SAP HANA Multiple-Container Mode
HBD169

Exercises / Solutions

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SAP TECHED

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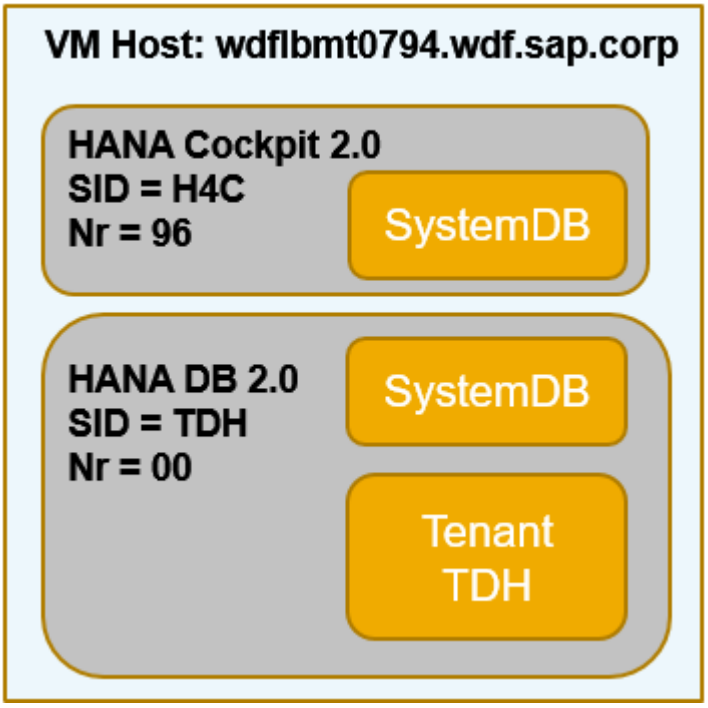
BEFORE YOU START

In this hands-on session, you have the opportunity to work on several exercises in the SAP HANA Operations / Lifecycle Management area. The exercises are designed to be completed in sequence, starting at the top and working your way down. At the end, there is an optional exercise.

To complete the exercise each group will be given access to its own SAP HANA 2.0 SPS 01 server running remotely on a small virtual machine (this is different from most other hands-on sessions where all participants share one single database). The access to SAP HANA is established through the SAP TechEd laptop. First you login to a Virtual Machine using the “Remote Login” option, then you do the exercises using the Google Chrome browser and the PuTTY SSH client. Hostname and credentials will be provided by the instructors.

For the exercises, there are two SAP HANA instances with SIDs H4C and TDH. Both are multitenant instances.

- Instance H4C is the new SAP HANA Cockpit 2.0 instance, replacing SAP HANA Studio as the recommended tool for administrative tasks. Instance H4C has a SYSTEMDB and no tenants.
- Instance TDH is a SAP HANA 2.0 SPS 01 database instance. Instance TDH has a SYSTEMDB and a database tenant also called TDH. During the exercise, you will create more tenants using SAP HANA Cockpit 2.0.

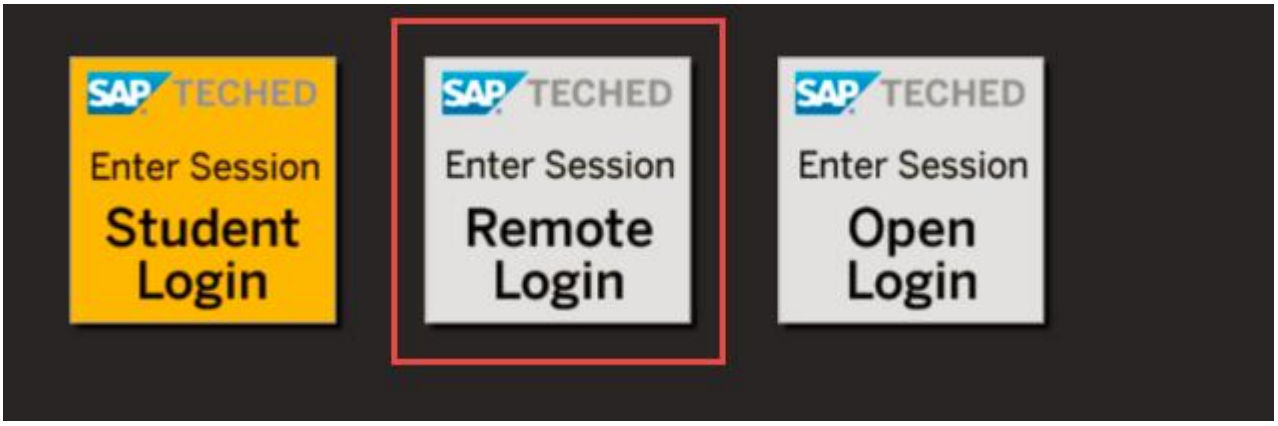


SAP HANA COCKPIT URL’S:

- SAP HANA Admin Cockpit: https://wdflbmt0794.wdf.sap.corp:51023
  The SAP HANA Admin Cockpit is used to register SAP HANA instances for the SAP HANA Cockpit.

- SAP HANA Cockpit: https://wdflbmt0794.wdf.sap.corp:51021
  The SAP HANA Cockpit give administrators the ability to manage registered SAP HANA instances.

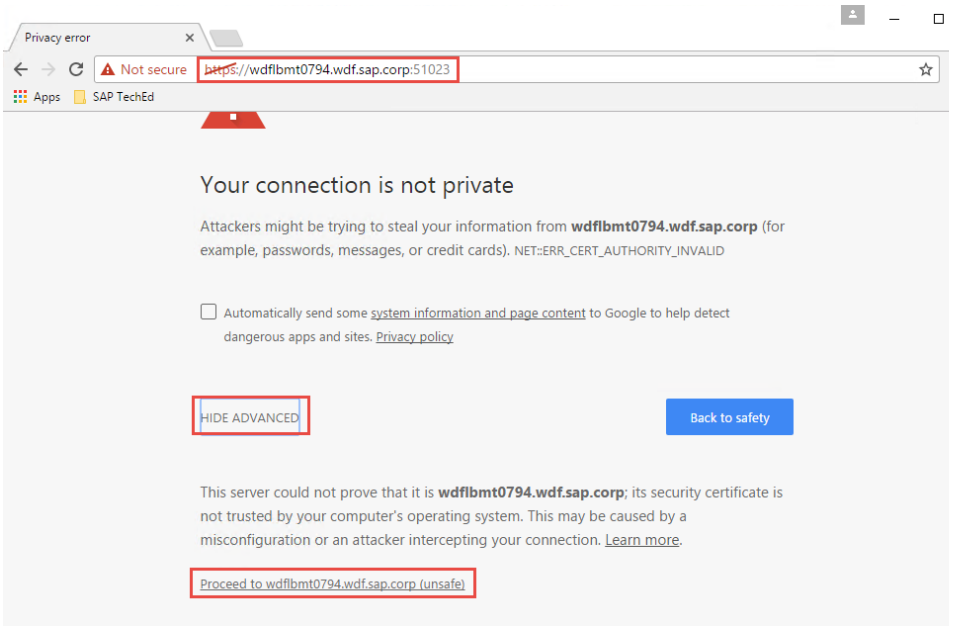
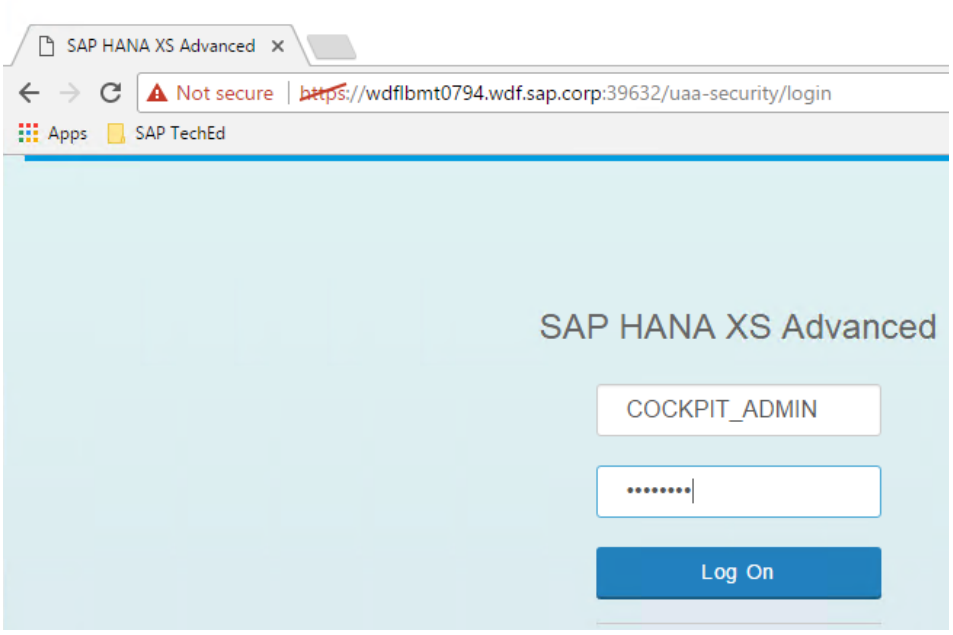
As stated, you first login into the front-end VM. On the laptop, choose the option “Remote Login”, enter the credentials supplied by the instructors

