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Multi-Tenancy Using BSM - Best Practices

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Introduction

Chapter 1: Scope and Motivation

Multi-tenancy means different things to different people. Different service providers have different multi-tenancy needs (for example SaaS – Software as a Service, MSP – Managed Services Provider, or IaaS – Infrastructure as a Service), and there may be shared or split ownerships between service providers and clients.

The implementation of global system integrators like MSP, and the common use of the BSM platform in a shared services environment, make it necessary to provide multi-tenant capabilities in a shared services platform. The following use cases were identified to demonstrate the multi-tenant capabilities of BSM in a shared service platform.

This document provides the following:

- Definition of multi-tenancy, solution overview, and high level architecture of multi-tenancy.
- Use cases supporting multi-tenancy in BSM.
- Detailed explanations on how to configure BSM to provide multi-tenancy capabilities.

Chapter 2: What is a Tenant?

A **tenant** is a set of people (customers, service providers, or suppliers), whose access to data in support of customer contracts is managed as a collective whole. It is commonly referred to as an organization.

In the world of enterprise systems, a tenant is referred to as a customer receiving organization (CRO). Tenants are managed as part of the customer on-boarding process of the service provider.

For larger customers, a tenant can be defined based on business unit, contract segment, or geography, depending on contract entitlement. For example:

- Acme Manufacturing vs. Acme Sales
- Acme Web Hosting vs. Acme Workplace Services
- Acme North America vs. Acme Europe

Note that a user can be associated with more than one tenant; this is common for service provider personnel, but less common for customer personnel. A tenant is not a user group or resource group.

Chapter 3: What is Multi-Tenancy?

Multi-tenancy refers to a principle in software architecture whereby a single instance of software runs on a logical system and serves multiple client organizations (tenants), thereby increasing resource utilization and reducing operational complexity and cost.

Multi-tenancy is contrasted with a multi-instance architecture, whereby separate software instances (or hardware systems) are set up for different client organizations. Multi-instance architecture increases the costs to clients and support organizations. Supporting multi-tenancy within a single system reduces these costs by leveraging common infrastructure and support models.

The advantages of multi-tenancy are not universally supported within the software industry, and this may be a source of competitive differentiation.

Chapter 4: Solution Overview

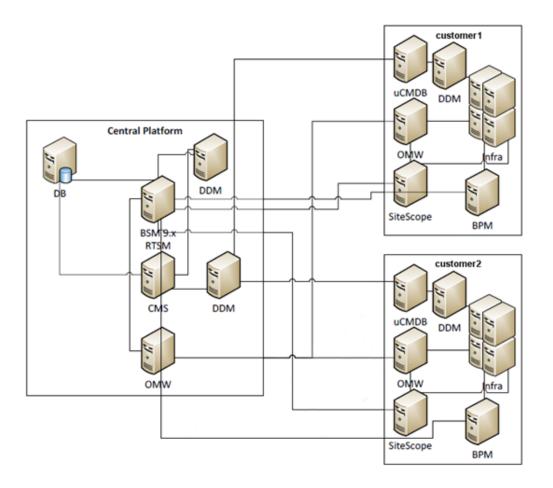
BSM 9.x does not support multi-tenancy out-of-the-box. This document describes the configuration steps required to enable BSM 9.x to support multi-tenancy use-cases.

The solution is based on the following:

- **Tenant Management.** Each tenant's data is identified within BSM by a dedicated attribute; this is the foundation of the entire solution. In some cases this attribute is automatically enriched, but in some cases the MSP administrator must update this attribute manually. This attribute identifies the tenant who owns the element, which means that the element is managed under the lifecycle of that tenant.
- Data-to-Tenant Relationship. All the elements in BSM CIs, events, views, and so on are related to one (and only one) tenant. Based on this information, data can be filtered in the different BSM applications to show data for each tenant; for example you can filter events or RTSM views based on the tenant attribute.
- Security Management. Using the BSM security model you can set permissions for different resources; BSM allows you to assign different permissions to different user groups. This can be used to define different permissions for different tenants. This security model is managed by the MSP administrator, and will probably be the most significant area requiring administration in the multi-tenancy solution on top of BSM 9.x.

