Informatica

Informatica® Dynamic Data Masking
9.9.1

User Guide

Informatica Dynamic Data Masking User Guide
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Table of Contents

Preface

The *Informatica Dynamic Data Masking User Guide* describes how to implement Dynamic Data Masking to protect sensitive information in a production environment. This guide assumes that you have knowledge of your operating systems and relational database systems, which includes the database engines, flat files, and mainframe systems in your environment.

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CHAPTER 1

Introduction to Dynamic Data Masking

This chapter includes the following topics:

Dynamic Data Masking Overview

Dynamic Data Masking is a data security product that operates between an application and a database to prevent unauthorized access to sensitive information. Dynamic Data Masking intercepts requests sent to the database and applies data masking rules to the request to mask the data before it is sent back to the application.

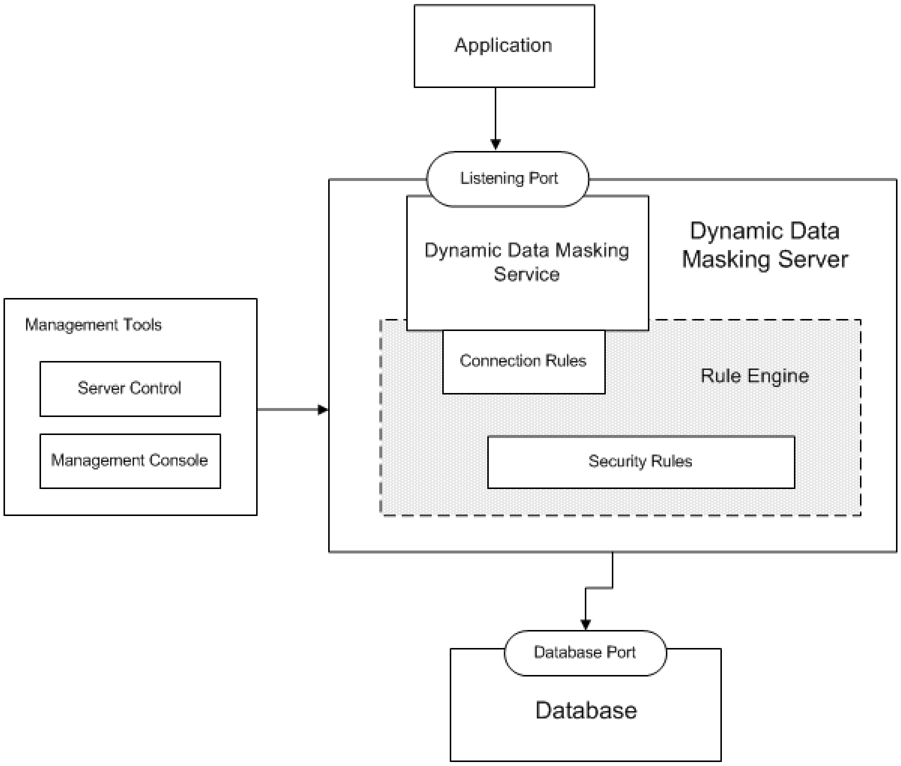
You can use Dynamic Data Masking to mask or prevent access to sensitive data stored in production and non-production databases. You set up the rules to specify the database requests to intercept and the masking actions to apply. Dynamic Data Masking monitors incoming database requests from the application. Dynamic Data Masking applies the data masking rules to the database request before it sends it to the database. The database processes the modified request as normal and returns masked results to Dynamic Data Masking. Dynamic Data Masking then sends the results to the application.

You can use Dynamic Data Masking to mask data for specific types of database requests or you can restrict access to data from certain groups within an organization. For example, you can create a rule to apply a masking function to credit card numbers when the database request comes from a support team member. When the database sends the data back to the application, the support team member sees the masked numbers instead of the real credit card numbers.

Dynamic Data Masking Architecture

Dynamic Data Masking acts as a security layer between the application and the database to protect sensitive data stored in the database. The Dynamic Data Masking Server intercepts SQL requests sent to the database and uses a set of connection and security rules to determine how to process the request.

The following figure shows the architecture of Dynamic Data Masking and how the Dynamic Data Masking Server relates to the application and the database:



The Dynamic Data Masking Server listens on the port where the application sends database requests. When the application sends a request to the database, the Dynamic Data Masking Server receives the request before it goes to the database. The Rule Engine uses the connection rules and security rules to determine the action to perform on the incoming request. The Dynamic Data Masking service sends the modified request to the database. The database processes the request and sends the results back to the application.

Dynamic Data Masking provides management tools that you can use to manage the Dynamic Data Masking Server and set up connection and security rules. With the Server Control tool, you can start, stop, and manage the Dynamic Data Masking Server. On the Management Console, you can configure and manage the Dynamic Data Masking services and create and manage connection and security rules.

Dynamic Data Masking Components

Dynamic Data Masking includes server components to intercept and process database requests and a client component to manage the server.

Dynamic Data Masking has the following components:

Dynamic Data Masking Server

The Dynamic Data Masking Server provides services and resources to intercept database requests and perform data masking tasks.

The Dynamic Data Masking Server includes the following components:

- Dynamic Data Masking services
- Rule Engine

Dynamic Data Masking Service

The Dynamic Data Masking service listens on the listener port to monitor and route incoming database requests.

You can run the following Dynamic Data Masking services:

Service	Description
DDM for Azure	Listens for and routes database requests for a Microsoft Azure SQL database. The service supports the SSL mode of communication.
DDM for DB2	Listens for and routes database requests for an IBM Db2 database. The service supports SSL and non-SSL modes of communication.
DDM for FAS	Listens for and routes database requests for Data Vault. The service supports SSL and non-SSL modes of communication.
DDM for Hive	Listens for and routes database requests for a Hive database. The service supports SSL and non-SSL modes of communication as well as Kerberos Authentication and Kerberos encrypted data.
DDM for Hive HTTP	Listens for and routes database requests for Hive databases using HTTP transport. The service supports SSL and non-SSL modes of communication, and Kerberos Authentication.
DDM for Impala	Listens for and routes database requests for an Impala database. The service supports SSL and non-SSL modes of communication as well as Kerberos Authentication.
DDM for Informix	Listens for and routes database requests in Informix native protocol to Informix databases.
DDM for Informix (DRDA)	Listens for and routes database requests in Distributed Relational Database Architecture protocol to Informix databases.
DDM for JDBC	Listens for database requests for a database that uses JDBC connectivity.
DDM for ODBC	Listens for database requests for a database that uses ODBC connectivity.
DDM for Oracle	Listens for and routes database requests for an Oracle database. The service supports SSL and non-SSL modes of communication.
DDM for PostgreSQL	Listens for and routes database requests for a PostgreSQL database.
DDM for SQL Server	Listens for and routes database requests for a Microsoft SQL Server database. The service supports SSL and non-SSL modes of communication.

Service	Description
DDM for Sybase	Listens for and routes database requests for a Sybase database.
DDM for Teradata	Listens for and routes database requests for a Teradata database.

Rule Engine

The Rule Engine evaluates incoming database requests and applies connection and security rules to determine how to route requests and mask data. The Rule Engine can modify the database request based on the rules defined in the Dynamic Data Masking Server.

The Rule Engine applies the following types of rules:

- Connection rule. Defines the conditions and actions that the Rule Engine applies to determine how to route a database connection request received from an application.
- Security rule. Contains the conditions and actions that define what to do with the database SQL request and how to apply SQL rewrites that manipulate the returned SQL result set.

Server Control

Server Control is a command line program that you use to configure and manage the Dynamic Data Masking Server. Use Server Control to start or stop the Dynamic Data Masking Server and services or to change the port number or password for the Dynamic Data Masking Server.

Management Console

The Management Console is a client application that you use to manage the Dynamic Data Masking Server. You can use the Management Console to create and manage rules and to configure and manage connections to databases.

Dynamic Data Masking Process

Dynamic Data Masking acts as a proxy server for the database.

The application sends a request to the database. As a proxy server, the Dynamic Data Masking Server intercepts the request and the Rule Engine evaluates the request before it sends the request to the database.

Dynamic Data Masking uses the following process to apply data masking to a database request:

1. The Dynamic Data Masking service listens on the listener port for requests sent to the database. When the application sends a database connection request, the Dynamic Data Masking service receives the request instead of the database.
2. The Rule Engine uses a connection rule to determine how to process the incoming connection request. The connection rule defines the criteria to identify and route the database request. If the database request matches the criteria, the Rule Engine determines the action to perform on the request. The connection rule action can include routing the connection to a specified database, host, and port, and applying a security rule set. The connection rule can block the connection request. If the database has a direct action, the connection rule can return a redirect request back to the application with the database host and port and the application can connect directly to the database.

   For example, you can define an Informatica ETL process or batch in Dynamic Data Masking that bypasses Dynamic Data Masking and reduces overhead on internal processes.

3. If the connection rule specifies the Use Rule Set processing action, Dynamic Data Masking connects the client to the database and applies the security rules to the SQL request and determines the action to perform on the request.
   The security rules can apply an action such as blocking the SQL request, modifying the SQL statement, doing nothing, or auditing the request.
4. The database processes the request and returns the results to the application. Because Dynamic Data Masking changes the SQL request, the results the database sends back to the application might be different from the results of the original database request.

Dynamic Data Masking Example

A reporting tool sends a request to the database for employee salaries. The connection matcher specifies that the Rule Engine apply a rule set called salary_rules to all incoming requests from the reporting tool.

The salary_rules rule set applies a masking function to all requests that reference employee salaries. The rule set restricts access to management salaries and masks the first three digits of the employee salary column.

The Dynamic Data Masking service intercepts the incoming SQL request, identifies that the request references the salary tables, rewrites it with the masking function, and sends the rewritten request to the database. The database receives the request and sends masked data back to the application through the Dynamic Data Masking service.

Management Console

The Management Console is the client component of the Dynamic Data Masking Server.

You can install the Management Console on a remote machine or the local system to manage the Dynamic Data Masking service. Use the Management Console to manage and configure domains and Dynamic Data Masking services, define connection rules for Dynamic Data Masking services, define security rules, and configure target databases.

Navigation

The Management Console is a user interface that you use to create and configure the Dynamic Data Masking domains, databases, services, and rule sets.

The left side of the Management Console contains a hierarchical tree that represents the components of Dynamic Data Masking. The tree contains domain, database, server, service, and rule set nodes. Use the menu and toolbar above the tree to add, edit, remove, cut, copy, paste, and sort items within the tree. You can drag and drop nodes to change the placement of the node within the tree.

The right side of the Management Console contains a view pane with parameters of the node you select in the tree.

Menu

The Management Console Tree menu contains options that you use to edit the nodes within the Management Console tree. The toolbar contains shortcuts to options in the menu. Available menu items change based on the type of node you select in the tree. Items that are not available for the tree node you select are grayed out.

The Management Console Tree menu contains the following options:

Menu Item	Action
Login	Shows the server host, port, and username for the last login.
Exit	Exits the Dynamic Data Masking session.
Add Domain	Creates a domain in the Management Console tree. Add Domain is available when a domain node is selected.
Add Database	Defines the connection properties for an additional database in the Management Console tree. Add Database is available when a domain node is selected.
Add DDM Services	Adds a Dynamic Data Masking service to the Management Console tree. Add DDM Services is available when the server node is selected.
Add Rule Set	Adds a security rule set to the Management Console tree. Add Rule Set is available when a domain node is selected.
Edit	Opens a window to edit domain and rule set names, define service listener ports, and edit connection information for databases and the Dynamic Data Masking Server.
Security Rule Set	Opens a security rule set. Security Rule Set is available when a security rule set is selected.
Connection Rules	Opens a connection rule set. Connection Rules is available when a Dynamic Data Masking service is selected.
Authorization	Opens a window to set and edit permissions for the selected node. Authorization is available when a database, domain, or security rule set node is selected.
Cut	Copies and deletes the selected Management Console tree node. You can cut server, database, domain, and security rule set nodes. You cannot cut service nodes or the root domain node.
Copy	Copies the selected Management Console tree node. You can copy database, domain, and security rule set nodes. You cannot copy service nodes, server nodes, or the root domain node.
Paste	Pastes the cut or copied Management Console tree node. You can paste on domain nodes.
Remove	Removes a node from the Management Console tree. **Note:** You cannot remove the Dynamic Data Masking Server or the Management Console root domain.
Start Service	Starts a Dynamic Data Masking service. The Start Service option is available when a Dynamic Data Masking service is selected.
Stop Service	Stops a Dynamic Data Masking service. The Stop Service option is available when a Dynamic Data Masking service is selected.
Add Logger	Adds a custom logger to the Management Console tree. Add Logger is available when the Loggers node is selected.
Add Appender	Adds an appender to the Management Console tree. Add Appender is available when a logger node is selected.

Menu Item	Action
Support	Creates an encrypted .zip archive of Dynamic Data Masking logs. You can send the log archive to Informatica Global Customer Support to troubleshoot issues with Dynamic Data Masking.
Manage Licenses	Allows you to select a new license file. Use the Manage Licenses option if the Dynamic Data Masking license file has expired. The Manage Licenses option is available when the Dynamic Data Masking Server node is selected.
Sort by Name	Sorts child nodes and nested child nodes in alphabetical order by the name of the node. Sort by Name is available when a node with child nodes is selected.
Sort by Owner	Sorts child nodes and nested child nodes in alphabetical order by the login name of the user that created the nodes. Sort by Owner is available when a node with child nodes is selected.
Sort by Type	Sorts child nodes and nested child nodes in alphabetical order by the type of node. Sort by Type is available when a node with child nodes is selected.

Management Console Tree

The Management Console tree is a navigation tree organized by nodes. When the Management Console is not connected to a Dynamic Data Masking Server, it shows a default domain node. All actions are disabled, except Login, Exit, and About. After successful login to a Dynamic Data Masking Server, the Management Console shows a tree with the Dynamic Data Masking Server node that it is connected to.

The Management Console tree can contain domain, database, server, service, logger, appender, and rule set nodes. Tree nodes are arranged hierarchically.

On the Management Console, the relationship between the Dynamic Data Masking Server and a database is based on the domain organization. The Dynamic Data Masking Server will connect to databases that are in the same domain or a sub domain of the Dynamic Data Masking Server. The Dynamic Data Masking Server will not connect to any database that is outside the domain that contains the Dynamic Data Masking Server.

Logging In to the Management Console

You can access the Dynamic Data Masking components through the Management Console. Log in to the Management Console to manage target databases, configure listener ports, and define rules.

To log in to the Management Console, you need the server address and port number of the server that Dynamic Data Masking operates on and the administrator credentials.

Logging In to the Management Console on Windows

On Windows, open the Management Console through the Start menu.

1. On Windows 7 and earlier, select **Start** > **All Programs** > **Informatica** > **Dynamic Data Masking** > **Management Console**.

   On Windows 10 and later, select **Search the Web and Windows** > **All apps** > **Informatica Dynamic Data Masking** > **Management Console**.

   The **Login** window appears.
2. Verify that the **Server Host** and **Port** display the correct information for the Dynamic Data Masking Server.

3. Enter the Dynamic Data Masking administrator user name and password. If you use LDAP authentication, the user name must be in LDAP format. Click **Connect**.

   A tree is visible in the Management Console after you login successfully.

Logging In to the Management Console on Linux

On Linux, start the Management Console with the `mng` script.

You must have the X Window server installed on the machine that you use to log in to the Management Console.

1. Open a terminal and navigate to the Dynamic Data Masking installation directory.

   For example, you might enter the following command:

   ```
   cd /home/Informatica/DDM
   ```
2. Run the following command to start the Management Console:

   ```
   ./mng
   ```

   The **Login** window appears.
3. Verify that the **Server Host** and **Port** display the correct information for the Dynamic Data Masking Server.
4. Enter the Dynamic Data Masking administrator user name and password. If you use LDAP authentication, the user name must be in LDAP format. Click **Connect**.

   A tree is visible in the Management Console after you log in.

Domain Management

A domain is a virtual node in the Management Console tree that you use to group other nodes. The Management Console contains a default root domain. You can use domains to create a visual representation of the structure of the databases within an organization.

You can create an unlimited number of domains in the Management Console tree. A domain can contain other domains, databases, and server child nodes. You can set user permissions on domain nodes.

You can add, edit, cut, copy, paste, and remove a domain. You cannot remove the root domain. Drag a domain up or down in the Management Console tree to change the position of the domain within the tree.

Security Rule Set

A security rule set is a tree node that contains references to one or more security rules. To secure data, you must create security rule sets with masking, rewrite, and blocking actions.

You can add a security rule set to a domain node in the Management Console tree.

The Management Console tree can contain an unlimited number of rule set nodes. Rule sets do not have child nodes. You can add, edit, move, and remove rule set nodes. You can set user permissions on security rule set nodes.

CHAPTER 2

Rules

This chapter includes the following topics:

Rules Overview

A rule contains the conditions and actions that the Rule Engine uses to process a request. Connection rules process application connection requests. Security rules process SQL statements. You create and define rules to manage the SQL requests that the client or application sends to the target database.

A rule defines connection criteria and masking techniques. The Rule Engine uses connection criteria to forward requests and masking techniques to mask data. Rules can be connection rules or security rules, placed in a rule tree. The organization of the rule tree determines the order in which the Rule Engine applies the rules. You can create and edit rules within the Management Console.

Rule Components

A rule consists of a matcher, an action, and a processing action. Each rule component defines how the Rule Engine identifies and processes a request to the database.

The Rule Engine applies a connection rule to incoming connection requests and applies security rules to SQL statements. A connection rule defines how the Dynamic Data Masking service establishes a connection with the application. A security rule defines the conditions and masking rules that the Rule Engine applies to the SQL statement request. The Rule Engine applies a security rule if you configure a connection rule to apply a rule set.

A rule consists of the following components:

Matcher

Defines the criteria that the Rule Engine uses to identify a match.

Action

Defines the action that the Rule Engine applies to the request.

Processing action

Defines the action that the Rule Engine applies to the request after the Rule Engine applies the rule. The processing action manages how the Rule Engine processes the request through the rule tree. A processing action can specify that the Rule Engine does not process further rules in the rule tree or that the Rule Engine continues to evaluate other rules.

Rule Trees

A rule tree represents the organizational structure of rules and rule folders. The position that you assign a rule or rule folder within the rule tree determines the order in which the Rule Engine processes the rule. You build conditional relationships between rules through the rule tree.

A rule tree can be a connection rule tree or a security rule tree. Each rule tree uses a system of folders and rules to determine the hierarchical order for rule processing.

When the Dynamic Data Masking Server receives a connection request, the Rule Engine parses the request through the connection rule tree. If the connection rule assigns a security rule set, then the Rule Engine parses the SQL request through the security rule tree. The security rule set defines the security techniques that the Rule Engine applies to rewrite the SQL statement.

Rule Tree Components

Connection rules and security rules work together to define when and how data is masked.

Use the following components to identify and manage application requests:

Rule

The conditions and actions that you want to apply to a request. A rule can be a connection rule or a security rule. You can create an individual rule or create a rule as part of a rule folder.

A rule consists of a matcher, action, and processing action.

Rule folder

A rule that uses the Folder rule action. You can use a rule folder to group conditional rules. The Rule Engine processes the contents of a rule folder hierarchically.

A connection rule folder contains connection rules. A security rule folder contains security rules.

Connection rule

A rule that defines the criteria that the Rule Engine uses to identify the target database for the request. A connection rule consists of a matcher and an action that you define to identify and route a connection request from an application.

Connection rule tree

The connection rule tree defines the order in which the Rule Engine processes connection rules. The connection rule tree contains all the connection rules that you define for the target databases. The Rule

Engine processes the first rule or rule folder in the connection rule tree and stops at the end of the rule tree or when there is a stop processing action.

Security rule

A rule that defines the criteria that the Rule Engine uses to parse and alter the SQL statement request. A security rule consists of a matcher and action that you define to identify and mask a SQL request.

Security rule set

A security rule set is a container for security rules. You use rule folders to organize and nest rules within the rule set. A security rule set can contain multiple rule folders. The Rule Engine processes the SQL statement through the rule set until the Rule Engine encounters a stop processing action.

Security rule tree

Each security rule set has an individual security rule tree. The security rule tree defines the order in which the Rule Engine processes security rules. The security rule tree contains the security rules for a particular security rule set. The Rule Engine processes the first rule or rule folder in the security rule tree and stops when there is a stop processing action.

Rule Tree Efficiency

Organize a rule tree to minimize the impact of Dynamic Data Masking on the target database. An efficient rule tree reduces the number of rules that the Rule Engine must apply and defines an organizational structure that leverages the best use of the rule components.

Use the following guidelines to create an efficient rule tree:

- Use text matchers for all incoming connections to ensure a faster response time. Text matchers take approximately one microsecond per request.
- Minimize the use of syntax matchers. Syntax matchers parse SQL request that Dynamic Data Masking listener port receives. A syntax matcher can take over 100 microseconds to process.
- Configure the matcher to keep the matcher result valid for all concurrent SQL requests that are open in a session. The default time that the Rule Engine stores matcher results is 3,600 seconds.

Security Rule Sets

A rule set is a collection of security rules. Create a rule set to group security rules that you want the Rule Engine to apply to SQL request statements. Assign the rule set to a connection rule. The Rule Engine applies the rule set if the connection request matches the conditions that the connection rule defines.

A security rule set can contain a combination of rules that perform different tasks. You can add security rules that mask data, block requests, rewrite the SELECT statement, or replace a part of the SELECT statement. To organize rules within a rule set, you use rule folders to group security rules that apply the same action. For example, group rules that use the mask action in one rule folder, and group rules that use the block action in a different rule folder.

Creating a Security Rule Set

Create a security rule set to group security rules that share a relational link.

1. In the Management Console, click on a domain node in the rule tree.

2. Click **Tree** > **Add Rule Set**.

   The **Add Rule Set** window appears.
3. Enter a name for the security rule set and click **OK**.

   The security rule set appears inside the rule tree in the Management Console.

You can add security rules to the rule set.

Rule Folders

A rule folder is a container for rules that share conditional relationships. You can rename, reconfigure, move, cut, copy, paste, delete, disable, and enable a rule folder. Create rule folders to organize related rules and define the order in which the Rule Engine applies them.

A rule folder can contain connection rules or security rules. A connection rule folder groups rules that you apply to connection requests. A security rule folder contains rules that you apply to SQL request statements.

To create a rule folder, specify the folder action for the rule. Within the rule folder, create relational rules that help the Rule Engine identify, match, and rewrite requests. Before you can add rules to a folder, you must outline the relationships between the rules that you want the folder to contain.

You can group rules that share the same purpose. For example, group masking rules together in a rule folder and group access control rules in another rule folder.

Note: When you create a rule folder, you must set the processing action to **Continue**. When the Rule engine encounters a continue processing action, the Rule Engine processes the request through the rules that the folder contains.

Creating a Connection Rule Folder

You can create a connection rule folder to group connection rules that share a conditional relationship. The preceding connection rule defines whether the Rule Engine applies the subsequent connection rule.

1. In the Management Console, click on the Dynamic Data Masking service in the rule tree.
2. Select **Tree** > **Connection Rules**.

   The **Rule Editor** opens.
3. Select the location within the rule tree where you want to add the folder. If you want to add a top-level rule folder, select **Connection Rules** at the top of the rule tree.
4. Select **Action** > **Append Rule**.

   The **Append Rule** window appears.
5. Enter a rule name in the **Rule Name** box.
6. Select and define a matcher.
7. Select the folder action.
8. Select the continue processing action.
9. Click **OK**.

   The rule appears as a folder in the rule tree.
10. Select **File** > **Update Rules**.

    The rule tree is saved.

You can add connection rules after you create the rule folder.

Creating a Security Rule Folder

Create a security rule folder to group security rules. Add a security rule folder to a rule set.

1. In the Management Console, select a security rule set.
2. Select **Tree** > **Security Rule Set**.

   The **Rule Editor** opens.
3. Select the location in the rule tree where you want to add the rule folder. If you want to add a top-level rule folder, select the name of the rule set at the top of the rule tree.
4. Select **Action** > **Append Rule**.

   The **Append Rule** window appears.
5. Enter a rule name in the **Rule Name** box.
6. Select and define a matcher.
7. Select the folder action.
8. Select the continue processing action.
9. Click **OK**.

   The rule appears as a folder in the rule tree.
10. Select **File** > **Update Rules**.

    The rule tree is updated.

You can add security rules after you create the rule folder.

Adding a Rule to a Rule Folder

You can add rules to a rule folder.

1. In the Management Console, open the **Rule Editor** for connection rules or security rules.
2. In the **Rule Editor**, select the rule folder where you want to add the rule.
3. Select **Action** > **Append Rule**.

   The **Append Rule** window appears.
4. Enter a name for the rule.
5. Enter a description for the rule.
6. Select and define a matcher.
7. Select and define a rule action.
8. Select and define the processing action.
9. Click **OK**.

   The rule appears in the rule folder.
10. Select **File** > **Update Rules**.

    The rule tree is updated.

Rule Management

You can rename, reconfigure, move, cut, copy, paste, delete, disable, and enable a rule. When you make changes to a rule, you must update the rule tree for the change to take effect.

When you create, edit, or add a connection rule, you must restart the current session with the application before the Rule Engine can apply the connection rule. Updates to a security rule take effect immediately. You do not need to start a new session for the Rule Engine to apply a security rule.

You can move a rule to change the position of the rule in the rule tree. You can move a rule folder to change the position of the folder in the rule tree. You cannot move a rule into or out of a folder. Move a rule to change the order in which the Rule Engine applies the rule.

You can enable or disable a rule or rule set. By default, the rule or rule set is enabled. When you enable a rule or rule set, the Rule Engine applies the rule or rule set to the request. When you disable a rule, the Rule Engine skips the rule or rule set and applies the next rule or rule set in the rule tree.

You can delete a rule or rule folder from the rule tree. When you delete a rule folder, you delete the content that the rule folder contains. You cannot undo the changes after you delete a rule or rule folder from the rule tree.

Editing a Rule

You can edit the matcher, action, processing action, and name for any rule.

1. Open the **Rule Editor** for connection rules or security rules.
2. Click on a rule in the rule tree.
3. Click **Edit**.

   The **Edit** window appears.
4. Make the changes that you want to the rule components.
5. Click **OK**.
6. Select **File** > **Update Rules**.

   The rule tree is updated.

Enabling and Disabling a Rule

You can enable or disable a rule. By default, the rule is enabled. When you enable a rule, the Rule Engine applies the rule to the request. When you disable a rule, the Rule Engine skips the rule and applies the next rule in the rule tree.

1. Open the **Rule Editor** to view security rules or connection rules.
2. Click the rule that you want to disable or enable.
3. Click the **Disable** check box from the **Rule Editor** tool bar.
4. Update the rules.

Deleting a Rule or Rule Folder

You can delete a rule or rule folder from the rule tree. When you delete a rule folder, you delete the rules that the rule folder contains. You cannot undo the changes after you delete a rule or rule folder from the rule tree.

1. Open the Rule Editor for security rules or connection rules.
2. Click a rule or rule folder from the rule tree.
3. Click **Delete**.

   The rule or rule folder is removed from the rule tree.
4. Update the rule tree.

Rule Export and Import

You can import and export rule folders and rule sets to back up and reuse data. If you have complex rules, you might want to export the rules so that you have a copy of the data. Additionally, if you have rules that you want to reuse, you can use the import and export utilities to create a copy of the rule, rule folder, or security rule set in the rule tree.

You can export rule folders and security rule sets. You cannot export a single connection rule or security rule. If you want to export a single rule, you must add the rule to a rule folder.

The exported XML file defines the configurations for rules that the rule folders and rule sets contain. When you import the XML file, you import the rules that the XML file defines.

Rule Example

Employees are permitted to access masked Social Security numbers of customers during business hours. You want to create a rule that blocks all access to Social Security numbers between 5:00 p.m. and 8:00 a.m.

You can create a rule set that contains rules that block or mask data based on the time that the applications send the request. Requests that do not fall within that time frame receive masked data.

Masking Rule

In the masking rule folder, create the masking rule.

To create the masking rule, assign the text matcher to identify SELECT lists that contain the Social Security column. If the SELECT list matches the security rule criteria, the Rule Engine applies the mask action to the SELECT list. The mask action hides all the digits of the Social Security number. Enable the keep matcher result option to store the matched result. Then, apply the Stop if Applied processing action. If the Rule Engine applies the action, the Rule Engine does not continue to process the SQL statement through the rule tree and forwards the rewritten request to the database. Otherwise, the Rule Engine processes the SQL statement through the next rule.

Blocking Rule

In the blocking rule folder, create the blocking rule.

The blocking rule identifies requests that applications send between 5:00 p.m. and 8:00 a.m. If the SELECT list matches the security rule criteria, the Rule Engine applies a block security action to the request. The user receives a message indicating that access is denied. Apply the Stop if Matched processing action so that the Rule Engine does not continue to process the request. The Dynamic Data Masking service sends the response to the application.

As a result of the security rule set, users can view masked Social Security numbers during business hours, but cannot see the data after business hours.

CHAPTER 3

Connection Rules

This chapter includes the following topics:

Connection Rules Overview

A connection rule defines the connection criteria that the Rule Engine uses to identify a connection and the target database.

A connection rule uses a matcher and a rule action to identify and route a connection. The matcher defines the criteria that the Rule Engine uses to identify a match. The rule action determines how the Rule Engine processes the matched connection.

When the Dynamic Data Masking service receives a connection request, the Rule Engine applies connection rules to the connection. If the connection request matches the criteria defined by the matcher, the Rule Engine applies the rule action to the connection. After the Rule Engine applies the rule action, the Rule Engine applies processing action. The processing action defines the next action that the Rule Engine applies to the request.

Connection Rule Parameters

Connection rule parameters are options that you use to configure a connection rule. Use connection rule parameters to define the matcher, rule action, and processing action that the Rule Engine uses to identify, match, and forward connections.

The following table describes the connection rule parameters:

Parameter	Description
Rule Name	The logical name of the rule that appears in the rule tree.
Matcher	Defines the criteria that the Rule Engine uses to identify a match. The matcher defines the matching method used for incoming connections.
Rule Action	Defines the action that the Rule Engine applies to incoming connections. The action determines where the Rule Engine routes the connection.
Processing Action	Determines how the Rule Engine processes the connection after the Rule Engine applies the connection rule.

Connection Rule Matchers

A connection rule matcher defines the criteria that the Rule Engine uses to identify incoming SQL requests that receive the connection rule action.

For example, to identify requests from a specific application, such as Toad, create a connection rule that uses the Client/Application Information matcher. Add Toad to the matcher Include List, and the Rule Engine returns a match. When a match occurs, the Rule Engine applies the rule action.

You can use the following connection rule matchers:

All Incoming Connections

The Rule Engine applies the rule action to all incoming connections.

Check Database Connection

The Rule Engine returns a match based on the availability of the database connection.

Check Database DSN

The Rule Engine returns a match based on the data source name of the database.

Check Database URL

The Rule Engine returns a match based on the URL that the client application gives for the driver.

Check Property

The Rule Engine returns a match based on a DSN property of the driver.

Check Server Name

The Rule Engine returns a match based on the name of the Dynamic Data Masking Server that sends the SQL request.

Client Information

The Rule Engine returns a match based on the client that sends the SQL request. The Client Information is available for the DDM for JDBC and DDM for ODBC services.

Client/Application Information

The Rule Engine returns a match based on the client or application that sends the SQL request. The Client/Application Information matcher is not available for the DDM for JDBC and DDM for ODBC services.

Current Target Database

The Rule Engine returns a match based on the target database of the SQL request.

Incoming DDM Listener Port

The Rule Engine returns a match based on the listener port where Dynamic Data Masking receives the request.

Incoming DDM Listener Address

The Rule Engine returns a match based on the address of the Dynamic Data Masking listener in the connection request.