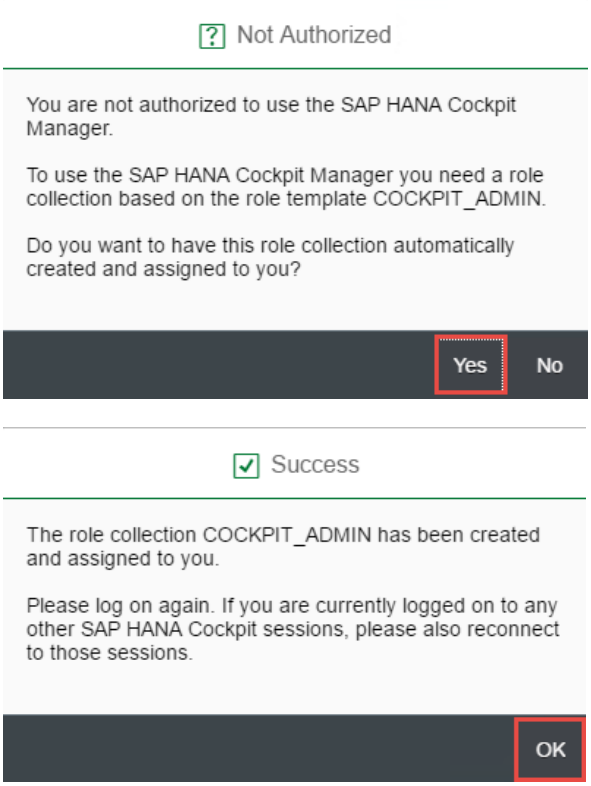
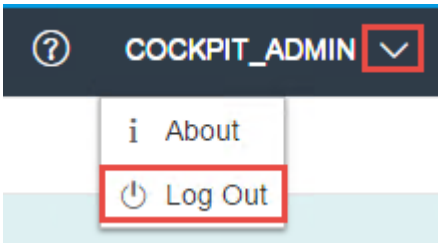


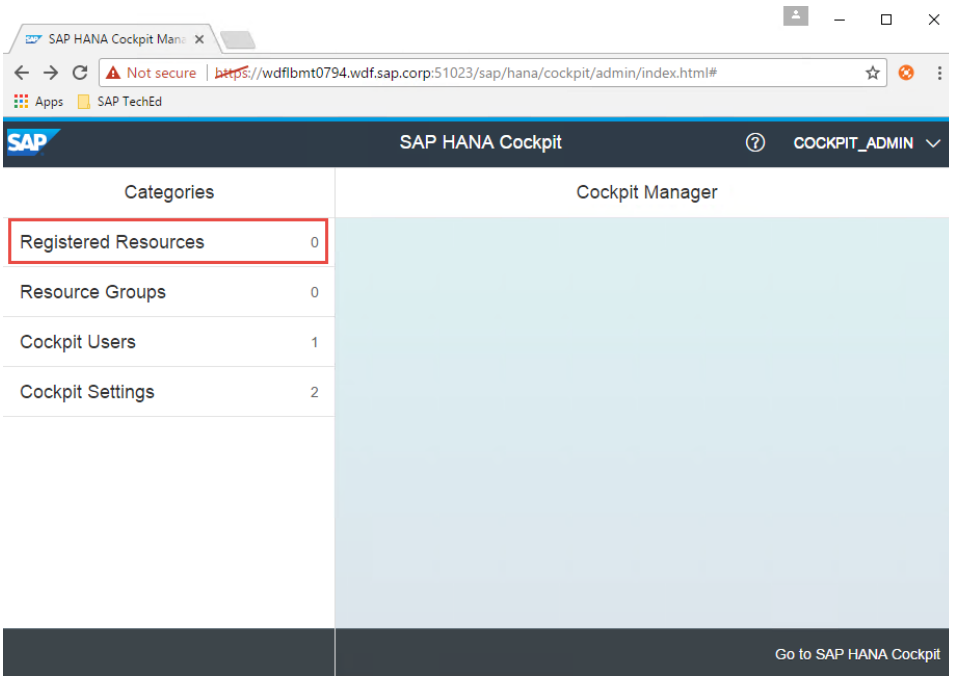
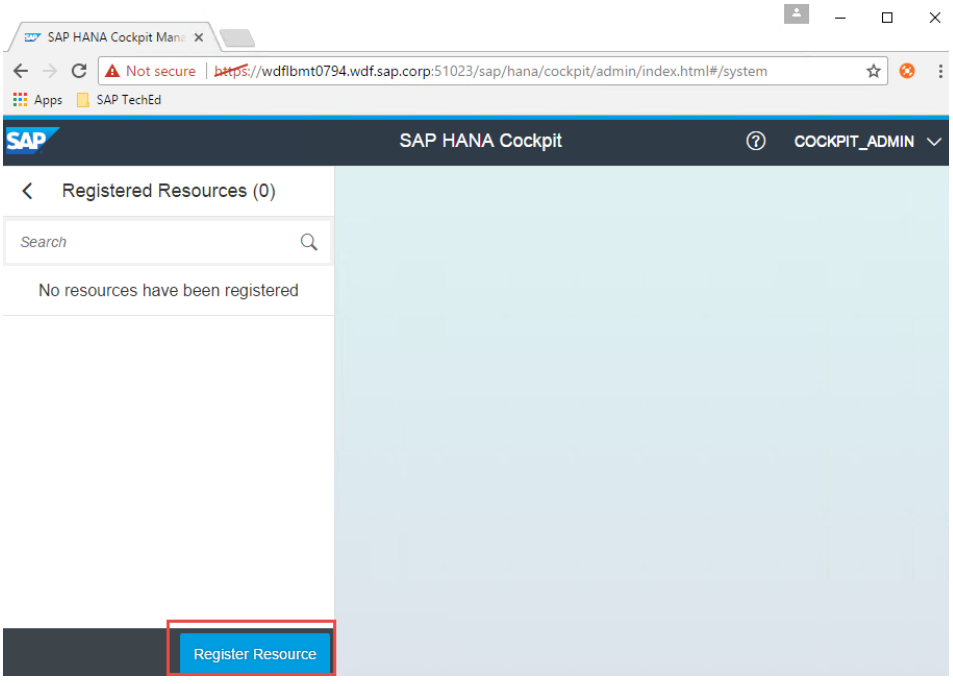
Once you are logged into the front-end Virtual Machine you can start the exercises.

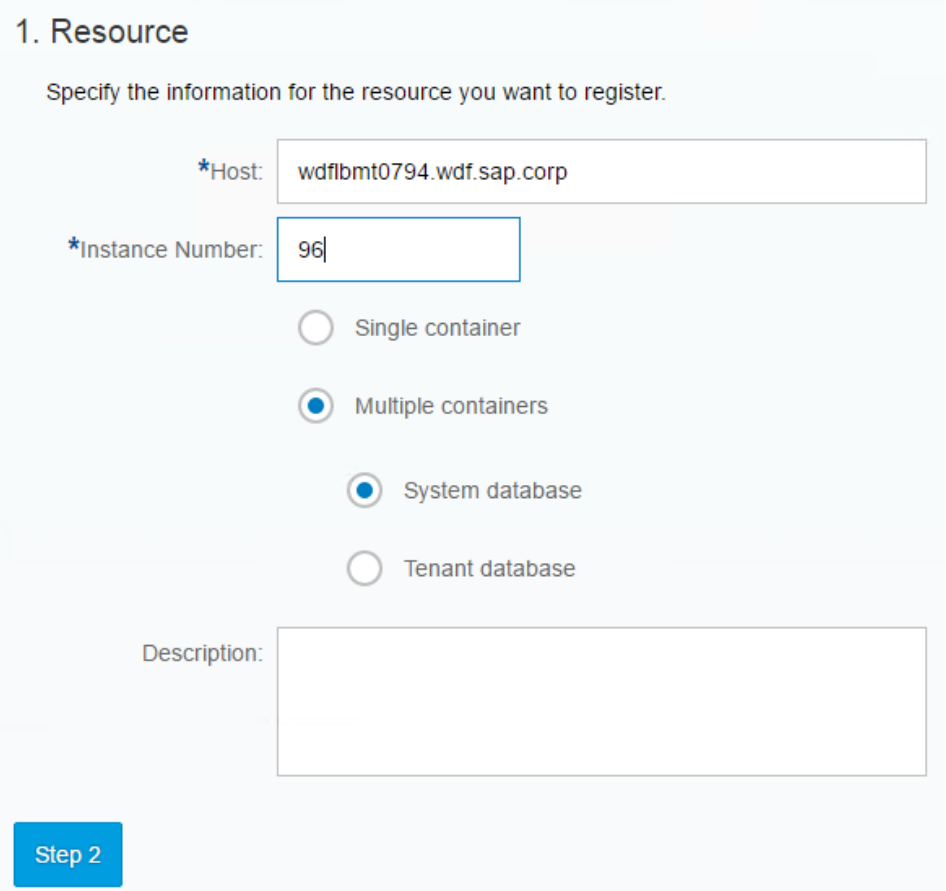
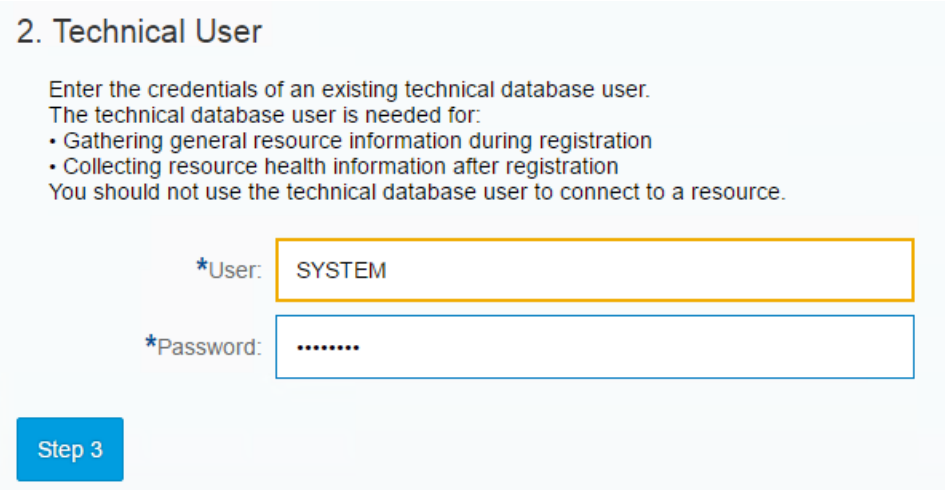
EXERCISE 1: CONFIGURE SAP HANA COCKPIT

