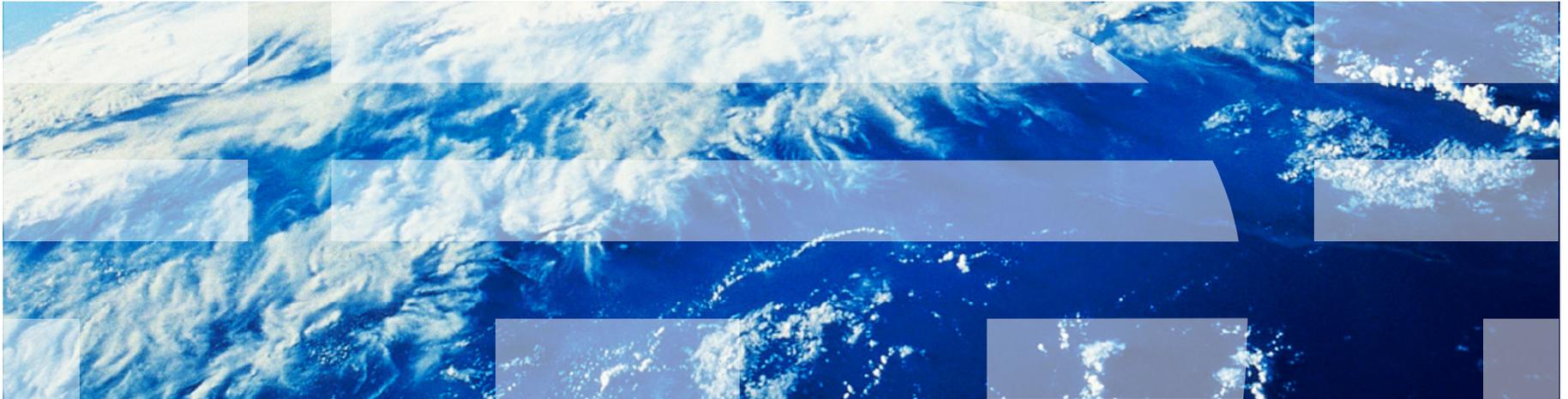


IBM Operational Decision Manager V8.9.x

Tuning Guide

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Performance Report Preview

- Purpose
 - Characterize the performance of Operational Decision Manager V8.9.0, 8.9.1 and 8.9.2

- Audience
 - IBM technical sales and services representatives and ODM customers

Product Versions

- IBM Operational Decision Manager V8.9.x
- WebSphere Application Server ND V8.5.5.11
- Java 7.1.4 and Java 8 sr5
- DB2 V10.5 DB2 V11
- ODM On Cloud on a Tier2
- Oracle 12.1.0.2.0 Enterprise Edition

Rule Execution Server Tuning Recommendations

Basic Tuning : Rule Execution Server

- The TraceLevel in the Rule Execution Server should be set to Severe or Warning in the production environment to increase performance. This property is accessible in the resource adaptor or in the ra.xml.
- The enableInterceptor flag should be unset to avoid if you don't need it. This property is accessible in the resource adaptor or in the ra.xml.
- Check the version of the ruleSession library.
- Java2security should be off if possible especially on JEE.
- Verify that your Application Server is not in Debug mode
- The optimal pool size depends on the number of possible concurrent connections and the number of rulesets to execute. The first performance measurement should be performed with the default size. The limit is reached by the memory consumption. A sizing methodology is available at :

<http://www-01.ibm.com/support/docview.wss?uid=swg21400803>

Basic Tuning : Rule Execution Server (Classic Rule Engine)

JVM Tuning

Memory

- Additional memory can improve performance but the recommended starting heap size is:
 - 1.2 GB per ODM server for 32 bit systems
 - 4GB to 8GB per ODM server for 64 bit systems

Garbage Collector

- gencon is the policy which gives the best results
- Limit the number of threads for garbage collector if you have more than 6 cores
 - `-Xgcpolicy:gencon -Xgcthreads6`

JIT configuration

- The JVM supplied with WAS 8.0.0.5 and further versions generates more JIT code than previous versions, which can lead to longer warm-up times and lower throughput.
- The JIT can take time to compile a large ruleset, but this behaviour can be modified by increasing the cache or by limiting the inlining on ODM classes.
 - `-Xjit:codeTotal=261072 compilationThreads=1` Cache size and number compilation threads
 - `-Xjit:{ilog/rules/engine/Sequential/generated/*}(disableInlining)` Limit the inlining for one of the ODM package

Basic Tuning : Rule Execution Server (Decision Engine)

JVM Tuning

Memory

- Additional memory can improve performance but the recommended starting heap size is:
 - 1GB per ODM server for 32 bit systems
 - 1GB per ODM server for 64 bit systems
- The new Decision Engine use less memory than Classic Rule Engine
- For existing Rule Projects that want to use the new Decision Engine, we recommend to make a new memory tuning, so it will reduce allocated memory on the server.