All Incoming Connections Matcher

The All Incoming Connections matcher applies the matching action to all incoming connections, regardless of target database, listener port, or application information. The All Incoming Connections matcher does not specify connection criteria and does not return a match. You can use the All Incoming Connections matcher to enforce the connection rule on all incoming connection requests to the database.

Check Database Connection Matcher

The Check Database Connection matcher checks whether Dynamic Data Masking has a connection to the database. Use the Check Database Connection matcher to send requests to the database based on whether a connection exists.

The Check Database Connection matcher uses the following parameter:

Database

The name of the database in the Management Console tree.

Database High Availability Example

You have a primary database and a secondary database. You want Dynamic Data Masking to send requests to the primary database if the database is available. If the primary database is unavailable, you want Dynamic Data Masking to send requests to the secondary database.

You create two connection rules. The first connection rule uses the Check Database Connection matcher to determine whether a connection to the primary database exists. The rule uses the Switch to Database rule action and Stop if Matched processing action to direct the request to the primary database if the connection is available.

If the first rule does not return a match, the Dynamic Data Masking sends the request to the second connection rule. The second rule uses the Check Database Connection matcher to determine whether a connection to the secondary database exists. If the second rule returns a match, the Switch to Database rule action instructs Dynamic Data Masking to the request to the secondary database.

Check Database DSN Matcher

The Check Database DSN matcher identifies a request based on the data source name of the database.

The Check Database DSN matcher is available for the DDM for ODBC service.

You can use the Check Database DSN matcher to identify and direct requests to the database. For example, if the DDM for DSN service serves multiple databases, you can create a connection rule that uses the Check Database DSN matcher to identify the database DSN and the Switch to Database rule action to direct the request to the correct database.

Configure the following parameter for the Check Database DSN matcher:

Value

The logical data source name that the client uses to connect to the database.

Check Database URL Matcher

The Check Database URL matcher identifies a request based on the URL that the client application gives for the driver.

The Check Database URL matcher is available for the DDM for JDBC service.

You can use the Check Database URL matcher to identify and direct requests to the database. For example, if the DDM for JDBC service serves multiple databases, you can create a connection rule that uses the Check Database URL matcher to identify the connection URL and the Switch to Database rule action to direct the request to the correct database.

Configure the following parameter for the Check Database URL matcher:

Value

The complete URL for the client application.

Check Property Matcher

The Check Property Matcher identifies a request based on a DSN property of the driver.

The Check Property matcher is available for the DDM for JDBC and DDM for ODBC services.

You can use the Check property matcher to identify and direct requests to the database. For example, if you have two versions of Oracle, you can create a connection rule that uses the Check Property matcher to identify the request based on the ODBC DSN version property and the Switch to Database rule action to direct the request to the correct database.

Note: For security, the database password is not sent to the Dynamic Data Masking Server. If the password is available, Dynamic Data Masking filters the password. Therefore, you cannot use the password property with the Check Property matcher.

Configure the following parameters for the Check Property matcher:

Property Name

The name of the DSN property.

Value

The value of the DSN property.

Check Server Name Matcher

The Check Server Name matcher creates a match based on the name of the Dynamic Data Masking Server that receives the request.

You can create connection rules and security rules for multiple Dynamic Data Masking Servers in a single Management Console. Use the Check Server Name matcher to apply the connection rule action to the request if the request is to the Dynamic Data Masking Server that you specify in the Server Name parameter.

The Check Server Name matcher uses the following parameter:

Server Name

The name of the Dynamic Data Masking Server that receives the request.

Client Information Matcher

The Client Information matcher determines the clients that can access the database.

The Client Information matcher is available for the DDM for JDBC and DDM for ODBC services.

The Client Information matcher provides an include and exclude list that you use to manage the clients that have access to the database. The include list specifies the clients that you want to restrict access to information within the database. The exclude list specifies the clients that you want to allow access to the database.

Enter the host name of the client where the JDBC or ODBC agent runs. The agent runs on the same machine as the application. You can find the host name in the `Host` property value of the Dynamic Data Masking `rule.log` file.

When the Rule Engine applies the Client Information matcher, the Rule Engine parses the exclude list first. Clients that are on the exclude list bypass Dynamic Data Masking and access the database directly. Next, the Rule Engine parses the include list. Clients that are on the include list can access obfuscated data.

Note: If you do not specify any information in the include list, all hosts can access unmasked data.

Configure the following parameters for the Client Information matcher:

Include List

Defines the client host name or IP address that you want to add to the include list. Add clients that you want to deny database access to.

Exclude List

Defines the client host name or IP address that you want to add to the exclude list. Add clients that you want to allow to access the database.

Client/Application Information Matcher

The Client/Application Information matcher determines the users and applications that can access the database. Use the application information, such as the user name, host information, and program name, to define the connection criteria for the Client/Application Information matcher.

The Client/Application Information matcher provides include and exclude lists that you use to manage the users and applications that have access to the database. The include list specifies the applications and users that you want to restrict access to information within the database. The exclude list specifies the applications and users that you want to allow access to the database. For example, you can use the Client/Application Information matcher to mask requests from development applications, but allow database administrators to access the application data.

When the Rule Engine applies the Client/Application Information matcher, the Rule Engine parses the exclude list first. Users and applications that are on the exclude list bypass Dynamic Data Masking and access the database directly. Next, the Rule Engine parses the include list. Users and applications that are on the include list can access obfuscated data.

Note: If you do not specify any information in the include list, the Rule Engine includes all application programs.

The Rule Engine uses regular expressions to perform application identification on the full name. For programs, you must use `.*` before the program name to match the full program path. For example, use `.*sqlplus.exe` for `application=C:\oracle\app\product\11.1.0\db_1\bin\sqlplus.exe`.

The following table describes the parameters for Client/Application Information matcher:

Parameter	Description
OS user	Operating system user name.
Host name	Client/application host name.
Program name	Name of the file to run the application.
Include list	Defines the program file names, hosts, and application users that you want to add to the include list.
Exclude list	Defines the program file names, hosts, and application users that you want to add to the exclude list.

The Client/Application Information matcher is not available for the DDM for JDBC or DDM for ODBC services.

Current Target Database Matcher

The Current Target Database matcher searches incoming requests for the target database value. Use the Current Target Database matcher to identify requests to the target database that you define in the Database Editor.

The following table describes the Current Target Database parameter:

Parameter	Description
Database	Defines the target database name.

Incoming DDM Listener Port Matcher

The Incoming DDM Listener Port matcher searches for the Dynamic Data Masking listener port in the connection request.

The following table describes the parameters for the Incoming DDM Listener Port matcher:

Parameter	Description
Incoming port	Defines the listener port.

Incoming DDM Listener Address Matcher

The Incoming DDM Listener Address matcher searches for the Dynamic Data Masking listener address in the connection request.

Configure the following parameters for the Incoming DDM Listener Address matcher:

Incoming Address

Defines the listener address.

Connection Rule Actions

The connection rule action defines the process that the Dynamic Data Masking service applies to the connection after the Rule Engine identifies a match.

Apply connection rule actions to manage the connection routing. An action can determine whether the Rule Engine blocks the connection request, applies a rule set to the connection, or forwards the connection to the database.

The following table describes the connection rule actions:

Connection Rule Action	Description
Nothing	Applies the connection processing action, but does not apply an action.
Folder	Creates a folder and processes the connection through the contents of the folder until a processing action stops the Rule Engine. Use the folder action to nest rules that are conditional upon each other. **Note:** Use the continue processing action with the folder connection rule action to apply the rules defined within the folder.
Switch to database	Forwards connections to the specified database.
Direct	Connects applications and clients directly to the target database. When the Rule Engine applies the direct action, the connection bypasses the Dynamic Data Masking service. You can only use the Direct action with the DDM for Oracle service.
Use rule set	Applies the specified security rule set to the SQL statement request.
Refuse	Defines the access that an application has to the database. The application receives an error that indicates that the database refuses the connection.
Transparent Archive	Routes the request to the Data Vault. Define the following parameters: - DDM Database Name. The Dynamic Data Masking database name for the Data Vault that you define in the Management Console. - DBA User. The Data Archive user name. - DBA Password. The password for the Data Archive user.
Load Control	Sets the priority levels for primary and secondary Dynamic Data Masking Servers when you configure Dynamic Data Masking Server high availability for Db2. Define the following parameters: - Host. The host names of the Dynamic Data Masking Servers. - Port. The listener port numbers of the Dynamic Data Masking Servers. - Priority. The priority of the Dynamic Data Masking Servers.

Load Control Action

The Load Control action sets the priority levels for primary and secondary Dynamic Data Masking Servers when you configure high availability for Db2.

You can configure the priority levels of two or more Dynamic Data Masking Servers in the Load Control action. The value of the Priority property corresponds to the frequency that the client sends the request through the Dynamic Data Masking Server. For example, if you have the priority of DDMServer1 set to one and the priority of DDMServer2 set to 19, DDMServer1 receives 5 percent of the requests from the client and DDMServer2 receives 95 percent of the requests.

Enter zero (0) as the priority level of a server to indicate that requests must only go through the server if no other server available. For example, if you have the priority of DDMServer1 set to zero and the priority of DDMServer2 set to one, DDMServer2 receives 100 percent of the requests from the client unless DDMServer2 is unavailable.

Configure the following properties for the Load Control action:

Host

The host names of the Dynamic Data Masking Servers.

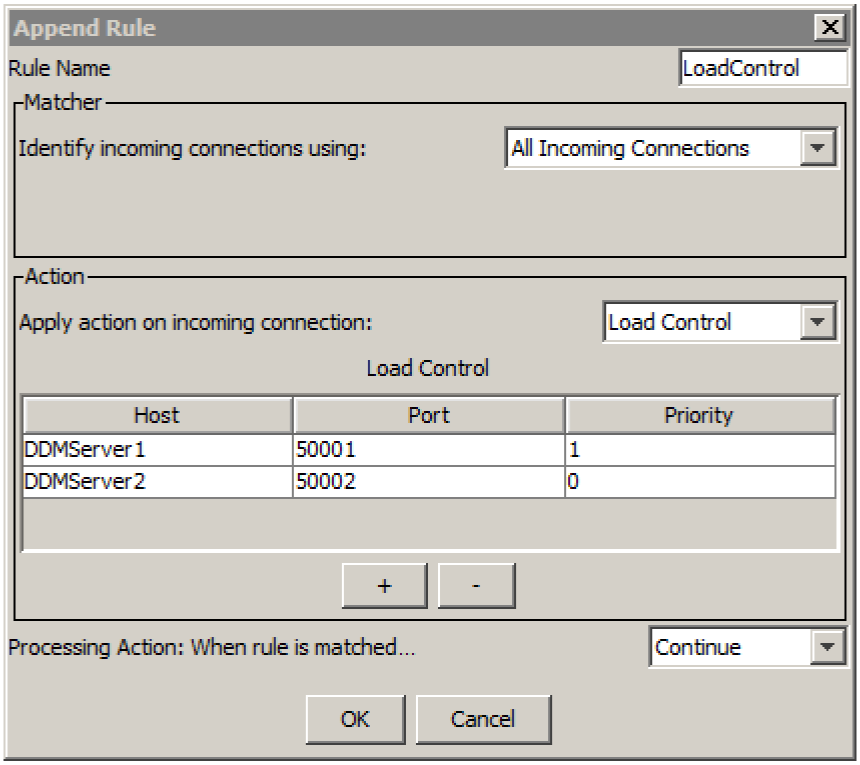
Port

The listener port numbers of the Dynamic Data Masking Servers.

Priority

The priority level of the Dynamic Data Masking Servers.

The following image shows the Load Control action configured for a primary Dynamic Data Masking Server and a failover Dynamic Data Masking Server:



Rule Name: LoadControl

Identify incoming connections using: All Incoming Connections

Apply action on incoming connection: Load Control

Load Control

Host	Port	Priority
DDMServer1	50001	1
DDMServer2	50002	0

Processing Action: When rule is matched... Continue

Processing Actions

The processing action defines what the Dynamic Data Masking service does after the rule action has been performed. The processing action determines whether the Rule Engine stops applying rules or continues to the next rule in the rule tree.

The following table describes the processing actions:

Connection Rule Processing Action	Description
Continue	The Rule Engine continues to the next rule in the rule tree. **Note:** Assign the Continue processing action to rule folders so that the Rule Engine applies the rules within the rule folder.
Stop if Applied	If the rule is applied, the Rule Engine does not continue to the next rule in the rule tree.
Stop if Matched	If the rule is matched, the Rule Engine does not process the connection rule action.

Creating a Connection Rule

Create a connection rule to manage how the Dynamic Data Masking service forwards incoming connections. Define the connection criteria and processing action for a connection rule. Add a single connection rule to the rule tree or nest a connection rule within a rule folder.

1. In the Management Console, select the Dynamic Data Masking service that you want to add the connection rule to, and click **Tree** > **Connection Rules**.

   The **Rule Editor** window appears.
2. Select **Action** > **Append Rule**.

   The **Append Rule** window appears.
3. Enter a rule name in the **Rule Name** box.
4. Select and define a matcher.
5. Select and define an action.
6. Select a processing action.
7. Click **OK**.

   The connection rule appears in the rule tree.
8. Select **File** > **Update Rules**.

   The connection rule is saved.

Connection Rule Export and Import

Export connection rules within security rule folders. You can save connection rule configurations in an XML file. You can import XML files to use saved connection rule configurations.

Connection Rule Export

Export a connection rule folder to an XML file to back up connection rule definitions. You can make a copy of a rule folder for complex rule configurations that you want to reuse. You can use the export utility to make a copy of a rule folder and import the copy to the connection rule tree.

An exported file contains the connection rules and the connection rule components, such as the connection rule matchers, connection rule actions, and connection rule processing actions. You must export connection rules inside a connection rule folder. To export a single connection rule, create a folder that contains only the connection rule.

Exporting Connection Rules

Export connection rules inside a connection rule folder through the Management Console.

1. In the Management Console, click **Tree** > **Connection Rules**.

   The **Rule Editor** appears.
2. Click the connection rule folder that you want to export.
3. Click **Action** > **Export**.

   The **Export** window appears.
4. Browse to a location to save the export file.
5. Enter a name for the export file.
6. Click **Export.**

Connection Rule Import

When you import a connection rule file, you import the connection rules and the connection rule components that the file defines. The connection rule components include matchers, actions, and processing actions. You can import connection rules into an empty rule folder or to the top of the connection rule tree. Import the connection rules, then update the rule tree.

Before you import rules, create an empty rule folder in the connection rule tree. If you import into a rule folder that is not empty, the imported rules override the rules in the rule folder.

If you choose to import the connection rules to the top of the connection rule tree, the contents of the imported file overrides the existing rules in the rule tree. The existing rules are deleted.

Importing Connection Rules

Import connection rules through the Management Console.

1. In the Management Console, click **Tree** > **Connection Rules**.

   The **Rule Editor** appears.
2. Click an empty rule folder or the top of the rule tree. Rules that you import appear in the location that you choose.
3. Click **Action** > **Import**.

   The **Import** window appears.
4. Browse to the location of the XML file that defines the connection rules that you want to import and double-click the file.

   The rule tree displays the connection rules.
5. Update the rule tree to save the changes.

CHAPTER 4

Security Rules

This chapter includes the following topics:

Security Rules Overview

A security rule defines the criteria that the Rule Engine uses to parse and rewrite an SQL request. A security rule is part of a security rule set. You can create a security rule in a rule folder or as a rule in a rule tree.

Security rules specify the technique that the Rule Engine uses to mask data. Security rules consist of a matcher, a rule action, and a processing action. Security rules mask data in a row or column. For example, create a security rule that rewrites SQL requests that reference the Social Security column from the Employee table.

Connection rules define the security rules that the Rule Engine applies. Use the connection properties to define security rules for Microsoft SQL Server.

Security Rule Parameters

The Rule Engine applies security rules to incoming SQL statements to identify a match to the criteria that you define. If a match occurs, the Rule Engine applies the security action to the SQL statement.

The following table describes the security rule parameters:

Parameter	Description
Rule Name	Name of the rule that appears in the rule tree.
Description	Optional rule description.
Matcher	Defines the portion of the SQL request that the Rule Engine must match to apply an action. Returns a match when the Rule Engine identifies a match.
Keep Matcher Result	Specifies that the Rule Engine must use the current matcher result for subsequent incoming requests for the amount of time that you specify in the **Try to match every ___ seconds per session** parameter.
Try to match every ___ seconds per session.	Specifies the amount of time that you want the Rule Engine to use the current matcher result for incoming requests. You must enable the Keep Matcher Result parameter to use the **Try to match every ___ seconds per session** parameter. Default is 3600 seconds.
Rule Action	Defines the action the Rule Engine applies to an SQL statement.
Processing Action	Defines how the Rule Engine processes the connection after the Rule Engine applies the security rule action.
Log When Rule is Applied	Creates an entry in the `rule.log` file if the Rule Engine applies the rule action to the request.

Security Rule Matchers

Security rule matchers define the criteria that the Rule Engine uses to identify incoming SQL requests that receive the rule action.

Select a security rule matcher based on the method you want the Rule Engine to use to identify SQL statements. For example, to restrict access to a customer table, use the From Clause Object matcher with the Block Statement processing action. Use the Text matcher to identify a specific text string within an SQL request or the symbol matcher to match a variable value, such as the session or client information. To apply the security rule to all incoming requests, use the Any matcher.

Any Matcher

The Any matcher applies the rule action to all incoming SQL statements.

Use the Any matcher for rules that apply the folder action, so that the Rule Engine processes the request through the contents of the folder.

From Clause Object Matcher

The From Clause Object matcher identifies SELECT statements that query an object or an alias in the FROM clause.

To specify a view only, use the From Clause Object matcher. Dynamic Data Masking matches based on the SQL parsing of the SELECT request. Dynamic Data Masking does not parse the execution plan of the SELECT request.

Java Matcher

The Java matcher runs a Java class that returns a boolean value. If the returned value is true, the matcher returns a match. If the returned value is false, the matcher does not return a match.

The Java class must contain a public static method with the following signature:

```
public static boolean match(RuleContext ctx)
```

Enter the correct class in the Class Path field of the Java matcher. The Rule Engine reads the rules in the rule set and returns an error if the class path is incorrect, even if a rule is disabled.

When an error occurs with the Java class, the Rule Engine does not apply the rule. Instead, the Rule Engine continues to the next rule. The Rule Engine logs a detailed error message in the following file:

```
<Dynamic Data Masking installation>\log\DDMError.txt
```

The Java matcher has the following parameters:

Class Path

Defines a list of JAR files that contain the Java matcher class and necessary libraries. Use semicolons to separate multiple JAR files.

Class Name

Defines the fully qualified class name. The class may be built within a named or unnamed package. The class must include a method named `match` with the following signature: `public static boolean match(RuleContext ctx).`

The `RuleContext` object contains data from the Rule Engine. The `RuleContext` object contains the following method to return the symbol value from the symbol name: `public String getSymbol(String symbol);` Use this method to retrieve symbol values that a Symbol rule action defines. Specify the name of the symbol as an argument to the method.

You can also use the following predefined symbols:

RuleContext.USERNAME

Retrieves the Oracle user name.

RuleContext.OS_USER

Retrieves the operating system user on the client machine.

RuleContext.CLIENT_HOST

Retrieves the name of the client machine.

RuleContext.PROGRAM

Retrieves the program name on the client machine.

RuleContext.STATEMENT

Retrieves the statement being processed.

Note: The Rule Engine runs the Java class with the Java Virtual Machine (JVM) that Dynamic Data Masking uses. You can compile the Java matcher class with a Java Development Kit (JDK) that is the same major version or earlier version of the JVM that Dynamic Data Masking uses.

Java Class Example

The following text is an example of a Java class that you can use as a Java matcher:

```
import com.activebase.rule.*;

public class ExampleJM {

    public static boolean match(RuleContext ctx) {
        String user = ctx.getSymbol("APPLICATION_USERNAME");
        if (user==null || "".equals(user.trim())) {
            user = ctx.getSymbol(RuleContext.OS_USER);
        }
        if (!"FRED".equals(user.toUpperCase())) {
            return true;
        }
        return false;
    }
}
```

The Java matcher runs the match method. The method uses the `getSymbol` invocation of the `RuleContext` object to return a value for the user based on the value in the user-defined APPLICATION_USERNAME symbol. If the value is null, the matcher obtains the operating system user name from the appropriate Dynamic Data Masking symbol name from RuleContext.OS_USER.

The method compares the symbol value to `FRED` and returns a match if they are different. To apply a masking function to requests that do not come from FRED, use the Mask rule action. Select the Stop if Applied processing action because FRED is the only user who is authorized to view unmasked data. If the user is not FRED, Dynamic Data Masking applies the masking action.

To retrieve the user name, create a security rule in the rule set with the Java matcher rule, higher in the rule sequence in the rule tree than the Java matcher rule. In the security rule, select the Text matcher and enter a regular expression to retrieve the user name from the request statement. Select the Define Symbol rule action and assign the user name to the APPLICATION_USERNAME symbol.

The incoming SELECT statement has a tag at the end, which consists of two consecutive hyphens (--) followed by a string. The string is the user name that the Java matcher uses for comparison.

To specify the consecutive hyphens as a place holder and capture the text after the place holder, enter the following expression:

```
.*--(.*)
```

The `(.*)` component of the regular expression captures the text. The Define Symbol rule action in the security rule references the text with the following regular expression markup:

```
\(1)
```

From the regular expression, the Define Symbol action defines the symbol name as APPLICATION_USERNAME and defines the value as `\(1)`.

For example, when the user Scott views the customer information screen, the application submits the following query to the database:

```
select customer_name from customer --Scott
```

The Text matcher captures the text `Scott` after the consecutive hyphens. The Define Symbol action sets the APPLICATION_USERNAME symbol to the value `Scott`. The Java matcher compares the APPLICATION_USERNAME symbol value to the value `FRED`. If you did not define the APPLICATION_USERNAME symbol in a previous security rule, the Java matcher instead compares FRED to a predefined Dynamic Data Masking symbol. Because the values in this example are not equal, the Java matcher returns a value of `True` and the Rule Engine applies the masking rule action in the Java matcher rule.

However, if the application submits the following query:

```
select customer_name from customer --Fred
```

The Java matcher returns a value of `True`, the Rule Engine does not apply the rule action in the Java matcher rule, and Fred can view masked data.

Error Handling

If the Java class fails, the Rule Engine does not apply the security rule. The Rule Engine continues to the next rule in the rule tree.

The Dynamic Data Masking service stores the Java printout messages in the `log\DDMError.txt` file.

Metadata Matcher

The Metadata Matcher uses the specified column name to apply masking rules to the result set of a Microsoft SQL Server stored procedure call.

Use the Metadata Matcher to match column names in the result set of a Microsoft SQL Server stored procedure, in order to mask the result set. You can also use the Metadata Matcher to match the XPath in the XML content of a column in the result set of a Microsoft SQL Server stored procedure call.

To mask the result set of a Microsoft SQL Server procedure call, use the Metadata Matcher in addition to the Procedure Call matcher. For more information, see Chapter 7, "Stored Procedure Result Set Masking" on page 96.

Parser Matcher

The Parser matcher identifies requests that Dynamic Data Masking is unable to parse.

You can use the Parser matcher with security rule actions to change the request. For example, if you want to block requests that Dynamic Data Masking cannot parse, you can create a rule with the following properties:

Rule Name

Enter a name for the rule. In this example, the rule name is parsed_statement.

Rule Matcher

Select the Parser matcher.

Rule Action

Select the Block Statement rule action. Enter a message that Dynamic Data Masking sends to the client when the statement is blocked. In this example the message is UNABLE TO PARSE STATEMENT.

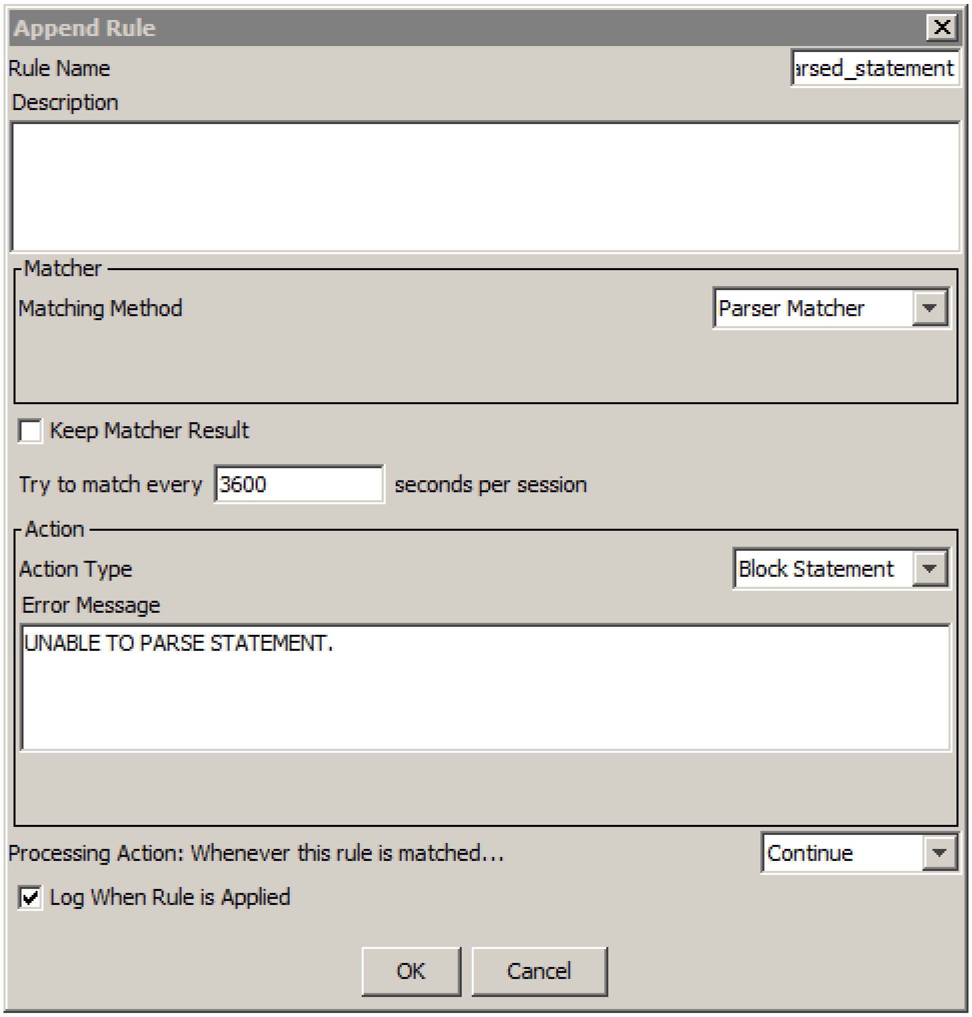
Processing Action

Select Continue. The Continue processing action indicates that the Rule Engine should continue to the next rule in the rule tree.

Log When Rule is Applied

Select the **Log When Rule is Applied** check box to create an entry in the `rule.log` file if the Rule Engine applies the rule action to the request.

The following image shows the rule parameters:



Rule Name: ırsed_statement

Description

Matching Method: Parser Matcher

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action Type: Block Statement

Error Message

UNABLE TO PARSE STATEMENT.

Processing Action: Whenever this rule is matched... Continue

☑ Log When Rule is Applied

PL/SQL Function Matcher

The PL/SQL Function matcher returns a match based on the PL/SQL function that you define and the parameters of the function.

When you use the PL/SQL Function matcher, you enter the name or the name and path of the function. You must include the path if the stored object is not in the client schema or catalog, depending on the database. On an IBM Db2 database, you must include the path if the stored object is not in the path that is returned by the following statement from the Dynamic Data Masking administrator:

```
SELECT CURRENT_PATH FROM SYSIBM.SYSDUMMY1
```

Select the parameters that the function uses. The Rule Engine returns an error if you do not select the correct parameters for the function. You can view the `rule.log` file or use the Security Rule Set Simulator to verify that you selected the correct parameters.

When the Rule Engine applies the PL/SQL Function matcher, the PL/SQL function returns a `1` or a `0`. If the PL/SQL function returns `1`, a match occurs and the Rule Engine applies the rule action. If the PL/SQL function returns `0`, a match does not occur and the Rule Engine does not apply the rule action.

Note: Informatica recommends that you create PL/SQL functions that have descriptive parameter names. If the parameter name describes the parameter value, the SQL script is comprehensible and easy to edit.

The PL/SQL Function matcher has the following properties:

Function Name

Enter the name and full path of the PL/SQL function. For example, you might enter `HR.dbo.get_employees`.

Include Database Username

Select if the function uses a database username parameter. The database username parameter defines the user for the session.

Include OS User

Select if the function uses an operating system user parameter. The operating system user parameter defines the user name for the user logged in to the operating system.

Include Client Host

Select if the function uses a client host parameter. The client host parameter defines the client host name or IP address.

Include Program Name

Select if the function uses a program name parameter. The program name defines the application or program name.

Include Statement

Select if the function uses a statement parameter. The statement parameter defines the SQL statement text. You must define the statement in VARCHAR.

Include SessionID

Select if the function uses a session ID parameter. The session ID parameter defines the session ID of the client.

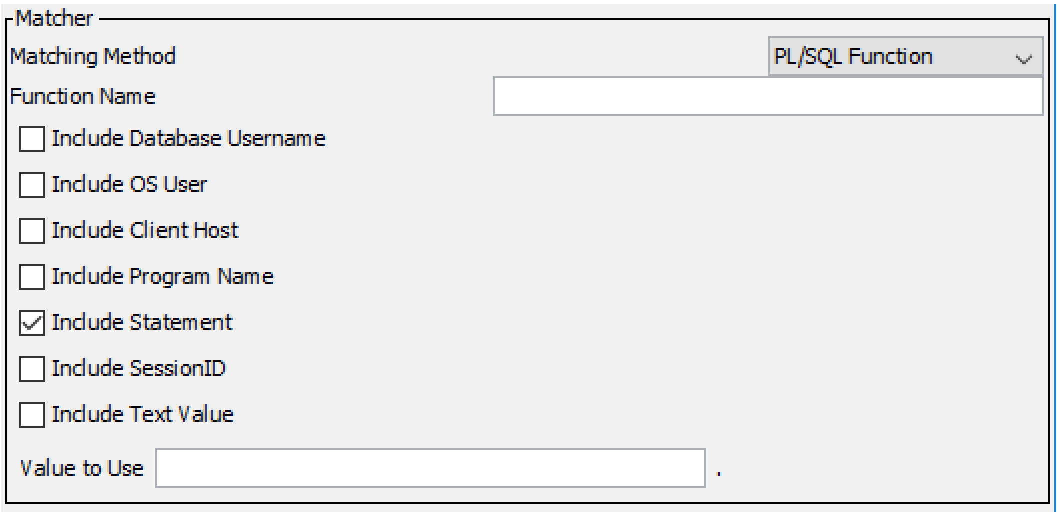
Include Text Value

Select if the function uses a text value parameter.

Value to Use

Enter a text value parameter if you selected the Include Text Value property. You can use text or a global symbol to define the text value.

The following image shows the PL/SQL Function matcher properties:



Matcher

Matching Method: PL/SQL Function

Function Name

☐ Include Database Username

☐ Include OS User

☐ Include Client Host

☐ Include Program Name

☑ Include Statement

☐ Include SessionID

☐ Include Text Value

Value to Use

PL/SQL Function Matcher Examples

Use the PL/SQL Function matcher examples as guidelines to create PL/SQL functions and corresponding security rules.