The solution architecture is designed to address the use cases described in the following section. The main concept of the solution architecture is based on a local IT Operations environment for each customer, which is monitored by different monitoring tools (such as SiteScope, OM, BPM), and discovered by DDM. All this information is then sent to a central BSM/CMS platform, and accessed by different tenants.

The diagram below is one example of a deployment scenario; there are many variations to multitenancy but the basic concept will be similar. For example, some of the monitoring products such as BPM or SiteScope can also be leveraged across tenants (using remote monitoring); in this case they are configured and managed by the service provider using the central BSM platform, and the monitored data is accessed through the various BSM applications (Event Console, Service Health and so on).



Chapter 5: Use Cases

The multi-tenancy solution should provide the following capabilities:

Dashboard

- Different Dashboards for Different Tenants. Show all IT components managed by the various monitoring tools (OM, SiteScope, BPM, and so on) in separate views for each tenant. This includes Service Health, Event Management, Reports, SLM, and so forth.
- Integrated Dashboard for the Operations Team. Show integrated views with data from all tenants, to be used by the MSP Operations team.
- Event Correlation. Provide event correlation for each tenant independently.

uCMDB

- Discovery and Integration. Provide integration of multiple CMDBs with one CMS system.
- Independent Discovery. Provide discovery and mapping capabilities for each tenant independently.

Monitoring

- Distributed Monitoring. Integrate all remote monitoring platforms using a central BSM platform.
- Event Views. Provide different event views for different tenants.
- **Reports.** Provide scheduled reports for different tenants.

Step-by-Step Configurations

Chapter 6: Configuration Changes in the Tenant's CMS

If your tenant will have discovery capabilities, the DDM probe in the tenant environment should be connected to the tenant's (local) CMS. You can then synchronize the relevant topology from this CMS into the central BSM/CMS.

To do this, you must perform the following configuration changes on each tenant's CMS:

- 1. Create an enrichment rule which will fill the Tenant Owner attribute for each CI in this local CMS. This is necessary so that when you synchronize CIs from the local CMS to the central CMS, the CIs will be associated with the correct tenant.
 - a. In each tenant's CMS, access Modeling > Enrichment Manager.
 - b. Create a new enrichment rule with a meaningful name. Activate the rule, and select **Base the Enrichment on a new Query**, as seen in the following images:

New Enrichment Rule						×
Rule General Attri	butes					
Fill in the general artritur	see of the new enrichmen	t ruio.				
Steps Pute General Attributes Pute Base Query Wizard Completion	Rule Name: Rule Description:	Update Tenant Owner	/Eributo			
	Pute is Active					
		< Back	Next>	Enish	Cancel	Нер

e Enrichment Rule			
Rule Base Query			
Fill in the information about	the base query of the new enric	shment rule.	
Steps			
Rule General Attributes	Base Query Type		
Rule Base Query	Base the Enrichment or	a new query	
Wizard Completion	Base the Enrichment or	an existing query	
	Base Query Attributes		
	Base Query Name:	UpdateTenantOwnerAttribute	
	Base Query Description:		
	base query bescription.		
	Barra Ourse Driatibu	b 14.4	•
	Base Query Priority:	🍋 Medium	
		< Back Next > Enish Cancel	Help
			rep

- c. Click Finish.
- d. In Query Mode, select the Configuration Item CI type.
- e. Within Enrichment Mode, right-click Configuration Item and select Update Query Node:

Update Tenant Owner Attribute		
Enrichment Mode 💌 Am 🌆	📋 🏠 Mode: 🚺	🖌 Select 💌 📐 🗶
	100	Add Relationship
	61	
		Delete Relationship/Query Node

f. Select the attribute you want to update; enter its value, and click Apply:

	Name	Туре		Value
Tenant Owner		string		
Description		string		
Name		string		
Tenant Owner		string	Tenant1	
TenantsUses		list of strings		
Now CI Update	1	boolean		
Jser Label		string		
inable Aging		boolean		
lote		string		
Value	Tenant1			
1000				
Advanced				
	Configuration Item	T	ack_cleared_time	- m (