Garbage Collector

- gencon is the policy which gives the best results
- Limit the number of threads for garbage collector if you have more than 6 cores
 - `-Xgcpolicy:gencon -Xgcthreads6`

JIT configuration

- No particular JIT configuration is needed.
- Java 8 JVM is recommended for best performance

Assertion configuration

- Decision Engine is using assertions. So disable assertions could be useful (`-da` or `-da:com.ibm.rules.*vmargs level`)

Basic Tuning : Rule Execution Server

- There are two main ways to optimize Decision Warehouse:
 - Decision Warehouse is configurable at a ruleset base with filter properties. With this, you can choose the information to save.
 - Decision Warehouse is customizable. Further customization can be done through the Decision Warehouse extension point for better execution performance. You can define how data can be persisted or queried through the extension point. An asynchronous version of decision warehouse for WAS7 and WAS8 is available as a contribution at:

<http://www-01.ibm.com/support/docview.wss?uid=swg21433167>

- In case of batch application you should consider stateful rulesession API to insure the same ruleset for the complete batch execution and to avoid the search of an engine for each single rule execution.

Advanced Tuning : Rule Execution Server

- Tune the execution trace and Decision Warehouse by filtering.
- Limit the size of your XOM to useful classes
- A ruleset on an XML XOM should be configured to run in multiple simultaneous executions. This tuning should be done at two levels:
 - By configuring the pool of XML document drivers at ruleset level. This is configured using the ruleset property `ruleset.xmlDocumentDriverPool.maxSize` (default value 1).
 - By configuring the connection factory property `documentBuilderFactoryProperties` with a value like `{pool.maxSize=20}` (default value 10), as described at:
https://www.ibm.com/support/knowledgecenter/SSQP76_8.9.2/com.ibm.odm.dserver.rules.res.managing/topics/con_res_config_rule_session_conx_pools.html
- Use the ruleset caching information (XU dump) from the Rule Execution Server console to get the status.
- DecisionID : if the DecisionID is set in the request, so it will optimize the response time.

Advanced Tuning : Rule Execution Server

- The XU dump could be generated every x seconds by configuring the connection factory (ra.xml in JSE case)
 - xuDumpSchedulerEnabled should be set to true
 - xuDumpSchedulerInterval is by default to 10000.
 - a Xudump is generated every 10s.
- This configuration has an impact on performance and should be configured for debug purpose only
- When activated, the XU will create a directory named 'xudumps' in the current directory and put all dumps in it.
- It is not working on TWAS

Advanced tuning: Rule Execution Server

- Minimizing the overhead of ruleset parsing
 - Parsing occurs at first invocation of the ruleset. To minimize the affect of this, the ruleset can be parsed before the first execution. This can be done with a dummy execution or a call of the `loadUptodateRuleset` (Management Session API).
 - When a new version of a ruleset is deployed a parse is launched which blocks the executions. This can be fixed by using the asynchronous parsing.
 - Ruleset is used infrequently, and removed from the pool running other rulesets. This can be fixed by setting `ruleset.maxIdleTime` to a number > 0

Advanced tuning: Rule Execution Server

Tuning of a RES JSE

Tomcat, Liberty, JSE application

- The connection manager should set a timeout to avoid the exception pool full when the RES is overloaded.

```
<config-property>  
<config-property-name>defaultConnectionManagerProperties</config-property-name>  
<config-property-type>java.lang.String</config-property-type>  
<config-property-value>pool.maxSize=50,pool.waitTimeout=3000</config-property-value>  
</config-property>
```

Advanced tuning: Rule Execution Server

Remove security of EJB3 on client

On the client side you should remove all the configuration around the security at connection level

The following options of the connection should not be set

- java.security.auth.login.config
- com.ibm.CORBA.ConfigURL
- com.ibm.SSL.ConfigURL
- com.ibm.SOAP.ConfigURL

Advanced tuning: Rule Execution Server

Remove security of EJB3 on client

Change the global security to use the following configuration

Cell=SamplesCell, Profile=ODMSample8800

Global security ?

Global security > CSiv2 inbound communications

Use this panel to specify authentication settings for requests that are received and transport settings for connections that are accepted by this server using the Object Management Group (OMG) Common Secure Interoperability (CSI) authentication protocol.

<p>CSiv2 Attribute Layer</p> <p><input checked="" type="checkbox"/> Propagate security attributes</p> <p><input type="checkbox"/> Use identity assertion</p> <p>Trusted identities <input type="text"/></p> <p>CSiv2 Transport Layer</p> <p>Client certificate authentication <input type="text" value="Supported"/></p> <p>Transport <input type="text" value="SSL-supported"/></p> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> <p>SSL settings</p> <p><input checked="" type="radio"/> Centrally managed</p> <ul style="list-style-type: none"> Manage endpoint security configurations <p><input type="radio"/> Use specific SSL alias</p> <div style="display: flex; align-items: center;"> <input style="margin-right: 10px;" type="text" value="NodeDefaultSSLSettings"/> <ul style="list-style-type: none"> SSL configurations </div> </div>	<p>CSiv2 Message Layer</p> <p>Message layer authentication <input type="text" value="Supported"/></p> <p>Allow client to server authentication with:</p> <p><input type="checkbox"/> Kerberos</p> <p><input checked="" type="checkbox"/> LTPA</p> <p><input checked="" type="checkbox"/> Basic authentication</p> <p>Additional Properties</p> <p>Login configuration <input type="text" value="RMI_INBOUND"/></p> <p><input checked="" type="checkbox"/> Stateful sessions</p> <p>Related Items</p> <ul style="list-style-type: none"> Trusted authentication realms - inbound
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Advanced tuning: Rule Execution Server