Text Value Example

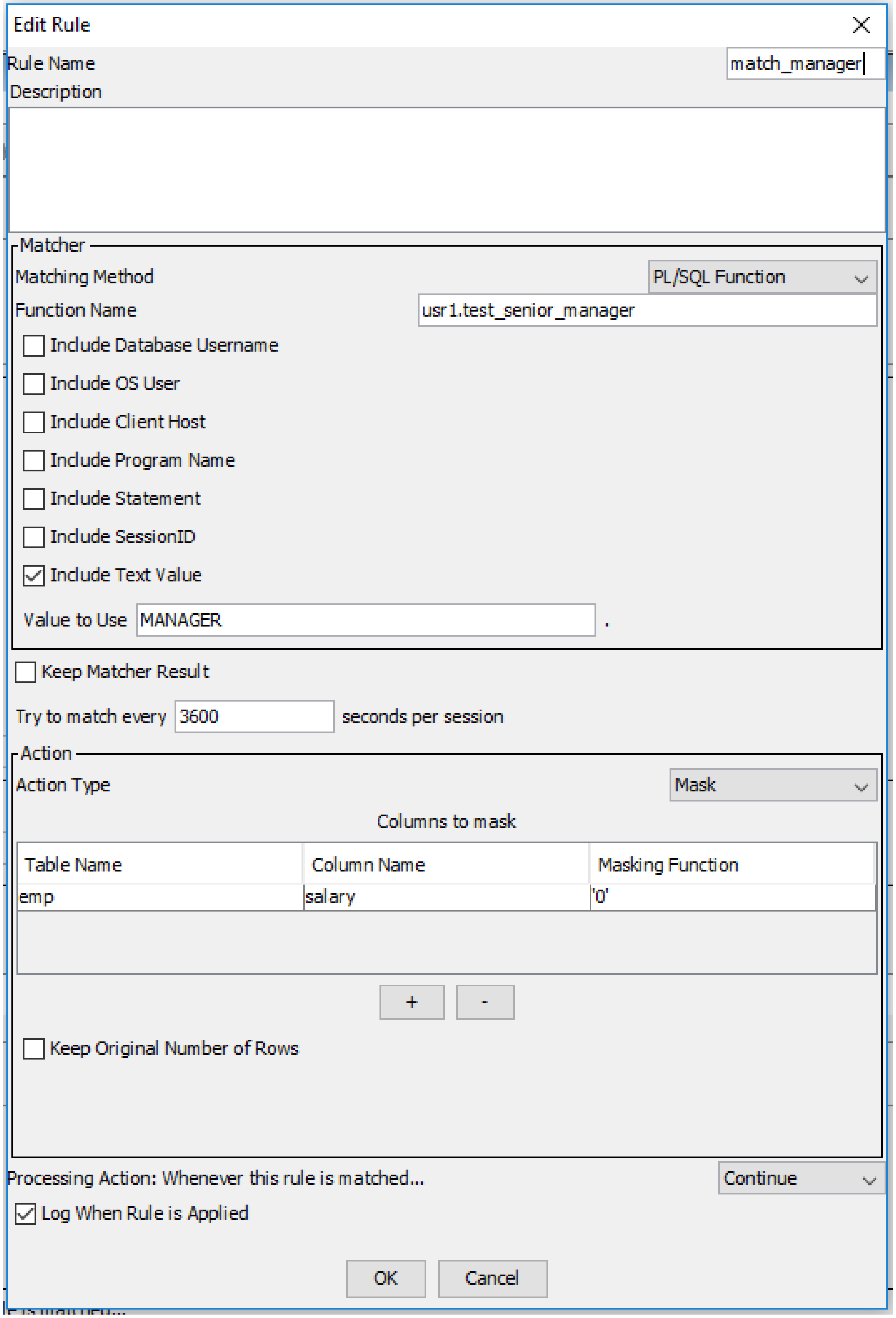
You want to mask the SALARY column of the EMP table based on the user that sends the request to the database. If the user is a senior manager, the result set is unmasked. If the user is not a senior manager, the result set contains a zero (0) in the SALARY column.

You create a PL/SQL function with the following code:

```
CREATE OR REPLACE FUNCTION test_senior_manager (position VARCHAR)
RETURN INTEGER AS
manager_type VARCHAR(50) ;
BEGIN
  manager_type := retrieve_manager_type(position) ;
  IF manager_type = 'SENIOR' THEN
     RETURN 0;
  ELSE
     RETURN 1;
  END IF;
END ;
```

The PL/SQL function returns `0` if the user is a senior manager and returns `1` if the user is not a senior manager.

Create the following security rule:



Edit Rule

Rule Name: match_manager

Description:

Matcher

Matching Method: PL/SQL Function

Function Name: usr1.test_senior_manager

☐ Include Database Username

☐ Include OS User

☐ Include Client Host

☐ Include Program Name

☐ Include Statement

☐ Include SessionID

☑ Include Text Value

Value to Use: MANAGER

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action

Action Type: Mask

Columns to mask

Table Name	Column Name	Masking Function
emp	salary	'0'

☐ Keep Original Number of Rows

Processing Action: Whenever this rule is matched... Continue

☑ Log When Rule is Applied

If the user is a senior manager and the PL/SQL function returns `0`, Dynamic Data Masking does not apply the rule action and the result set is unmasked. If the user is not a senior manager and the PL/SQL function returns `1`, the rule action masks the values in the SALARY column according to the masking function.

Text Value With Multiple Arguments Example

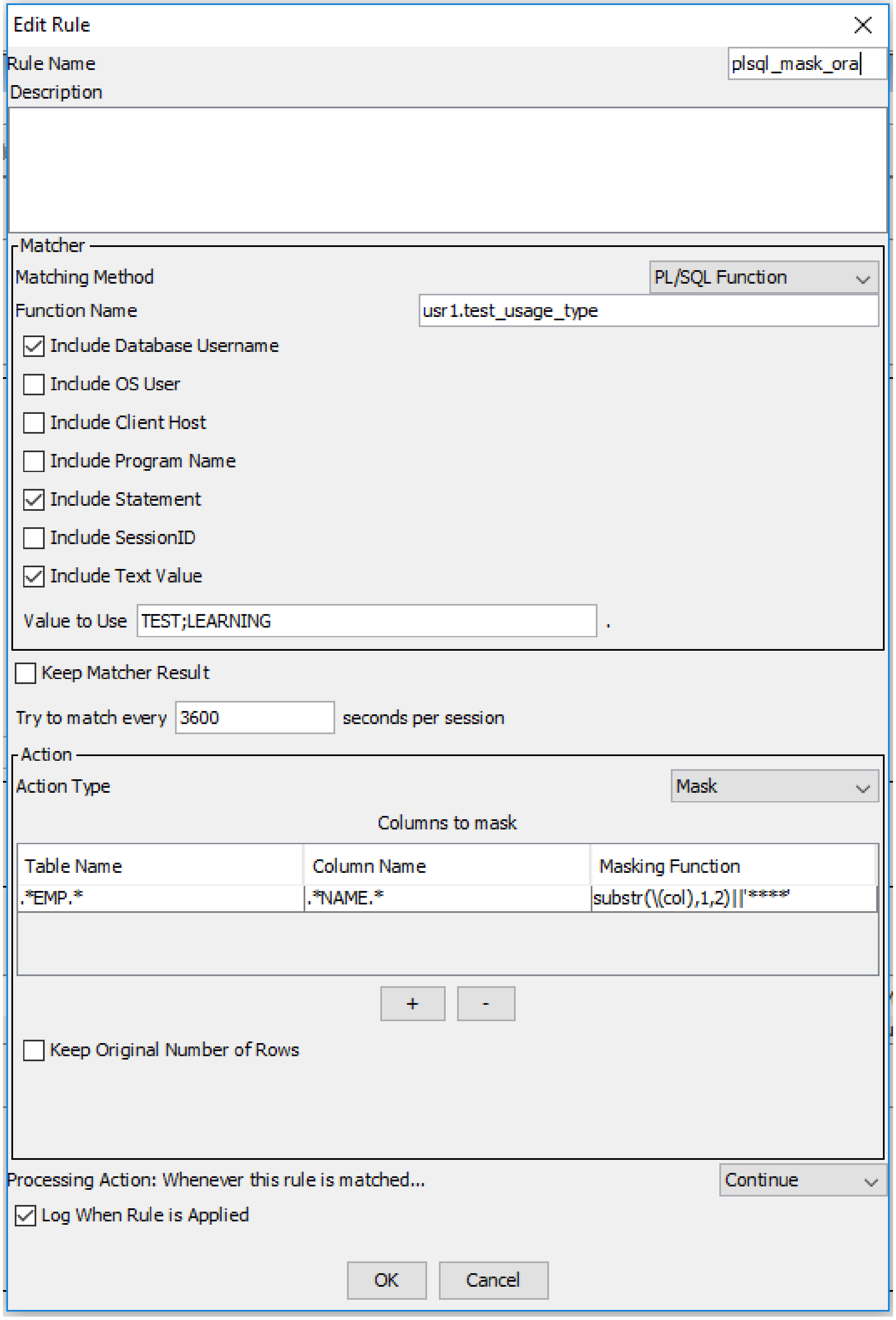
You want to mask data based on the user that sends the request and whether the statement returns columns that contain a specific type of data.

You create a PL/SQL function with the following code:

```
CREATE OR REPLACE TYPE LIST_TYPE IS VARRAY (5) OF VARCHAR(50);
CREATE OR REPLACE FUNCTION test_usage_type (db_user VARCHAR2, statement VARCHAR2, usages
VARCHAR2)
RETURN INTEGER AS
  usage_list LIST_TYPE;
BEGIN
  IF db_user = 'SCOTT' THEN
    IF is_usage_type_col_in_tables(statement) THEN
      usage_list := spiltSemicolonList(usages);
      IF check_usages(usage_list) THEN
        RETURN 1; -- If there is a usage in security rule that implies masking is needed
then return 1
      ELSE
        RETURN 0;
      END IF ;
    ELSE
      RETURN 0;
    END IF;
  ELSE
    RETURN 0;
  END IF;
END;
```

The PL/SQL statement returns `1` if the user is SCOTT and the returned columns contain data from the usage_list. Otherwise, the PL/SQL statement returns `0`.

You create the following security rule:



Rule Name: plsql_mask_ora

Description:

Matcher

Matching Method: PL/SQL Function

Function Name: usr1.test_usage_type

☑ Include Database Username

☐ Include OS User

☐ Include Client Host

☐ Include Program Name

☑ Include Statement

☐ Include SessionID

☑ Include Text Value

Value to Use: TEST;LEARNING .

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action

Action Type: Mask

Columns to mask

Table Name	Column Name	Masking Function
.*EMP.*	.*NAME.*	substr(\(col),1,2)||'****'

☐ Keep Original Number of Rows

Processing Action: Whenever this rule is matched... Continue

☑ Log When Rule is Applied

The rule contains Include Database Username and Include Statement parameters, which are fixed value arguments that you define in the PL/SQL function. The Value to Use parameter contains a list of delimiters that are separated by a semicolon. In this example, the delimiters are TEST and LEARNING. If the PL/SQL function matcher matches the request, the rule masks the NAME column of the EMP table.

OS User and Statement Example

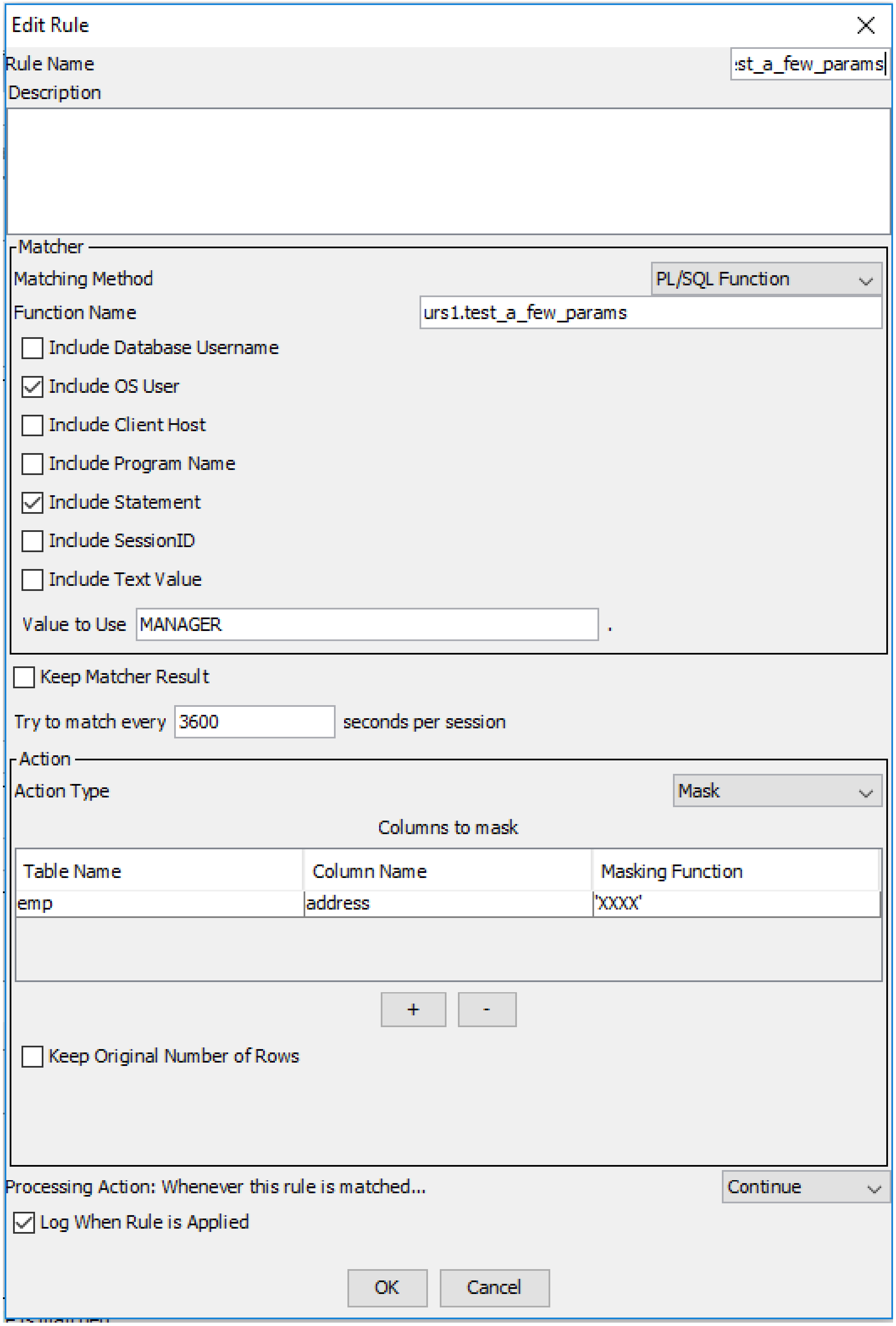
You want to mask data in the production database based on the operating system user that sends the request to the database.

You create a PL/SQL function with the following code:

```
CREATE OR REPLACE FUNCTION test_a_few_params (os_user VARCHAR2, statement VARCHAR2)
RETURN INTEGER AS
stmt_contains_prod_tables BOOLEAN ;
os_user_is_su BOOLEAN ;
needs_masking BOOLEAN ;
BEGIN
  stmt_contains_prod_tables := is_stmt_contains_prod_tables (statement) ;
  os_user_is_su := is_su (os_user) ;
  needs_masking := os_user_is_su AND stmt_contains_prod_tables;
  IF needs_masking THEN
     RETURN 1;
  ELSE
     RETURN 0;
  END IF;
END ;
```

The PL/SQL function returns `1` if the operating system user is su and the request contains production tables. Otherwise, the function returns `0`.

You create the following security rule:



Rule Name :st_a_few_params

Description

Matcher

Matching Method: PL/SQL Function

Function Name: urs1.test_a_few_params

☐ Include Database Username

☑ Include OS User

☐ Include Client Host

☐ Include Program Name

☑ Include Statement

☐ Include SessionID

☐ Include Text Value

Value to Use: MANAGER .

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action

Action Type: Mask

Columns to mask

Table Name	Column Name	Masking Function
emp	address	'XXXX'

☐ Keep Original Number of Rows

Processing Action: Whenever this rule is matched... Continue

☑ Log When Rule is Applied

If the operating system user is su and the request contains production tables, Dynamic Data Masking applies the masking function in the rule action. If the operating system user is not su or the request does not contain production tables, the PL/SQL function returns 0 and Dynamic Data Masking does not apply the rule action.

Procedure Call Matcher

The Procedure Call matcher identifies an input query as a valid Microsoft SQL Server procedure call. Use the Procedure Call matcher to specify the name of a Microsoft SQL Server stored procedure.

For more information, see Chapter 7, “Stored Procedure Result Set Masking” on page 96.

SQL Syntax Matcher

The SQL Syntax matcher compares the incoming SELECT statement to the SQL statement that you define within the matcher.

For a match to occur, the objects and predicates must be in the same order as the statement that you define in the rule. The objects and predicates that you define must ignore spaces, line breaks, and capitalization.

If you define an SQL statement that includes predicates that use literals, enter the literal value in the statement text. For SQL statements that include predicates that use bind variables, enter `Column name<operator>:[any string]` in the statement text. For example, if you enter `emp_number =:emp`, you replace statements that use any variation of emp_number.

The SQL Syntax matcher only matches SELECT statements. It does not match other data manipulation language commands such as INSERT, UPDATE, or DELETE.

Note: The SQL Syntax matcher ignores the alias of a table name.

The following table describes options for the SQL syntax matcher:

Option	Description
Allow bind variables to match any value in the statement	Enables the Rule Engine to match bind variables in the request statement. If you select the bind variable option, the Rule Engine matches any bind variable or literal. Bind variables can match functions, including `sysdate` or `to_date()`. For example, if the matching statement is `select * from cars where year=:year_no`, the Rule Engine matches all statements that use `select * from cars`. If you do not select the bind option, the Rule Engine matches request statements that exactly match `select * from cars where year=year_no`.
Allow any select list in the statement	Enables the Rule Engine to match request statements by using the defined statement, regardless of the contents of the select list.

Rewriting Statements With Bind Variables

Use bind variable naming conventions to rewrite incoming statements.

The Rule Engine identifies the values in the positions specified by bind variables in the incoming statement. You must enter the same bind variable names in the predicate of the rewrite statement. The Rule Engine identifies the values in the incoming statement and rewrites the statement with the inserted values.

Symbol Matcher

The Symbol matcher identifies and stores client and database variable values.

The Symbol matcher uses global variables to identify a match. A global variable has a name and a value. Global variables are case sensitive and have an assigned value for the database session. The database management system provides most of the values and there might be discrepancies between database versions of the same type.

For example, the Symbol matcher can identify a connection initiated by the database administration team. To identify team members that are not Dynamic Data Masking administrators and set a matching action that blocks access to the requested data, use the global variable AUTH_USERNAME. When the Rule Engine encounters the symbol, it blocks access to the data.

You can reference a global variable by placing the global variable in parentheses preceded with a backslash. For example, \(AUTH_USERNAME) is replaced with the database username.

The availability of a global variable is dependent on the database type. To identify global variable values, use the Client Info entry in the `rule.log` file.

You can use the following global variables:

AUTH_CURRENT_DATABASE

Defines the current database.

You can use AUTH_CURRENT_DATABASE on Sybase, IBM Db2, Informix (DRDA), Teradata, Data Vault, Microsoft SQL Server, and Hive. For Hive, AUTH_CURRENT_DATABASE contains a value only when you provide a database name in the connection URL and Hive protocol is binary.

AUTH_DATABASE_IP

The IP address of the database that the client is connected to.

You can use AUTH_DATABASE_IP on Oracle, Sybase, Microsoft SQL Server, IBM Db2, Informix, Teradata, Data Vault, and Hive databases.

AUTH_DATABASE_NAME

Defines the Dynamic Data Masking database name that you define in the Management Console.

You can use AUTH_DATABASE_NAME on Oracle, IBM Db2, Sybase, Informix, Data Vault, Teradata, Hive, and Microsoft SQL Server.

AUTH_DATABASE_PORT

The database port that the client is connected to.

You can use AUTH_DATABASE_PORT on Oracle, IBM Db2, Sybase, Informix, Microsoft SQL Server, Data Vault, Hive, and Teradata.

AUTH_DRIVER_CLASS

The driver class name that the Generic JDBC client instruments at runtime.

You can use AUTH_DRIVER_CLASS with the DDM for JDBC service.

AUTH_DRIVER_NAME

The JDBC driver name.

You can use AUTH_DRIVER_NAME with the DDM for JDBC service.

AUTH_EXTERNAL_AUTHENTICATION

Defines whether the user is connected to the database with a password. If the user is connected to the database with a password, the value is FALSE. If the user is connected to the database without a password, the value is TRUE.

You can use AUTH_EXTERNAL_AUTHENTICATION on Informix.

AUTH_ORIG_STATEMENT

The statement that is sent by the client. The symbol is updated each time the client sends a statement.

You can use AUTH_ORIG_STATEMENT on Oracle, IBM Db2, Sybase, Informix, Microsoft SQL Server, Data Vault, Hive, and Teradata.

AUTH_MACHINE

Defines the client host name and is not dependent on the client.

You can use AUTH_MACHINE on Oracle, Sybase, IBM Db2, Informix, Data Vault, and Microsoft SQL Server.

AUTH_PROGRAM_NM

Defines the program name.

You can use AUTH_PROGRAM_NM on Oracle, IBM Db2, Sybase, Microsoft SQL Server, and Teradata.

AUTH_SERIAL_NUM

Defines the session serial number.

You can use AUTH_SERIAL_NUM on Oracle.

AUTH_SESSION_ID

Defines the session ID configured for Dynamic Data Masking.

You can use AUTH_SESSION_ID on Oracle, Microsoft SQL Server, Hive, and Teradata.

AUTH_SID

Defines the client user name.

You can use AUTH_SID on Oracle, Teradata, Data Vault, and Microsoft SQL Server (when you log in using Windows authentication).

AUTH_STATEMENT_RECEIVED_TIME

Date and time Dynamic Data Masking received a statement. The date format is dd MMMM yyyy HH:mm:ss and is not customizable. AUTH_STATEMENT_RECEIVED_TIME is populated immediately after parsing of the protocol and before rule set processing.

You can use AUTH_STATEMENT_RECEIVED_TIME on Oracle, IBM Db2, Sybase, Informix, Microsoft SQL Server, Data Vault, Hive, and Teradata.

AUTH_TERMINAL

Defines the client host name and is dependent on the client. For example, if you use SQL Developer to connect to an Oracle database, AUTH_MACHINE contains the client host name, but AUTH_TERMINAL does not contain the client host name.

You can use AUTH_TERMINAL on Oracle.

AUTH_USERNAME

Defines the database user name.

You can use AUTH_USERNAME on Oracle, IBM Db2, Sybase, Informix, Microsoft SQL Server, Data Vault, Kerberos Hive, and Teradata.

CLIENT_IP

Defines the IP address of the client machine.

You can use CLIENT_IP on Oracle, Sybase, Microsoft SQL Server, IBM Db2, Informix, Teradata, Data Vault, and Hive databases.

CLIENT_PORT

Internal port of the client machine that connects to Dynamic Data Masking.

You can use CLIENT_PORT on Oracle, Sybase, Microsoft SQL Server, IBM Db2, Informix, Teradata, Data Vault, and Hive databases.

DDM_HOST

The host name of the machine where the Dynamic Data Masking Server runs.

You can use DDM_HOST on Oracle, Sybase, Microsoft SQL Server, IBM Db2, Informix, Teradata, Data Vault, and Hive databases.

DDM_IP

The IP address of the machine where the Dynamic Data Masking Server runs.

You can use DDM_IP on Oracle, Sybase, Microsoft SQL Server, IBM Db2, Informix, Teradata, Data Vault, and Hive databases.

DDM_PORT

The internal port of the Dynamic Data Masking machine that connects to the database.

You can use DDM_PORT on Oracle, Sybase, Microsoft SQL Server, IBM Db2, Informix, Teradata, Data Vault, and Hive databases.

DDM_VERSION

The version of the Dynamic Data Masking Server.

You can use DDM_VERSION on Oracle, IBM Db2, Sybase, Informix, Microsoft SQL Server, Data Vault, Hive, and Teradata.

Rewrite Select List Example

The following example is a simple method you can use to view the values of the global variable for a session.

Create a security rule that rewrites an SQL request, such as `SELECT * FROM ALL_GLOBALS`, and replaces the SQL request with the following query, based on the database management system type:

Oracle

```
select '\(CLIENT_IP)' "Client IP", '\(AUTH_USERNAME)' "Username",'\(AUTH_SID)' "OS
User",'\(AUTH_MACHINE)' "Host name", '\(AUTH_TERMINAL)' "OS user name", '\
(AUTH_SERIAL_NUM)' "SERIAL#", '\(AUTH_PROGRAM_NM)' "Program",'\
(AUTH_DATABASE_NAME)' "DDM Name",'\(AUTH_SESSION_ID)' "SID", '\
(AUTH_CURRENT_DATABASE)' "Current Database" from dual
```

IBM Db2

```
select '\(CLIENT_IP)' "Client IP", '\(AUTH_USERNAME)' "Username",'\(AUTH_SID)' "OS
User",'\(AUTH_MACHINE)' "Host name", '\(AUTH_TERMINAL)' "OS user name", '\
(AUTH_SERIAL_NUM)' "SERIAL#", '\(AUTH_PROGRAM_NM)' "Program",'\
(AUTH_DATABASE_NAME)' "DDM Name",'\(AUTH_SESSION_ID)' "SID", '\
(AUTH_CURRENT_DATABASE)' "Current Database" from sysibm.sysdummy1
```

Microsoft SQL Server

```
select '\(CLIENT_IP)' "Client IP", '\(AUTH_USERNAME)' "Username",'\(AUTH_SID)' "OS
User",'\(AUTH_MACHINE)' "Host name", '\(AUTH_TERMINAL)' "OS user name", '\
(AUTH_SERIAL_NUM)' "SERIAL#", '\(AUTH_PROGRAM_NM)' "Program",'\
(AUTH_DATABASE_NAME)' "DDM Name",'\(AUTH_SESSION_ID)' "SID", '\
(AUTH_CURRENT_DATABASE)' "Current Database"
```

Text Matcher

The Text matcher defines the statement string text that the Rule Engine uses to match a request statement.

The Rule Engine applies the rule action if the request statement fully matches the statement string text, including spaces and line breaks.

Wildcards

Use the percent sign (%) and the underscore character (_) to match parts of an incoming SQL statement.

The percent sign matches an undefined number of characters. The percent sign can match zero. The underscore character matches one character. The asterisk (*) is not a wildcard because it is a valid SQL syntax.

Regular Expression - Regex

You can use regular expression to identify incoming SQL statements that match the criteria that you define for the matcher. A regular expression consists of character literals and metacharacters.

The Rule Engine uses metacharacters to determine the algorithm for processing regular expression characters. The Rule Engine matches each character at least one time.

To match multiple instances of a character in a regular expression, apply a quantifier or a repetition operator. For example, to find a match that starts with the letter `a` and ends with the letter `b`, use the following the regular expression: `^a.*b$`. The asterisk metacharacter repeats the preceding match for any metacharacter (.) zero, one, or more times. If you want to use the like character to define the same pattern, use `a%b` with the percent sign to indicate zero, one, or multiple occurrences of any character.

The following table describes the regular expression metacharacters that you can use with Dynamic Data Masking:

Expression	Description
\t	Indicates a tab character.
\n	Indicates a new line.
.	Matches any character except for new lines.
|	Indicates the expression on the left or right side matches the target string.
[ ]	Defines the enclosed characters that can match the target character. For example, the expression `[ab]` matches the letters a and b. The expression `[0-9]` matches any digit.
[^]	Indicates that the enclosed characters do not match the target character. For example, `[^ab]` matches all characters except "a" and "b." `[^0-9]` matches any character that is not a digit.

Expression	Description
*	Indicates that the character to the left of asterisk in the expression will match zero or more times. For example, `be*` matches "b," "be," and "bee."
+	Indicates that the character to the left of the plus sign matches one or more times. For example, `be+` matches `be` and `bee`, but not `b`.
?	Indicates that the character to the left of question mark in the expression matches zero or one time. For example, `be?` matches `b` and `be`, but not `bee`.
^	Indicates that the expression to the right of `^` matches when `^` is at the beginning of a line. For example, `^A` matches an `A` at the beginning of a line.
$	The expression to the left of `$` matches when `$` is at the end of a line. For example, the expression `e$` matches the letter `e` that is at the end of a line.
( )	Defines tagging and the processing order of expressions.
\	Indicates an escape character. Use double backslashes to view the backslash character.
\Q	Indicates the start of a quoted expression. The parser ignores special characters.
\E	Indicates the end of a quoted expression.
\S	Defines a separator for space, tab, or new line.

Backslashes

Use the backslash character to apply escaped constructs and to quote characters that are interpreted as unescaped constructs. For example, the expression `\\` matches a single backslash, and the expression `\{` matches a left brace.

Java interprets backslashes that are used as string literals as Unicode or character escapes. To prevent the Java byte code compiler from interpreting them, use a double backslash in string literals that use regular expressions.

For example, the string literal `\b` matches a single backspace character when interpreted as a regular expression. However, `\\b` matches a word boundary. The string literal `\(hello\)` is illegal and results in a compile-time error. To match the string "(hello)," use the string literal `\\(hello\\)`.

Note: Do not use a backslash before any alphabetic character that does not denote an escaped construct. Use a backslash before a character if the character is not alphabetic and not part of an unescaped construct.

Character Classes

A character class contains a list of one or more characters. Use the bracket expression to create a character class and to match an expression that has a character in a given space.

You can use metacharacters, such as `-, ^, \, [:...:]`, to perform an advanced search on character classes. Use class shorthands, such as \d, \D, \s, \S, \w, and \W, as shortcuts for character classes.

The following table lists the precedence of character-class operators from highest to lowest:

Priority	Description	Character Class
1	Literal escape	\x
2	Group of characters	[aeiou]
3	Range of characters	[a-z]
4	Union of characters	[a-e][i-u]
5	Intersection of characters	[a-z&&[aeiou]]

Line Terminators

A line terminator is a one or two character sequence that indicates the end of a line for the input character sequence.

The following table describes the characters that you can use as line terminators:

Character	Description
\n	Newline character
\r\n	Carriage return character followed immediately by a new line character
\r	Standalone carriage return character
\u0085	Next line character
\u2028	Line separator character
\u2029	Paragraph separator character

Rules and Guidelines for Line Terminators

Consider the following rules and guidelines when you use a line terminator:

- If the `UNIX_LINES` mode is active, the Rule Engine recognizes the line terminators as new line characters.
- You can specify the `DOTALL` flag to indicate that the period character matches any character except for a line terminator.
- You can use the caret and dollar characters to ignore line terminators and to match the beginning and end of the input sequence.
- If the `MULTLINE` mode is active, the caret characters match the beginning of the input sequence and after any line terminator. The end of the input is not included. The dollar symbol matches before a line terminator and at the end of the input sequence.

Capturing Groups

A capturing group is a method that you can use to group multiple characters inside a set of parenthesis. Count the opening parentheses from left to right to enumerate the capturing group.

In the expression ((A)(B(C))), there are four groups: ((A)(B(C))), (A), (B(C)), and (C). Group zero stands represents the whole expression.

The captured characters in a group are the most recent sub-sequence that the group matched. All captured input is discarded at the beginning of each match. If a group is matched again, the previously captured value is retained if the second evaluation fails. For example, the matching the string "aba" in the expression `(a(b)?)+`changes group two set to `(B)`.

Groups that start with the expression `(?` do not capture text and do not count toward the group total.

Capturing Groups That Rewrite or Search and Replace

You can use line terminators and capturing groups to rewrite or search and replace expressions.