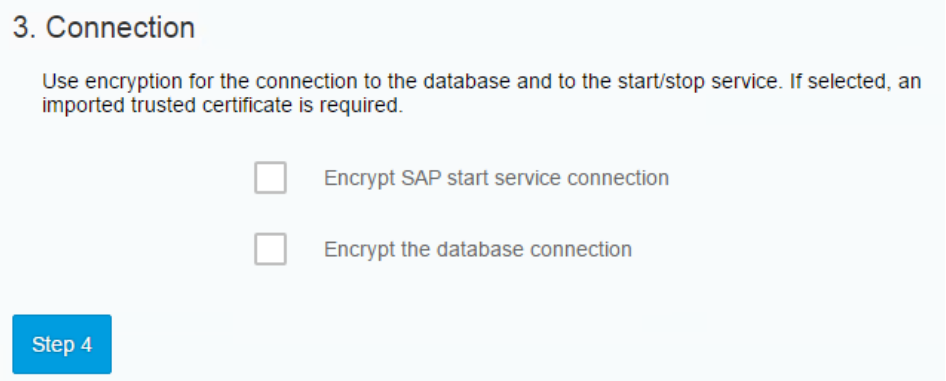
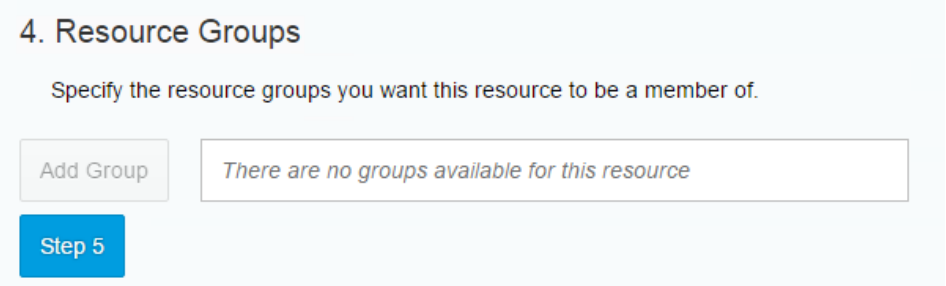
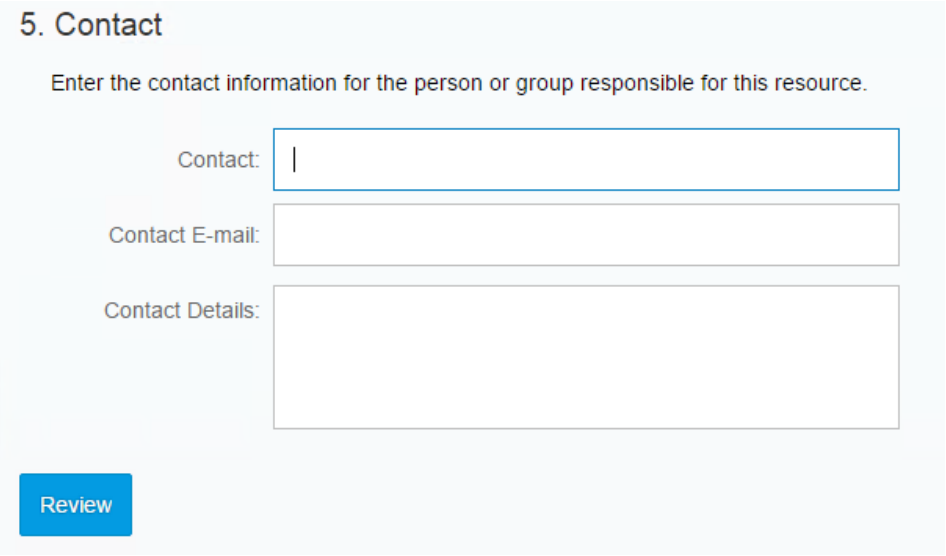
In this first exercise, we will setup SAP HANA Cockpit and register SAP HANA databases to it.

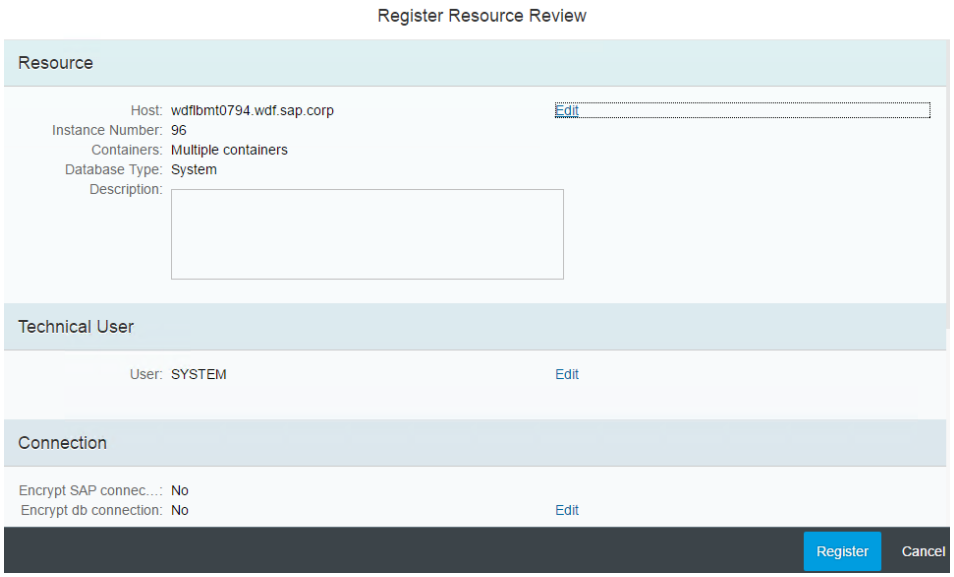
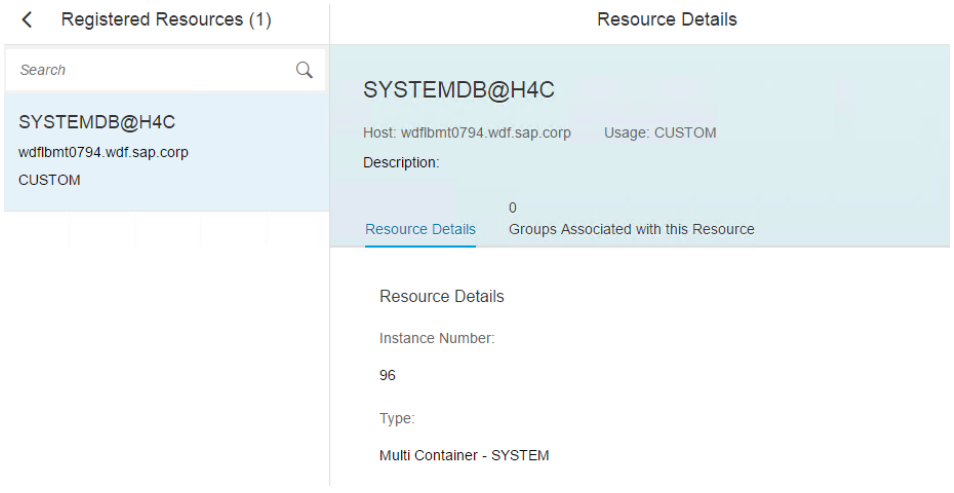
Explanation	Screenshot
1. Open Google Chrome and enter URL **https://wdflbmt0794.wdf.sap.corp:51023/**. Click through the security warning by selecting “Advanced” and “Proceed to https://wdflbmt0794.wdf.sap.corp:51023/ (unsafe)”	
2. Enter user **COCKPIT_ADMIN** and the **password** provided by the instructors.	