Tuning on WebSphere Liberty Profile

- The tcpOptions element (tcpOptions soReuseAddr="true") is added in the server configuration to enable immediate rebind to a port with no active listener and improve the throughput of the server.
- The JSE RES is embedded in every applications using ODM.
- The pool size, the traceLevel and the enableinterceptor should be configured in every application (htds, customer application) .
- Enableinterceptor should be unset

Decision Center

Tuning Recommendations

Basic Tuning : Decision Center

JVM Tuning

Memory

- Additional memory can improve performance but the recommended starting heap size is:
 - 4GB to 16GB per ODM DC server for 64 bit systems
 - 8GB is good starting point

Garbage Collector

- gencon is the policy which gives the best results
- Limit the number of threads for garbage collector if you have more than 6 cores
 - `-Xgcpolicy:gencon -Xgcthreads6`
- Java2security should be off if possible especially on JEE
- Apply the session management configuration for WAS described at
 - [Logging out results in a WebSphere Application Server error message](#)

Basic Tuning : Decision Center

- **Limit memory consumption**
 - Parsing a ruleset consumes memory so you can disable the “Archive parsing flag” option (Project > Edit project options > Check the ruleset archive).
 - Use Automatic build to avoid a ruleset generation cost at “first ruleset generation”.
 - Set in the installation manager the configuration parameter `teamserver.build.archive.storage` to file instead of memory. Default value is now file

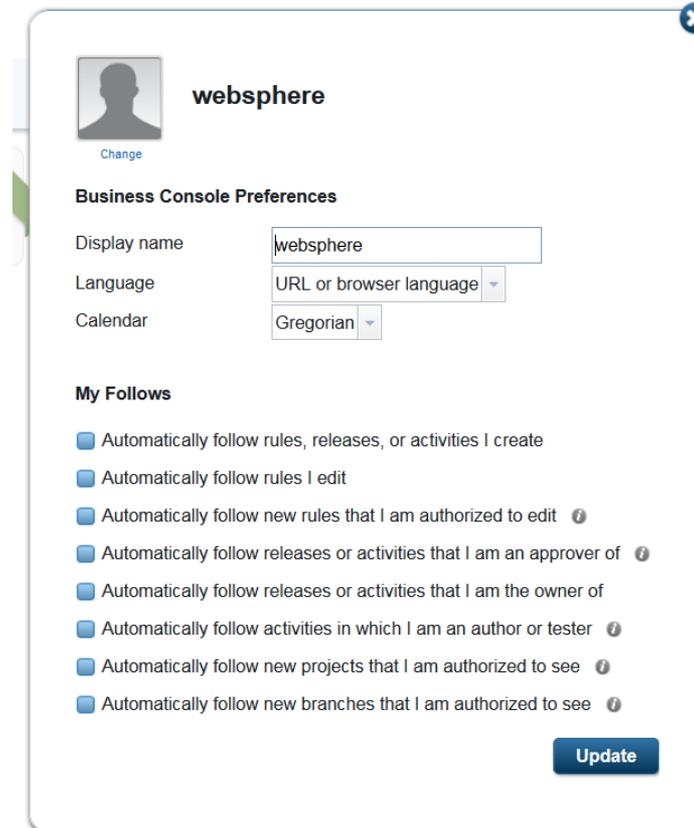
- **Build performance**
 - Disable “Archive parsing flag”.
 - Disable “Rule analysis checks”.

- **Decision Engine Bytecode generation**
 - For Decision Center, you must have enabled the XOM management to be able to activate the bytecode generation

Basic Tuning : Decision Center

■ Business Console Stream configuration

- You can configure it at profil level. It is really useful before the synchronization of a project otherwise this user will follow every artifact of this project



The screenshot shows a user profile configuration window for 'websphere'. At the top left is a placeholder profile picture with a 'Change' link below it. The user's name 'websphere' is displayed to the right. Below the name is the section 'Business Console Preferences' which includes three settings: 'Display name' (text input field containing 'websphere'), 'Language' (dropdown menu showing 'URL or browser language'), and 'Calendar' (dropdown menu showing 'Gregorian'). Below this is the 'My Follows' section, which contains eight toggleable options, all of which are currently turned on. Each option includes an information icon (i) to its right. At the bottom right of the window is a blue 'Update' button.