You can use parentheses to enclose tagged expressions to indicate a capturing group. Then, you can use `\0`, `\1`, `\2`, and `\3` to reference tagged expressions. The expression \0 indicates a tagged expression that represents the entire substring that was matched. The expression `\1` denotes the first tagged expression, `\2` is the second expression, and `\3` is the third expression.

The following table describes how you can use capturing groups and line terminators to rewrite or search and replace text:

Original	Search	Replace	Result
abc	(ab)(c)	\0-\1-\2	abc-ab-c
abc	a(b)(c)	\0-\1-\2	abc-b-c
abc	(a)b(c)	\0-\1-\2	abc-a-c

Sample Expressions

To identify strings of text in an incoming SQL request, define regular expression character literals and metacharacters in the Text matcher.

The following table provides examples of regular expressions:

Regular Expression Matching	SQL Text	Description

`invoice \.number`
or
`sqlplus\.exe`
	`SELECT invoice.number FROM invoices`	The `\.` expression defines a period. The period matches any character. The backslash before the period character removes the value of the following character in regular expression.

`.*(customers)\s+.*`	`SELECT customers FROM dual`	The pattern matches statements with the text string `customers`. The expression `.*` indicates that any text can appear before the text string `customers`. The expression `\s+` after `customers` indicates that there must be one or more spaces. The expression `.*` indidcates that any text can follow the spaces.

<table>
<tr><th>Regular Expression Matching</th><th>SQL Text</th><th>Description</th></tr>
<tr><td>`.*\s+(cust)+\s+.*`</td><td>`SELECT CustCustcust FROM dual`</td><td>The pattern matches text strings with one or more `cust` texts.</td></tr>
<tr><td>`.*WHERE.*(\W+TR\w*\s*)((=\s*')|(IN)|(between)|(>)|(,\s*')|(<)|(=\s*DMN_TABLE)).*`</td><td>`SELECT * FROM dual WHERE tr = 'sdf`</td><td>The pattern matches text strings that use nonword characters. A nonword character does not use [a-zA-Z_0-9]). The pattern defines `\W` followed by `TR` and any number of characters or spaces `\w*\s*`.</td></tr>
<tr><td>`create\s+or\s+replace\s+view\s+C\$_C100008J13\s+\s+As\s+select\s+(.*)From\s+OA.S_CAMP_CON\s+S_C,\s+OA.S_ORG_EXT\s+S_O,\s+OA.S_ORG_EXT_X\s+Where\s+(.*)`</td><td>`CREATE or REPLACE VIEW C$_C100008J13 AS SELECT a, b, c, d, e, f FROM OA.S_CAMP_CON S_C, OA.S_ORG_EXT S_O, OA.S_ORG_EXT_X WHERE a=b and c = d`</td><td>The regular expression uses `\s+` to identify one or more spaces or the end of line in the original statement. The expression `C\$_C100008J13\` changes to `C$_C100008J13` because the dollar sign is a special sign in regular expression. If you do not want to use the regular expression version of the dollar sign, you must use the backslash character before the dollar sign.</td></tr>
</table>

Time of Day Matcher

The Time of Day matcher defines a time frame during which the Rule Engine matches statements.

The time format depends on the time zone defined for the operating system. To specify a different time zone, select a time zone from the **Time Zone** parameter.

For example, you can configure the Time of Day matcher to block requests between 6:00 p.m. and 8:00 a.m.

Security Rule Actions

Security rule actions define the masking technique applied to an SQL statement.

When an incoming SQL statement matches the matcher criteria, the Rule Engine applies the rule action that you define for the security rule. The rule action defines the masking technique that the Rule Engine applies to the SQL statement.

To determine how the Rule Engine processes the SQL statement, use the following actions:

- Apply Masking
- Block Statement
- Content Masking
- Custom Transformer
- Define Symbol
- Folder
- Java
- Log Message
- Lookup into Symbol

- Mask
- Masking
- Nothing
- PL/SQL Function
- Process Result
- Replace Table
- Rewrite
- Search and Replace

Apply Masking Action

The Apply Masking action applies the masking actions that you configured to mask the result set of a Microsoft SQL Server stored procedure. Use the Apply Masking action in the mandatory final rule of the rule set that you have configured to mask the result set of a Microsoft SQL Server stored procedure.

For more information, see Chapter 7, "Stored Procedure Result Set Masking" on page 96.

Block Statement Action

The Block Statement action does not allow the SQL request statement to reach the database.

If the Rule Engine applies a Block Statement action, the Dynamic Data Masking service sends an error message to the client or application.

Applications and tools can present the database error message and the Dynamic Data Masking error, which you can use to determine the reason that access is blocked.

Note: If you create a rule that uses the Any matcher and the Block rule action, the application will fail to start and will not return the Block message you specify in the Rule Editor. You can log the internal application SQL requests before you block access to the database with a rule that uses the Nothing rule action followed by a rule that uses the Block rule action. The application will initiate and send the Dynamic Data Masking message to the user before it blocks the request.

The following table describes the Block Statement action parameters:

Parameter	Description
Error message	Defines the error message sent to the client or application when the Rule Engine applies the block statement action.

Content Masking Action

The Content Masking action defines a rule set to process XML data within the result set of a Microsoft SQL Server stored procedure call. Use the Content Masking action when you want to mask XML type data within the result set of a Microsoft SQL Server stored procedure call. The rule set that you specify in the Content Masking action contains a rule or rules that identify the XPath to the XML elements in the stored procedure result set that you want to mask.

For more information, see Chapter 7, "Stored Procedure Result Set Masking" on page 96.

Custom Transformer Action

Use the Custom Transformer action to define a custom masking function for the result set of a Microsoft SQL Server stored procedure call.

The Custom Transformer action has the following parameters:

Class Path

Defines a list of JAR files that contain the Java action class and necessary libraries. Use semicolons to separate multiple JAR files.

Class Name

Defines the fully qualified class name. The class must implement the following interface: `com.activebase.content.mask.transformer.CustomTransformer`. The class must also provide an implementation for the following method: `public Object transform(Object originalValue, ContentProcessor cp, ProtectionAction pa).`

For more information, see Chapter 7, "Stored Procedure Result Set Masking" on page 96.

Define Symbol Action

Use the Define Symbol action to define symbols and set the symbol value.

You can define multiple symbols with the Define Symbol action. Symbol values can contain symbols that you previously defined.

To define a global symbol, enter Yes in the **Keep Per Session** field. A global symbol lasts throughout the client session and exists until the client disconnects from the database.

If you do not want the symbol to be a global symbol, enter No in the **Keep Per Session** field. If you enter No in the **Keep Per Session** field, the symbol exists only during the SQL request. To use the symbol value in the subsequent rules in the security rule set, select the Continue processing action. The Rule Engine continues to the next rule and uses the symbol replacements.

If you want to define a symbol value based on a symbol that you previously defined, use the expression `\(Symbol_name)` to call the symbol value.

The following table describes the Define Symbol action parameters:

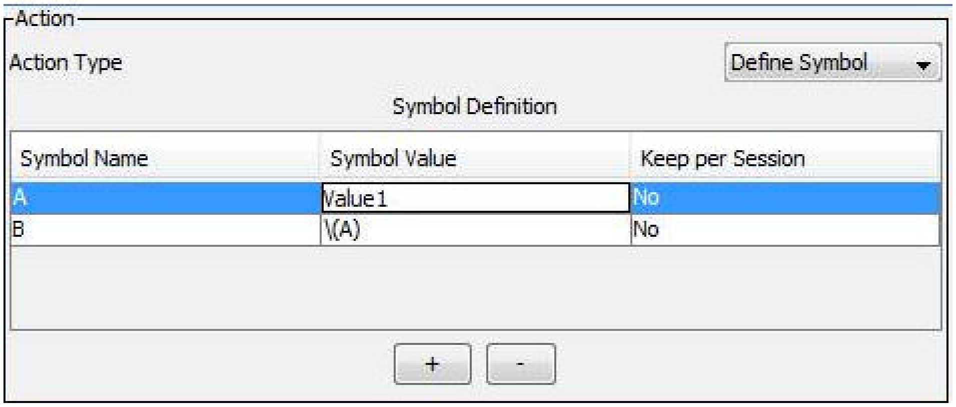
Parameter	Description
Symbol Name	The name of the symbol. The symbol name must begin with a letter and can contain ASCII characters, numbers, and underscores.
Symbol Value	The value of the symbol.
Keep Per Session	Defines whether the symbol is a global symbol. You can enter the following Keep Per Session values: - Yes. The symbol exists during the client session. - No. The symbol exists during the SQL request.

Defining Multiple Symbols

You can define symbols based on another symbol that you define in the same rule or a symbol that you defined in a previous rule.

To define a symbol based on another symbol in the same rule, use the expression `\(Symbol_name)` to call the symbol value in a subsequent row.

The following image shows a rule that defines two symbols:



Action Type: Define Symbol

Symbol Definition

Symbol Name	Symbol Value	Keep per Session
A	Value1	No
B	\(A)	No

In the image, the value of symbol A is set to Value1. Because symbol B calls the value of symbol A, the value of symbol B is also set to Value1.

However, if you reverse the order of the rows in the rule, symbol A is not defined when the value of symbol B is set, and symbol B has a null value.

Folder Action

The Folder rule action creates a folder in the rule tree. Use folders to nest and group rules.

For example, you can create a folder to group rules for a group of users or for an application. Use folders to manage rules and improve rule readability.

Java Action

The Java action runs a Java class that returns a string. The string value is an SQL statement that replaces the original SQL statement from the client request.

The Java class must contain a public static method with the following signature:

```
public static String execute(RuleContext ctx)
```

You must enter the correct class in the Class Path field of the Java action. The Rule Engine reads every rule in the rule set and returns an error if the class path is incorrect, even if the rule is disabled.

When an error occurs with the Java class, the Rule Engine does not apply the rule. Instead, the Rule Engine continues to the next rule. The Rule Engine logs a detailed error message in the following file:

```
<Dynamic Data Masking installation>\log\DDMError.txt
```

The Java action has the following parameters:

Class Path

Defines a list of JAR files that contain the Java action class and necessary libraries. Use semicolons to separate multiple JAR files.

Class Name

Defines the fully qualified class name. The class may be built within a named package or an unnamed package. The class must include a method named `execute` with the following signature: `public static String execute(RuleContext ctx).`

The `RuleContext` object contains data from the Rule Engine. The `RuleContext` object has one method, `public String getSymbol(String symbol);`, that returns the symbol value from the symbol name. Use this method to retrieve symbol values defined by a Symbol rule action. Specify the name of the symbol as an argument to the method.

You can also use the following predefined symbols:

RuleContext.USERNAME

Retrieves the Oracle user name.

RuleContext.OS_USER

Retrieves the operating system user on the client machine.

RuleContext.CLIENT_HOST

Retrieves the name of the client machine.

RuleContext.PROGRAM

Retrieves the program name on the client machine.

RuleContext.STATEMENT

Retrieves the statement being processed.

Note: The Rule Engine runs the Java class with the JVM that Dynamic Data Masking uses. You can compile the Java action class with a JDK of the same major version or lower version of the JVM that Dynamic Data Masking uses.

Java Class Example

The following text is an example of a Java class. The Java action runs the execute method.

```
import com.activebase.rule.*;
public class ExampleJA {
    public static String execute(RuleContext ctx) {
        return "select 'OK' from dual";
    }
    public static boolean match(RuleContext ctx) {
        String user = ctx.getSymbol(RuleContext.USERNAME).toUpperCase();
        if ("SCOTT".equals(user)) {
            return true;
        }
        return false;
    }
```

Log Message Action

The Log Message action logs the security rule event.

You can use the Log Message rule action with loggers that you create in the Management Console tree. When you create the security rule, you include the name of the logger. The logger creates output based on its appenders.

The Send As property defines the severity of the event. The severity corresponds to the Log Level property that you set in the Dynamic Data Masking Management Console. If the Send As property is an equal or greater severity than the Log Level property, the logger logs the event. If the Send As property is a lower severity than the Log Level property, the logger does not log the event.

Note: Do not use system loggers with the Log Message rule action because you might not be able to perform log analysis on the logs if they contain information from security rules.

The following table describes the Log Message action parameters:

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Logger Name</td><td>The name of the logger. The logger name corresponds to a logger in the Management Console tree.</td></tr>
<tr><td>Send As</td><td>The severity of the event.
You can choose one of the following severities:
- Information
- Warning
- Error</td></tr>
<tr><td>Logger Message</td><td>A message to write to the log. You can enter text or a regular expression logger message.
If you are sending user activity to Secure@Source, the Logger Message must be in CEF format so Secure@Source can read the data and monitor the activity. For example:<pre>
CEF: 0|Informatica Inc.|DDM|\(DDM_VERSION)|Audit|Audit.DAM|Informative|dst=
\(AUTH_DATABASE_IP) duser=\(AUTH_USERNAME) src=\(CLIENT_IP) rt=
\(AUTH_STATEMENT_RECEIVED_TIME) cs1=\(AUTH_DATABASE_NAME)
 cs1Label=Database cs2=0 cs2Label=AffectedRows cs3=
\(AUTH_ORIG_STATEMENT) cs3Label=ParsedQuery cs4=
\(AUTH_PROGRAM_NM) cs4Label=ApplicationName
</pre></td></tr>
</table>

Lookup into Symbol Action

The Lookup into Symbol action calls a PL/SQL function or Java function with or without input parameters and returns a value for the defined symbol name. You can use the defined symbol name in the next rules for processing.

Use the Lookup into Symbol action when user access to data is based on other data elements in the database or an external system.

For example, a database might map a user name to a team name, a team name to a subject area, and a subject area to table names. If a user has access to the table name, you want to allow the query. Otherwise, you want to block the query. You can use the Lookup into Symbol action to implement a PL/SQL function to determine whether the user has access to the table name and return the result into a defined symbol name.

To define a global symbol, select the **Keep Per Session** check box. A global symbol lasts throughout the client session and exists until the client disconnects from the database.

If you do not want the symbol to be a global symbol, clear the **Keep Per Session** check box. If you clear the **Keep Per Session** check box, the symbol exists only during the SQL request.

The Lookup into Symbol action supports the following lookup types:

Java

The Java lookup type runs a Java class that returns the value for the defined symbol name.

PL/SQL Function

The PL/SQL lookup type runs a PL/SQL function that returns the value for the defined symbol name.

Java Lookup

The Java lookup runs a Java class that returns the value for the defined symbol name.

The following table describes the Java lookup parameters:

Parameter	Description
Symbol Name	The name of the symbol to be populated. The symbol name must begin with a letter and can contain ASCII characters, numbers, and underscores.
Keep Per Session	Defines whether the symbol is a global symbol. Select if you want to define a global symbol. A global symbol exists until the client disconnects from the database. If you clear the **Keep Per Session** check box, the symbol exists only during the SQL request.
Lookup Type	The type of lookup. When you select Java, the **Java Class** and **Class Path** fields appear.
Java Class	The name of the Java class to use for the lookup. The Java class must contain a public static method with the following signature: `public static String lookup(RuleContext ctx)` Dynamic Data Masking runs the `lookup(RuleContext)` function in the Java class that returns the value for the defined symbol name.
Class Path	The path of the JAR file that contains the Java class.

PL/SQL Function Lookup

The PL/SQL lookup type runs a PL/SQL function that returns the value for the defined symbol name.

The following table describes the PL/SQL function lookup parameters:

Parameter	Description
Symbol Name	The name of the symbol to be populated. The symbol name must begin with a letter and can contain ASCII characters, numbers, and underscores.
Keep Per Session	Defines whether the symbol is a global symbol. Select if you want to define a global symbol. A global symbol exists until the client disconnects from the database. If you clear the **Keep Per Session** check box, the symbol exists only during the SQL request.
Lookup Type	The type of lookup. When you select **PL/SQL Function**, the applicable fields appear.
Database	The Dynamic Data Masking database name where the lookup function runs. The database can be any db node available in Dynamic Data Masking server.
Function Name	The fully qualified name of the PL/SQL function. For example, `HR.dbo.get_lookup_for user`.
Include Database Username	Select if the function uses a database user name parameter. The database username parameter defines the user for the session.
Include OS User	Select if the function uses an operating system user parameter. The operating system user parameter defines the user name for the user logged in to the operating system.

Parameter	**Description**
Include Client Host	Select if the function uses a client host parameter. The client host parameter defines the client host name or IP address.
Include Program Name	Select if the function uses a program name parameter. The program name defines the application or program name.
Include Statement	Select if the function uses a statement parameter. The statement parameter defines the SQL statement text. You must define the statement in VARCHAR.
Include Text Value	Select if the function uses a text value parameter.
Value to Use	If you selected **Include Text Value**, enter a text value parameter. You can use text or a global symbol to define the text value.

Mask Action

The Mask action rewrites the SELECT request. The Mask action uses a masking function to define how the Rule Engine rewrites the SELECT request.

The Rule Engine uses regular expression matching to verify whether the SQL statement contains sensitive object names. If a table name match occurs, the Rule Engine parses the SQL statement to identify select lists, which include the columns, aliases, objects, and inline queries. Based on the column names, objects, and mask functions you specify in the masking rule, Dynamic Data Masking rewrites the incoming SELECT request and changes the select list accordingly.

For masking functions, use the `\(col)` and `\(alias)` regular expressions to identify columns. For example, if you want to mask all columns that include a Social Security number, you can identify columns that you want to mask as `.*SSN.*`. The Mask rule action can include different column names, but you must define the Mask rule action only once. The Mask rule action might be `substring(\(col),1,2)||'xxxx').`

The following table describes the Mask action parameters:

Parameter	**Description**
Table name	Defines the table name used in the statement request.
Column name	Defines the column name used in the statement request.
Masking function	Defines how the Rule Engine masks the select list. Use SQL functions to define the masking function.
Keep original number of rows	Preserves the original number of rows in the masked output. Select **Keep original number of rows** if the query contains the DISTINCT operator or a GROUP BY, HAVING, or ORDER BY clause and you want the output to contain the same number of rows as the original data set. Default is unchecked and the original number of rows is not preserved.

Keep Original Number of Rows Example

The following example shows possible outputs with and without the **Keep original number of rows** check box selected.

You have a data set that contains first name values:

FIRST_NAME	CONT(*)
LYNN	1
CYNTHIA	1
KEVIN	1
LESLIE	1
JOHN	1
JEAN	1

You create a masking rule with the following values in the Mask rule action:

Table Name	Column Name	Masking Function
.*EMPLOYEE.*	.*NAME.*	substr(\(col),1,2)||'****'

You send a SELECT query to the database:

```
SELECT FIRST_NAME,count(*) from EMPLOYEE group by FIRST_NAME
```

The following data set is an example of masked data that Dynamic Data Masking might return if you do not select the **Keep original number of rows** check box:

FIRST_NAME	CONT(*)
J****	2
K****	1
L****	2
C****	1

The masked output does not have the same number of rows as the original data set.

The following data set is an example of masked data that Dynamic Data Masking returns if you select the **Keep original number of rows** check box:

FIRST_NAME	CONT(*)
L****	1
C****	1

FIRST_NAME	CONT(*)
K****	1
L****	1
J****	1
J****	1

The masked output has the same number of rows as the original data set.

Masking an SQL Batch

If you use Dynamic Data Masking with a Sybase or Microsoft SQL Server database, you can mask an SQL batch.

Dynamic Data Masking masks the following SQL batch use cases:

- SQL batch without a delimiter.
  For example:
  ```
  select * from account
  select  * from employee
  ```
- SQL batch with a delimiter.
  For example:
  ```
  select * from account;
  select  * from employee;
  ```
- SQL batch that contains an IF ... ELSE block.
  For example:
  ```
  if (select 123) < 7000
   select * from EMPLOYEE where EMPLOYEE_ID = 15120
  else
   select EMPLOYEE_ID from EMPLOYEE
  ```
- SQL batch that contains an IF ... ELSE block and a BEGIN ... END statement.
  For example:
  ```
  if (select EMPLOYEE_ID from employee where EMPLOYEE_ID=123) < 7000
  BEGIN
   select *  from account;
   END
  else
   BEGIN
    select *  from employee;
   END
  ```
- SQL batch that contains an IF EXISTS or IF NOT EXISTS statement.
  For example:
  ```
  select * from employee
  select top 2 * from employee
  select a.Last_name  as name from employee a

  select distinct a.first_name as name
  from employee a inner join employee b on a.first_name=b.first_name

  if exists (select  distinct (last_name) from employee where last_name = 'SMITH')
  select top 3 a.last_name as name
  from employee a left outer join employee b on a.last_name=b.last_name
  ```

```
select last_name from employee group by last_name
```

- SQL batch that contains an IF EXISTS or IF NOT EXISTS statement and a BEGIN ... END statement.
  For example:

  ```
  if exists (select distinct (empid) from employee where empid = 101)
  BEGIN
  select * from employee
  select * from account
  END
  ```

- SQL batch that contains a GO statement.
  For example:

  ```
  select * from account
  select  * from employee
  GO
  select * from account
  ```

- SQL batch that contains a GO statement with an argument.
  For example:

  ```
  select * from account
  select  * from employee
  GO 3
  ```

Dynamic Data Masking does not mask the following SQL batch use cases:

- SQL batch that contains an anonymous SQL block.
  For example:

  ```
  BEGIN
  select * from employee
  select * from account
  END
  ```

- SQL batch that declares a stored procedure.
  For example:

  ```
  Create procedure SP1 as
  select * from employee
  ```

- SQL batch that contains a SET command.
  For example:

  ```
  SET QUOTED_IDENTIFIER OFF
  select * from employee
  ```

- SQL batch that contains a USE command.
  For example:

  ```
  USE DDM
  select * from employee
  ```

- SQL batch that declares a statement.
  For example:

  ```
  DECLARE       @return_value int
  SET    @return_value = 101
  SELECT * FROM EMPLOYEE where EMPID = @return_value
  ```

- SQL batch that calls a stored procedure.
  For example:

  ```
  select * from employee
  EXEC SP1 10,20
  select * from account
  ```

Using a Fully Qualified Table Name in Mask Action

You can use a fully qualified table name in the Table Name field of a Mask action.

The following table shows the regular expression to use based on the database and the value in the Table Name column.

If Database is...	And Table Name Contains...	Use this format for the Regular Expression
Oracle	schemaName.tableName	`(\")?<SchemaName>(\")?(\s)*(\.)(\s)*(\")?<TableName>(\")?(\s)*`
	schemaName.tableName with DBlink	`(\")?<SchemaName>(\")?(\s)*(\.)(\s)*(\")?<TableName>(\")?(\s)*(\@)(\s)*(\")?<DBLink>(\")?(\s)*`
	tableName with DBlink	`(\")?<TableName>(\")?(\s)*(\@)(\s)*(\")?<DBLink>(\")?(\s)*`

Microsoft SQL Server	schemaName.tableName	`(\")?<SchemaName>(\")?(\s)*(\.)(\s)*(\")?<TableName>(\")?(\s)*`
		If the object in the user query is enclosed by square brackets as in [schemaName].[tablename], use the following format:
		`(\[)?<SchemaName>(\])?(\s)*(\.)(\s)*(\[)?<TableName>(\])?(\s)*`

	Database.schemaName.tableName	`(\")?< Database Name>(\")?(\s)*(\.) (\")?<SchemaName>(\")?(\s)*(\.)(\s)*(\")?<TableName>(\")?(\s)*`
	LinkedServer.Database.schemaName.tableName	`(\")?< LinkedServer Name>(\")?(\s)*(\.) (\")?< Database Name>(\")?(\s)*(\.) (\")?<SchemaName>(\")?(\s)*(\.)(\s)*(\")?<TableName>(\")?(\s)*`
Teradata	schemaName.tableName	`(\")?<SchemaName>(\")?(\s)*(\.)(\s)*(\")?<TableName>(\")?(\s)*`

Hive	schemaName.tableName	`(\")?<SchemaName>(\")?(\s)*(\.)(\s)*(\")?<TableName>(\")?(\s)*`
		If the object in the user query is enclosed by a back quote as in 'schemaName'.'tablename' use the following format:
		`` (\`)?<SchemaName>(\`)?(\s)*(\.)(\s)*(\`)?<TableName>(\`)?(\s)* ``

When the statement contains the same table name from different schema names, use the following Mask action rules:

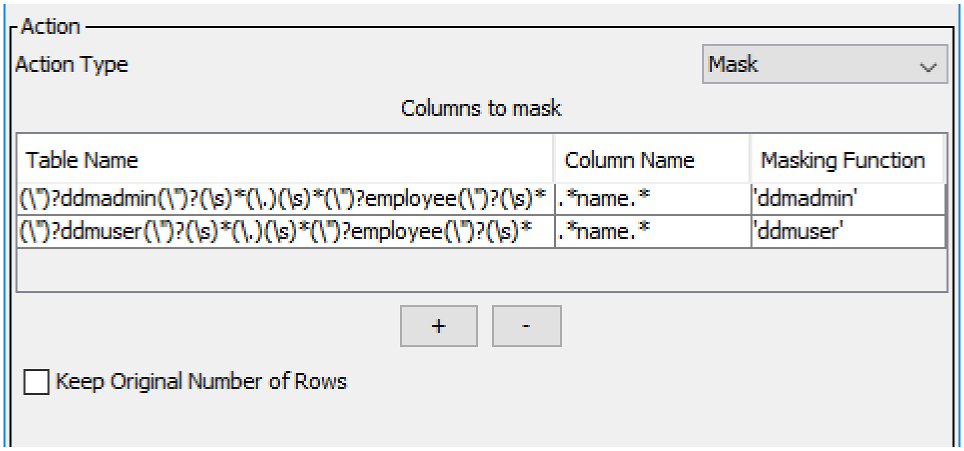
When all references are fully qualified.

Example:

```
select da.first_name,du.first_name
from ddmadmin.employee da, ddmuser.employee du
```

Mask action rule for the **Table Name** field:

Enter a fully qualified table name for each table candidate you want to mask.



Action

Action Type: Mask

Columns to mask

Table Name	Column Name	Masking Function
(\")?ddmadmin(\")?(\s)*(\.)(\s)*(\")?employee(\")?(\s)*	.*name.*	'ddmadmin'
(\")?ddmuser(\")?(\s)*(\.)(\s)*(\")?employee(\")?(\s)*	.*name.*	'ddmuser'

☐ Keep Original Number of Rows

When all references from non-current schemas are fully qualified, but the reference to the current schema is not fully qualified.

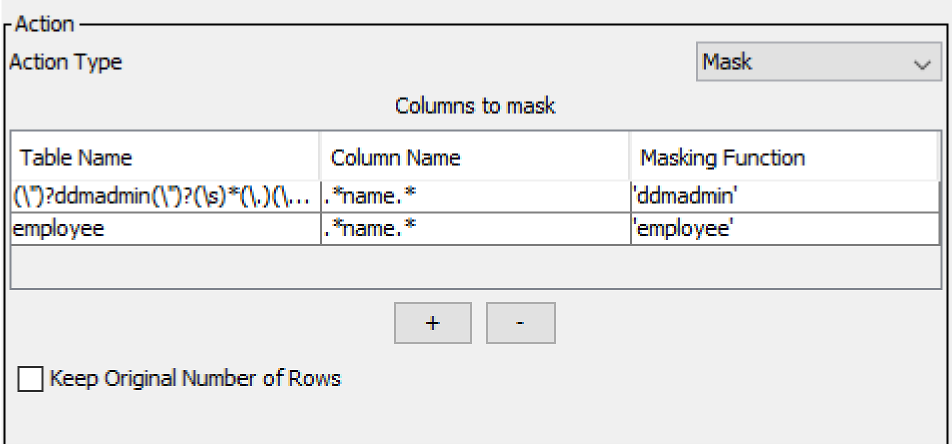
Example where the current schema is `ddmuser`:

```
select da.first_name,du.first_name
from ddmadmin.employee da, employee du
```

Mask action rules for the **Table Name** field:

- Enter a fully qualified table name for each table with a qualified table name in the statement.
- Enter a schema for tables that do not have a fully qualified name in the statement.
- Define the tables with a fully qualified name first. Then define the tables that do not have a fully qualified name.

The following image shows the recommended Mask action rules:



Action

Action Type: Mask

Columns to mask

Table Name	Column Name	Masking Function
(\")?ddmadmin(\")?(\s)*(\.)(\...	.*name.*	'ddmadmin'
employee	.*name.*	'employee'

☐ Keep Original Number of Rows

Masking Action

The Masking action specifies how the Rule Engine masks the result set of a Microsoft SQL Server stored procedure call. You select the type of data in the result set column that you want to mask. Supported types are string, number, or date. You also select the type of masking and configure the relevant parameters.

The following table describes the Masking action parameters:

Parameter	Description
Data Type	Type of data within the result set column that you want to mask. Select string, number, or date.
Masking Type	Type of masking that the Rule Engine applies to the result set data. For string and number data types, you can select pattern masking, redaction, or constant. - Pattern masking allows you to mask part of the data while leaving characters at the beginning or end of the string unmasked. Pattern masking does not preserve the length of the actual data. Configure the following properties for pattern masking: - Exposed Prefix. The number of characters at the beginning of the string that you want to be unmasked. - Value. The string that replaces the masked data. - Exposed Suffix. The number of characters at the end of the string that you want to be unmasked. - Redaction is similar to pattern masking, but preserves the original data length. Configure the following properties for redaction masking: - Exposed prefix. The number of characters at the beginning of the string that you want to be unmasked. - Value. The character that you want to replace the masked characters. - Exposed suffix. The number of characters at the end of the string that you want to be unmasked. - Constant masking replaces data with the exact string that you define. For date data types, you can select only the constant masking type. When you select constant masking for a date data type, you configure the Value parameter as the text that you want to return after masking is applied. For example, you can enter 01-01-2000 as the value and Dynamic Data Masking returns all of the matched date values as 01-01-2000. You must also configure the Date Format parameter. The Date Format parameter tells Dynamic Data Masking the format of the value you have entered. For example, DD:MM:YYYY. If the Value parameter contains a time, you must also include the time in the Date Format parameter. For example, if the Value parameter is 01-01-1970 01.10.12.888, configure the Date Format parameter as DD-MM-YYYY HH:mm:ss:SSS. Valid date formats are Java-supported date formats.

For more information, see Chapter 7, “Stored Procedure Result Set Masking” on page 96.

Nothing Action

The Nothing rule action does not apply an operation on the processed SQL request.

You can use the Nothing action to audit the SQL request by selecting Log When Rule is Applied.

If Dynamic Data Masking does not need to process data manipulation language commands, you can use the Nothing action to make SQL requests bypass rule processing sections. For example, you can create a rule tree in which the first rule identifies SQL requests with data manipulation language commands. In the rule, select the Nothing rule action and the Stop if Applied processing action. Dynamic Data Masking sends SQL requests with data manipulation language commands to the database instead of to the next rule in the tree.

For example, if you do not want to mask data manipulation language commands for a specific table, apply the Nothing action to data manipulation language commands. When the Rule Engine applies the rule to a request statement that uses data manipulation language commands, the Rule Engine does not mask the statement.

PL/SQL Function Action

The PL/SQL Function rule action replaces an incoming request with a valid query that Dynamic Data Masking sends to the database for execution.

When you use the PL/SQL Function action, you enter the name or the name and path of the function. You must include the path if the stored object is not in the client schema or catalog, depending on the database. On an IBM Db2 database, you must include the path if the stored object is not in the path that is returned by the following statement from the Dynamic Data Masking administrator:

```
SELECT CURRENT_PATH FROM SYSIBM.SYSDUMMY1
```

Select the parameters that the function uses. The Rule Engine returns an error if you do not select the correct parameters for the function. You can view the rule.log file or use the Security Rule Set Simulator to verify that you selected the correct parameters.

The PL/SQL Function rule action has the following properties:

Function Name

Enter the name and full path of the PL/SQL function. For example, you might enter `HR.dbo.get_employees_masked`.