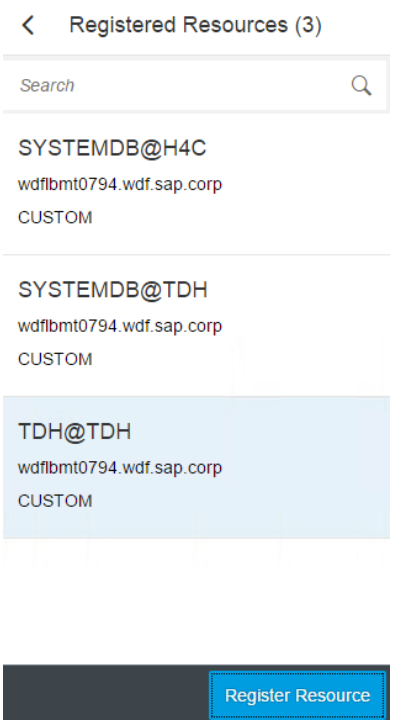
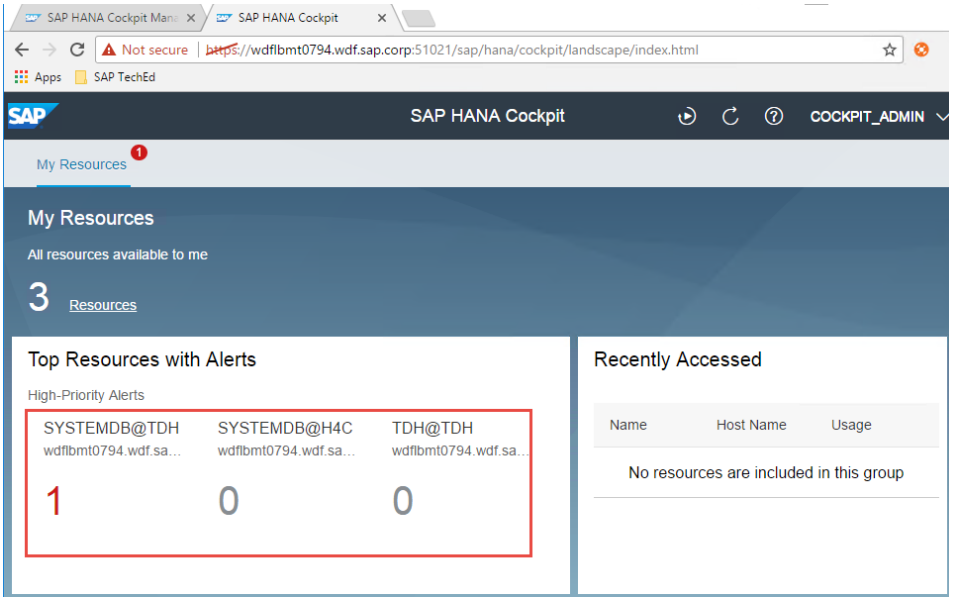
Explanation	Screenshot
3. You will get asked whether you want to have the role created and assigned to you. Select **Yes**. The next message will ask you to log on again.	
4. Log out by clicking on the triangle icon in the top right, and select **Log Out**. Next, **log in** using the same user and password (COCKPIT_ADMIN). Note: If you get a blue browser screen without any text, hit **F5** to refresh.	

Explanation	Screenshot
5. Once logged in, click on "**Registered Resources**"	
6. Click on "**Register Resource**"	

Explanation	Screenshot
7. We need to add three resources. We will start with the SYSTEMDB of HANA instance H4C. Enter / Select Host=**wdflbmt0794.wdf.sap.corp** Instance Number = **96** **Multiple Containers** **System Database** **Step 2**	
8. Enter User = **SYSTEM** and the **password** provided by the instructors. **Go to Step 3**. *Note: a better option is to use a technical user, but we use SYSTEM for simplicity.*	

Explanation	Screenshot
9. **Uncheck** the options to encrypt the communication. **Go to Step 4.**	
10. **Go to step 5.**	
11. Adding contact details is optional. Click on **Review**.	

Explanation	Screenshot
12. Verify your entries and make any needed corrections. When finished, click **Register**.	
The result of registering the first of three resources.	

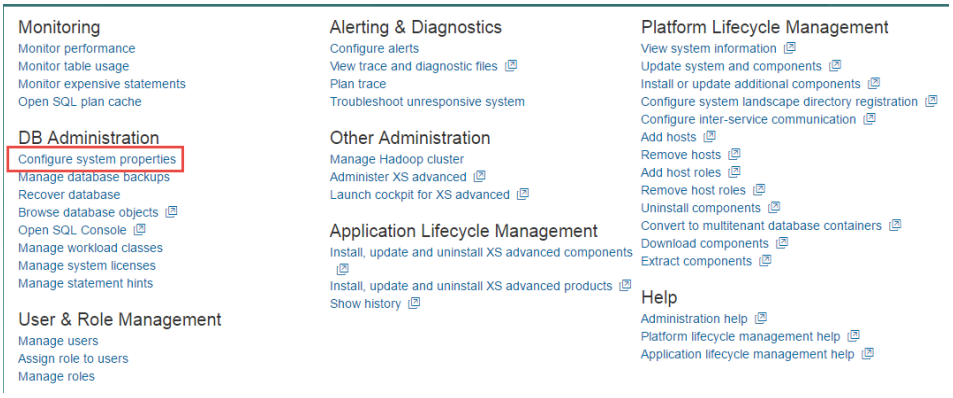
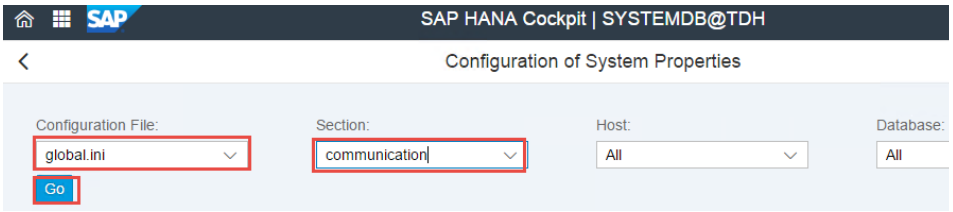
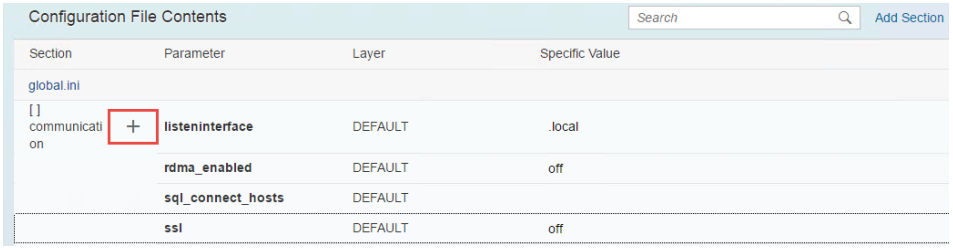
Explanation	Screenshot
13. Register two more resources by repeating steps 5 through 12 with the same data except for: Instance number = **00** Add both the System database and Tenant database = **TDH**. The result is shown in the picture.	
14. Open a new tab in Google Chrome and enter URL https://wdflbmt0794.wdf.sap.corp:51021 You see that the resources are available for administrative tasks in the SAP HANA Cockpit. This concludes the SAP HANA Cockpit Setup.	

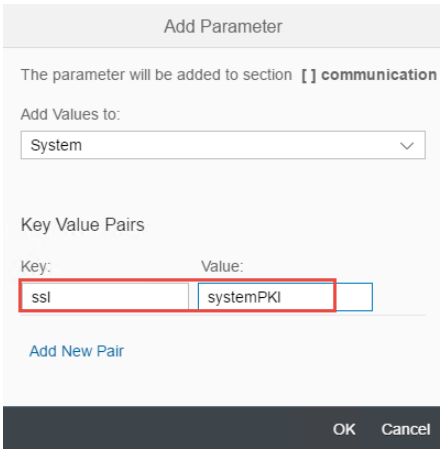
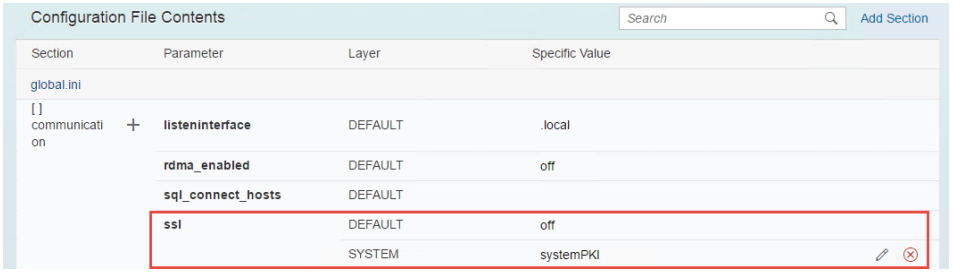
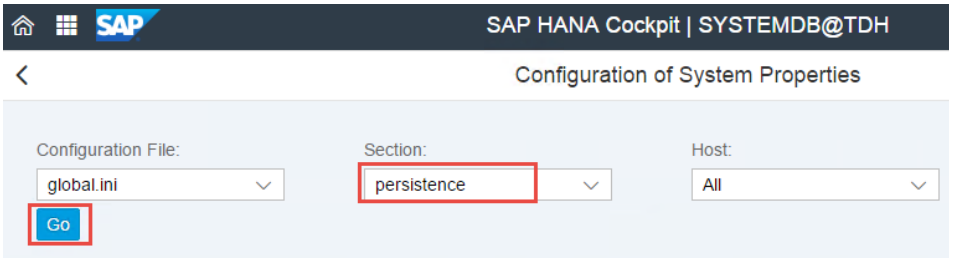
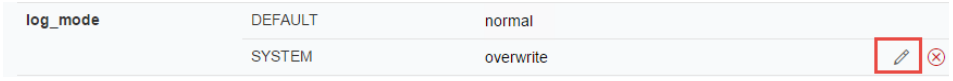
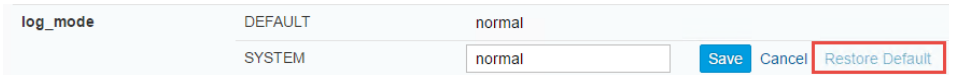
EXERCISE 2: COPY/CLONE TENANT DATABASE TDH