websphere

Change

Business Console Preferences

Display name

Language

Calendar

My Follows

- Automatically follow rules, releases, or activities I create
- Automatically follow rules I edit
- Automatically follow new rules that I am authorized to edit ⓘ
- Automatically follow releases or activities that I am an approver of ⓘ
- Automatically follow releases or activities that I am the owner of
- Automatically follow activities in which I am an author or tester ⓘ
- Automatically follow new projects that I am authorized to see ⓘ
- Automatically follow new branches that I am authorized to see ⓘ

Update

Basic Tuning : Decision Center

- Use out-of-the-box features of the product and limit the number of customizations as much as possible: all the provided benchmarks are done on a customization-free product;
- If you meet some performance issue, try to reproduce it without your customizations before opening a PMR in the ODM Support;
- Having custom value provider in your authoring environment is known to be a performance killer feature in the product (authoring and compilation time).
- If you have to interact with the backend, be sure that the session is not used in multi-threaded mode as that could lead to an important additional overhead due to the synchronized blocks in the code.

Advanced Tuning : Decision Center

■ Configuration of Solr

- To limit the number of indexations
 - Repackage of DecisionCenter.war (in the ear)
 - Update the file preferences.properties in WEB-INF/classes
 - Add the following properties

```
decisioncenter.web.search.SearchProvider = SolrEmbedded  
decisioncenter.web.search.SolrEmbeddedDataDir = /yourpath
```

In 8.9 the default configuration is setting SolrEmbeddedDataDir to temp which could be an issue if you have several servers on the same node

Advanced Tuning : Decision Center

■ Configuration of Solr

– To deactivate Solr :

- Go to the Decision Center EAR > decisioncenter.war\WEB-INF\spring.
- Edit dispatcher-servlet.xml and uncomment the following line:
`<!-- context:exclude-filter type="regex"
expression="com\.ibm\.rules\.decisioncenter\.web\.search\.*/ -->`
- The result of this configuration is the deactivation of the search feature of the Business Console which is launched on each changes (especially after a merge action).

Advanced Tuning : Decision Center

- Decision center cache and clustering
 - If the Decision Center Cache is put in a local directory the command “Clean Decision Center Cache” will clean the local directory only, not every caches of each node.
 - To avoid that issue you can:
 - Put the cache on a shared disk
 - Run Clean Decision Center Cache on each node of the cluster

- Debug information for Decision Engine
 - Set in the installation manager the configuration parameter : ”Include debug information in Decision Engine Archive” to true

Advanced Tuning : Decision Center

- In case of Error 500.. No session available in the current thread, you should call `IlrSession.beginUsage`
 - You have to set the cookie expiration along with the session timeout.
 - Select the current browser session option.

[Enterprise Applications](#) > [teamserver-WAS85](#) > [Session management](#) > [Cookies](#)

Use this page to specify cookie settings for Hypertext Transfer Protocol (HTTP) session management.

Configuration

General Properties

Cookie name

Restrict cookies to HTTPS sessions

Set session cookies to HTTPOnly to help prevent cross-site scripting attacks

Cookie domain

Cookie maximum age

Current browser session

Set maximum age
 seconds

Cookie path

Advanced Tuning : Decision Center

■ Configuration of the datasource

– Datasource custom properties to Set

- Additional properties → WebSphere Application Server -> data source properties
- Prepared statement cache size: 100 (Increase the size the prepared statement cache to 100).
- webSphereDefaultIsolationLevel property should be set to 2
- Use this data source in container managed persistence (CMP) must be unsetted

– Configure the pool:

- Connection timeout: 30
- Maximum connections: 10
- Minimum connections: 5
- Reap time : 60
- Unused timeout : 90
- Aged timeout: 120
- Purge policy : FailingConnectionOnly

– This configuration is a starting point for performance tuning

Advanced Tuning : Decision Center

■ Configuration of the datasource

– Datasource pool size

- The pool size depends on the number of concurrent users.
- A user is using 5 concurrent connections to the database
 - a) Nb users < 5 you should have a pool size of 10
 - b) $5 < \text{nb users} < 10$ you should have a pool size of 20
 - c) $10 < \text{nb users} < 20$ you should have a pool size of 30
 - d) Nb users > 20 the pool size should not be over 50.

Advanced Tuning : Decision Center

■ Datasource configuration examples:

– With JBOSS

```
<datasource jta="false" jndi-name="java:/jdbc/ilogDataSource" pool-name="DCDataSource"
enabled="true" use-ccm="false" statistics-enabled="false">
  <connection-url>jdbc:oracle:thin:@localhost:1521:BD</connection-url>
  <driver-class>oracle.jdbc.OracleDriver</driver-class>
  <driver>oracle</driver>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <validation>
    <validate-on-match>>false</validate-on-match>
    <background-validation>>false</background-validation>
  </validation>
  <statement>
    <prepared-statement-cache-size>100</prepared-statement-cache-size>
    <share-prepared-statements>>true</share-prepared-statements>
  </statement>
</datasource>
```

Advanced Tuning : Decision Center

■ Datasource configuration examples:

– With LIBERTY

```
<dataSource id="jdbc/ilogDataSource"  
  jndiName="jdbc/ilogDataSource"  
  statementCacheSize="100"  
  isolationLevel="TRANSACTION_READ_COMMITTED"  
  purgePolicy="FailingConnectionOnly"  
  type="javax.sql.XADataSource">
```