Include Database Username

Select if the function uses a database user name parameter. The database username parameter defines the user for the session.

Include OS User

Select if the function uses an operating system user parameter. The operating system user parameter defines the user name for the user logged in to the operating system.

Include Client Host

Select if the function uses a client host parameter. The client host parameter defines the client host name or IP address.

Include Program Name

Select if the function uses a program name parameter. The program name defines the application or program name.

Include Statement

Select if the function uses a statement parameter. The statement parameter defines the SQL statement text. You must define the statement in VARCHAR.

Include SessionID

Select if the function uses a session ID parameter. The session ID parameter defines the session ID of the client.

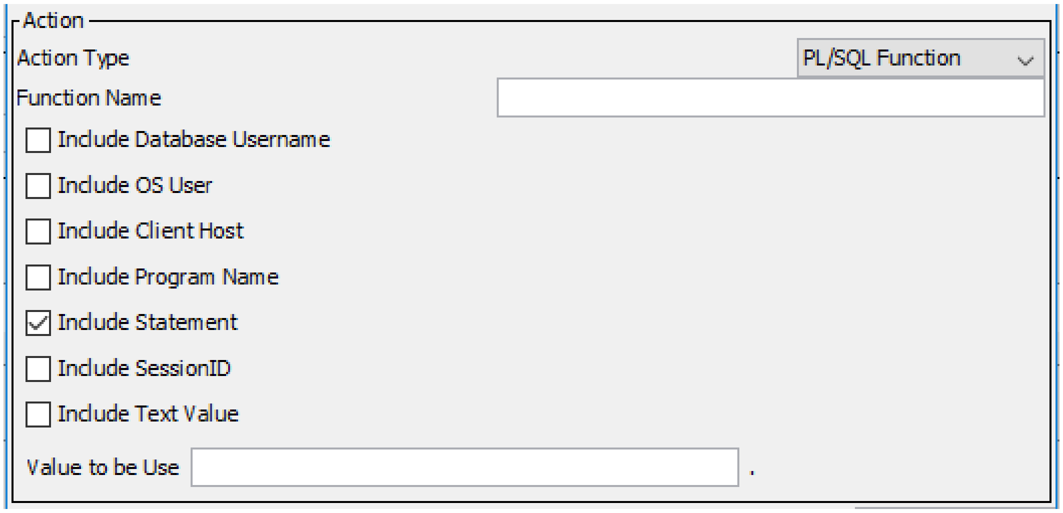
Include Text Value

Select if the function uses a text value parameter.

Value to Use

Enter a text value parameter if you selected the Include Text Value property. You can use text or a global symbol to define the text value.

The following image shows the PL/SQL Function rule action properties:



Action

Action Type: PL/SQL Function

Function Name

☐ Include Database Username

☐ Include OS User

☐ Include Client Host

☐ Include Program Name

☑ Include Statement

☐ Include SessionID

☐ Include Text Value

Value to be Use

Process Result Action

In Microsoft SQL Server stored procedure result set masking, the Process Result action defines the rule set that processes the result set. Use the Process Result action to specify the name of the rule set that the Rule Engine applies.

Since the Process Result action is applied on the SQL query, you can use any existing matcher that is applicable to the SQL query in conjunction with the Process Result action. The most common matchers that you can use with the Process Result action are the Procedure Call matcher or the Text matcher with a regular expression to match the stored procedure.

For more information, see Chapter 7, “Stored Procedure Result Set Masking” on page 96.

Replace Table Action

The Replace Table rule action removes rows that contain sensitive data from the result set.

You can use the Replace Table action to change the FROM clause of the original SQL statement to provide row-level security. You can replace the table reference with a table reference or subquery that you define in the Alternative Object or Query field.

The Alternative Object or Query filed can contain global symbols or the Replace Table rule action symbols. You can define global symbols in other security rules that you wan to use in the Replace Table rule action.

The Replace Table rule action symbols relate to the current SQL statement FROM clause. Use the \(prefix), \(tableOnly), and \(table) symbols to specify that you want to preserve the table name, preserve the path, or replace the path and the table name.

The following table describes the Replace Table action parameters:

Parameter	Description
Table Name	A regular expression that represents the database object names that you want to replace.
Alternative Object or Query	The object name or query that you want to replace the original table name.

Replace Table Action Symbols

You can use symbols to specify which part of the SQL statement you want to replace.

Use the \(table), \(prefix), and \(tableOnly) symbols in the Alternative Object or Query field to replace part or all of the FROM clause of the current SQL request.

The following table describes the Replace Table action symbols:

Symbol	Description
\(table)	Replaces the full object reference in the original SQL statement with the Table Name parameter value.
\(prefix)	Replaces the prefix of the object reference, including the separator, with the Table Name parameter value.
\(tableOnly)	Replaces the table name with the Table Name parameter value, but preserves the path.

For example, you want to use symbols to alter the following statement:

```
SELECT * FROM [HR].[DBO].employee
```

The following table describes which parts of the SQL statement the symbols replace:

Symbol	Replaced Value
\(table)	[HR].[DBO].employee
\(prefix)	[HR].[DBO].
\(tableOnly)	employee

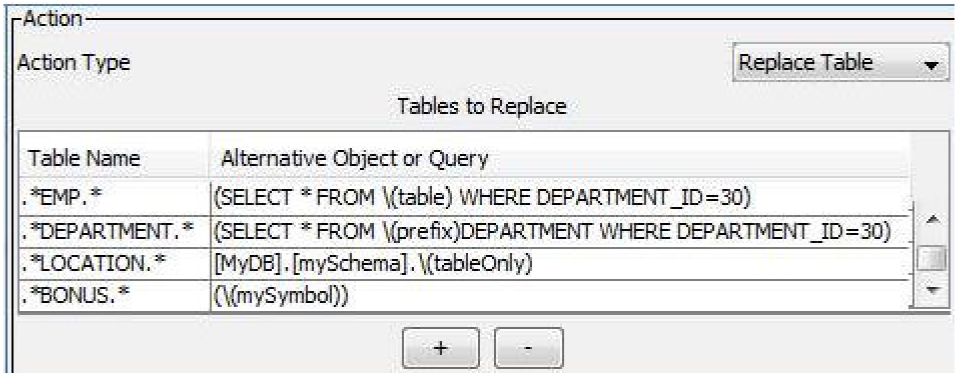
Replace Table Example

You want to use the Replace Table rule action to mask a variety of SQL requests.

You want to mask incoming requests to the EMP, DEPARTMENT, and LOCATION tables. In a previous security rule, you defined the global symbol (\mySymbol) with the following value:

```
SELECT * FROM BONUS WHERE ENAME LIKE 'S%'
```

The following figure shows the Replace Table rule action parameters that you define:



Action

Action Type: Replace Table

Tables to Replace

Table Name	Alternative Object or Query
.*EMP.*	(SELECT * FROM \(table) WHERE DEPARTMENT_ID=30)
.*DEPARTMENT.*	(SELECT * FROM \(prefix)DEPARTMENT WHERE DEPARTMENT_ID=30)
.*LOCATION.*	[MyDB].[mySchema].\(tableOnly)
.*BONUS.*	(\(mySymbol))

The following table describes sample SQL requests and how Dynamic Data Masking alters the requests based on the Replace Table rule action parameters:

Original Statement	Replaced Statement
SELECT * FROM [HR].[DBO].employee	SELECT * FROM ((SELECT * FROM "HR"."DBO"."EMPLOYEE" WHERE DEPARTMENT_ID=30)) "EMPLOYEE"
SELECT * FROM [HR]..EMP1	SELECT * FROM ((SELECT * FROM "HR".."EMP1" WHERE DEPARTMENT_ID=30)) "EMP1"
SELECT * FROM [HR].[DBO].Department	SELECT * FROM ((SELECT * FROM "HR"."DBO".DEPARTMENT WHERE DEPARTMENT_ID=30)) "DEPARTMENT"
SELECT * FROM Department	SELECT * FROM ((SELECT * FROM DEPARTMENT WHERE DEPARTMENT_ID=30)) "DEPARTMENT"
select * from [hr].[dbo].location	select * from [MyDB].[mySchema]."LOCATION" "LOCATION"
select * from location	select * from [MyDB].[mySchema]."LOCATION" "LOCATION"
SELECT * FROM BONUS	SELECT * FROM (SELECT * FROM BONUS WHERE ENAME LIKE ‘S%’) “BONUS”

Rewrite Action

The Rewrite action replaces the SQL statement with an alternate statement. You can rewrite any type of SQL request, including data manipulation language commands, DIGITAL Command Language commands, and data definition language commands.

You can use symbols and reference bind variables to rewrite predicates in the incoming SQL statement.

If you want to use a symbol value to rewrite all or part of the SQL statement, use the expression `\(Symbol_name)` in the Alternate Statement field.

The following table describes the Rewrite action parameters:

Parameter	Description
Alternate statement	Defines the SQL statement that the Rule Engine uses to rewrite the original SQL statement.

Rewriting Statements With Bind Variables

Use bind variable naming conventions to rewrite incoming statements.

The Rule Engine identifies the values in the positions specified by bind variables in the incoming statement. You must enter the same bind variable names in the predicate of the rewrite statement. The Rule Engine identifies the values in the incoming statement and rewrites the statement with the inserted values.

Search and Replace Action

The Search and Replace action searches for specific text within a statement request and replaces it with the text that you define in the replacement string.

You can use symbols to rewrite predicates in the incoming SQL statement.

The following table describes the Search and Replace action parameters:

Parameter	Description
Search Text	Defines the search text. Enter the search text by using a string, wildcard, or regular expression.
Replacement String	Defines the replacement text. Enter string values or symbols for the replacement text.

Processing Actions

A processing action defines what the Dynamic Data Masking service does after the rule action has been performed. In the **Edit Rule** window, the processing action is referred to as Whenever this Rule is Matched.

The following table describes the processing actions after an SQL request is matched by a rule:

Processing Rule Action	Description
Continue	The Rule Engine continues to the next rule in the rule tree. **Note:** Assign the Continue processing action to rule folders so that the Rule Engine applies the rules within the rule folder.
Stop if Applied	If the rule is applied, the Rule Engine does not continue to the next rule in the rule tree. The SQL request is sent to the database for execution.
Stop if Matched	If the rule is matched, the Rule Engine does not continue to the next rule in the rule tree. The SQL request is sent to the database for execution.

Creating a Security Rule

Create a security rule to define the criteria that the Rule Engine uses to parse an SQL request. To create a security rule, configure a matcher, action, and processing action.

Use the following high-level steps to create a security rule. The steps vary based on the types of matcher methods and actions that the rule uses.

1. In the Management Console, click the security rule set that you want to add the rule to.
2. Select **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.
3. Click **Action** > **Append Rule**.

   The **Append Rule** window appears.
4. Enter a name for the rule in the **Rule Name** field.
5. Enter an optional description for the rule.
6. Select a matcher type and define the matching criteria.
7. Select **Keep matcher result** to store the result if a match occurs.
8. Choose a rule action and define the rule action criteria.

9. Choose a rule processing action.
10. Select **Log when rule is applied** to log the rule information in the rule log.
11. Click **OK**.

    The rule appears in the rule tree.
12. Select **File** > **Update Rules** to save the rule in the rule tree.

Security Rule Export and Import

Export security rules within security rule folders. You can save security rule configurations in an XML file. You can import XML files to use saved security rule configurations.

Security Rule Export

You can export a security rule folder to an XML file to back up security rule definitions. Make a copy of a rule folder for complex rule configurations that you want to reuse. Use the export utility to make a copy of a rule folder and import the copy to the security rule tree.

An exported file contains the security rules and the security rule components, such as the security rule matchers, security rule actions, and security rule processing actions. You must export security rules within a folder. You must export security rules inside a security rule folder or security rule set. To export a single security rule, create a folder that contains only the security rule.

Exporting Security Rules

Use the Management Console to export security rules within a security rule folder.

1. In the Management Console, click **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.
2. Click the security rule folder that you want to export.
3. Click **Action** > **Export**.

   The **Export** window appears.
4. Browse to a location to save the export file.
5. Enter a name for the export file.
6. Click **Export.**

Security Rule Import

When you import a security rule file, you import the security rules and the security rule components that the file defines. The security rule components include matchers, actions, and processing actions. You can import security rules into an empty rule folder or to the top of the security rule tree. After you import the security rules, update the rule tree.

Before you import security rules, you must create an empty rule folder in the security rule tree. If you import into a rule folder that is not empty, the imported rules override the rules in the rule folder.

If you choose to import the security rules to the top of the security rule tree, the contents of the imported file overrides the existing rules in the rule tree. The existing rules are deleted.

Importing Security Rules

Import security rules through the Management Console.

1. In the Management Console, click **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.

2. Click an empty rule folder or the top of the rule tree. Rules that you import appear in the location that you choose.
3. Click **Action** > **Import**.

   The **Import** window appears.

4. Browse to the location of the XML file that defines the security rules that you want to import and double-click the file.
5. Select the file and click **Import**.

   The rule tree displays the security rules.

6. Select **File** > **Update Rules**.

   The rule tree is updated.

Security Rule Set Export and Import

Export security rule sets within the Management Console. You can save security rule set configurations in an XML file. You can import XML files to use saved security rule set configurations.

Security Rule Set Export

You can export a security rule set to an XML file to back up security rule definitions. Additionally, you can use the export utility to make a copy of a rule set and import the copy to the security rule tree. You might want to make a copy if you have a complex rule set structure that you want to reuse. Exported security rule sets retain the tree rule structure.

An exported file contains the components of a security rule set, such as the rule folders, security rule matchers, actions, and processing actions for each rule in the rule set.

Exporting Security Rule Sets

Use the Management Console to export security rule sets.

1. In the Management Console, click the security rule set that you want to export.
2. Click **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.

3. Click the rule set name at the top of the rule tree.
4. Click **Action** > **Export**.

   The **Export** window appears.

5. Browse to the location where you want to save the rule set.
6. Enter a name for the exported file.
7. Click **Export.**

Security Rule Set Import

You can import a security rule set into the rule tree or into a rule folder. When you import a rule set, the rule tree displays the original structure of the rule set. After you import the security rules, save and update the rule set to the rule tree.

Before you import a security rule set, create an empty security rule set in the rule tree. Rules that you import appear in this rule set. If you import security rules into a rule set that is not empty, the imported rule set overrides the existing rule set.

You can also import a rule set into a rule folder that is part of an existing rule set.

Importing Security Rule Sets

Import security rule sets through the Management Console.

1. In the Management Console, click the rule set to which you want to add the imported rule set.
2. Click **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.
3. Click the rule set name at the top of the rule tree to import the rule set directly into the security rule tree. Or click a rule folder to import the rule set into a rule folder.
4. Click **Action** > **Import**.

   The **Import** window appears.
5. Browse to the location of the XML file that contains the rule set and double-click it.

   The rules appear in the security rule tree.
6. Select **File** > **Update Rules**.

   The rule tree is updated.

CHAPTER 5

Security Rule Set Simulator

This chapter includes the following topics:

Security Rule Set Simulator Overview

Use the Security Rule Set Simulator to test security rules and regular expressions within the Management Console.

Access the Security Rule Set Simulator through the Rule Editor. Within the Security Rule Set Simulator, you select a database, enter database user information, define symbols, and enter an SQL statement that you want to use to test the rule. The simulator displays log output that you review to verify whether you created the security rule correctly. If you want to view detailed log information, you can run the simulator in debug mode.

Running the Security Rule Set Simulator

Run the Security Rule Set Simulator to test a rule, a rule folder, or a rule set.

Open the Security Rule Set Simulator from the **Action** menu in the Rule Editor. Select **Action** > **Security Rule Set Simulator**.

Run the Security Rule Set Simulator on the following rule tree nodes:

Rule

To run the simulator on a rule, select the rule in the Rule Editor and open the Security Rule Set Simulator. The simulator tests only the rule, even if the rule uses the Continue processing action.

Rule Folder

To run the simulator on the rules in a rule folder, select the rule folder in the Rule Editor and open the Security Rule Set Simulator. The simulator tests all the rules in the folder. The simulator stops running after it tests the last rule in the rule folder, even if the last rule uses the Continue processing action.

Rule Set

To run the simulator on the rules in a rule set, select the rule set in the Rule Editor and open the Security Rule Set Simulator. The simulator tests the rules in the rule set and applies the processing actions.

Working with the Security Rule Set Simulator

You can choose to run the Security Rule Set Simulator without a database or a database user.

When you run the Security Rule Set Simulator, you enter a database name and database user login information. To receive authentic results, Informatica recommends that you enter a privileged user name and password when you run the Security Rule Set Simulator. If you choose to run the simulator without database information, the simulator displays the log output with a warning that you did not specify the database or database user.

Some SQL requests require the Dynamic Data Masking Server to access the database. To receive accurate log output, you must define the database and the user name and password of a privileged user in the simulator. The following types of requests require the Dynamic Data Masking Server to access the database:

- Security rules that use the PL/SQL rule matcher
- SQL statements that contain an asterisk (*)
- Requests that retrieve information about the case sensitivity of the database

Security Rule Set Simulator Parameters

The Security Rule Set Simulator contains fields for database information, symbol definitions, an SQL statement, and log output.

The Security Rule Set Simulator contains the following parameters:

DDM Database Name

The name of the Dynamic Data Masking database that you defined in the Management Console. If you do not enter a database name, the simulator runs without a database.

DBA Username

The name of the database user that you want to use to connect to the database. The user should be a privileged user that has access to all the tables in the database. Generally it is the user that you used to connect to the database in the Management Console.

Note: If you want to simulate the rule for a non-privileged user, enter login information for a privileged user and enter the non-privileged user name in the AUTH_USERNAME symbol in the **Symbol Definition** box.

DBA Password

The password for the database user.

Symbol Definition

A list of Dynamic Data Masking symbols or variables. When you open the Security Rule Set Simulator, the **Symbol Name** column lists the default global symbols. You can enter a value for the symbol in the **Symbol Value** column, or you can choose not to define the symbol. If you want to add additional symbols, click the plus (+) icon below the **Symbol Definition** box.

To run the simulator as a database user that is different from the database user that you entered in the **DBA Username** and **DBA Password** fields, define a value for the AUTH_USERNAME symbol. For example, you might enter a non-privileged user name in the AUTH_USERNAME **Symbol Value** field. The simulator runs the SQL statement as if the non-privileged user sent the request.

Note: Symbols that you define in the Security Rule Set Simulator only exist within the simulator and do not affect the Dynamic Data Masking Server configuration.

SQL Statement

The SQL statement that you want to run in the simulator.

Log Output

The log output from the last simulation. Dynamic Data Masking does not save the Security Rule Set Simulator log output in the Dynamic Data Masking log files. To save the log output from the simulator, click **Save File** at the bottom of the Security Rule Set Simulator.

Debug Mode

Runs the simulator in debug mode and creates a detailed log output that displays information similar to the log output in the server.log file.

Run

Runs the simulator.

Note: When you run the simulator, the simulator overwrites the log output from the previous simulation. If you want to save the log output from the previous simulation, click **Save File** before you run the simulator.

Open File

Opens a dialog box that you use to import a saved simulator file into the Security Rule Set Simulator.

Save File

Opens a dialog box that you use to save the save the simulator configuration and log output as an xml file. By default, the dialog box opens to the user root directory.

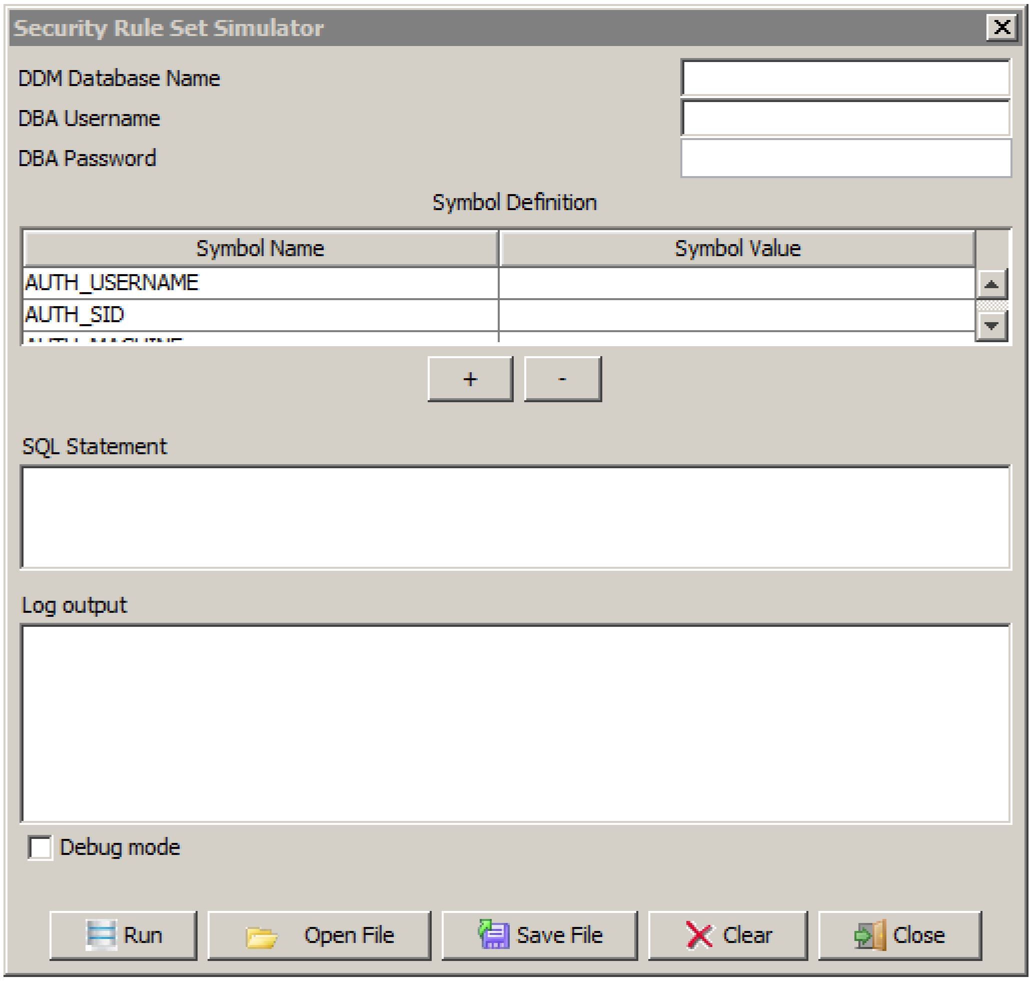
Clear

Clears the simulator configuration and log output.

Close

Closes the Security Rule Set Simulator. The Security Rule Set Simulator saves the simulator configuration and log output until you close the security rule set. When you close the rule set, the simulator resets.

The following image shows the Security Rule Set Simulator:



Simulating a Rule

Use the Security Rule Set Simulator to test a Dynamic Data Masking security rule before you use it in production.

1. In the Management Console, open a security rule set.
2. In the Rule Editor, select the rule, folder, or rule set that you want to test.

   For example, if you want to test the entire rule set, click the rule set name. If you want to test rules in a rule folder, click the folder name. If you want to test a single rule, click the rule name.
3. Click **Action** > **Security Rule Set Simulator**.

   The **Security Rule Set Simulator** opens.
4. Enter the following database details:

DDM Database Name

The name of the database that you saved in the Management Console tree.

DBA Username

The name of the database user that you want to use to connect to the database. The user should be a privileged user that has access to all the tables in the database. Generally it is the user that you used to connect to the database in the Management Console.

Note: If you want to test the rule for a non-privileged user, enter login information for a privileged user and enter the non-privileged username in the AUTH_USERNAME symbol in the **Symbol Definition** box.

DBA Password

The password for the database user.

5. Optionally, enter one or more symbol values in the **Symbol Definition** box. The simulator lists the global symbols. To add a symbol, click the plus (+) button.

   If you want to validate whether the security rule works for a non-privileged user, enter the database user name of the non-privileged user as the AUTH_USERNAME symbol value.

6. Enter the SQL statement that you want to use to test the rule or rules.
7. Click **Run**.

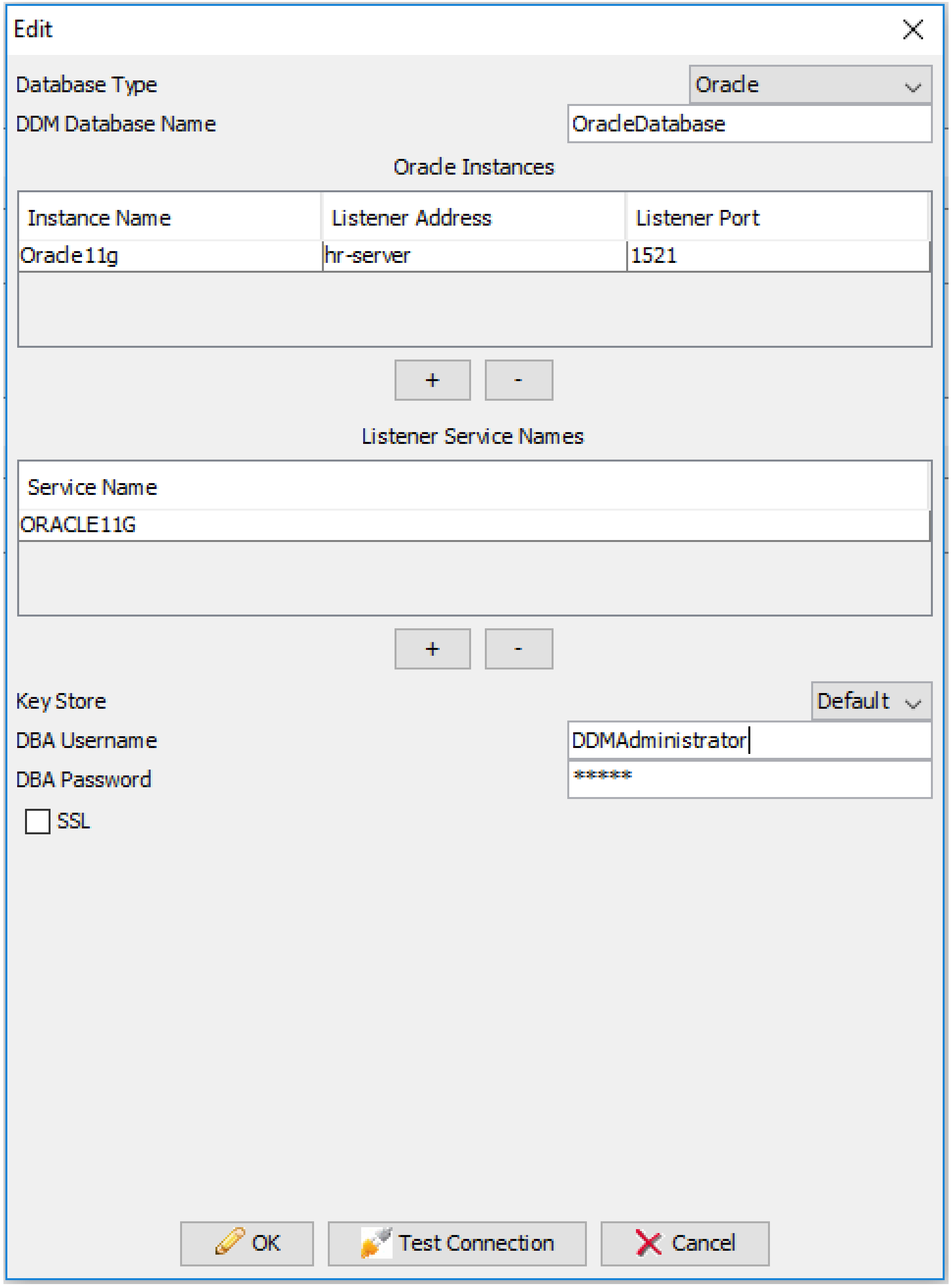
   The simulator runs and displays the log information in the **Log Output** box.

8. If you want to save the simulator configuration and the log output, click **Save File**. Dynamic Data Masking does not save the simulator log output to the Dynamic Data Masking log files.

Security Rule Set Simulator Example

You have a database that contains sensitive employee information and you want to create and test a masking rule that prevents non-privileged database users from viewing the sensitive data.

You create a database connection in the Management Console. The following image shows the database connection parameters:



Database Type: Oracle

DDM Database Name: OracleDatabase

Instance Name	Listener Address	Listener Port
Oracle11g	hr-server	1521

Service Name
ORACLE11G

Key Store: Default

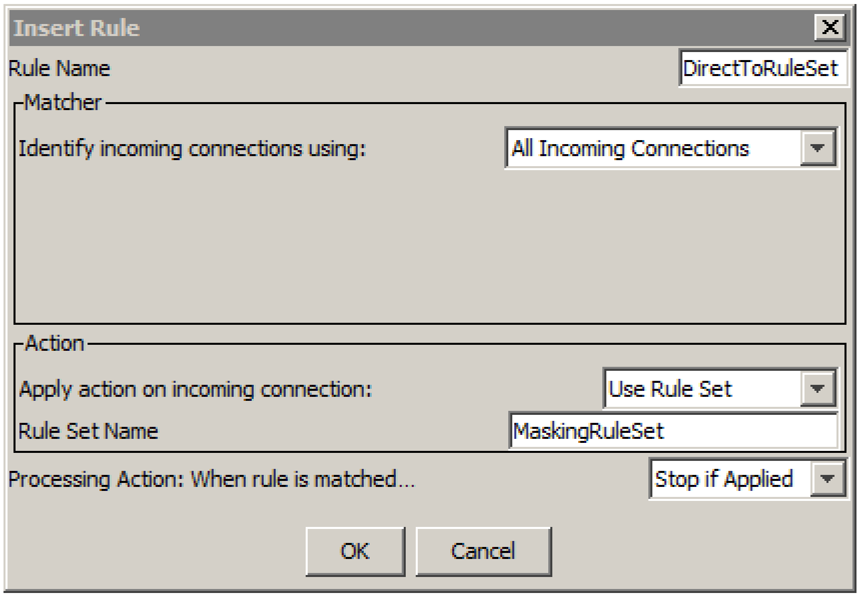
DBA Username: DDMAdministrator

DBA Password: *****

☐ SSL

Note the **DDM Database Name** and **DBA Username** values. You use the database connection parameters when you run the Security Rule Set Simulator.