- g. Click **OK** to save the enrichment rule and activate it.
- h. You can validate the enrichment results in IT Universe Manager.
- 2. Modify the Integration TQLs that you will use to synchronize topology from the local CMS to the central CMS, to also synchronize the Tenant Owner attribute:
 - a. On each tenant's CMS, within Modeling Studio > Resource Type access Queries.
 - b. In each Integration TQL, right-click each of the query nodes and select **Query Node Properties**:

_	🔄 hostDataimport 🗵	
3	Query Definition	
ъ.	în 🗉 🖪 🔍 🗙 🖻	
-	Ø.	Location_Room +
	Ĩ	Nembership (0)
		Query Node Properties
		Show Bernert Instances

- c. In the Query Node Properties dialog box, open the Element Layout tab.
- d. Add the **Tenant Owner** attribute to the query.
- e. Click OK to save your changes.
- f. Repeat the above step b step e for each element in the query, and then click **Save** in the left pane.
- Within the central BSM, define an integration point to the tenant's CMS in order to synchronize CIs into BSM:
 - a. Within the central BSM, access Admin > RTSM Administration > Data Flow Management > Integration Studio.

Note: You must connect the Data Flow Probe to BSM before performing these steps, and configure credentials to CMS in Probe administration. This is done using the Data Flow Probe set up; for details refer to the Data Flow Management Guide.

b. Create a new integration point:

🚣 Edit Integration Proper	ties 🗙
Nedit Integrati	on Properties
Integration Prope	rties
 Integration Name 	CMS2RTSM
Integration Description	
Adapter	UCMDB 9.x
Is Integration Activated	
Connection Prop	erties
 Hostname/IP 	UCMDB9VM
Port	8080
Customer Name	Default Client
State (default empty)	
 Credentials 	genericprotocol: admin
Push Back Ids	Disabled
Probe Name	OBAAPP1
	Test connection
	OK Cancel

- c. Add new jobs; for each job select the Integration TQL for which you configured Layout Settings in step 4 above.
- d. Save the integration point, and perform full synchronization.
- e. Within IT Universe Manager, check that you received CIs from the local CMS, and that they contain the Tenant Owner attribute:

📇 barr9-cipa		Properties History Discovery
ama: bam9-dpa	ID: c415034d70f55cf17d53c619f39642e4f	CIType: Windowa
🗄 🛄 I 👔 I 🕷 🔬 I 🧷 I	Edit 🎦 Export 🔹	
sagar.		1
OeDescription		
OsFamily	windows	
OsVendor		
PrimaryDnaName		
SerialNumber	VMWARE-56 4D FE 3	3 22 AF 07 CD-51 61 3A 49 5C A3 80 6E
Snmp Sys Name	BSM9-DPS	
SwapMemory Size		
Sys Objectt id	1.3.6.1.4.1.311.1.1.3.1	.2
Tenant Owner	Tenanti 🚽	_
Updated By	CMS2RTSM: DS_CM	S2RTSM_Basic Infrastructure Sync 🛛 🔫 💳
User Label	eqb-erred	-
Vendor		

Note: In your deployment scenario, if each tenant's DDM will be connected directly to the central BSM, you need to employ a different approach to enrich the Tenant Owner attribute in BSM, such as using an Enrichment Rule.

Chapter 7: Configuration for End User Monitoring

You can configure EUM-level permissions for users to restrict access to tenant-specific applications (see "Create MyBSM Pages" on page 31). However, to separate the applications and application views in RTSM, you must add the **TenantOwner** attribute manually for all the Business Applications. This needs to be done once for each Business Application CI; it can be done before or after creating the Business Application configuration in EUM Administration.