– With TOMCAT

```
<Resource auth="Container"  
  defaultTransactionIsolation="READ_COMMITTED"  
  driverClassName="com.ibm.db2.jcc.DB2Driver"  
  name="jdbc/ilogDataSource"  
  username="db2admin" password="password"  
  jdbcInterceptors="StatementCache(prepared=true,callable=false,max=100)"  
  maxActive="10"  
  maxIdle="50"  
  minIdle="10"  
  suspectTimeout="60"  
  timeBetweenEvictionRunsMillis="30000"  
  type="javax.sql.DataSource"  
  url="jdbc:URL;" />
```

Advanced Tuning : Decision Center

■ Configuration of DB2 (LUW)

- The user space page size, should be at 32Kb. A 4Kb page size is a performance killer.
 - CREATE TABLESPACE USERSPACE1 PAGESIZE 32K BUFFERPOOL BP32K;
 - CREATE SYSTEM TEMPORARY TABLESPACE USERSPACE1TMPTS PAGESIZE 32K BUFFERPOOL BP32K;
- To increase the transaction log and optimize DB2 you could use that type of ddl commands:
 - connect to DatabaseName;
 - AUTOCONFIGURE USING MEM_PERCENT 80 APPLY DB AND DBM;
 - ALTER BUFFERPOOL IBMDEFAULTBP IMMEDIATE SIZE AUTOMATIC;
 - ALTER TABLESPACE USERSPACE1 FILE SYSTEM CACHING;
 - UPDATE DB CFG FOR DatabaseName USING LOGFILSIZ 65535;
 - UPDATE DB CFG FOR DatabaseName using LOGPRIMARY 100;
 - UPDATE DB CFG FOR DatabaseName using LOGSECOND 100;
 - You could also send the transaction log on another disk sample on windows
UPDATE DB CFG FOR DatabaseName USING NEWLOGPATH F:\;
- To increase the performance in multiuser mode for DB2 10.5 and ODM 8.9.0 and before
 - Add db2set DB2_SKIPDELETED=YES and db2set DB2_SKIPINSERTED=YES
 - You should check them for the user used by Decision Center. (use db2set to check)

Advanced Tuning : Decision Center

■ Configuration of Oracle

- The number of open cursor should be $>$ number of max connections * Prepared statement cache size
 - In our case $> 10 * 100 = 1000$
 - A way to configure that : **alter system set open_cursors = 1100**
- You should let the database analyses the tables to improve the performance
- SGA size has an impact. It should not be too big
- You could use Oracle Enterprise Management to follow or to force the optimization adapted to your repository.
- A performance test should be done at the end of the analyse by Oracle of all the tables.

Advanced Tuning : Decision Center

- Configuration for Microsoft SQL Server
 - Set in the installation manager the configuration parameter `teamserver.concurrencyGateEnabled = false`
 - Prepared Statement cache should be set at 100
 - A possible optimization is to alter the database with the following command:
 - `ALTER DATABASE <basename> SET READ_COMMITTED_SNAPSHOT ON;`

Advanced Tuning : Decision Center

- Configuration for PostgreSQL
 - Set in the installation manager the configuration parameter `teamserver.concurrencyGateEnabled = false`
 - Prepared Statement cache should be set at 100
- Configuration for MySQL
 - Should upgrade to 5.7 or more. Version 5.6 is really slow with Decision Center
 - Set in the installation manager the configuration parameter `teamserver.concurrencyGateEnabled = false`
 - Prepared Statement cache should be set at 100

Database migration of Decision Center

■ Step 1 Creation of the new schema

- You should get the extensions used in the old version
- The files to get (BRDX and BRMX) are available in the diagnostic tab or via the following requests:
 - `select * from ODMRTSADMIN88.RTSRESOURCE where name = 'teamserver.extensionModel';`
 - `select * from ODMRTSADMIN88.RTSRESOURCE where name = 'teamserver.extensionData';`

■ Step 2

- Launch Teamserver + the wizard for the database schema creation.
- Stop Decision Center

Database migration of Decision Center

■ Step 3

- Once all table are created, change the password manually in ODMInstallDir\teamserver\bin\teamserver-anttasks.properties
- Go to the distrib directory ODMInstallDir\teamserver\bin and open a command prompt:
- ant gen-migration86-role -Dserver.url=<http://localhost:8180/teamserver> -DdatasourceName=jdbc/ilogDataSource -DoldDatabaseSchemaName=ODMRTSADMIN88 -Dusername=rtsAdmin -DoutputFile=gen-migration86-role.sql >> gen-migration86-role.log
- a gen-migration86-role.sql file is generated.
- Run this script with your DB tool.
- If the database used is Oracle you should start Decision Center on the new database to finalize the role initialisation.