You add the Dynamic Data Masking service for the database in the Management Console and create a connection rule. The connection rule directs requests to the database to a security rule set. The All Incoming Connections rule matcher creates a match for all connections to the database. The Use Rule Set rule action directs all connections to the rule set that you specify in the Rule Set Name parameter. The following image shows the connection rule parameters:



Rule Name: DirectToRuleSet

Identify incoming connections using: All Incoming Connections

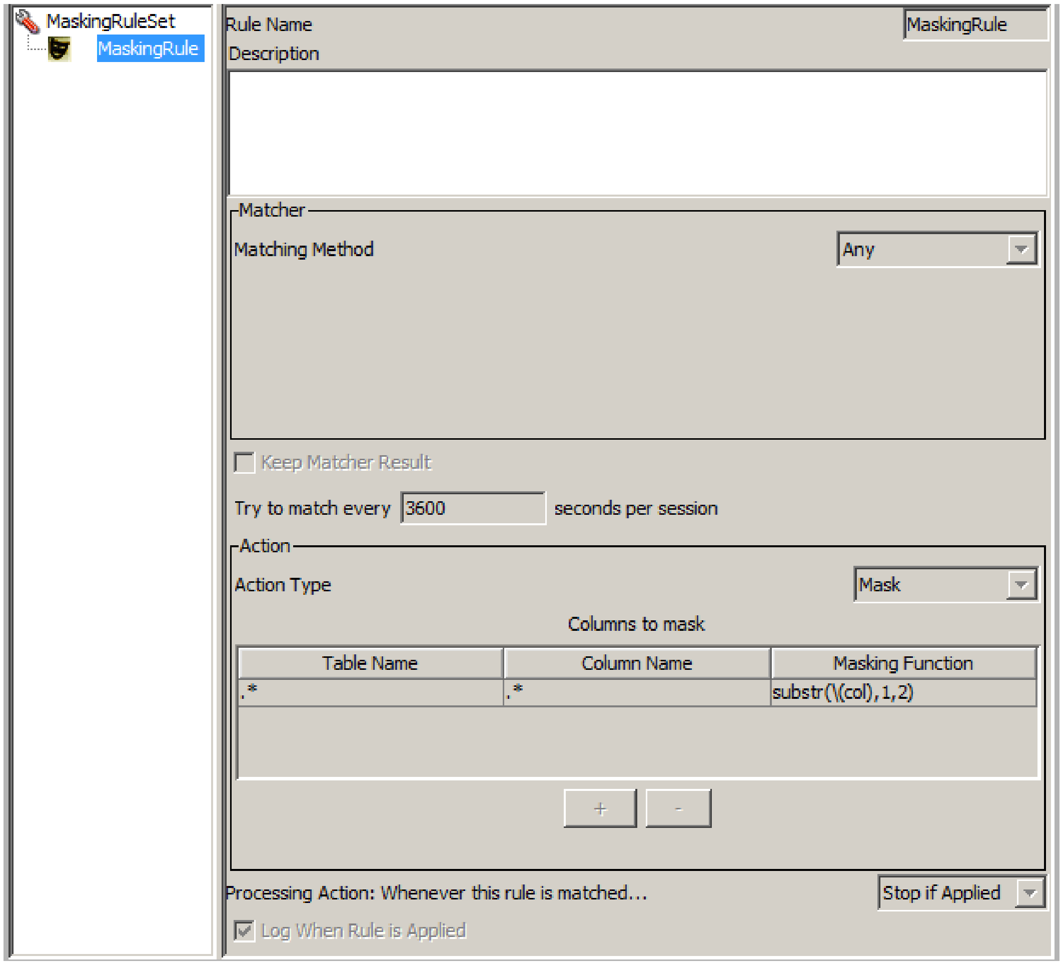
Apply action on incoming connection: Use Rule Set

Rule Set Name: MaskingRuleSet

Processing Action: When rule is matched... Stop if Applied

Note the **Rule Set Name** value. You use the value to name the security rule set.

You create a masking security rule that uses the column alias to truncate all values in the database. The Any rule matcher matches all requests that go through the rule. The mask rule action uses a masking function to mask the sensitive data. The following image shows the rule set and the masking rule parameters:



Rule Name: MaskingRule

Description

Matcher

Matching Method: Any

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action

Action Type: Mask

Columns to mask

Table Name	Column Name	Masking Function
.*	.*	substr(\(col),1,2)

Processing Action: Whenever this rule is matched... Stop if Applied

☑ Log When Rule is Applied

In the Rule Editor, you highlight the masking rule in the rule tree and open the Security Rule Set Simulator.

In the Security Rule Set Simulator you enter the following information:

DDM Database Name

The database name that you used to create the database node in the Management Console.

DBA Username

The database user name that you used to connect to the database in the Management Console.

DBA Password

The password for the database user.

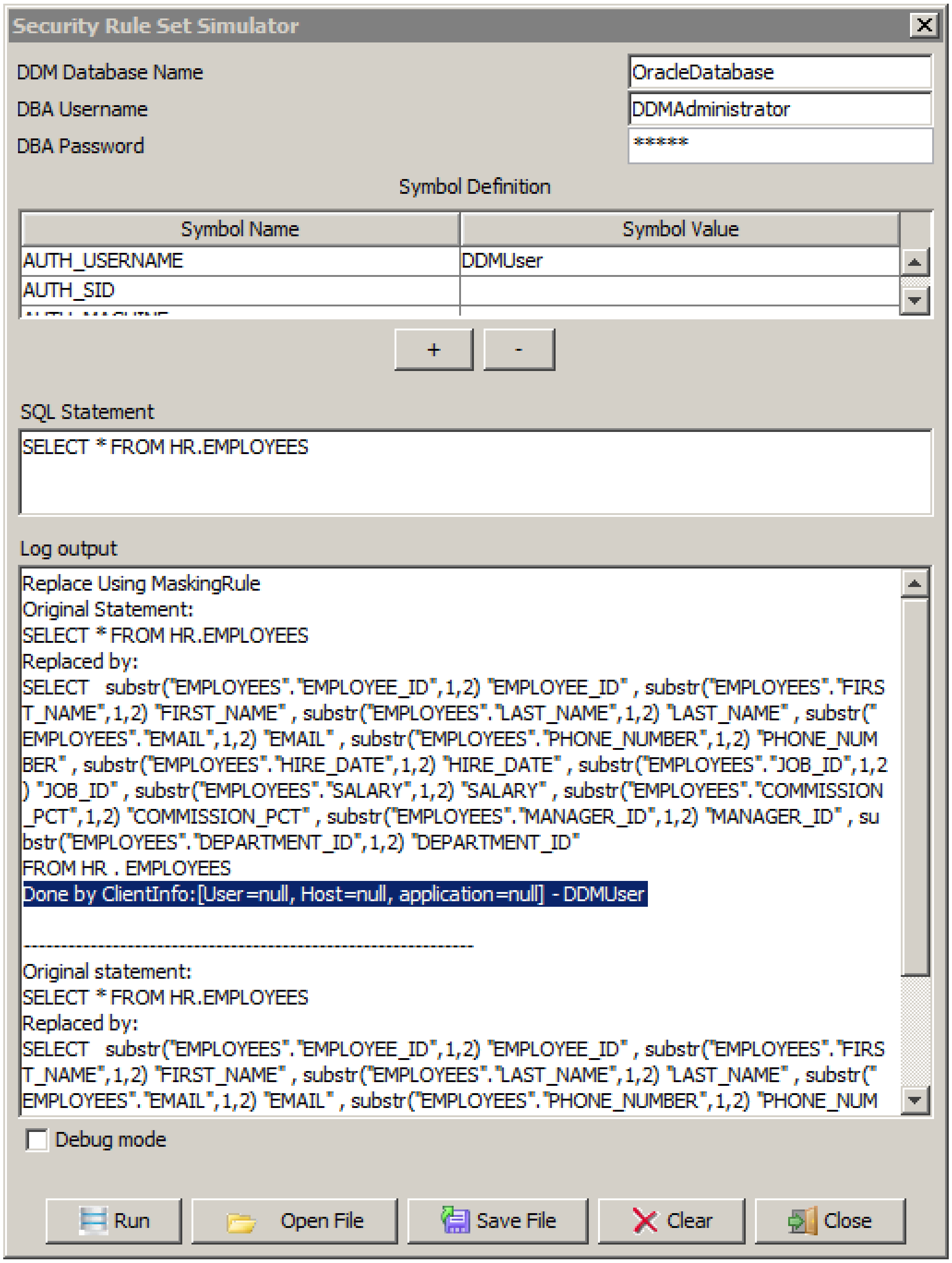
AUTH_USERNAME Symbol Value

The database user name that you want to use to test the masking rule. If you do not enter a database user name, the simulator uses the Dynamic Data Masking administrator user name and password that you used to connect to the database in the Management Console.

SQL Statement

The SQL request that you want to use to test the masking rule.

Click **Run** to run the simulator and test the rule. The following image shows the Security Rule Set Simulator parameters and the simulator log output:



DDM Database Name: OracleDatabase
DBA Username: DDMAdministrator
DBA Password: *****

Symbol Name	Symbol Value
AUTH_USERNAME	DDMUser
AUTH_SID	

SQL Statement

```
SELECT * FROM HR.EMPLOYEES
```

Log output

```
Replace Using MaskingRule
Original Statement:
SELECT * FROM HR.EMPLOYEES
Replaced by:
SELECT   substr("EMPLOYEES"."EMPLOYEE_ID",1,2) "EMPLOYEE_ID" , substr("EMPLOYEES"."FIRS
T_NAME",1,2) "FIRST_NAME" , substr("EMPLOYEES"."LAST_NAME",1,2) "LAST_NAME" , substr("
EMPLOYEES"."EMAIL",1,2) "EMAIL" , substr("EMPLOYEES"."PHONE_NUMBER",1,2) "PHONE_NUM
BER" , substr("EMPLOYEES"."HIRE_DATE",1,2) "HIRE_DATE" , substr("EMPLOYEES"."JOB_ID",1,2
) "JOB_ID" , substr("EMPLOYEES"."SALARY",1,2) "SALARY" , substr("EMPLOYEES"."COMMISSION
_PCT",1,2) "COMMISSION_PCT" , substr("EMPLOYEES"."MANAGER_ID",1,2) "MANAGER_ID" , su
bstr("EMPLOYEES"."DEPARTMENT_ID",1,2) "DEPARTMENT_ID"
FROM HR . EMPLOYEES
Done by ClientInfo:[User=null, Host=null, application=null] - DDMUser

------------------------------------------------------------
Original statement:
SELECT * FROM HR.EMPLOYEES
Replaced by:
SELECT   substr("EMPLOYEES"."EMPLOYEE_ID",1,2) "EMPLOYEE_ID" , substr("EMPLOYEES"."FIRS
T_NAME",1,2) "FIRST_NAME" , substr("EMPLOYEES"."LAST_NAME",1,2) "LAST_NAME" , substr("
EMPLOYEES"."EMAIL",1,2) "EMAIL" , substr("EMPLOYEES"."PHONE_NUMBER",1,2) "PHONE_NUM
```

☐ Debug mode

The log output shows that the simulator tested the rule as the user that you entered for the AUTH_USERNAME symbol.

The following text shows the complete simulator log output:

```
Replace Using MaskingRule
Original Statement:
SELECT * FROM HR.EMPLOYEES
Replaced by:
SELECT   substr("EMPLOYEES"."EMPLOYEE_ID",1,2) "EMPLOYEE_ID" ,
substr("EMPLOYEES"."FIRST_NAME",1,2) "FIRST_NAME" , substr("EMPLOYEES"."LAST_NAME",1,2)
"LAST_NAME" , substr("EMPLOYEES"."EMAIL",1,2) "EMAIL" ,
substr("EMPLOYEES"."PHONE_NUMBER",1,2) "PHONE_NUMBER" , substr("EMPLOYEES"."HIRE_DATE",
1,2) "HIRE_DATE" , substr("EMPLOYEES"."JOB_ID",1,2) "JOB_ID" ,
substr("EMPLOYEES"."SALARY",1,2) "SALARY" , substr("EMPLOYEES"."COMMISSION_PCT",1,2)
"COMMISSION_PCT" , substr("EMPLOYEES"."MANAGER_ID",1,2) "MANAGER_ID" ,
substr("EMPLOYEES"."DEPARTMENT_ID",1,2) "DEPARTMENT_ID"
FROM HR . EMPLOYEES
Done by ClientInfo:[User=null, Host=null, application=null] - DDMUser

-------------------------------------------------------------
Original statement:
SELECT * FROM HR.EMPLOYEES
Replaced by:
SELECT   substr("EMPLOYEES"."EMPLOYEE_ID",1,2) "EMPLOYEE_ID" ,
substr("EMPLOYEES"."FIRST_NAME",1,2) "FIRST_NAME" , substr("EMPLOYEES"."LAST_NAME",1,2)
"LAST_NAME" , substr("EMPLOYEES"."EMAIL",1,2) "EMAIL" ,
substr("EMPLOYEES"."PHONE_NUMBER",1,2) "PHONE_NUMBER" , substr("EMPLOYEES"."HIRE_DATE",
1,2) "HIRE_DATE" , substr("EMPLOYEES"."JOB_ID",1,2) "JOB_ID" ,
substr("EMPLOYEES"."SALARY",1,2) "SALARY" , substr("EMPLOYEES"."COMMISSION_PCT",1,2)
"COMMISSION_PCT" , substr("EMPLOYEES"."MANAGER_ID",1,2) "MANAGER_ID" ,
substr("EMPLOYEES"."DEPARTMENT_ID",1,2) "DEPARTMENT_ID"
FROM HR . EMPLOYEES
```

You select **Debug Mode** and run the simulator to view the detailed log output. The detailed log output shows additional connection and Dynamic Data Masking Server information. The following text shows the debug log output:

```
Database set to: OracleDatabase
FolderAction: trying: MaskingRule for: []
MaskingRule.match: matcher: AnyMatcher h: []
Applying rule: MaskingRule
MaskingAction.execute: SELECT * FROM HR.EMPLOYEES
OracleDatabase: Getting connection for: DDMAdministrator
OracleDatabase.buildURL: Finished being built URLjdbc:informatica:oracle://hr-
server;ServiceName=Oracle11g
OracleDatabase: Is Setting schema: true
Try and impersonate using: user=DDMAdministrator and null catalog.
Starting to impersonate user: DDMAdministrator -- Null catalog
Adding for execution SQL statement: ALTER SESSION SET CURRENT_SCHEMA = DDMAdministrator
Here are the 1 return codes after executing the statement list:-
0:
Statement returned with number of rows:
0
Completed impersonation to user: DDMAdministrator
Completed successfully impersonating user: DDMAdministrator -- Null catalog
MaskingAction: Alias set is: ["EMPLOYEES"]
OracleDatabase: Impersonating
OracleDatabase: Getting connection for admin user = DDMAdministrator
OracleDatabase: Getting connection for ddm admin user and password
OracleDatabaseUser = DDMAdministrator ; Password = GCMNFIENGEBPNCBI
OracleDatabaseAbout to obtain non-pooled connection.
OracleDatabase.buildURL: Finished being built URLjdbc:informatica:oracle://hr-
server;ServiceName=Oracle11g
OracleDatabaseObtained connection successfully.
OracleDatabase: Using ddm admin user DDMAdministrator, testing if impersonating
supported for: client user = DDMUser ;client catalog = null ;client path = null
OracleDatabase: Using ddm admin user DDMAdministrator, impersonating supported for:
client user = DDMUser ;client catalog = null ;client path = null
Try and impersonate using: user=DDMUser and null catalog.
Starting to impersonate user: DDMUser -- Null catalog
Adding for execution SQL statement: ALTER SESSION SET CURRENT_SCHEMA = DDMUser
Here are the 1 return codes after executing the statement list:-
0:
Statement returned with number of rows:
0
Completed impersonation to user: DDMUser
Completed successfully impersonating user: DDMUser -- Null catalog
MaskingAction: Rewriting start to:  SELECT   "EMPLOYEES" . "EMPLOYEE_ID" , "EMPLOYEES" .
"FIRST_NAME" , "EMPLOYEES" . "LAST_NAME" , "EMPLOYEES" . "EMAIL" , "EMPLOYEES" .
```

```
"PHONE_NUMBER" , "EMPLOYEES" . "HIRE_DATE" , "EMPLOYEES" . "JOB_ID" , "EMPLOYEES" .
"SALARY" , "EMPLOYEES" . "COMMISSION_PCT" , "EMPLOYEES" . "MANAGER_ID" , "EMPLOYEES" .
"DEPARTMENT_ID"
FROM HR . EMPLOYEES
Replace Using MaskingRule
Original Statement:
SELECT * FROM HR.EMPLOYEES
Replaced by:
SELECT   substr("EMPLOYEES"."EMPLOYEE_ID",1,2) "EMPLOYEE_ID" ,
substr("EMPLOYEES"."FIRST_NAME",1,2) "FIRST_NAME" , substr("EMPLOYEES"."LAST_NAME",1,2)
"LAST_NAME" , substr("EMPLOYEES"."EMAIL",1,2) "EMAIL" ,
substr("EMPLOYEES"."PHONE_NUMBER",1,2) "PHONE_NUMBER" , substr("EMPLOYEES"."HIRE_DATE",
1,2) "HIRE_DATE" , substr("EMPLOYEES"."JOB_ID",1,2) "JOB_ID" ,
substr("EMPLOYEES"."SALARY",1,2) "SALARY" , substr("EMPLOYEES"."COMMISSION_PCT",1,2)
"COMMISSION_PCT" , substr("EMPLOYEES"."MANAGER_ID",1,2) "MANAGER_ID" ,
substr("EMPLOYEES"."DEPARTMENT_ID",1,2) "DEPARTMENT_ID"
FROM HR . EMPLOYEES
Done by ClientInfo:[User=null, Host=null, application=null] - DDMUser

FolderAction: rule matched: true
FolderAction: rule applied: true
DNRStatementProcessor.getStatementHandler: rule match: [] on: SELECT * FROM HR.EMPLOYEES
-----------------------------------------------------------
Original statement:
SELECT * FROM HR.EMPLOYEES
Replaced by:
SELECT   substr("EMPLOYEES"."EMPLOYEE_ID",1,2) "EMPLOYEE_ID" ,
substr("EMPLOYEES"."FIRST_NAME",1,2) "FIRST_NAME" , substr("EMPLOYEES"."LAST_NAME",1,2)
"LAST_NAME" , substr("EMPLOYEES"."EMAIL",1,2) "EMAIL" ,
substr("EMPLOYEES"."PHONE_NUMBER",1,2) "PHONE_NUMBER" , substr("EMPLOYEES"."HIRE_DATE",
1,2) "HIRE_DATE" , substr("EMPLOYEES"."JOB_ID",1,2) "JOB_ID" ,
substr("EMPLOYEES"."SALARY",1,2) "SALARY" , substr("EMPLOYEES"."COMMISSION_PCT",1,2)
"COMMISSION_PCT" , substr("EMPLOYEES"."MANAGER_ID",1,2) "MANAGER_ID" ,
substr("EMPLOYEES"."DEPARTMENT_ID",1,2) "DEPARTMENT_ID"
FROM HR . EMPLOYEES
```

You view the log output to verify that you defined the rule correctly. You can save the Security Rule Set Simulator parameters and log output to a file. You can load the saved parameters and log output to a new instance of the Security Rule Set Simulator.

The log output shows that you created the rule properly. You exit the Security Rule Set Simulator and save the rule.

CHAPTER 6

Masking Functions

This chapter includes the following topics:

Masking Functions Overview

A masking function is a component of the security rule Mask action. Masking functions define how sensitive information is returned to an unauthorized user.

Masking functions mask, scramble, and randomize data.

Masking Function Examples

A masking function defines how the Rule Engine masks data. The Rule Engine applies masking functions to incoming SELECT SQL statements that an unauthorized client sends to the database. Dynamic Data Masking rewrites the SQL statement. When the database receives the request, the database sends masked data to the client.

To create masking functions, use regular expressions and database management system SQL functions on the SELECT LIST columns.

The following table describes examples of masking functions:

Masking Function	**Description**
`"`	Hides the contents of the table column.
`xxxx`	Replaces the returned value inside ' '.
`to_date(’YYYY-MM-DD’)`	Applies a date to the masking function.

Masking Function	**Description**
`customer_codecase customer_code when 4 then 'confidential vip customer' when 2 then 'confidential vip customer' else customer_name end`	Applies row level security and masks VIP customers identified by `customer_code = 4`.
`decode ( substr ( p.bankaccno , 1 , 4 ) , 4500 , 450014265523 , 5314 , 531431925755 , 3210 , 321014760512 , 312331322 ) bankaccno`	Maintains the first four digits of account numbers and replaces the rest of the numbers with masked values.

Column and Alias Regular Expression Symbols

You can parse column names with the regular expression symbols `\(col)` and `\(alias)`.

Column Alias \(alias)

Use the column alias, `\(alias)`, for columns in multiple tables to prevent ambiguity.

Using \(alias) Example

You want to mask a column, `deptno`, in the `emp` and `dept` tables. Use the column alias, `\(alias)`, with the masking function `substr(deptno, 1,2)||'**'`.

The masking function `mask_function(\(alias)deptno)` changes `select e.deptno, d.deptno from emp e, dept d` to `select substr("E".deptno,1,2)||'**' "DEPTNO" , substr("D".deptno,1,2)||'**' "DEPTNO" from "EMP" "E" , "DEPT" "D"`.

Create a rule that searches for tables with the column name `deptno`. When a match occurs, the Rule Engine applies the masking function to replace the data in the `deptno` column.

In the security rule, use the with the Mask rule action. The table name is `.*`, the column name is `deptno`, and the masking function is `substr(deptno, 1,2)||'**'`

Column Alias \(col)

Use the column alias, `\(col)`, to mask columns with similar names.

When you use the column alias, the Rule Engine rewrites each identified column name with the respective name of the column. For example, the Rule Engine rewrites `select credit from customer` to `select mask_function(credit) from customer`.

Using the Column Alias Example

For example, you want to mask credit card numbers. Use the column alias to mask columns that start with `credit.*`.

Create a security rule that uses the Mask action and searches all tables for the column name `credit.*`. Define the table name as `.*`, the column name as `CREDIT.*`, and the masking function as `nvl2\(col), ('****-****-****-'||substr(CREDIT_CARD,length(trim(CREDIT_CARD))-3)),'')`. If the Rule Engine matches the column name, it rewrites the statement as `nvl2\(col),('****-****-****-'|| substr(CREDIT_CARD,length(trim(CREDIT_CARD))-3)),'')`.

Scrambling Functions

A scrambling function is a masking technique that rearranges values in the requested data. Scrambling functions use Oracle database syntax and are created by using the security rule Mask action.

The following table describes examples of scrambling functions.

Scrambling Function	Description
`translate(reverse(\(col)), '1234567890', '97865301')`	Scrambles the locations of the digits.
`max(\(col)) over(order by empno rows between 1 and preceding and 1 following)`	Provides list scrambling. The Rule Engine replaces the name with the letter value of the preceding and subsequent records.
`nvl( lead(ename) over (order by ename), first_value(ename) over ( order by ename)`	Offsets the address by a single row. If the value is null, the Rule Engine assigns the `first_value` of `ename` found in the `emp` table after sorting by `ename`.

Reverse Masking Function

The reverse masking function rewrites the `WHERE` clause of masked request statements to return the actual value stored in the database.

You can use the reverse masking function to prevent requests that use masked data. For example, you send a request to the database for an account number and the database returns a masked value. You send another request to the database. The request references the masked account number and the database returns an error message. The reverse masking function replaces the masked `WHERE` clause with actual data and you do not receive an error message.

Reverse Masking Example

The following example shows how to create a reverse masking function. The reverse masking function uses the Search and Replace security rule action to replace the `WHERE` clause in a request statement.

To create reverse masking functions, use nested security rules. The top-level folder uses the Any matcher, the Folder action, and the Continue processing action.

Create two security rules. The first rule performs reverse masking. If the request statement does not match the criteria for the first rule, the Rule Engine applies the second rule. The second rule masks the account information.

In the top level folder, create a security rule called Unmask. The Unmask rule rewrites the `WHERE` clause with the reverse masked value by using regular expression. Configure the security rule to use the Any matcher and the Search and Replace rule action. In the Search Text field, enter `ACCOUNT\s*=\s*(\:\w+)`. Select the Regular Expression identification method. In the Replacement String field, enter `ACCOUNT = substr(\(1), 1,6) || translate('3412', '1234', substr(\(1),7)) || subst.(\(1),11).`

Select the Continue processing action so that the Rule Engine continues to the next rule in the rule tree.

In the top level folder, create a security rule called Account Masking. Select the Any matcher and the Mask rule action.

In the Table name field, enter `.*` for all tables. In the Column Name field, enter `ACCOUNT`. In the Masking Function field, enter `substr(\(col),1,6) || translate('1234', '3412', substr(\(col),7)) || substr(\(col),11)`.

Select the Stop if Applied processing action so that the Rule Engine does not continue to the next rule in the rule tree.

Column Level Masking

Column level masking prevents users from seeing data contained in a specific column and table.

In this example, the masking function shows the `sal` column in the `emp` table for employees that do not have the name King. To apply column level security, add the following masking function to the stored procedure in the database:

```
    create or replace function mask_sal(sal in number, name in varchar) return integer as
begin
if name = 'KING'
then
return -1;
end if;
return sal;
end;
```

Next, create a security rule masking function which causes the Rule Engine to mask select statements containing the `emp` table and `sal` column by using the `mask_sal(\(col). \(alias)ename)` masking function. Specify the Table name as `emp`, the Column Name as `sal`, and the Masking Function as `mask_sal(\(col). \(alias)ename)`.

Session Changing Commands

You can use session changing commands within a SQL block for Microsoft SQL Server and Sybase databases.

In previous versions, Dynamic Data Masking handled database session changing commands through special rules. In these rules the session changing command was identified using a regular expression match. Then Dynamic Data Masking created the appropriate symbol to handle the command. However, when a session changing command was inside a SQL block, the command was ignored.

Dynamic Data Masking can now extract the session changing info from the command. Dynamic Data Masking then rewrites the command appropriately to extract the correct column metadata from the table.

Microsoft SQL Server Session Changing Commands

The following table lists the session changing commands you can use with a Microsoft SQL Server database:

SQL Command	Description	Syntax	Masking is Affected
USE (Transact-SQL)	Changes the database context to the specified database or database snapshot in Microsoft SQL Server.	USE {database_name} [;]	Yes
SET ANSI_DEFAULTS ON	SET QUOTED_IDENTIFIER is modified depending on the value set to ANSI_DEFAULTS.	SET ANSI_DEFAULTS {ON | OFF}	Yes
SET QUOTED_IDENTIFIER (Transact-SQL)	Causes SQL Server to follow the ISO rules regarding quotation mark delimiting identifiers and literal strings. Identifiers delimited by double quotation marks can be either Transact-SQL reserved keywords or can contain characters not generally allowed by the Transact-SQL syntax rules for identifiers.	SET QUOTED_IDENTIFIER { ON | OFF }	Yes
EXECUTE AS	When an EXECUTE AS statement is run, the execution context of the session is switched to the specified login or user name.	{ EXEC | EXECUTE } AS <context_specification> [;] <context_specification>::= { LOGIN | USER } = 'name' [WITH { NO REVERT | COOKIE INTO @varbinary_variable }] | CALLER	Yes

The following table lists examples of the SQL commands in use:

Description	Example
SQL block that contains USE followed by a SELECT statement.	USE DDM SELECT * FROM EMPLOYEE
SQL block that contains SET ANSI_DEFAULTS followed by a SELECT statement.	SET ANSI_DEFAULTS OFF SELECT * FROM EMPLOYEE
SQL block that contains SET QUOTED_IDENTIFIER followed by a SELECT statement.	SET QUOTED_IDENTIFIER OFF SELECT * FROM EMPLOYEE
SQL block that contains only session changing commands.	USE DDM SET ANSI_DEFAULTS OFF SET QUOTED_IDENTIFIER OFF
SQL block that contains EXEC AS followed by SELECT statement.	EXECUTE AS USER = 'U21' SELECT * FROM EMP EXECUTE AS LOGIN = 'loginA' SELECT * FROM EMP

Sybase Session Changing Commands

The following table lists the session changing commands you can use with a Sybase database:

SQL Command	Description	Syntax	Masking is Affected
USE (Transact-SQL)	Changes the database context to the specified database or database snapshot in Sybase.	USE {database_name} [;]	Yes
SET QUOTED_IDENTIFIER (Transact-SQL)	Causes Sybase to follow the ISO rules regarding quotation mark delimiting identifiers and literal strings. Identifiers delimited by double quotation marks can be either Transact-SQL reserved keywords or can contain characters not generally allowed by the Transact-SQL syntax rules for identifiers.	SET QUOTED_IDENTIFIER { ON | OFF }	Yes
SETUSER	Allows a database owner to impersonate another user.	SETUSER["USER_NAME"]	Yes
SET PROXY	Restricts which roles cannot be acquired when switching identities.	SET PROXY USER|ROLE	Yes

The following table lists examples of the SQL commands in use:

Description	Example
SQL block that contains USE followed by SELECT statement.	USE DDM SELECT * FROM EMPLOYEE
SQL block that contains SET QUOTED_IDENTIFIER followed by SELECT statement.	SET QUOTED_IDENTIFIER OFF SELECT * FROM EMPLOYEE
SQL block that contains SETUSER followed by SELECT statement.	SETUSER 'ddmuser1' SELECT * FROM EMPLOYEE
SQL block that contains SET PROXY followed by SELECT statement.	SET PROXY ddmuser1 SELECT * FROM EMPLOYEE
SQL block that contains only session changing commands.	USE DDM SET QUOTED_IDENTIFIER OFF

CHAPTER 7

Stored Procedure Result Set Masking

This chapter includes the following topics:

Stored Procedure Result Set Masking Overview

You can mask the result set of a Microsoft SQL Server stored procedure call at run time. Dynamic Data Masking does not create temporary or staging database tables during the result set masking process. Result set masking is available for numeric, string, date, and XML data types, though the process for XML data types differs.

Result Set Masking for String, Numeric, and Date Data Types

When you configure result set masking for a Microsoft SQL Server stored procedure with numeric, string, or date data types, you create two security rule sets. The first rule set must contain a rule that identifies the procedure call as a valid procedure call with a result set that you want to mask. This rule uses the Procedure Call matcher and the Process Result action. The Procedure Call matcher specifies the exact name of the stored procedure, and the Process Result action specifies the name of the second rule set that you create.

This second rule set contains the rule or rules that identify the column names that contain the data that you want to mask with the Metadata matcher. With these rules you also configure the type of masking that the Rule Engine applies to the data, with the Masking action. The second rule set must also contain a final rule that includes the Apply Masking action. Without the final rule that includes the Apply Masking action, the result set is not masked.

Step 1. Create a Security Rule Set with a Procedure Call and Process Result Rule

The first rule set that you create contains a rule to identify the procedure call and process the result set with the following security rule set.

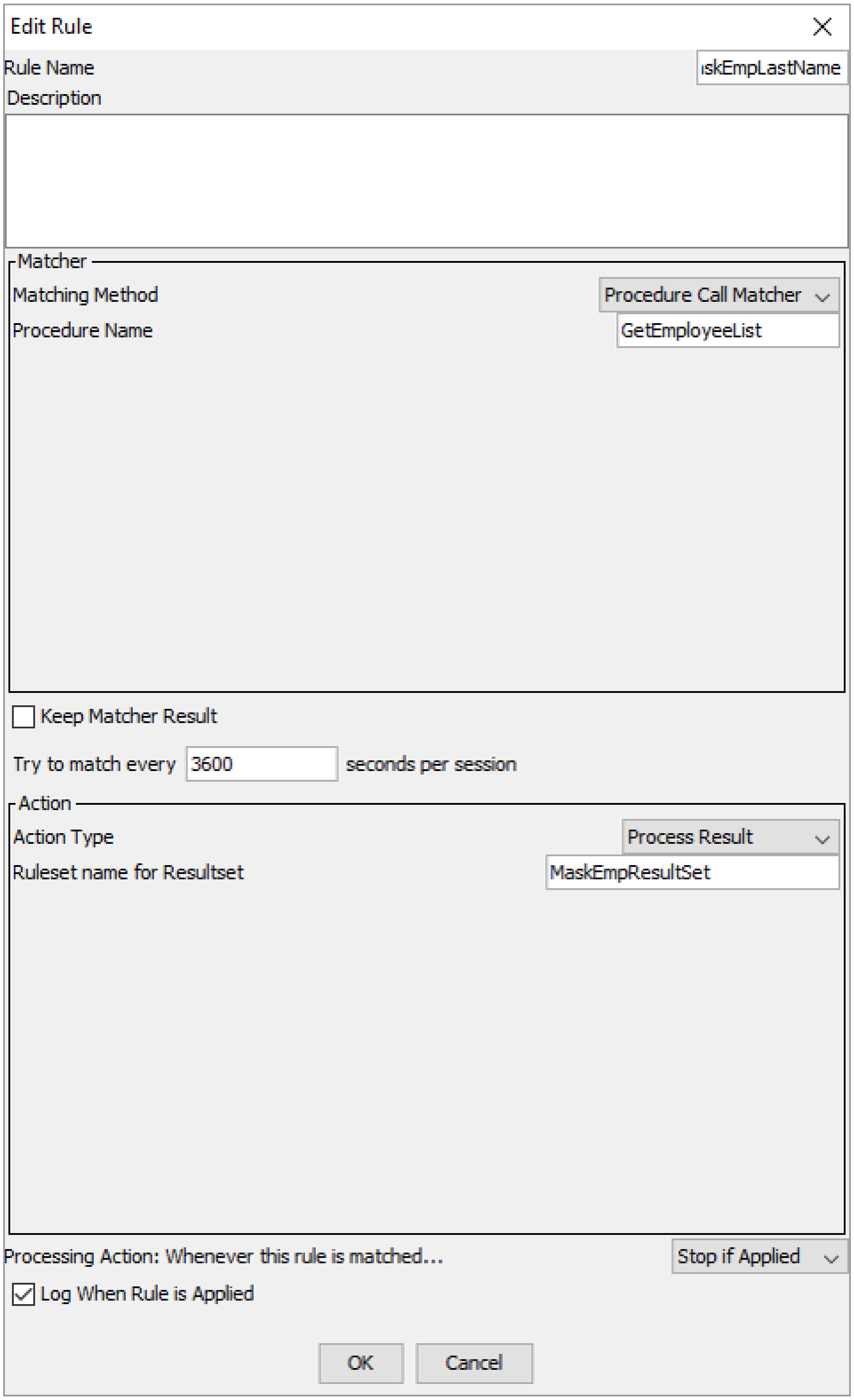
1. To create a security rule set, click on a domain node in the rule tree.
2. Click **Tree** > **Add Rule Set**.