- If you prefer to do this before EUM configuration, create the Business Application in Admin > RTSMAdministration > Modeling Studio, and fill the TenantOwner attribute with the relevant value. In EUM Administration you will edit the CI and add BPM/RUM configuration.
- If you prefer to do this after EUM configuration, edit the Business Application CI's properties in Admin > RTSM Administration > IT Universe Manager, and fill the TenantOwner attribute with the relevant value. If you will use naming conventions for the Business Applications (such as using tenant name as suffix), you can easily assigning the TenantOwner attribute with an enrichment rule.

Once the application is configured for monitoring, you will use the Custom event template to add the **TenantOwner** attribute for automatic assignment of events to the respective event consoles (see "Enriching Events Which are Generated from Within BSM" on page 21).

Chapter 8: Configuration for OMi

To enable each tenant to only see their relevant events, you will assign a custom attribute to events. This custom attribute will be used for filters, and for auto-assignment of event to groups. There are several ways to assign this custom attribute, depending on the event source.

Enriching Events Which are Forwarded from OMi

If you cannot set the custom attribute within the OM monitoring policy directly (or the integration policy when using an integration adapter), you can enrich incoming events with tenant information on the OMi server as follows:

- 1. Access Admin > Operations Management > Event Automation > Event Processing Customization.
- 2. Select **Before CI/ETI Resolution**, and add a new script.
- 3. In the **General** window, enter **AddTenantOwner** as the script name. In the **Script** window, enter the script below.

Note that you must add each OM server and each tenant separately. For performance considerations, we recommended doing this in one script. A similar approach can be used for events received via the Integration Adapter, where the **source ci hint** can be used in the **if** statement.

Here is the basic script:

```
import java.util.List;
import com.hp.opr.api.scripting.Event;
class GroovyScriptSkeleton
{
    def init()
    {
    }
    def destroy()
    {
    }
    def process(List events)
    {
        events.each {Event event ->
```

```
String tenantOwner = null;
NodeInfo originatedServer = event.getOriginatingServer();
String serverDnsName = originatedServer.getDnsName() ;
if ("omServer1.hp.com".equals(serverDnsName))
tenantOwner = "TenantGroup1";
else if ("omServer2.hp.com".equals(serverDnsName))
tenantOwner = "TenantGroup2";
// else if ... for each OM server/Tenant info
If (tenantOwner != null)
event.addCustomAttribute("TenantOwner", tenantOwner)
}
```

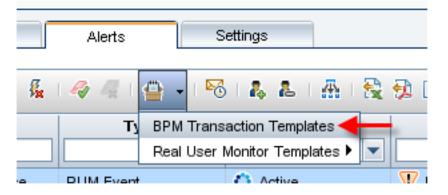
- 4. Click Next.
- 5. You can specify additional elements for your script in the **Advanced Tab** (for example, you can add an external jar which will be used by the script or events filter), or click **Finish**.

Enriching Events Which are Generated from Within BSM

Some events are generated from within BSM, such as alert actions, health indicator (HI) status changes, or events from SiteScope. For these events you must add the custom attribute in the event template, as described in the following section.

(This example is for BPM Alerts, but the procedure is similar for other events generated from within BSM.)

1. Within Admin > End User Management > Alerts, click BPM Transaction Templates:



2. Select the **BPM Trans Alert Default** template (marked with the Default icon), and click **Duplicate selected template**:

🕌 BPM Transaction Template Repos	itc
Templates	
* 🖬 🛅 🔛 💥	ľ
	Ε.
BPM Trans Alert Default	

- 3. Edit the duplicated template, and rename the template name to be unique for a tenant.
- 4. In the **Custom Attributes** tab, add a new key. The key name should be **TenantOwner** (as in the Groovy script), and the value should be the tenant name:

a	1)	
Properties		
 Template name 	BPM Trans Aler	t template for Tenant1
Set the selected ter	mplate to be the defau	ilt template
General Custom /	Attributes	
General Custom	Attributes	
		Value
* • ×		Value < <transaction name="">></transaction>
* - X Nar		

- 5. Save your changes.
- 6. When you create a BPM transaction alert on a tenant's business application, make sure you select the correct event template:



Automatically Assigning Events to User Groups

As part of the solution, role-based access will be used to configure and provide access permissions to RTSM, Service Health, OMi and EUM for the respective tenants; for details see section 2.6. Events which are assigned to these groups/users contain associated permissions; events which are not assigned to them are not displayed.