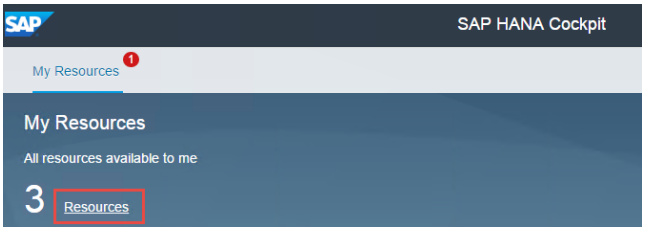
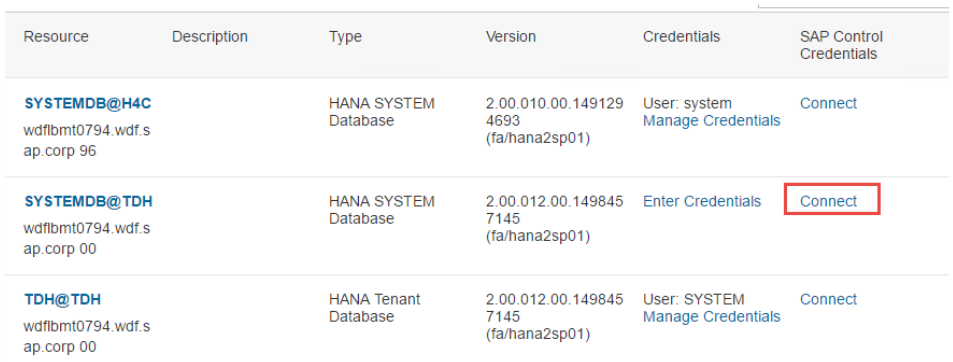
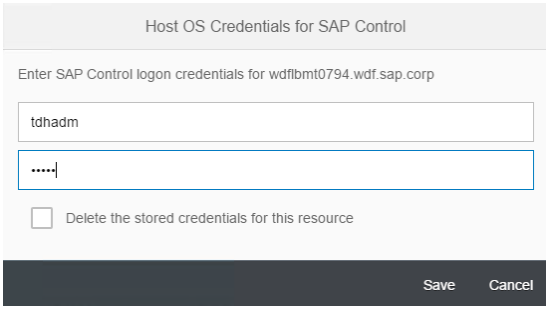
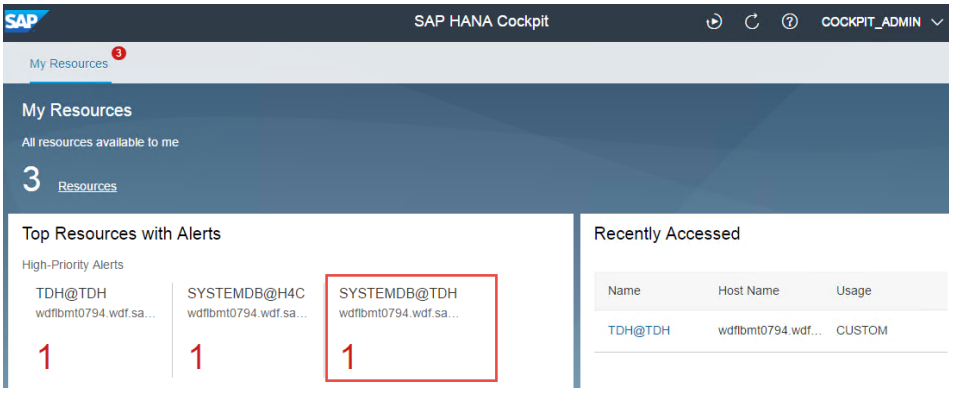
In a normal situation, you would most probably copy/clone a tenant between two SAP HANA instances. In the following exercise, we will perform the copy/clone in one HANA instance to illustrate the steps required to perform the copy/clone in a secure manner using SSL.

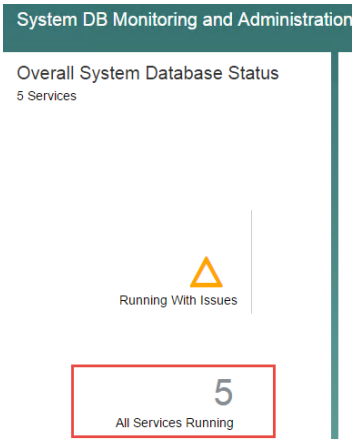
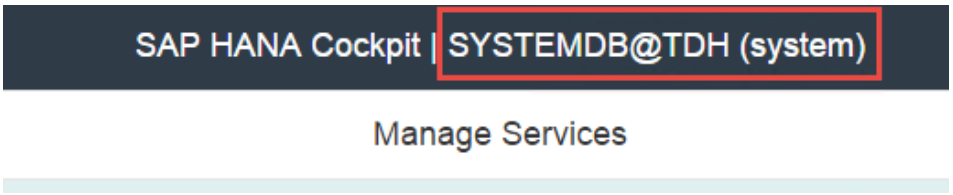
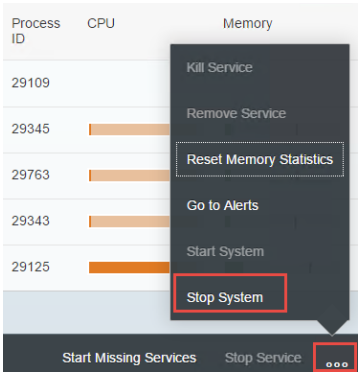
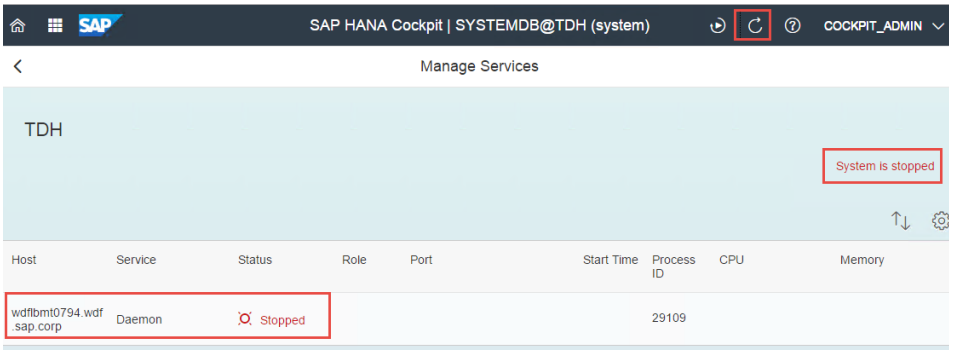
Example Use Cases:
Use Cases

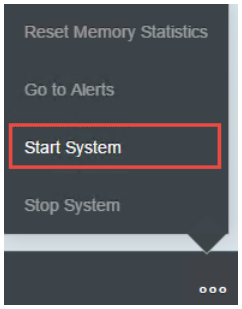
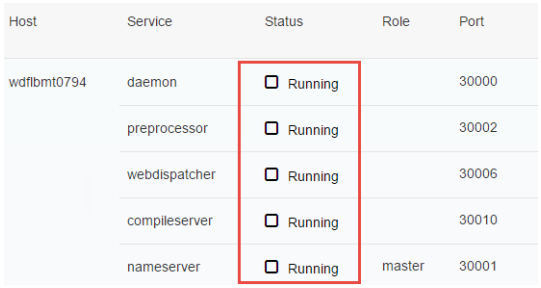
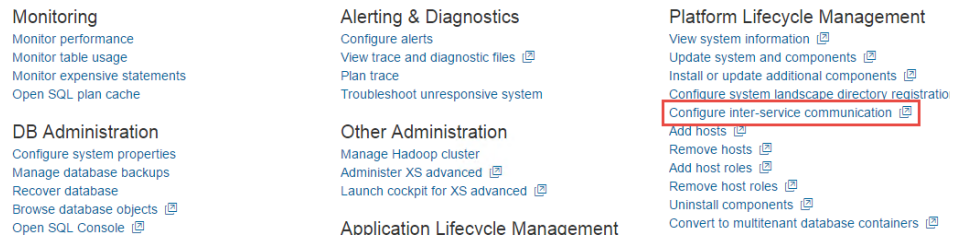
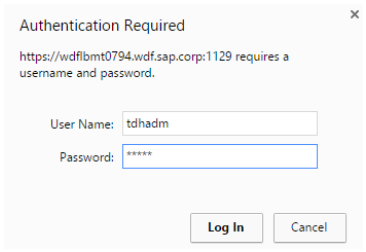
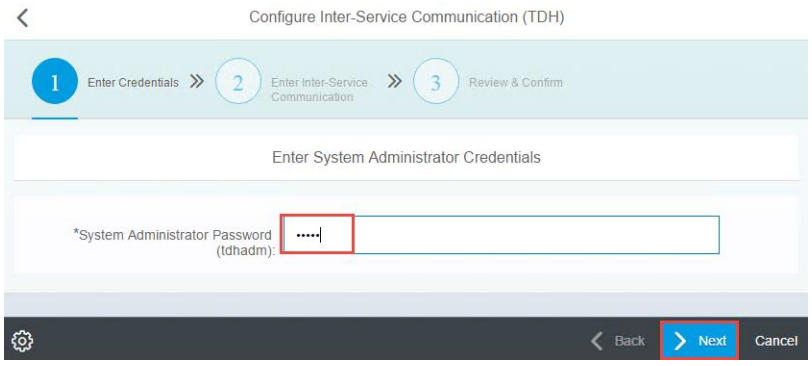
- Load balancing between systems – for example, a tenant database is running a more demanding workload than anticipated, so you move it to a system running on a host with more CPU resources.
- Management of deployment environment – for example, you want to copy a tenant database running in your test system to the live production system.
- Tenant-database-specific upgrades – for example, you want to upgrade a single tenant database but not the entire system, so you move the tenant database to a system already running the higher version.
- Template databases – for example, you create a tenant database with a default configuration that you want to reuse as the basis for new tenant databases in other systems. You can simply copy the tenant database as a template to other systems.