   The **Add Rule Set** window appears.
3. Enter a name for the security rule set, for example, "SQLServerRules."
4. Click **OK**.

   Within this rule set, create a rule to specify the stored procedure call and process the result set through the following rule set.
5. In the Management Console, click the security rule set that you created in the previous step.
6. Select **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.
7. Click **Action** > **Append Rule**.

   The **Append Rule** window appears.
8. Enter a name for the rule, for example, "MaskEmpLastName."
9. For the **Matching Method**, select **Procedure Call**.
10. For **Procedure Name**, give the exact name of the stored procedure with the result set that you want to mask.
11. For **Action Type**, select **Process Result**.
12. For **Ruleset Name for Resultset**, give the name of the next rule set that you will create. For example, "MaskEmpResultSet."
13. For **Processing Action**, select **Stop if Applied**.



Rule Name: skEmpLastName

Description:

Matcher
- Matching Method: Procedure Call Matcher
- Procedure Name: GetEmployeeList

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action
- Action Type: Process Result
- Ruleset name for Resultset: MaskEmpResultSet

Processing Action: Whenever this rule is matched... Stop if Applied

☑ Log When Rule is Applied

14. To create the rule, click **OK**.

15. Select **File** > **Update Rules** to save the rule in the rule tree.

Step 2. Create a Security Rule Set to Process the Result Set

Create a security rule set to process the result set. Give the rule set the name that you provided in Step 1. as the "Ruleset Name for Resultset" parameter. Then create the rule or rules to match the columns in the result set that you want to mask, and configure the type of masking on those columns. Finally, you must create a rule within this rule set to apply the masking function.

1. To create a security rule set, click on a domain node in the rule tree.
2. Click **Tree** > **Add Rule Set**.

   The **Add Rule Set** window appears.
3. Enter the name of the security rule set that you gave as the **Ruleset Name for Resultset** property in the previous step. For example, "MaskEmpResultSet."
4. Click **OK**.

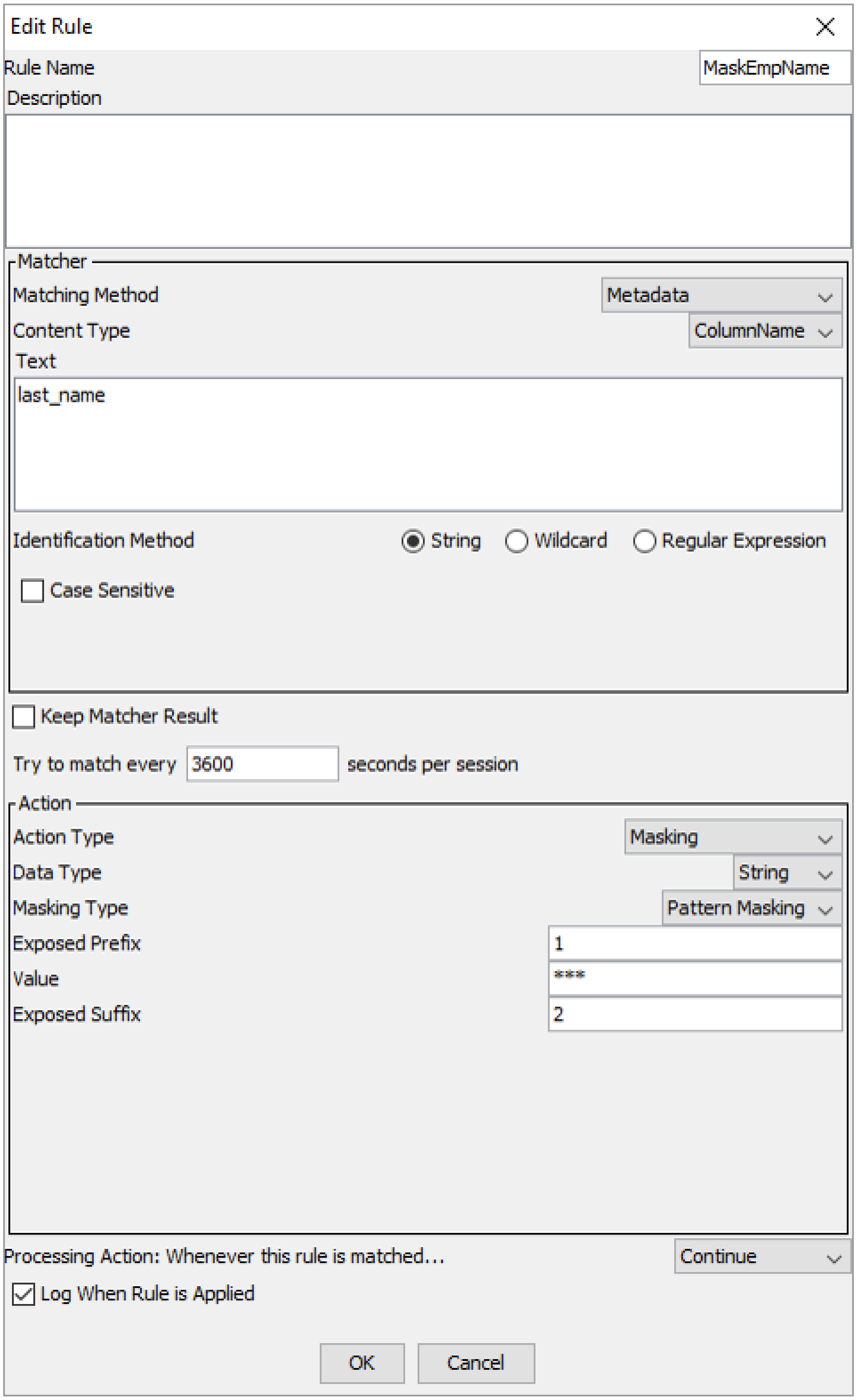
   Within this rule set, create a rule or rules to match the column name in the result set that you want to mask, and specify the masking action.
5. In the Management Console, click the security rule set that you created in the previous step.
6. Select **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.
7. Click **Action** > **Append Rule**.

   The **Append Rule** window appears.
8. Enter a name for the rule, for example, "MaskEmpName."
9. For the **Matching Method**, select **Metadata**.
10. For **Content Type**, select **Column Name**.
11. In the text box, enter the column name and select **String** as the identification method.

    Alternatively, you can configure the wildcard or regular expression options as identification methods. Dynamic Data Masking cannot distinguish between a result set that is part of a stored procedure call and a result set that is part of other system calls. As a best practice, do not use multiple generic regular expressions to define the column metadata matcher.
12. For **Action Type**, select **Masking**.
13. For **Data Type**, select the type of data in the result set that you want to mask. You can choose from string, numeric, or date.
14. For **Masking Type**, select the type of masking that you want to apply to the data. For numeric and string data types, you can choose from pattern, redaction, or constant masking. For the date data type, you can select only constant masking.

    For more information about the Masking action, the masking types, and their parameters, see Chapter 4, “Security Rules” on page 36.
15. For the **Processing Action**, select **Continue**.



Rule Name: MaskEmpName

Description:

Matcher

Matching Method: Metadata

Content Type: ColumnName

Text: last_name

Identification Method: ● String ○ Wildcard ○ Regular Expression

☐ Case Sensitive

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action

Action Type: Masking

Data Type: String

Masking Type: Pattern Masking

Exposed Prefix: 1

Value: ***

Exposed Suffix: 2

Processing Action: Whenever this rule is matched… Continue

☑ Log When Rule is Applied

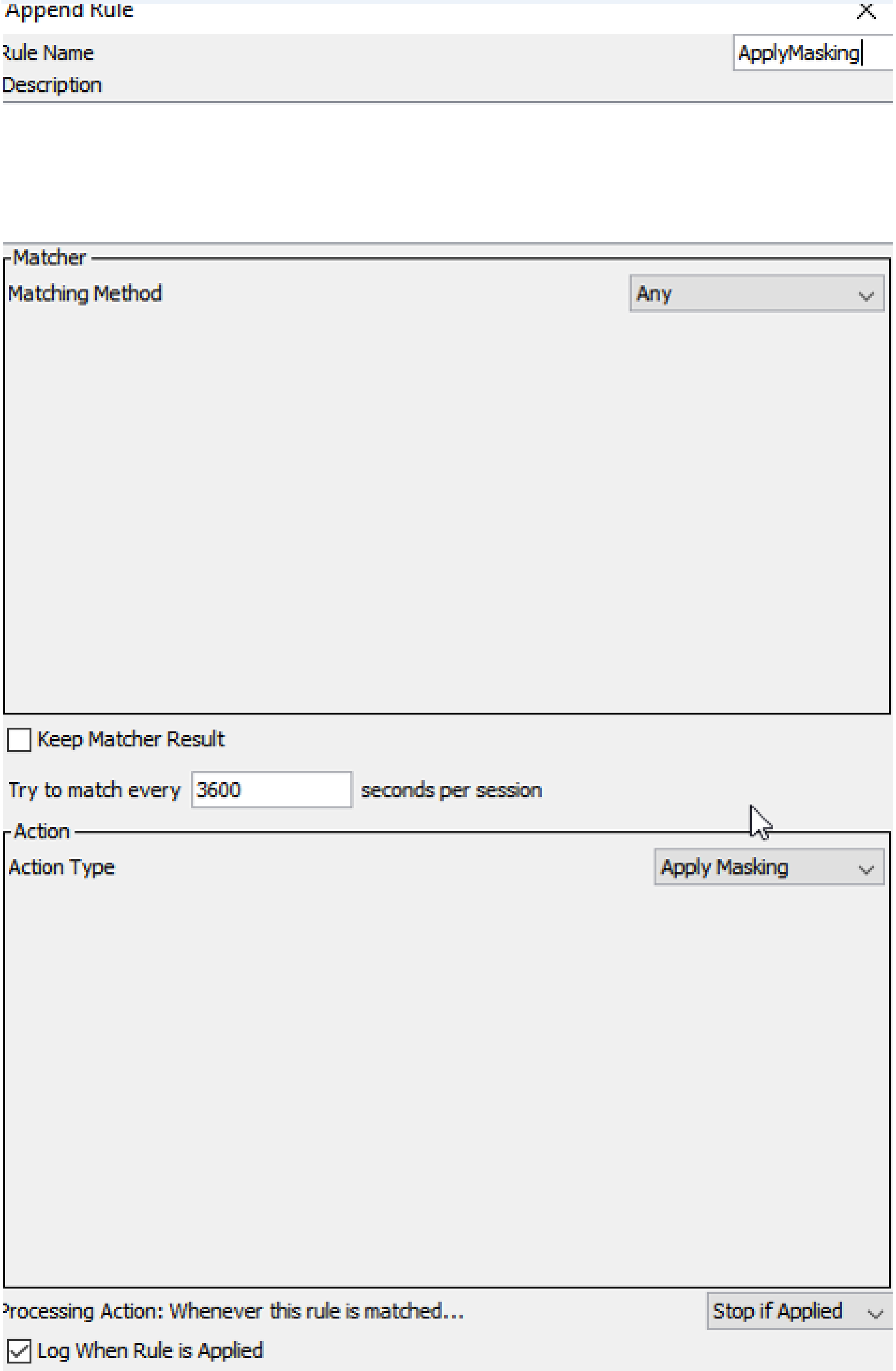
16. Click **OK.**

17. Select **File** > **Update Rules** to save the rule in the rule tree.
18. Optionally, you can create additional rules within this rule set on other columns in the same result set.

    When you are finished creating the rules that match the result set columns and mask the column data, create a final rule to apply the masking. This rule is mandatory and must be the final rule in the rule set.
19. Select **Tree** > **Security Rule Set**.

    The **Rule Editor** appears.
20. Click **Action** > **Append Rule**.

    The **Append Rule** window appears.
21. Enter a name for the final rule, for example, "ApplyMasking."
22. For the **Matching Method**, select **Any**.
23. For **Action Type**, select **Apply Masking**.
24. For the **Processing Action**, select **Stop if Applied**.
25. Click **OK**.



Rule Name: ApplyMasking

Description

Matching Method: Any

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action Type: Apply Masking

Processing Action: Whenever this rule is matched... Stop if Applied

☑ Log When Rule is Applied

26. Select **File** > **Update Rules** to save the rule in the rule tree.

Unsupported Data Types

Most numeric, string, and date data types are supported for stored procedure result set masking. The following Microsoft SQL Server data types, however, are not supported:

- NULL
- UNIQUEIDENTIFIER
- DATETIME2
- DATETIMEOFFSET
- CLR UDT
- IMAGE
- SQL_VARIANT

Result Set Masking for XML Data Types

To mask XML type data in a result set, create three security rule sets.

The first and second rule sets are similar to result set masking for numeric, string, and date data types. The first rule set contains a rule that identifies the procedure call as a valid procedure call with a result set that you want to mask. Although you can use the Procedure Call matcher and provide the name of a stored procedure, you can also use other types of matchers in this rule, for example the From Clause or Text matcher. You cannot, however, use the Any matcher in this rule set. The matcher that you use works at the level of the SQL query. Use the Process Result action to specify the name of the second rule set that you create.

The second rule set that you create again contains the rule that identifies the column that contains the XML data that you want to mask. You must know and provide the name of the column that contains the XML data. When you configure the action for this rule, you select the Content Masking action. The Content Masking action specifies the final rule set that you create. If you want to mask multiple columns in a result set that contain XML data, you can define individual rule sets for each column. Similar to result set masking for string, numeric, and date data types, the second rule set for XML masking must also contain a final rule that includes the Apply Masking action. Without the final rule that includes the Apply Masking action, the result set is not masked.

The final rule set that you create for XML masking, which is specified in the previous rule set when you select the Content Masking action, contains rules that directly process the XML data itself and not the result set. For XML data type masking, you select the Masking action, the String data type, and a masking type. When you create these rules, use the Metadata matcher and select "XPath" as the content type. In the Text box under XPath, give a path that points to the XML element that you want to match. For example, if you give the following XPath: `Personnel/Employee/Name`, then all of the Name elements that match this XPath will be masked using the action that you select in the rule. You cannot use "text()" after the element to be masked in the XPath. For example, if you give the XPath as "`Personnel/Employee/Name/text()`, the Name element will not be masked.

Similar to the second rule set that you created, the final rule set for XML masking must also contain a final rule that includes the Apply Masking action. Without the final rule that includes the Apply Masking action, the result set is not masked.

Dynamic Data Masking does not mask CDATA that is part of the XML data in the result set. Dynamic Data Masking also does not support result set masking for binary XML format, which is used by some Microsoft SQL Server clients.

Step 1. Create a Security Rule Set to Specify the Procedure Call and Process the Result Set

The first rule set contains a rule that identifies the procedure call as a valid procedure call with a result set that you want to mask. You can use the Procedure Call matcher in this rule to give the name of the stored procedure, or you can use other matchers, for example the From Clause or Text matchers. The matcher works at the level of the SQL query. Use the Process Result action to specify the name of the second rule set that you create.

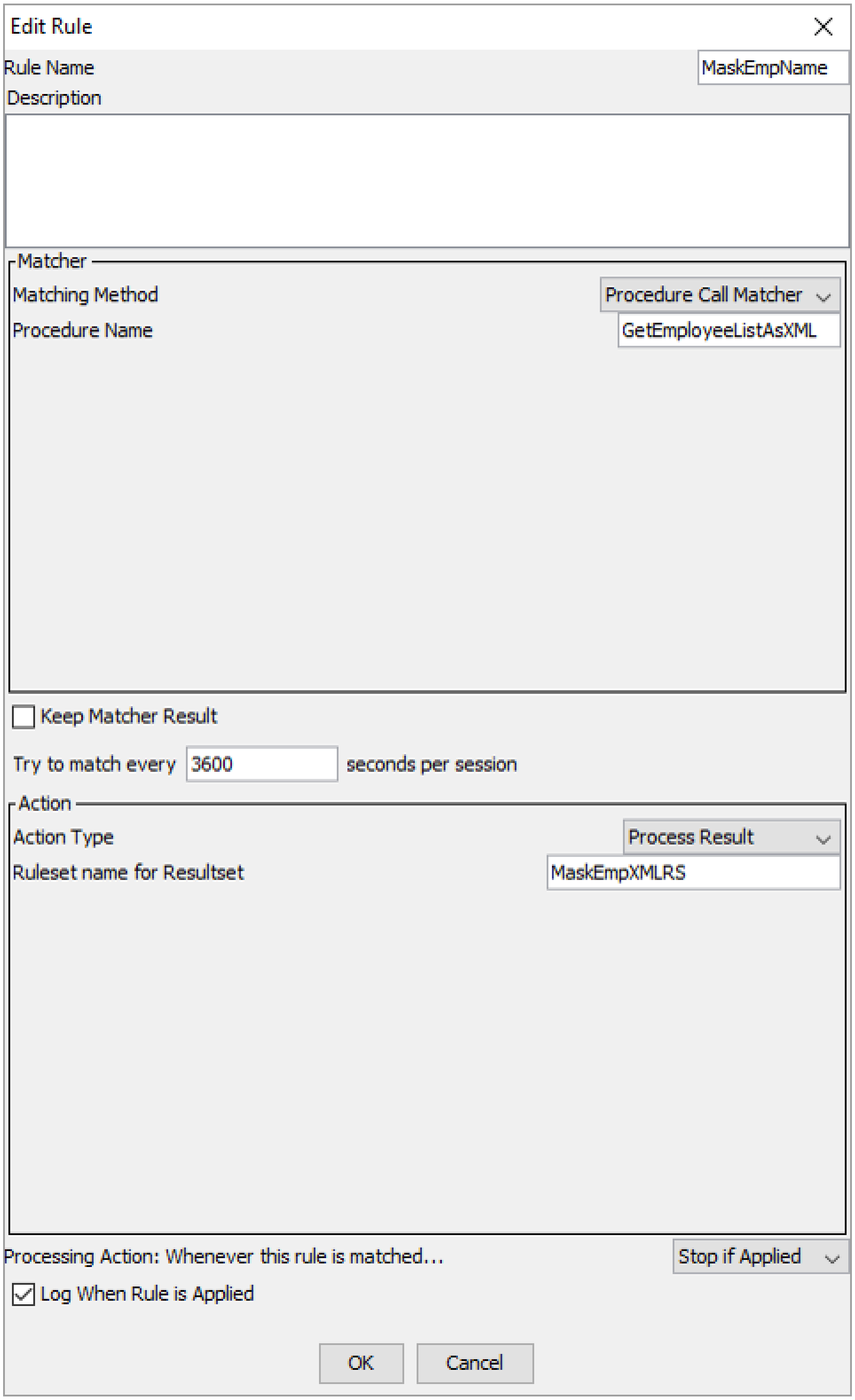
1. To create a security rule set, click on a domain node in the rule tree.
2. Click **Tree** > **Add Rule Set**.

   The **Add Rule Set** window appears.
3. Enter a name for the security rule set, for example, "SQLServerRulesXML."
4. Click **OK**.

   Within this rule set, create a rule to specify the stored procedure call and process the result set through the following rule set.
5. In the Management Console, click the security rule set that you created in the previous step.
6. Select **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.
7. Click **Action** > **Append Rule**.

   The **Append Rule** window appears.
8. Enter a name for the rule, for example, "MaskEmpLastName."
9. For the **Matching Method**, you can select **Procedure Call** or another matcher to identify the procedure call. If you select Procedure Call, provide the name of the stored procedure.
10. For **Action Type**, select **Process Result**.
11. For **Ruleset Name for Resultset**, give the name of the next rule set that you will create to process the result set. For example, "MaskEmpXMLRS."
12. For **Processing Action**, select **Stop if Applied**.



Rule Name: MaskEmpName

Description:

Matching Method: Procedure Call Matcher

Procedure Name: GetEmployeeListAsXML

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action Type: Process Result

Ruleset name for Resultset: MaskEmpXMLRS

Processing Action: Whenever this rule is matched… Stop if Applied

☑ Log When Rule is Applied

13. To create the rule, click **OK**.

14. Select **File** > **Update Rules** to save the rule in the rule tree.

Step 2. Create a Rule Set or Rule Sets to Process the Result Set

Create a security rule set to process the result set. Give the rule set the name that you provided in Step 1. as the "Ruleset Name for Resultset" parameter. Then create a rule to match the columns in the result set that you want to mask, using the Metadata matcher. For the rule action, select Content Masking. When you select the Content Masking action, provide the name of the third rule set that you will create in the next step, the XML masking rule set. Finally, you must create a rule within this second rule set to apply the masking function.

If you want to mask multiple columns in a result set that contain XML data, you can define individual rule sets for each column.

1. To create a security rule set, click on a domain node in the rule tree.
2. Click **Tree** > **Add Rule Set**.

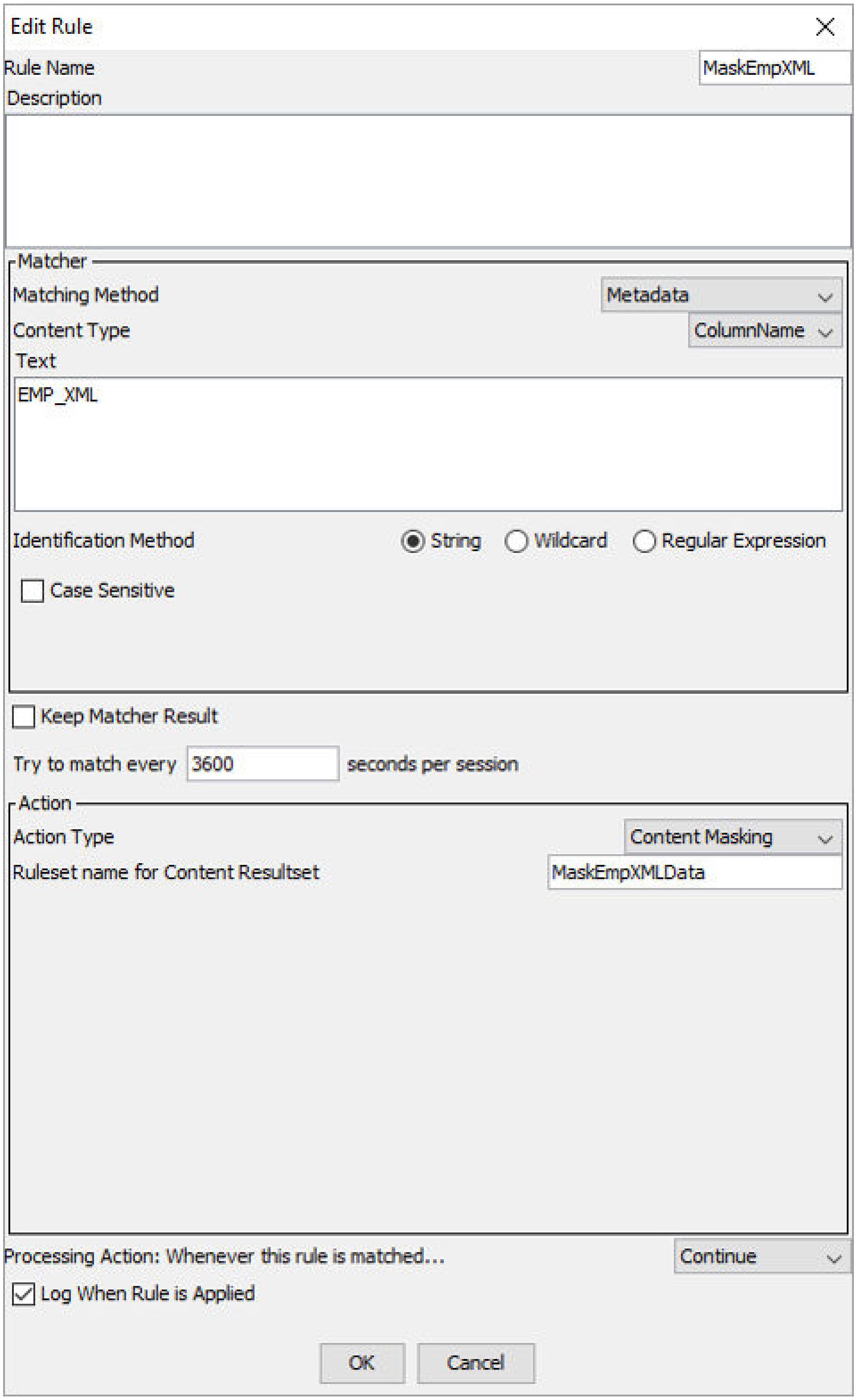
   The **Add Rule Set** window appears.
3. Enter the name of the security rule set that you gave as the **Ruleset Name for Resultset** property in the previous step. For example, "MaskEmpXMLRS."
4. Click **OK**.

   Within this rule set, create a rule or rules to match the column name in the result set that you want to mask.
5. In the Management Console, click the security rule set that you created in the previous step.
6. Select **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.
7. Click **Action** > **Append Rule**.

   The **Append Rule** window appears.
8. Enter a name for the rule, for example, "MaskEmpXML."
9. For the **Matching Method**, select **Metadata**.
10. For **Content Type**, select **Column Name**.
11. In the text box, enter the column name and select **String** as the identification method.

    Alternatively, you can configure the wildcard or regular expression options as identification methods. Dynamic Data Masking cannot distinguish between a result set that is part of a stored procedure call and a result set that is part of other system calls. As a best practice, do not use multiple generic regular expressions to define the column metadata matcher.
12. For **Action Type**, select **Content Masking**.
13. For **Ruleset Name for Content Resultset**, provide a name for the third and final rule set that you will create in the next step, the XML masking rule set. For example, "MaskEmpXMLData."
14. For the **Processing Action**, select **Continue**.



Rule Name: MaskEmpXML

Description:

Matcher

Matching Method: Metadata

Content Type: ColumnName

Text: EMP_XML

Identification Method: ● String ○ Wildcard ○ Regular Expression

☐ Case Sensitive

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action

Action Type: Content Masking

Ruleset name for Content Resultset: MaskEmpXMLData

Processing Action: Whenever this rule is matched... Continue

☑ Log When Rule is Applied

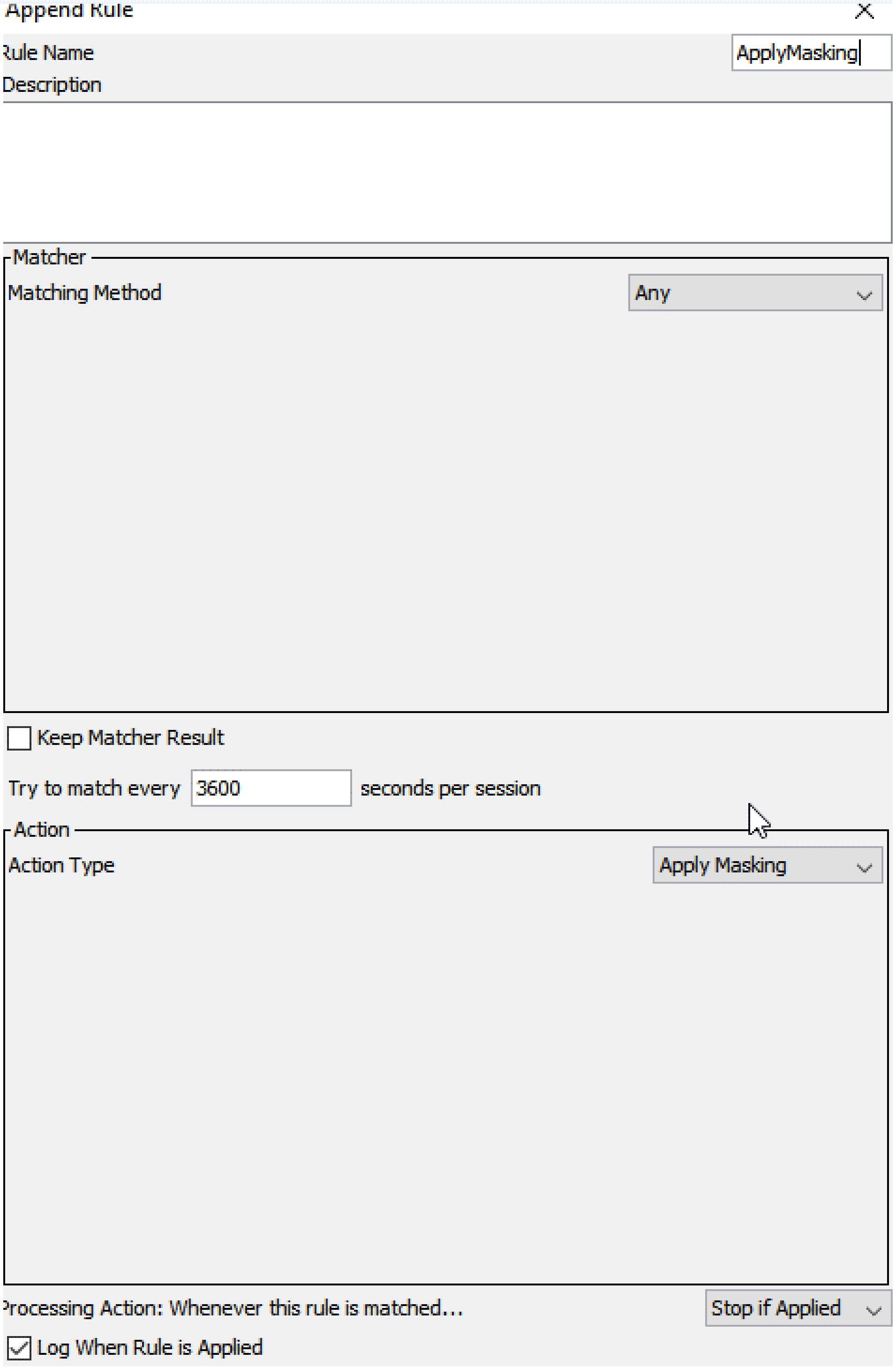
15. Click **OK.**

16. Select **File** > **Update Rules** to save the rule in the rule tree.
17. Optionally, you can create additional rules within this rule set on other columns in the same result set.

    When you are finished creating the rules that match the result set columns, create a final rule to apply the masking. This rule is mandatory and must be the final rule in the rule set.
18. Select **Tree** > **Security Rule Set**.

    The **Rule Editor** appears.
19. Click **Action** > **Append Rule**.