Perform the following steps to automatically assign events to user groups based on the **TenantOwner** attribute:

- 1. Within Admin > Operations Management > Event Automation > User Group Assignments, create a new assignment rule.
- 2. Create a new event filter by clicking Browse... > New Simple Filter.
- 3. Provide a meaningful name for the filter.
- 4. In the Additional Event Properties tab, mark the Custom Attribute checkbox. Add TenantOwner as the attribute name, and enter the tenant name as its value (as you did in the Groovy script and event templates):

Filter Configuration		×
Filter Display Name: 🧚	Tenant1 events	
Filter Description:		
General Dates	Additional Event Properties	
Application:	equals 🗸	
Object:	equals 🗸 🗸	
🔲 Key:	equals 🗸 🗸	
🔲 Original Data:	equals 🗸	
CI Type:	derived from	
Solution:	equals 👻	
🗹 Custom Attribute	e: TenantOwner equals V Tenant1	
		•
	OK Advanced Mode Cancel	Help

- 5. Click **OK**, and select your event filter.
- 6. In the assignment rule, select a user group or user that represents the tenant (creating user groups is explained in "Configure Users and Permissions" on page 32):

Tenant1 - Create	New Event Assignment Rule 🗙
Filter: 😽	Tenant1 events
User Group: 🜸	Tenant1
Description:	Automatically assign Tenant1 events to the relevant user group
(≉) Required fie	ld
	OK Cancel Help

7. Click **OK**, and save your rule.

Viewing the Tenant Owner Attribute in the Event Console

To enable a super-admin who is working across tenants to see the **Tenant Owner** event attribute as a column in the Event Console, configure the following infrastructure setting:

- 1. Within Admin > Platform Administration > Infrastructure Settings, select Applications: Operations Management.
- 2. In the section **Operations Management Custom Attribute Settings**, edit the setting **Available Custom Attributes**.
- 3. Add a semicolon (;), and then type **TenantOwner**. Save your changes.

You can then add a column that will show the **Tenant Owner** attribute in the Events Console.

You can also create Event Browser filters to only view events from a specific tenant. You can reuse the same filters you created in "Automatically Assigning Events to User Groups" on page 23.

A useful filter for the super-admin can be to show all events whose **Tenant Owner** attribute is empty.

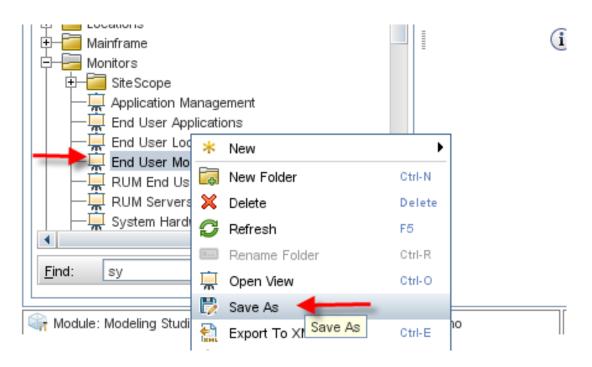
Chapter 9: Create Views in BSM

Use the following procedure to create different pattern-based views for different tenants, and to add conditions to the CITs in each view to collect data relevant to the tenants. In this procedure, the **TenantOwner** attribute is used to identify and limit the data relevant to the tenants, and user level permissions are configured for the respective tenants.

1. Within Admin > RTSM Administration > Modeling Studio, create a folder for each tenant. This will hold all the views belonging to that tenant and make it easy to manage the views.