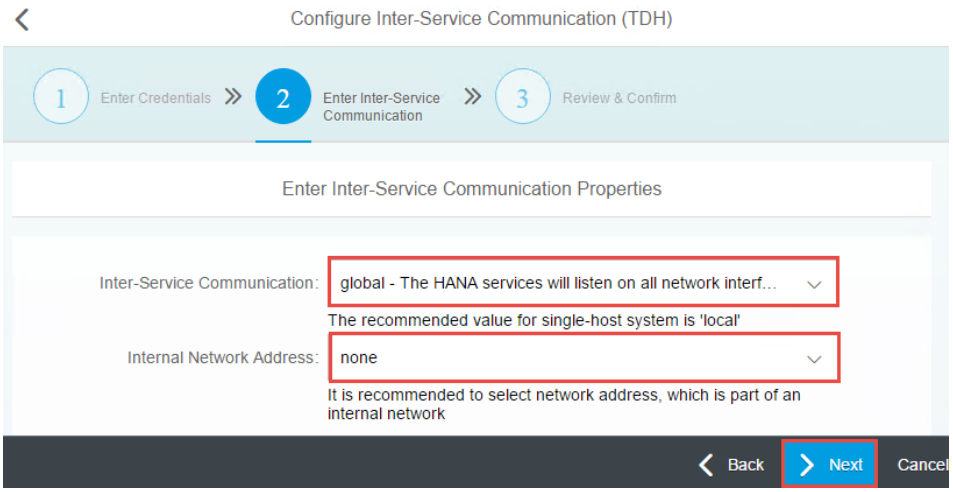
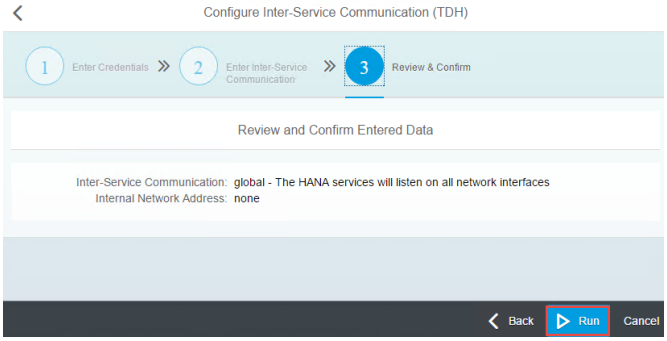
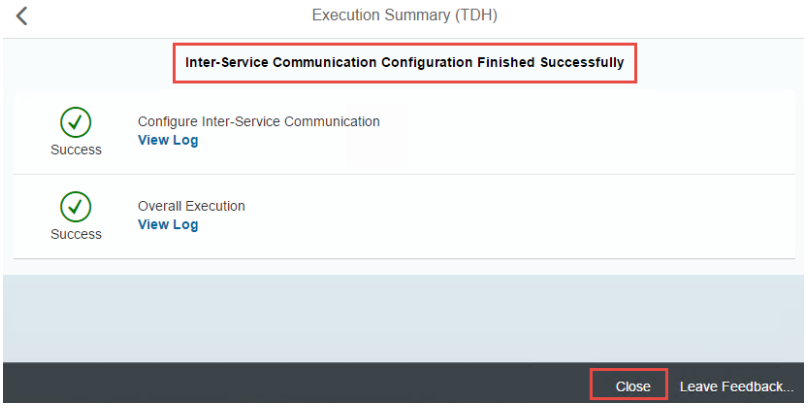
Explanation	Screenshot
15. Start logged in as **COCKPIT_ADMIN** user in the SAP HANA Cockpit (https://wdflbmt0794.wdf.sap.corp:51021). Click on **SYSTEMDB@TDH**. If you are challenged for database credentials, use the **SYSTEM** user.	
16. Scroll down to select "**Configure system properties**"	
17. Use the drop down to select **global.ini** configuration file, section **communication**, and **Go**.	
18. To change a parameter setting, you have to add a new one. Click on the **+**.	

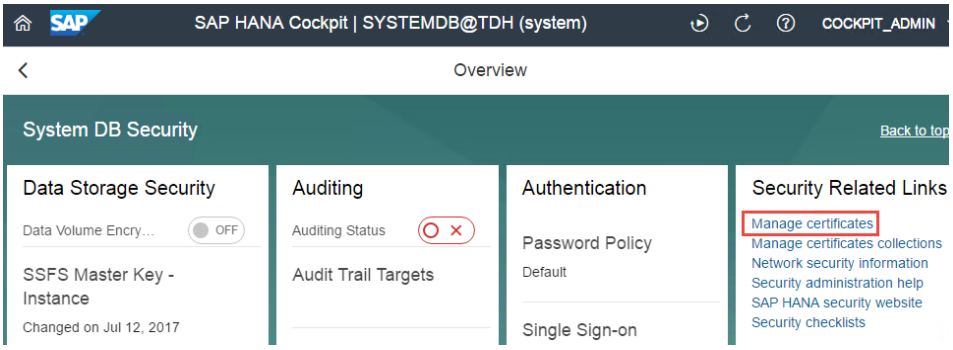
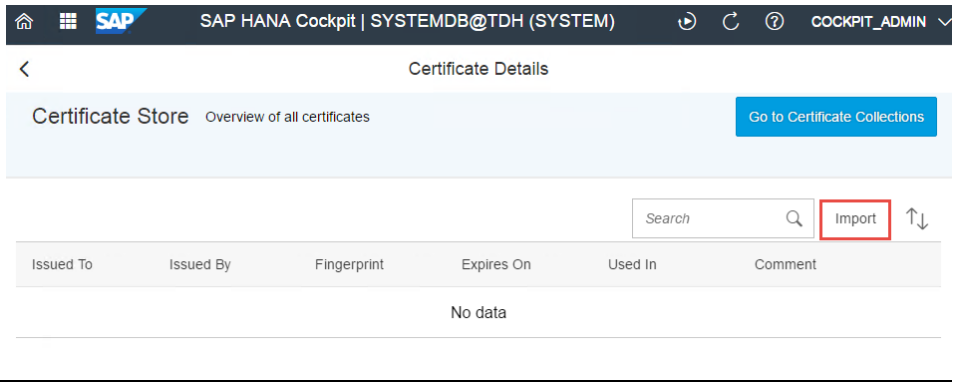
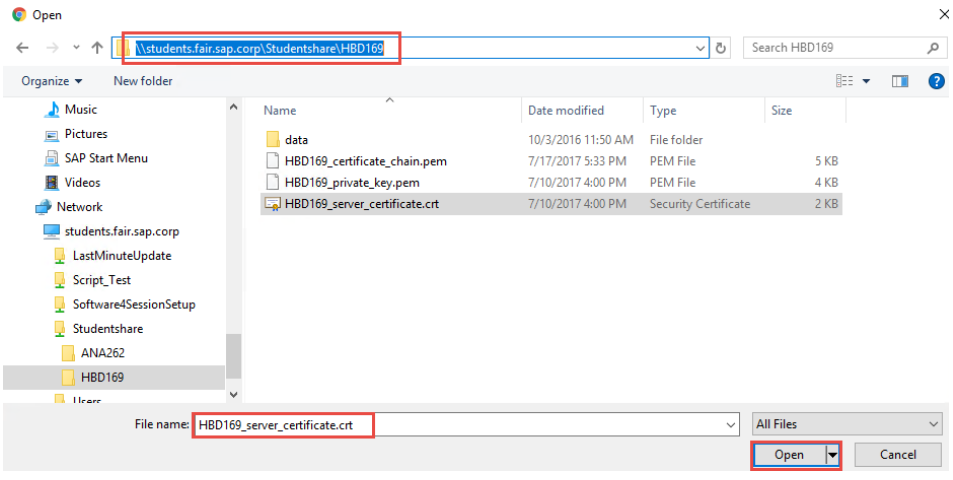
Explanation	Screenshot
19. Type “**ssl**” as the key, and **systemPKI** as the value (case-sensitive), and **OK.**	
20. The result looks like this.	
21. To change the next parameter, change the section to **persistence** and click on **Go.**	
22. Find the **log_mode** parameter and click on the **pencil** next to overwrite. *Note: for the sake of space we have set the log_mode to overwrite, usually this is set to normal in a customer system.*	
23. Click on “**Restore Default**” to set the value back to normal, and hit **Save**.	