Database migration of Decision Center

■ Step 4

- Insure that Decision Center is stopped (especially in Oracle case) on new and old schema
- Go to the distrib directory ODMInstallDir\teamserver\bin and open a command prompt:
- `ant gen-migration86-script -Dserver.url=http://localhost:8180/teamserver -DdatasourceName=jdbc/ilogDataSource -DoldDatabaseSchemaName=ODMRTSADMIN88 -Dusername=rtsAdmin -DoutputFile=gen-migration86-script.sql >> gen-migration86-script.log`
- an `gen-migration86-script.sql` file is generated.
- Run this script.

■ Step 5 **Recompute** the statistics after the migration before any connection of **Decision Center**

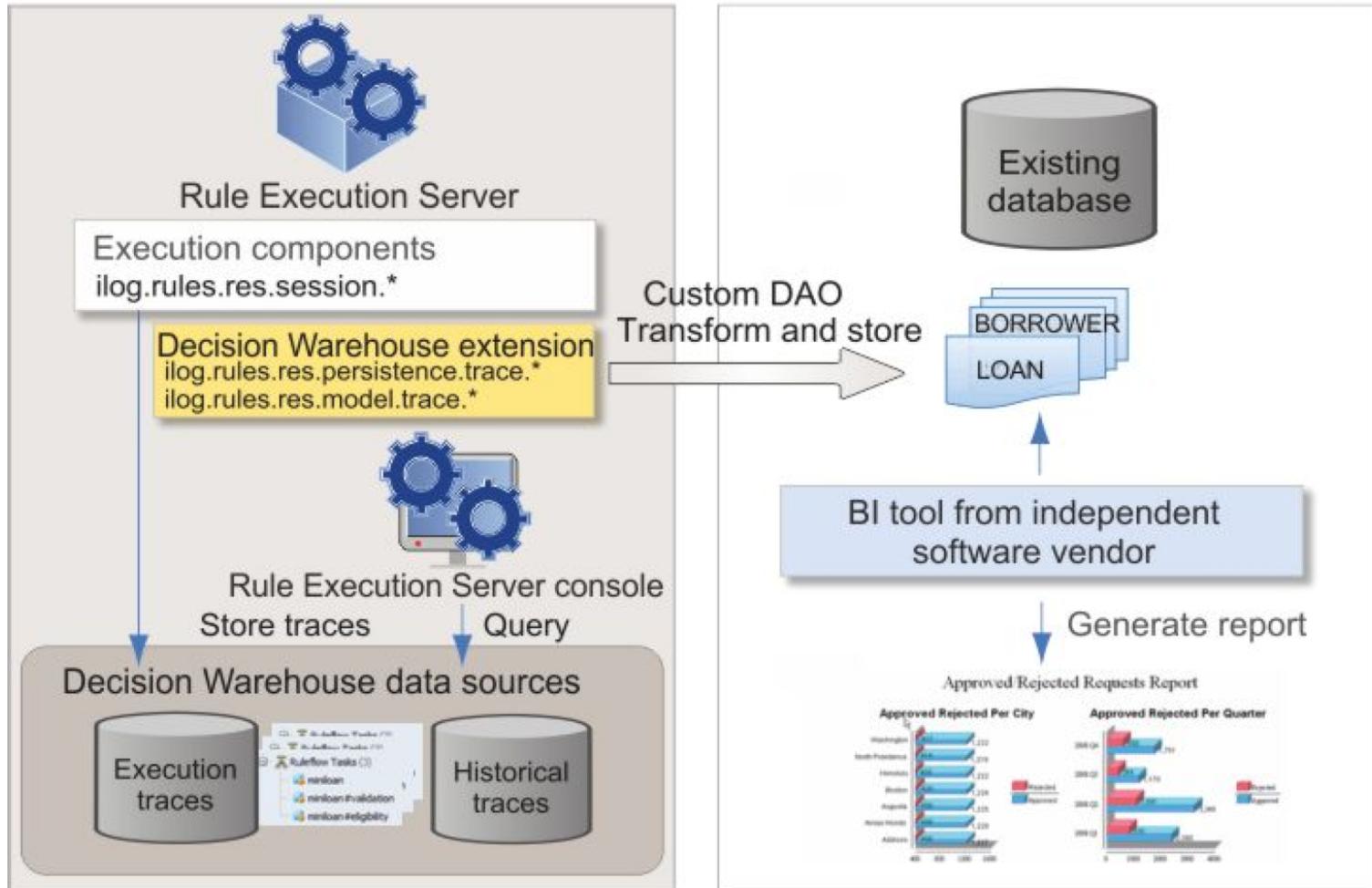
■ Step 6 Restart Decision Center on the new schema

Decision Warehouse Tuning Recommendations

Decision Warehouse Overview

Enterprise applications
Operational system

Reporting and analysis



Decision Warehouse execution

- Decision Warehouse execution is divided into the following actions:
 - This mode executes the rule with the execution trace on; this into the performance cost.
 - At the end of execution, a serialization of input and output parameters is done (BOM serialization).
 - A complete serialization to XML of the execution trace.
 - A database insertion.