Modeling > Modeling Studio
Modeling Data Flow Management Administration
<u>Resource ▼ Edit ▼ View ▼ Layout ▼ Operations ▼ Editor</u>
* New - 🖹 🕞 🏓 🤁 🗖
Resources CI selector CI Types
Resource Type: Views

2. Right-click a view, and select Save As to create a view for a specific tenant.



3. Give the new view a relevant name and save it in the correct folder. Make sure you select the **New query** checkbox.

🕌 Save Pa	attern ¥iew 🔀
—	Sa∨e Pattern View Choose the View name, and path (Folder) in order save to it. You may also check the New Query in order to save the base query with a different name.
🗔 🗶 (
View name	e: End User Monitors(Tenant1) 🗹 New query End User Monitors(Tenant1)
	HP-SHR HPDemo BM Web Sphere MQ Integrations J2EE Local impact views Locations Mainframe Monitors Network Operations Management Perspectives SAP Service Desk SLM SOA Storage Tenant1 Virtualization
<u>F</u> ind:	
	OK Cancel

 Select the cloned view, and edit the node which will have tenant owner information for filtering. In this example, we will edit the Business Application CI (see "Configuration for End User Monitoring" on page 19):

Ouery D	ofinition								
Query D		Q	×	F					
>					-			Query Node Properties	
						1		Show Element Instances	
								Set Data Sources	
┇							>	Change Element Type	
U E							2	Add Related Query Node	
9							Îø	Add Relationship	
							Å.	Add Join Relationship	
3						je	1 ₽	Add Calculated Relationship	
							急	Add Compound Relationship	

Add a new property condition; select the **TenantOwner** attribute, and enter the relevant value. Do
not harm the logic of the existing condition (if it exists); if necessary add parentheses to maintain
the existing condition:

🔬 Query Node Properties						×						
Query Node Properties Enables you to add attributes, cardinality, qualifiers and CI specific conditions												
Bement name: BusinessApplication 🖉 Visible 😨 Include subtypes												
Attribute Cardinality Qualifier Identity												
* 🕱 🏦 😓 🖸 Advanced layout	semings	Crite	aria	1		And/Or						
		Monitored By C			,	OR						
		Monitored By C		-)	AND						
		Tenant Owner E	Equal "Tenant1"			•						
Attribute name:	Operator:	Parameterized:	Value:									
Tenant Owner - (string)	Equal	💌 🔿 Yes 🖲 No	Tenant1									
				Cuery Result Count	OK Cancel	Help						

- 6. Click **OK**.
- 7. When you finish filtering the query nodes, click **Preview** to validate the view results.
- 8. When you finish validating, click **Save**.

Note: You might want to create a view which shows all the CIs that do not have the **TenantOwner** attribute defined as expected, or that are connected to such CIs. Such a view is very useful for the

super-admin.

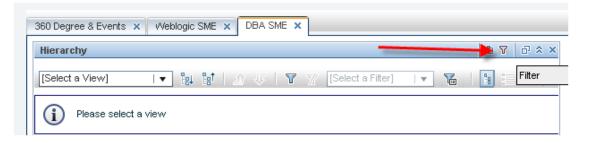
Chapter 10: Create MyBSM Pages

You can create different MyBSM pages for different tenants. These pages can be filtered to specific views in order to differentiate tenants' workflows and provide each tenant with specific Dashboards. You can also configure permissions for each page, so users will not be able to modify the pages.

Components which contain a view selector are only populated with the views that a user has permissions to access.

You can also create new URL-based components in MyBSM, for example using a tenant's knowledge base portal. You can then assign permissions for these components (see "Configure Users and Permissions" on page 32).

- 1. Within MyBSM, create a new page or open an existing page and save it with a new name.
- 2. Build your page by adding the relevant components.
- 3. Click **Filter** on a Service Health, SLM or EUM component.



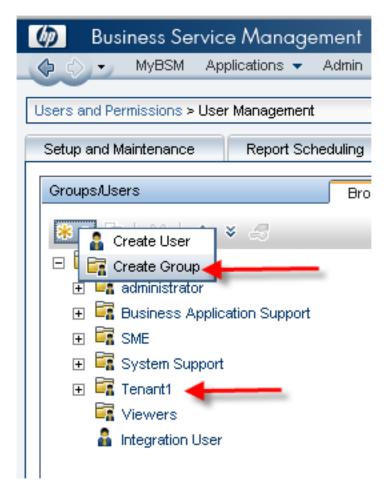
- 4. Select the relevant filter criteria (view, SLAs or Business Applications) and click OK.
- 5. Click Save.