    The **Append Rule** window appears.
20. Enter a name for the final rule, for example, "ApplyMasking."
21. For the **Matching Method**, select **Any**.
22. For **Action Type**, select **Apply Masking**.
23. For the **Processing Action**, select **Stop if Applied**.



Append Rule

Rule Name ApplyMasking

Description

Matcher

Matching Method Any

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action

Action Type Apply Masking

Processing Action: Whenever this rule is matched... Stop if Applied

☑ Log When Rule is Applied

24. Click **OK**.
25. Select **File** > **Update Rules** to save the rule in the rule tree.

Step 3. Create the XML Masking Rule Set

Create the third and final rule set for masking XML data types in a result set. Give the rule set the name that you specified in the previous rule set when you selected the Content Masking action. Then create the rules that directly process the XML data itself. Finally, create a rule within this rule set to apply the masking function.

1. To create a security rule set, click on a domain node in the rule tree.
2. Click **Tree** > **Add Rule Set**.

   The **Add Rule Set** window appears.
3. Enter the name of the security rule set that you gave as the **Ruleset Name for Resultset** property in the previous step. For example, "MaskEmpXMLData."
4. Click **OK**.

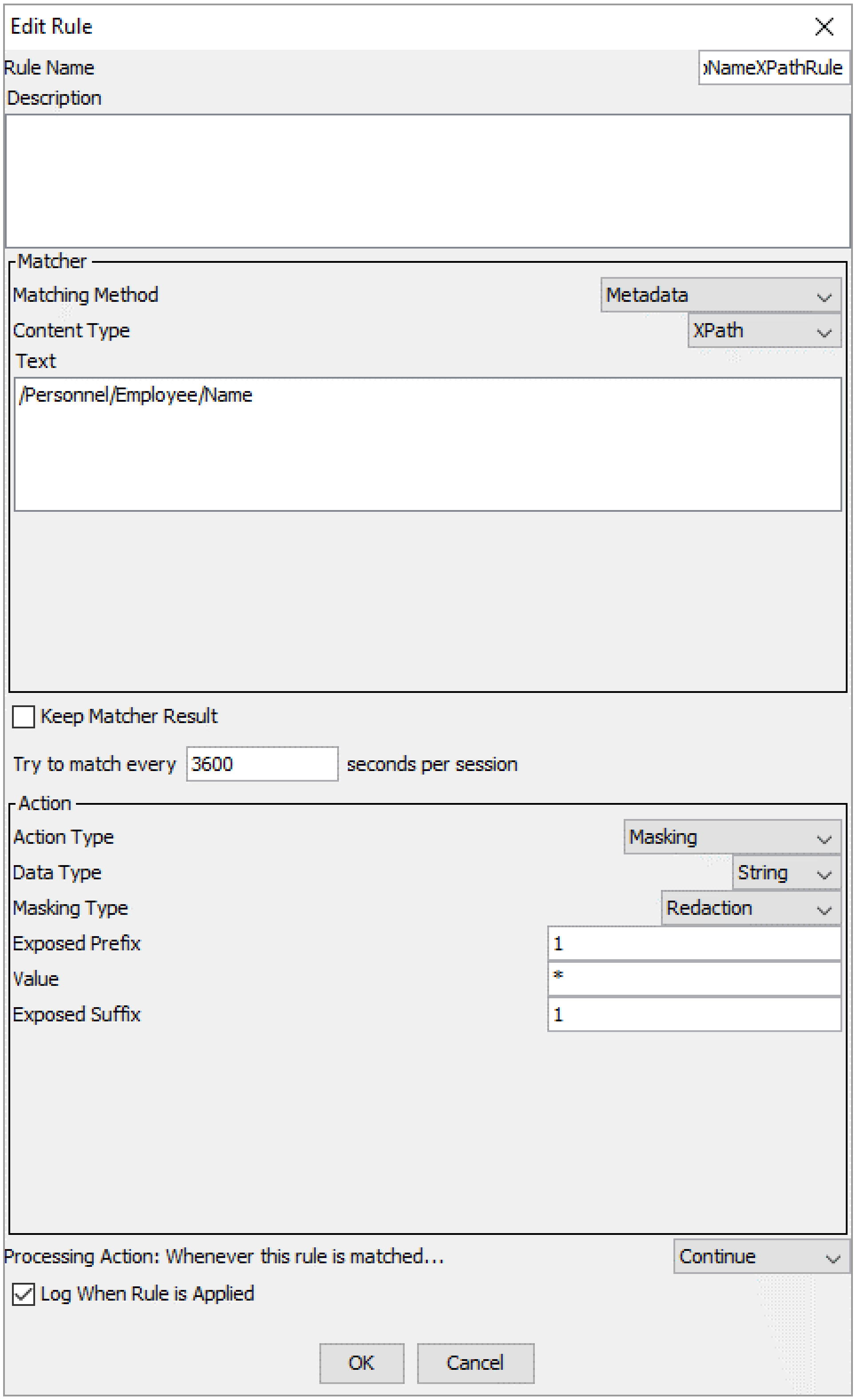
   Within this rule set, create a rule or rules to match the XML content that you want to mask.
5. In the Management Console, click the security rule set that you created in the previous step.
6. Select **Tree** > **Security Rule Set**.

   The **Rule Editor** appears.
7. Click **Action** > **Append Rule**.

   The **Append Rule** window appears.
8. Enter a name for the rule, for example, "EmpNameXPathRule."
9. For the **Matching Method**, select **Metadata**.
10. For **Content Type**, select **XPath**.
11. In the Text box, provide the XPath expression to match the XML elements that you want to mask. For example:

    ```
    /Personnel/Employee/Name
    ```
12. For **Action Type**, select **Masking**.
13. For **Data Type**, select **String**.
14. For **Masking Type**, select the type of masking that you want to apply to the data. You can choose from pattern, redaction, or constant masking.

    For more information about the Masking action, the masking types, and their parameters, see Chapter 4, “Security Rules” on page 36.
15. For the **Processing Action**, select **Continue**.



Rule Name: ›NameXPathRule

Description

Matcher

Matching Method: Metadata

Content Type: XPath

Text: /Personnel/Employee/Name

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action

Action Type: Masking

Data Type: String

Masking Type: Redaction

Exposed Prefix: 1

Value: *

Exposed Suffix: 1

Processing Action: Whenever this rule is matched... Continue

☑ Log When Rule is Applied

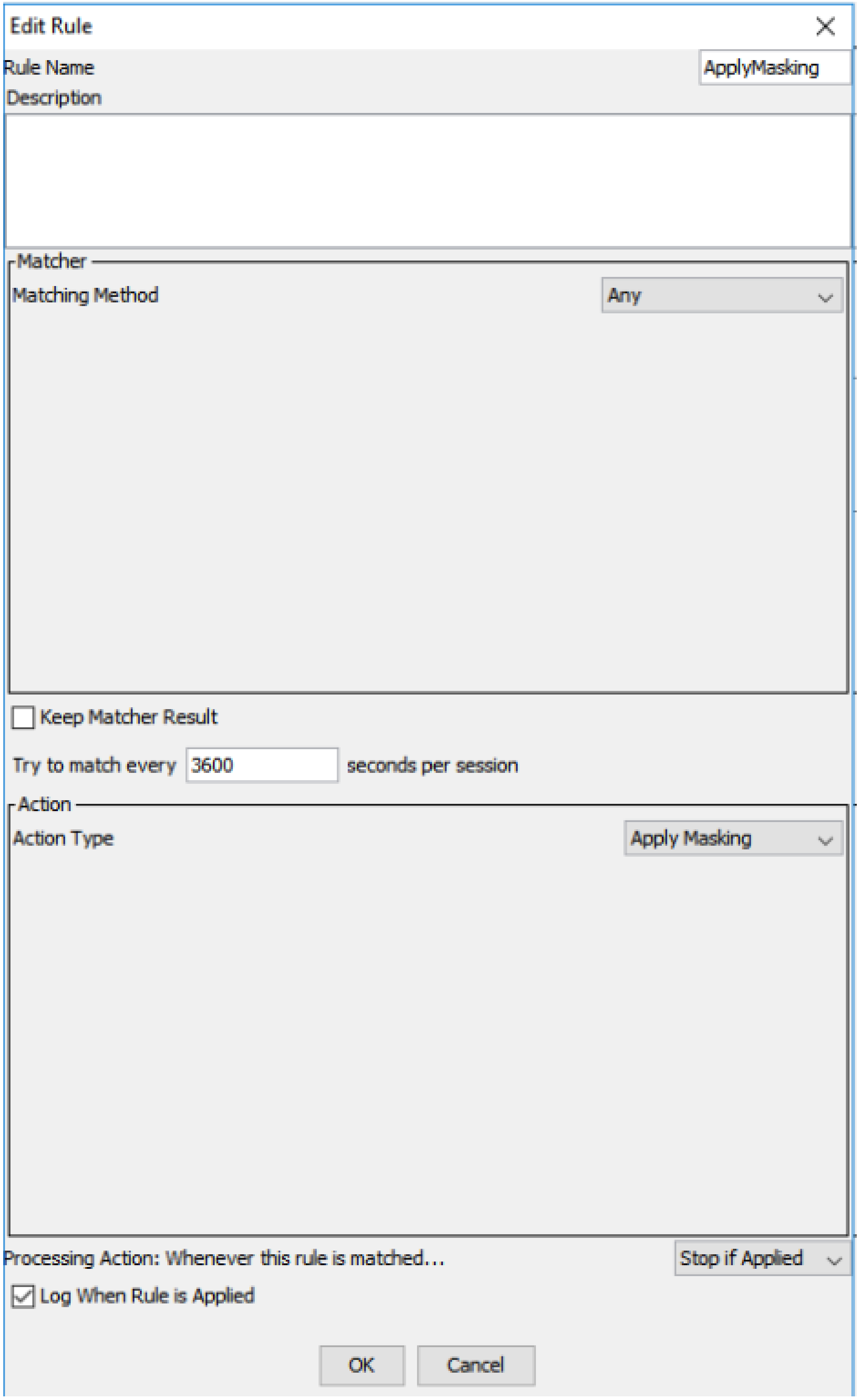
16. Click **OK.**

17. Select **File** > **Update Rules** to save the rule in the rule tree.
18. Optionally, you can create additional rules within this rule set on other XPath expressions.

    When you are finished creating the rules that match the XML data and configure the type of masking, create a final rule to apply the masking. This rule is mandatory and must be the final rule in the rule set.
19. Select **Tree** > **Security Rule Set**.

    The **Rule Editor** appears.
20. Click **Action** > **Append Rule**.

    The **Append Rule** window appears.
21. Enter a name for the final rule, for example, "ApplyMasking."
22. For the **Matching Method**, select **Any**.
23. For **Action Type**, select **Apply Masking**.
24. For the **Processing Action**, select **Stop if Applied**.



Rule Name: ApplyMasking

Description

Matching Method: Any

☐ Keep Matcher Result

Try to match every 3600 seconds per session

Action Type: Apply Masking

Processing Action: Whenever this rule is matched... Stop if Applied

☑ Log When Rule is Applied

25. Click **OK**.
26. Select **File** > **Update Rules** to save the rule in the rule tree.

Tabular Data Stream Protocol for Result Sets

Tabular Data Stream objects are converted between Microsoft SQL Server data types and Java types when the result set of a procedure call is created.

If the result set rewrite process encounters a column with an unsupported data type, the TDS protocol cannot create the result set. Consequently Dynamic Data Masking cannot mask any result set that contains a column with an unsupported data type, nor any other result sets subsequent to that result set in the response.

The following table shows the conversion that takes place between TDS types, Microsoft SQL Server data types, and Java types:

TDS Type	Microsoft SQL Server Type	Supported?
Fixed-Length Data Types		
NULLTYPE = %x1F	Null	No
INT1TYPE = %x30	TinyInt	Yes
BITTYPE = %x32	Bit	Yes
INT2TYPE = %x34	SmallInt	Yes
INT4TYPE = %x38	Int	Yes
DATETIM4TYPE = %x3A	SmallDateTime	Yes
FLT4TYPE = %x3B	Real	Yes
MONEYTYPE = %x3C	Money	Yes
DATETIMETYPE = %x3D	DateTime	Yes
FLT8TYPE = %x3E	Float	Yes
MONEY4TYPE = %x7A	SmallMoney	Yes
INT8TYPE = %x7F	BigInt	Yes
		Yes
Variable-Length Data Types		
GUIDTYPE = %x24	UniqueIdentifier	No
INTNTYPE = %x26	(see below)	Yes
DECIMALTYPE = %x37	Decimal (legacy support)	Yes
NUMERICTYPE = %x3F	Numeric (legacy support)	Yes
BITNTYPE = %x68	Bit	Yes

TDS Type	Microsoft SQL Server Type	Supported?
DECIMALNTYPE = %x6A	Decimal	Yes
NUMERICNTYPE = %x6C	Numeric	Yes
FLTNTYPE = %x6D	Float	Yes
MONEYNTYPE = %x6E	SmallMoney/Money	Yes
DATETIMNTYPE = %x6F	(see below)	Yes
DATENTYPE = %x28	(introduced in TDS 7.3)	Yes
TIMENTYPE = %x29	(introduced in TDS 7.3)	Yes
DATETIME2NTYPE = %x2A	(introduced in TDS 7.3)	Yes
DATETIMEOFFSETNTYPE = %x2B	(introduced in TDS 7.3)	No
CHARTYPE = %x2F	Char (legacy support)	Yes
VARCHARTYPE = %x27	VarChar (legacy support)	Yes
BINARYTYPE = %x2D	byte[]	Yes
VARBINARYTYPE = %x25	VarBinary (legacy support)	Yes
BIGVARBINTYPE = %xA5	VarBinary	Yes
BIGVARCHRTYPE = %xA7	VarChar	Yes
BIGBINARYTYPE = %xAD	Binary	Yes
BIGCHARTYPE = %xAF	Char	Yes
NVARCHARTYPE = %xE7	NVarChar	Yes
NCHARTYPE = %xEF	NChar	Yes
XMLTYPE = %xF1	XML (introduced in TDS 7.2)	Yes
UDTTYPE = %xF0	CLR UDT (introduced in TDS 7.2)	No
TEXTTYPE = %x23	Text	Yes
IMAGETYPE = %x22	Image	No
NTEXTTYPE = %x63	NText	Yes
SSVARIANTTYPE = %x62	Sql_Variant (introduced in TDS 7.2)	No

CHAPTER 8

Integration with Informatica Products

This chapter includes the following topics:

- Secure@Source Integration Overview, 116
- Integration with Other Informatica Products, 118

Secure@Source Integration Overview

You can use Dynamic Data Masking to mask columns or block requests to a table that Informatica Secure@Source has identified as sensitive. From Secure@Source, you can export a CSV file that contains information about a particular data store. When you import the CSV file in Dynamic Data Masking, Dynamic Data Masking identifies which columns in the data store tables are protected by a security rule in Dynamic Data Masking. If a column is not protected by any security rule, you can apply a security rule at the column level or block requests to the table at the table level.

If you use Secure@Source in addition to Dynamic Data Masking, you can export details about a specific data store from Secure@Source as a CSV file. Export the `DataStoreDetails.csv` file from the **Sensitive Fields** page in Secure@Source. The `DataStoreDetails.csv` file includes fields that the database scan in Secure@Source identified as sensitive. For more information about the `DataStoreDetails.csv` file, see the chapter "Overview Workspace" in the *Informatica Secure@Source User Guide*. If you try to import any CSV file other than the `DataStoreDetails.csv` file exported by Secure@Source, the import fails.

After you export the `DataStoreDetails.csv` file from Secure@Source, you can import it in Dynamic Data Masking. When you import the file, Dynamic Data Masking determines which columns in the data store are protected by a security rule already defined in Dynamic Data Masking. If all of the sensitive columns are protected by Dynamic Data Masking, you receive a message that All the columns are protected.

For unprotected columns, you can choose to apply a masking action or block all requests to the table. When you apply a masking action or block requests to the table, Dynamic Data Masking creates a rule based on the action you selected. If you choose the block action, Dynamic Data Masking creates a rule for every table name displayed in the table list. If you choose a masking action, Dynamic Data Masking creates a rule for every column name displayed in the table list. Dynamic Data Masking uses the From Clause Object matcher to match the column using the table name.

Importing the DataStoreDetails.csv File

To determine which columns in the data store are protected by Dynamic Data Masking, import the `DataStoreDetails.csv` file.

Export the `DataStoreDetails.csv` file from Secure@Source. For more information, see the *Informatica Secure@Source User Guide*.

1. Import the `DataStoreDetails.csv` file.
    - Click **Action** > **Import Sensitive Columns**.
    - Alternatively, click the **Import Sensitive Columns** icon in the **Rule Editor** toolbar.

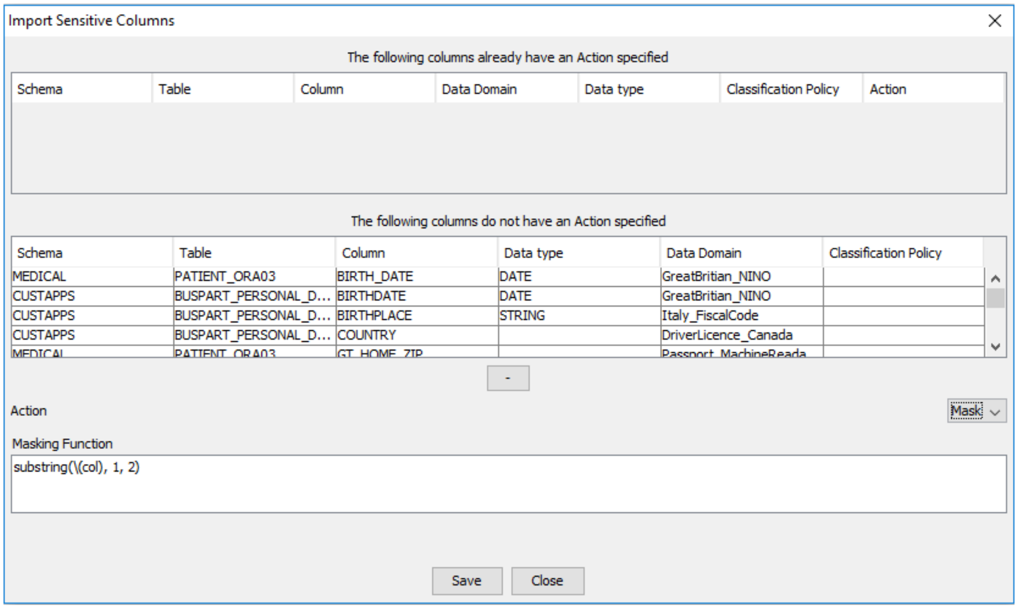
    The **Import File** window appears.
2. Select the `DataStoreDetails.csv` file from the location where you saved it after export, and then click **Import File**.

    If all of the sensitive columns identified in the CSV file are protected by Dynamic Data Masking, you receive a message that All the columns are protected. If any of the columns are unprotected, the **Import Sensitive Columns** window appears.

Creating Rules for Sensitive Columns

From the **Import Sensitive Columns** window, you can apply a masking action to any columns that are not protected by Dynamic Data Masking. You can also block all requests to a specific table.

1. After you import the `DataStoreDetails.csv` file, review the list of protected and unprotected columns from the **Import Sensitive Columns** window.



The following columns already have an Action specified

Schema	Table	Column	Data Domain	Data type	Classification Policy	Action

The following columns do not have an Action specified

Schema	Table	Column	Data type	Data Domain	Classification Policy
MEDICAL	PATIENT_ORA03	BIRTH_DATE	DATE	GreatBritian_NINO	
CUSTAPPS	BUSPART_PERSONAL_D...	BIRTHDATE	DATE	GreatBritian_NINO	
CUSTAPPS	BUSPART_PERSONAL_D...	BIRTHPLACE	STRING	Italy_FiscalCode	
CUSTAPPS	BUSPART_PERSONAL_D...	COUNTRY		DriverLicence_Canada	
MEDICAL	PATIENT_ORA03	GT_HOME_ZIP		Passport_MachineReada	

Action: Mask

Masking Function: substring(\(col), 1, 2)

2. To protect any columns identified as unprotected, select either **Mask** or **Block** from the **Action** menu.
    - If you select the **Mask** action, Dynamic Data Masking creates a rule for each column according to the masking function that you define. If you do not want to create a rule for any of the columns identified as unprotected, select the column and click the **-** icon to remove the column from the list.

- If you select the **Block** action, Dynamic Data Masking creates a rule for each table in the list of unprotected columns. The rule blocks all requests to the identified tables. You can specify an error statement, for example, "Blocked by administrator," before you apply the blocking action. If you do not want to create a rule for any table, select row that contains the table name and click the **-** icon to remove the row from the list.

3. Click **Save** in the dialog box.

   The rules appear in the security rule tree.

4. To save the rules, click the **Save** icon in the toolbar, or click **File** > **Save**.

Integration with Other Informatica Products

Dynamic Data Masking can import sensitive columns from any Informatica product that can identify sensitive columns in the specified CSV file format.

To identify sensitive columns and create security rules in Dynamic Data Masking, import a CSV file in the following format:

SchemaName /FolderName	Object	Field Name/ FileType	isSensitive	DomainName	DataType	Verified

SchemaName/FolderName

Schema name of the table.

Object

Table name.

FieldName/FileType

Column in the table.

isSensitive

Whether or not the column is sensitive. Valid values for this column are Y and N.

DomainName

Category to which the column data belong to.

DataType

Data type of the value in the column.

Verified

Whether or not the column is verified as sensitive. Valid values for this column are Y and N.

APPENDIX A

XML Functions Reference

This appendix includes the following topics:

XML Functions Overview

Dynamic Data Masking parses and masks SQL statements that contain XML functions. The XML functions that you can use with Dynamic Data Masking vary based on the database type. Use the tables below to determine which XML functions Dynamic Data Masking parses and masks for each database type.

IBM Db2

The following table lists the XML functions you can use with an IBM Db2 database:

XML Function	Parser	Masking Action	Comments
XMLATTRIBUTES	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLELEMENT	Yes	Yes	For masking, the XMLATTRIBUTES function is an optional clause in the XMLELEMENT function.
XMLEXISTS	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLQUERY	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLTABLE	Yes	No	

XML Function	**Parser**	**Masking Action**	**Comments**
XMLAGG	Yes	Yes	
XMLCAST	Yes	Yes	For masking, you must verify that masking does not violate the requirement of the function. The type of the cast operand or the specified datatype must be XML.
XMLCOMMENT	Yes	Yes	For masking, the expression cannot be a quoted string.
XMLCONCAT	Yes	Yes	
XMLDOCUMENT	Yes	Yes	
XMLFOREST	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLNAMESPACES	Yes	Yes	
XMLPI	Yes	Yes	For masking, you must verify that the optional value_expr object resolves to a string.
XMLROW	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLTEXT	Yes	N/A	
XMLXSROBJECTID	Yes	No	
XMLPARSE	Yes	Yes	For masking, the expression cannot be a quoted string.
XMLSERIALIZE	Yes	Yes	

Microsoft SQL Server

The following table lists the XML functions you can use with a Microsoft SQL Server database:

XML Function	**Parser**	**Masking Action**
FOR XML Clause	Yes	N/A
OPEN XML	Yes	No
XQUERY.VALUE	Yes	N/A
XQUERY.EXISTS	Yes	N/A

Oracle

The following table lists the XML functions you can use with an Oracle database:

XML Function	Parser	Masking Action	Comments
XMLATTRIBUTES	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLELEMENT	Yes	Yes	
XMLEXISTS	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLQUERY	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLTABLE	Yes	No	
XMLAGG	Yes	Yes	
XMLCAST	Yes	Yes	For masking, you must verify that the masked expression can be casted to the specified datatype.
XMLCOLATTVAL	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLCOMMENT	Yes	Yes	For masking, the expression cannot be a quoted string.
XMLCONCAT	Yes	Yes	
XMLFOREST	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLNAMESPACES	Yes	Yes	
XMLPI	Yes	Yes	For masking, the expression cannot be a quoted string.
XMLSEQUENCE	Yes	Yes	
XMLPARSE	Yes	Yes	For masking, the expression cannot be a quoted string.
XMLSERIALIZE	Yes	Yes	

Sybase

The following table lists the XML functions you can use with a Sybase database:

XML Function	Parser	Masking Action	Comments
XMLATTRIBUTES	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLELEMENT	Yes	Yes	For masking, the XMLATTRIBUTES function is an optional clause in the XMLELEMENT function.
XMLEXISTS	Yes	Yes	For masking, the expression must be followed by an AS alias clause.
XMLTABLE	Yes	No	
XMLAGG	Yes	Yes	
XMLCOMMENT	Yes	Yes	For masking, the expression cannot be a quoted string.
XMLCONCAT	Yes	Yes	
XMLPI	Yes	Yes	For masking, you must verify that the optional value_expr object resolves to a string.
XMLPARSE	Yes	Yes	For masking, the expression cannot be a quoted string.
XMLSERIALIZE	Yes	Yes	

APPENDIX B

Glossary

All Incoming Connections matcher

A matcher that applies the rule matching action to all incoming connections, regardless of target database, listener port, or application information.

Any matcher

Security rule matcher that applies the rule action to all incoming SQL requests.

appender

Management Console tree node that uses log4j classes to define the output format of log information.

Block Statement rule action

Security rule action that applies the security processing action, but does not apply a rule action.

Client/Application Information matcher

A matcher that defines the client or application information that the Rule Engine uses to identify a connection rule match.

connection rule

A rule that defines the criteria that the Rule Engine uses to identify the target database for the request. A connection rule consists of a matcher and an action that identify and route a connection request from an application.

connection rule matcher

A matcher that defines the matching method that the Rule Engine applies to identify a database request to be routed.

connection rule tree

A rule tree that defines the hierarchy that the Rule Engine uses to processes connection rules. The connection rule tree contains all the connection rules that you define for the target databases. The Rule Engine processes the first rule or rule folder in the connection rule tree and stops when there is a stop processing action.

Continue processing action

Processing action that causes the Rule Engine to continue to the next rule in the rule tree. You must assign the Continue processing action to rule folders so that the Rule Engine applies the rules within the folder.

Current Target Database matcher

A matcher that defines the target database that the Rule Engine uses to identify a connection rule match.

data masking

The process of disguising data to prevent access to sensitive information.

Define Symbol rule action

Security rule action that replaces strings or variables with the symbol that you specify.

Direct action

Connection rule action that connects applications and clients directly to the target database. When the Rule Engine applies the Direct action, the connection bypasses the Dynamic Data Masking service.

domain

A virtual node in the Management Console tree that you use to group other nodes. The Management Console contains a default root domain. You can use domains to create a visual representation of the structure of the databases within an organization.

Dynamic Data Masking Server

A server that provides services and resources to intercept database requests and perform data masking tasks.

Dynamic Data Masking service

A service that routes SQL queries to Oracle, Db2, Microsoft SQL Server, and Informix databases.

Folder rule action

A rule action that creates a rule folder. Use the folder action to nest and group rules.

From Clause Object matcher

Security rule matcher that identifies a request statement that uses an object or an alias in the FROM clause. Use the From Clause Object matcher to identify a reference to a view that does not appear in the execution plan.

Incoming Dynamic Data Masking Listener Port matcher

Defines the listener port that the Rule Engine uses to identify a connection rule match.

Informatica Dynamic Data Masking

A data security software that operates between an application and a database to prevent unauthorized access to sensitive information.

Java matcher

Security rule matcher that uses a Java class as a matcher.

Java rule action

Security rule action that uses a custom Java class as a matching action.

logger

Management Console tree node that uses Apache log4j to create a log of events.

log level

The severity of an event that you want to log. Define the Dynamic Data Masking Server log level to specify the events that you want to log.

Log Message rule action

Security rule action that uses a logger to log security rule event information.

Management Console

A client application that you use to manage the Dynamic Data Masking Server. You can use the Management Console to create and manage rules and to configure and manage connections to databases.

masking function

Defines the SQL function that the Rule Engine applies to rewrite the SQL SELECT statement.

Mask rule action

Security rule action that rewrites the SELECT statement in the SQL request. The Mask rule action uses a masking function to define how the Rule Engine rewrites the statement request.

matcher

Defines the criteria that the Rule Engine uses to identify a match. The matcher defines the matching method used for incoming connections.

Nothing rule action

A rule action that applies the processing action, but does not apply a rule action.

Parser matcher

Security rule matcher that identifies requests that Dynamic Data Masking cannot parse.

personally identifiable information (PII)

Information that uniquely identifies an individual, such as credit card information, social security number, birthday, and name.

PL/SQL Function matcher

Security rule matcher that defines a PL/SQL function name and searches for specific parameter values in the PL/SQL code.

processing action

Defines the action that the Rule Engine applies to the request after the Rule Engine applies the rule. The processing action manages how the Rule Engine processes the request through the rule tree.

Refuse action

Connection rule action that defines the access that an application has to the database. The application receives an error that indicates that the database refuses the connection.

Replace Table action

A security rule action that replaces the FROM clause of the SQL request to remove rows that contain sensitive data from the result set.

Rewrite rule action

Security rule action that replaces the SQL statement with an alternate statement.

rule

The conditions and actions that you want to apply to a request. A rule can be a security rule or a connection rule. You can create an individual rule or create a rule as part of a rule folder. A rule consists of a matcher, action, and processing action

rule action

Defines the action that the Rule Engine applies to incoming connections. The rule action determines where the Rule Engine routes the connection.

Rule Engine

A Dynamic Data Masking Server component that evaluates incoming database requests and applies connection and security rules to determine how to route requests and mask data. The Rule Engine can modify the database request based on the rules defined in the Dynamic Data Masking Management Console.

rule folder

An organizational tool that you use to group conditional rules. The Rule Engine processes the contents of a rule folder hierarchically. A connection rule folder contains connection rules. A security rule folder contains security rules.

rule tree

An organizational tool that defines the organizational structure of rules and determines the order in which the Rule Engine processes rules.

Search and Replace rule action

Security rule action that searches for specific text within a statement request and replaces it with the text that you define in the replacement string.

security rule

A rule that defines the criteria that the Rule Engine uses to parse and alter the SQL statement request. A security rule consists of a matcher and action that you define to identify and mask an SQL request.

security rule set

A tree node in the Management Console tree that contains references to one or more security rules. You must create security rule sets to secure data by using security rule actions. The Rule Engine processes the SQL statement through the rule set until the Rule Engine encounters a Stop processing action.

security rule tree

Each security rule set has an individual security rule tree. The security rule tree defines the order in which the Rule Engine processes security rules. The security rule tree contains the security rules for a particular security rule set. The Rule Engine processes the first rule or rule folder in the security rule tree and stops when there is a stop processing action.

Server Control

A command line program that you can use to configure and manage Dynamic Data Masking Server properties. Server Control is one of the management components of Dynamic Data Masking. It is installed with the Dynamic Data Masking Server.

SQL Syntax matcher

Security rule matcher that compares the incoming request statement to the SQL statement that you define within the matcher.

Stop if Applied processing action

Processing action. If the connection or security rule is applied, the Rule Engine does not continue to the next rule in the rule tree.

Stop if Matched processing action

Processing action. In a connection rule, if the rule is matched, the Rule Engine does not process the rule action. In a security rule, the Rule Engine does not continue to process the request.

Switch to Database rule action

Connection rule action that forwards connections to the specified database.

Symbol matcher

Security rule matcher that identifies and stores client and database variable values.

system logger

Pre-defined logger node in the Management Console tree that logs Dynamic Data Masking Server, service, and rule events.

Text matcher

Security rule matcher that defines the statement string text that the Rule Engine uses to match a request statement.

Time of Day matcher

Security rule matcher that defines a time frame during which the Rule Engine matches statements.

Use Rule Set action

Connection rule action that applies the specified security rule set to the SQL statement request.

INDEX