Performance of Decision Warehouse

- In general, the performance of Decision Warehouse depends on the following factors:
 - The performance of generating execution trace.
 - The serialization performance, which divides into two principal cases for the input/output parameter serialization to BOM (depending on the size of the ruleset parameters) and the serialization of the execution trace (depending on the ruleset characteristics, such as the number of rules, the number of rules fired, and so on).
 - The performance of the database server and the network used to access it.

Optimization of Decision Warehouse

- Decision Warehouse is configured inside the ruleset properties. With this, you can choose the information to save. This is accessible in RES Console

- You can remove the BOM serialization. See *Optimizing Decision Warehouse* at the following website:

https://www.ibm.com/support/knowledgecenter/en/SSQP76_8.9.2/com.ibm.odm.dserver.rules.res.managing/topics/tpc_res_config_optim_dw_intro.html

Optimization of Decision Warehouse

- The performance of the Decision Warehouse depends on the database.
 - For example, the database should be optimized to handle CLOB data, not in a generic way, but for the specific case of the ruleset.
 - Further customization can be done through the extension point for better execution performance. You can define how data can be persisted or queried through the extension point.
 - You can also implement your own asynchronous logging of the data captured with Decision Warehouse.

Optimization of Decision Warehouse

■ Asynchronous Decision Warehouse

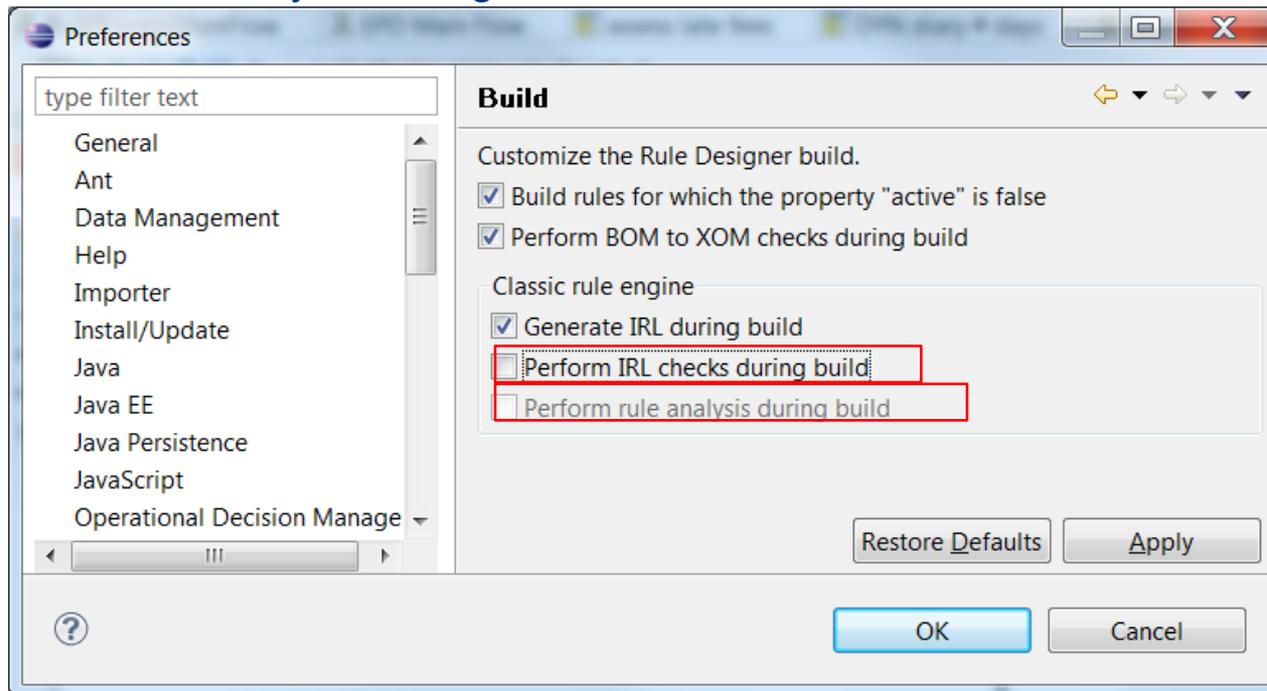
- An asynchronous version of decision warehouse on WAS is available as a contribution at the following website:
 - <http://www-01.ibm.com/support/docview.wss?uid=swg21433167>
 - This implementation is using the WorkManager API to manage the insertion in the database separately from execution
- There is also a sample in the product which shows the reference architecture for using the extension point with JMS