For more information on working with MyBSM, refer to the MyBSM part of the BSM User Guide.

Chapter 11: Configure Users and Permissions

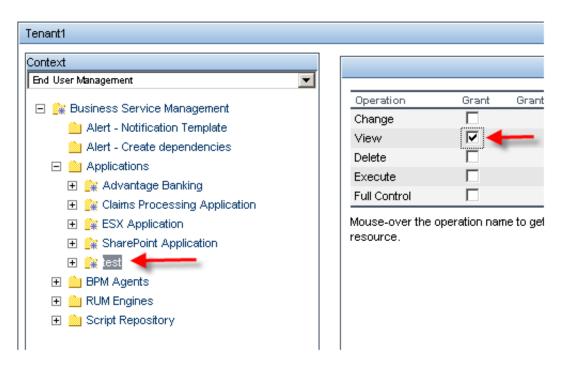
Use the following procedure to define group-level role-based permissions. You will use user groups to identify tenants and distinguish between users of each tenant. By defining permissions on the user group level, you avoid managing permissions on the user level. Moreover, when a new user is added to a group, it inherits permissions from the group. If a user belongs to two groups, the user gains access to events and views of two tenants.

- 1. Access Admin > Platform Administration > Users and Permissions > User Management.
- 2. For each tenant, create a group:



- 3. Edit permissions for each group you create, as follows:
 - a. Select the group.
 - b. Select the Permissions tab; click Apply Permissions after each modification.

c. Select the End User Management context, and assign operations for each element (for example, you can grant View permissions for the tenant's applications only:



- d. Select the **Operations Management** context. Make sure that **Events not assigned to user** is not selected, and **Events assigned to user** is selected. You can also set permissions on tools, actions and other administration tasks.
- e. Select the **RTSM** context and assign View permissions to the specific views you created for this tenant. Make sure other tenants' views are not selected. You will probably want to deselect the out-of-the-box views for this tenant, they are Pattern views which are not filtered for specific tenant owner.
- f. Select the Service Health context and assign permissions to MyBSM pages for this tenant.
- g. If you created SLAs for this tenant, select the **Service Level Management** context and assign permissions for these SLAs.
- h. If you create custom, trend or service reports for this tenant, select the **User Defined Reports** context and assign permissions for each category for this tenant.

For more details on users and permissions, refer to the BSM Platform Administration Guide.

Chapter 12: Multi-Tenancy and Other Data Collectors

Some data collectors support multi-tenancy more easily than others:

- **BPM.** BSM can handle multiple BPM agents, which means that you can have different BPM agents for different tenants. This allows fully segregation between tenants.
- **RUM.** BSM can handle multiple RUM engines and each engine can handle multiple RUM probes. This allows fully segregation between tenants.
- SiteScope. BSM can handle multiple SiteScope instances, so you can have different SiteScope instances for different tenants. Since SiteScope creates topology in RTSM, you can also use the **RoutingDomain** attribute to segregate the topology that each SiteScope creates. You can populate the **TenantOwner** attribute using enrichment, or you can use the SiteScope Profile CI in your enrichment.
- **Diagnostics.** Only one Diagnostics server/commander can be connected to BSM. You can connect multiple Diagnostics probes to the server/commander, but the data and topology that are sent into BSM will not have any tenant information; you must assign topology and data to specific tenants manually. You can assign permissions on the Application within User Management, in the context Transaction Management.
- NNMi. Only one NNMi server can be connected to BSM. Future versions of NNMi will enable multitenancy, but currently you must manually assign the topology to tenants (or using enrichment, for example based on IP address ranges). This is also true for events with more complicated Groovy script.
- BSM Connector/IA. BSM can work with multiple connectors, which means you can have a different connector for each tenant. You can also customize topology, and include the **TenantOwner** attribute in the topology sent by the connector. You can also customize events and include the **TenantOwner** attribute in the event itself.

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