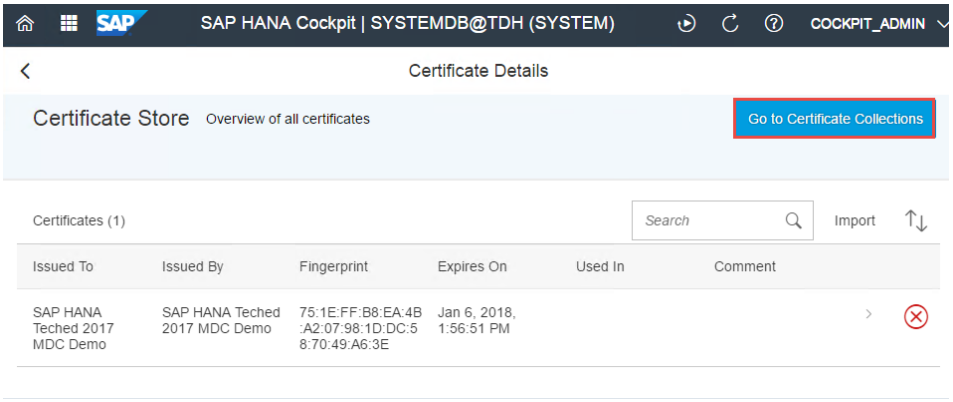
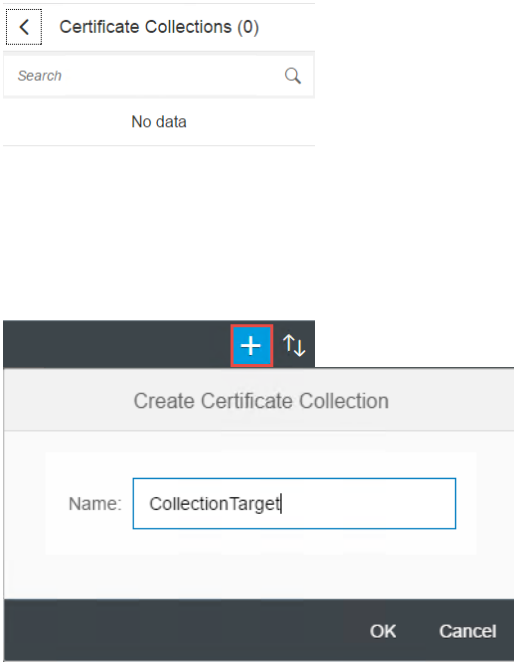
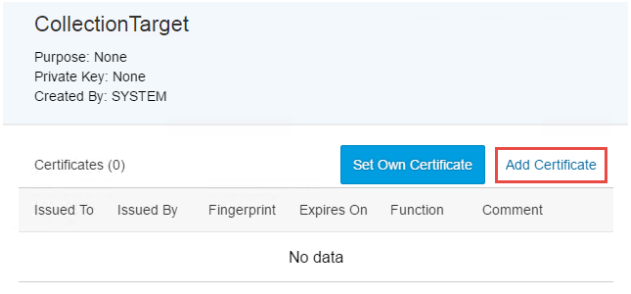
Explanation	Screenshot
24. Next we need to restart the SAP HANA instance TDH. Go to the Home screen and click on **Resources**.	
25. Find the entry for SYSTEMDB@TDH and select **Connect.**	
26. Enter the credentials for the **tdhadm** user and click **Save**.	
27. Go to the home screen and click on **SYSTEMDB@TDH**.	

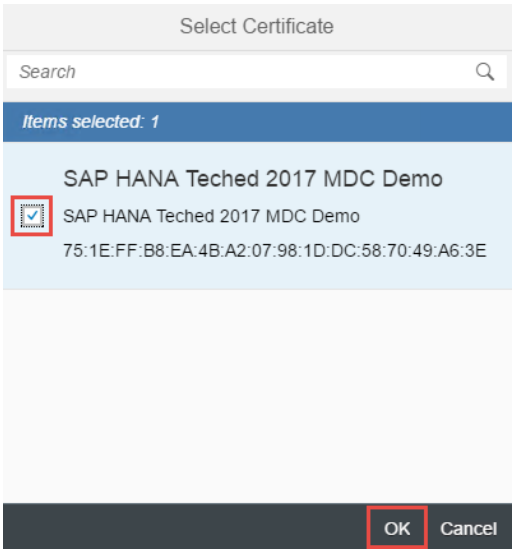
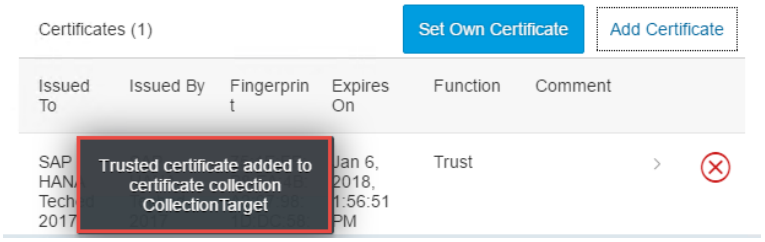
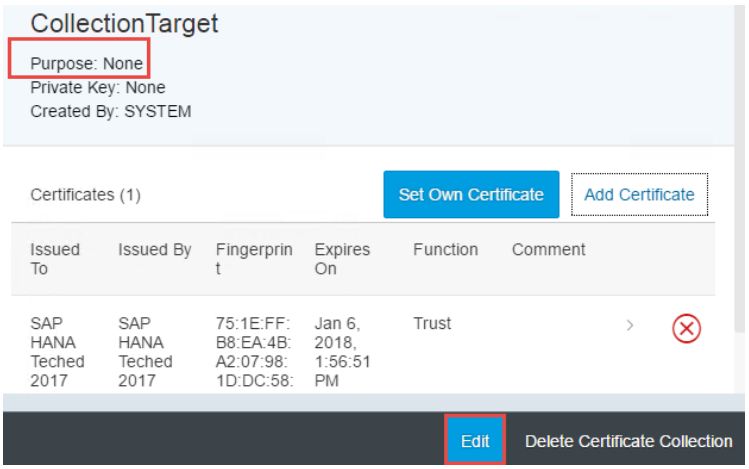
Explanation	Screenshot
28. Scroll down to System DB Monitoring and Administration. Click on the **All Services Running** icon.	
29. Verify that the top of the screen states SYSTEMDB@TDH.	
30. In the lower right corner click on the **three dots**, and select **Stop System**	
31. Click on the **refresh** icon a few times until the services disappear and you get the message “system is stopped”.	

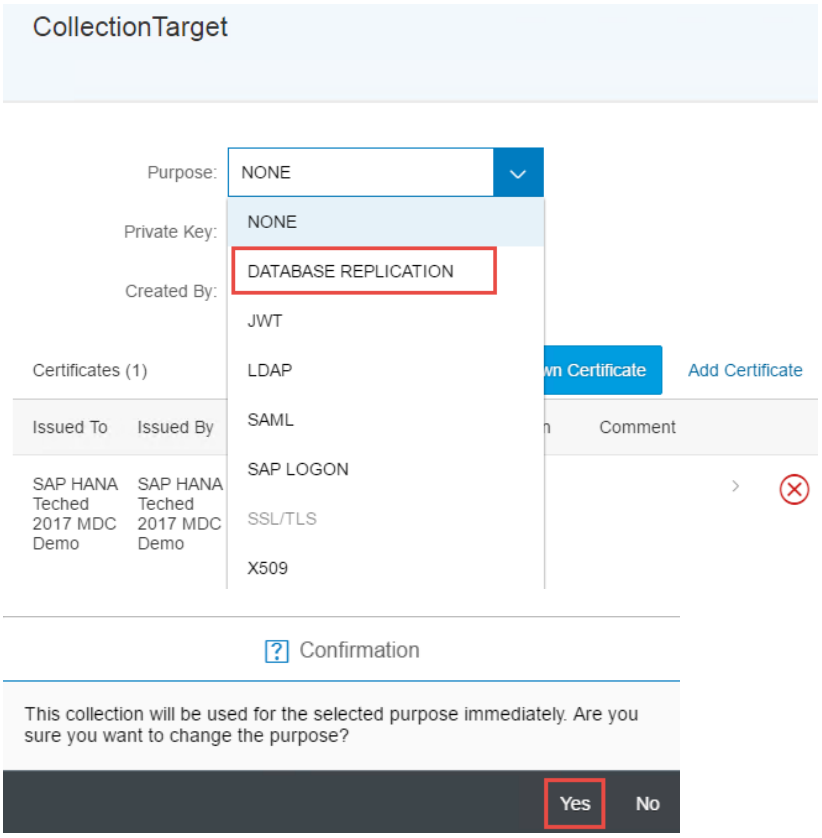
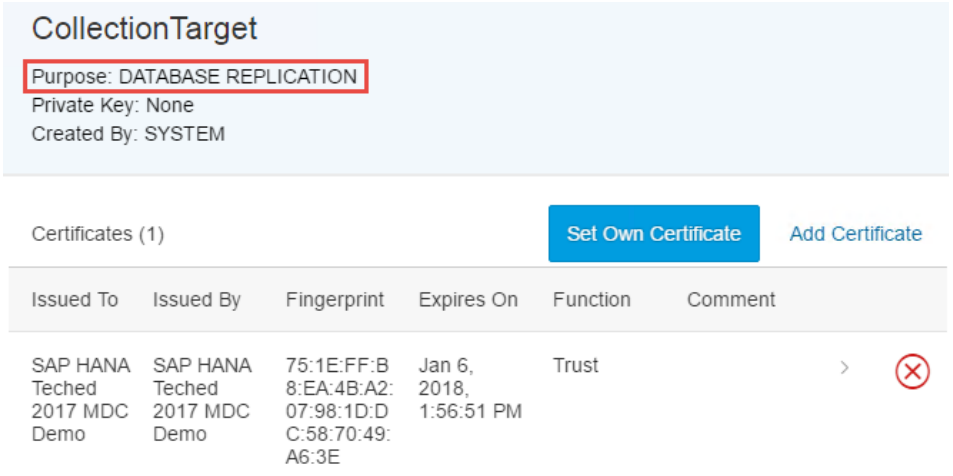
Explanation	Screenshot
32. In the lower right click on the **three dots icon**, and select "**Start System**". When asked, answer **Yes** to confirm you really want to start the system.	
33. Click the **refresh** icon a few times until all the services show status running.	
34. Click on the back ( ) button in the upper left and scroll down to select "**Configure Inter-service communication**".	
35. Proceed through the security warnings and enter the **tdhadm** user and password. Click **Log In**.	
36. Enter the tdhadm password again and click **Next.**	