Rule Designer

Tuning Recommendations

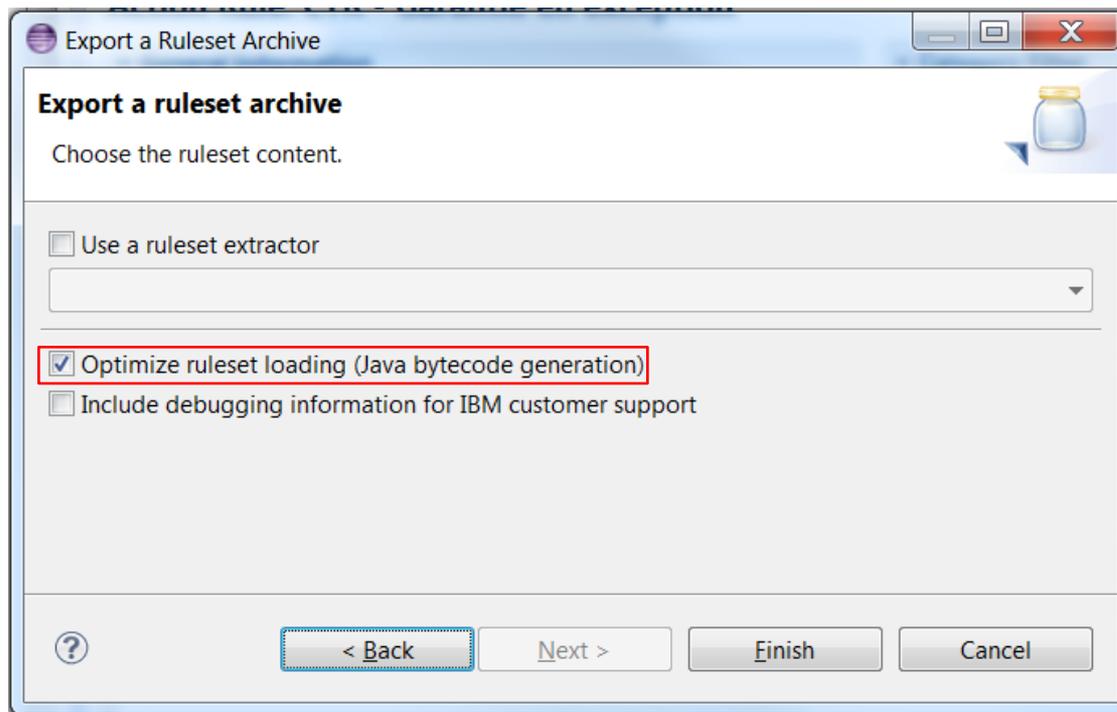
Basic Tuning : Rule Designer

- Configuration to get better build performance
 - Uncheck the ‘build automatically’ option on large rule projects (eclipse options)
 - On large rule projects close “Rule Project Map” view before the build
 - Rule Designer Menu> Windows> Preferences> Rule Designer > Build
 - Remove perform IRL checks during build
 - Perform rule analysis during build



Basic Tuning : Rule Designer (Decision Engine)

- Configuration to get better loading time with Decision Engine
 - Rule Explorer with selected Rule Project> Right clic> Export> Ruleset Archive
 - For best loading time, leave checked (default) the “Optimize ruleset loading (Java Bytecode generation). To have DE Archive format archive, just uncheck it.



VMWare ESX

Tuning Recommendations for Java

Key indicator of a CPU issue

- **CPU Ready Time should be less 2%**
 - Otherwise there is a performance issue at CPU level.
 - In general this is due to :
 - An overload of the ESX
 - A VM with too many vCPUs

Tuning of an ESX

- 1 Do not allocate too many vCPU on one machine otherwise the impact will on that machine but also on all machines on the same hypervisor
 - <http://www.gabesvirtualworld.com/how-too-many-vcpus-can-negatively-affect-your-performance/>
 - <https://www.virtualease.fr/vmware-mecanismes-de-gestion-cpu/> (in French)
- 2 Desactivate not mandatory processes like indexation of disks or screen saver, becareful with the scheduling of antivirus
- 3 For Database desactivate the antivirus scans on these files You should follow the VMWare best practices.
- 4 Install the drivers "Paravirtual" in the VMs => SCSI controller Paravirtual and network VMXNET3 that a real advantage on CPU consumption , and network bandwidth
- 5 Install VmwareTools and up to date them

Tuning of an ESX

- 6 Configure the hypervisors on mode "Full Performance" in the BIOS + mode "High performance" In the "Power Management Settings" on the ESX
- 7 Pre-allocation of the VMs ' disks (the most critical) In this case the start is slower but the I/O performance are much better
- 8 Group on the same hypervisor the machines which need to communicate a lot (You need to add some "DRS" rules for that), By this way we don't use the network for this communication
- 9 If possible group the VM with the same number of vCPU on the same hypervisors. One important point to notice the smaller VMs are always a better priority when the ESX got a contention at CPU level

Tuning of an ESX

- 10 Be careful the ration vCPU/pCPU, on a hypervisor should not be more than 2 for production machines (1 for critical machines / 2 for prod / 3 maximum)

You need to compute the total number of vCPU allocated on the machines of the same hypervisor divided the number of physical cores

- 11 On Storage side, the access to the datastores should use several fiber links and several fiber routers the usage of some SSD disks for cache on the NAS are really useful (hybrid mode)
- 12 Follow the "Performance Best Practices VMWARE"

<http://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/techpaper/vmware-perfbest-practices-vsphere6-0-white-paper.pdf>

- 13 "Best Practices Java VMWARE"

<http://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/techpaper/enterprise-java-applications-on-vmware-best-practices-guide.pdf>