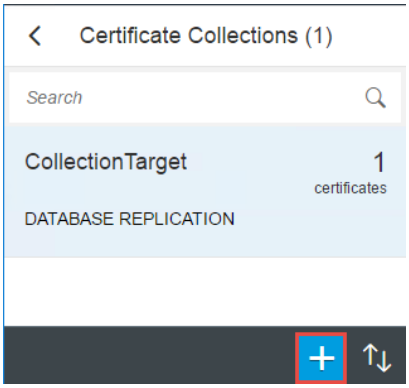
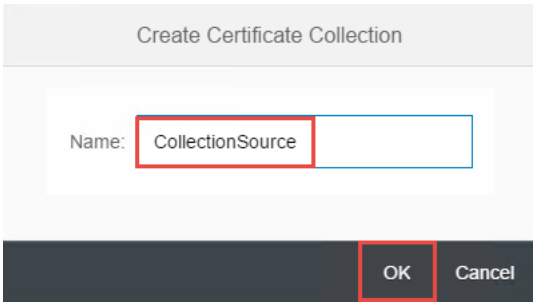
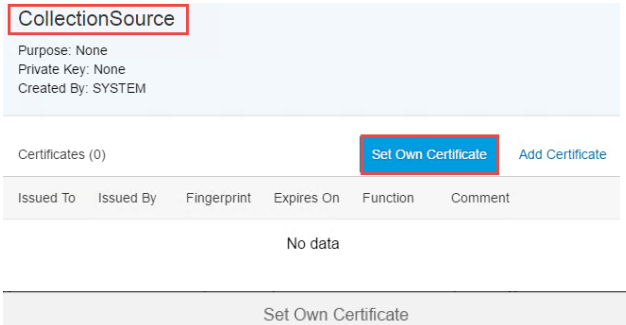
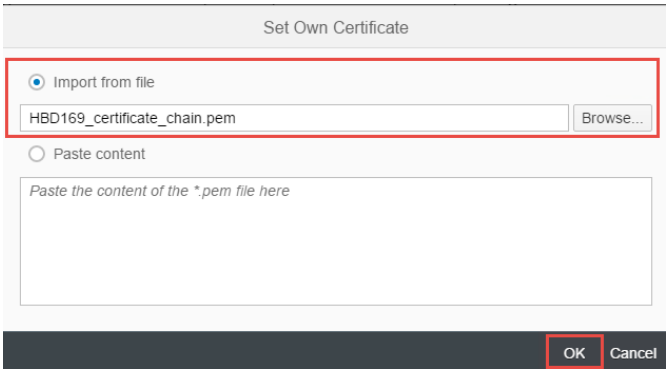
Explanation	Screenshot
37. Select **global**, **none**, and **Next**. Note: in a customer system you likely will have an internal network to select.	
38. Select **Run**	
39. Verify it finished correctly, and select **Close**.	

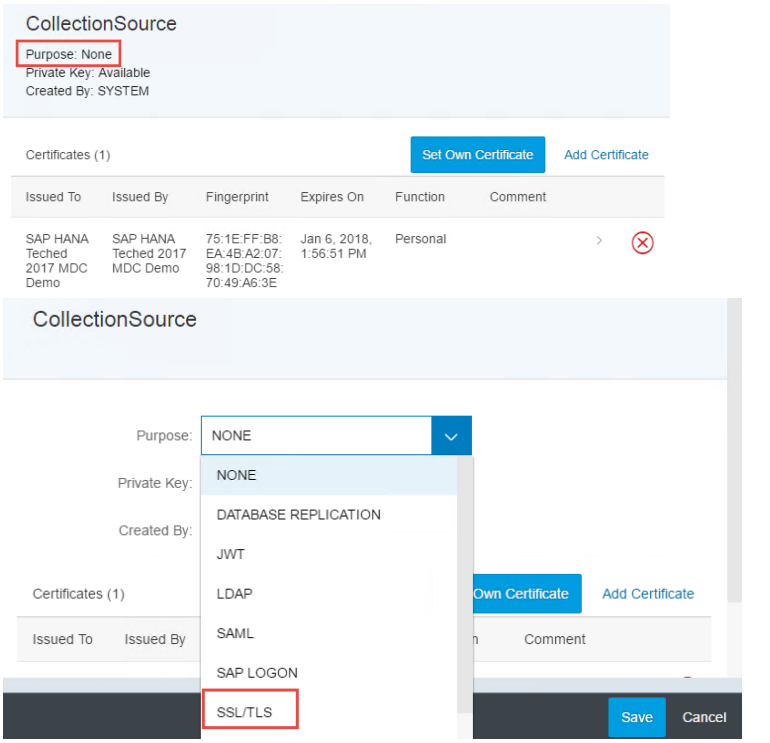
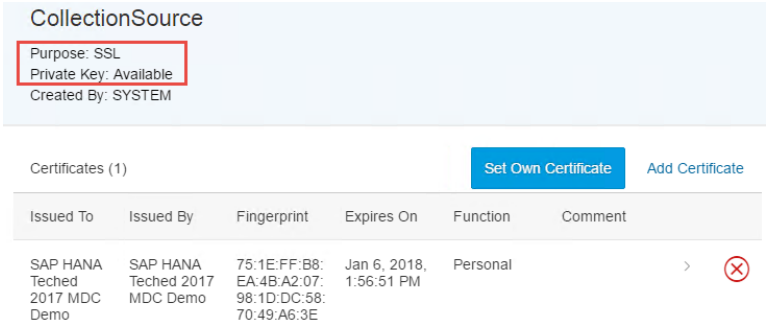
Explanation	Screenshot
40. Switch back to the SYSTEMDB@TDH cockpit tab. Scroll down to the System DB Security section and click on “**Manage certificates**”	
41. Select **Import**	
42. Browse to the student share for session HBD169. Select the **HDB169_server_certificate.crt** file, click Open and OK. You should get a message “Certificate saved” The location is \\students.fair.sap.corp\Studentshare\HBD169\Certificates	

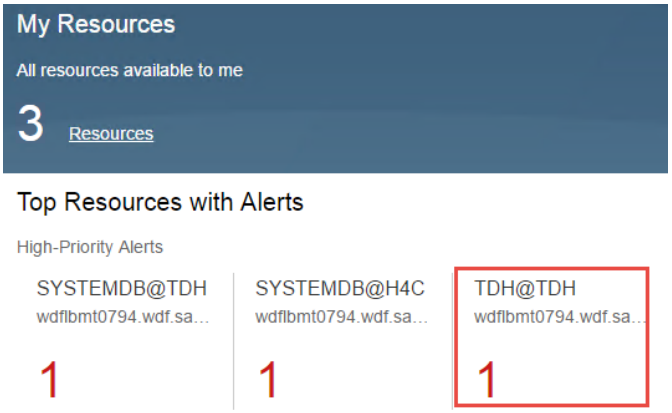
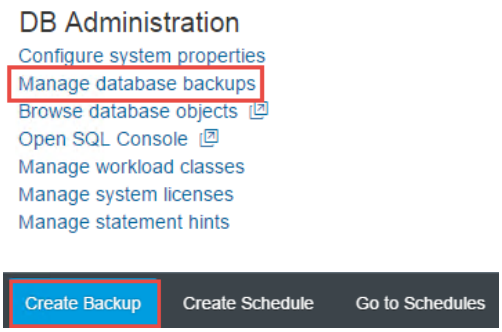
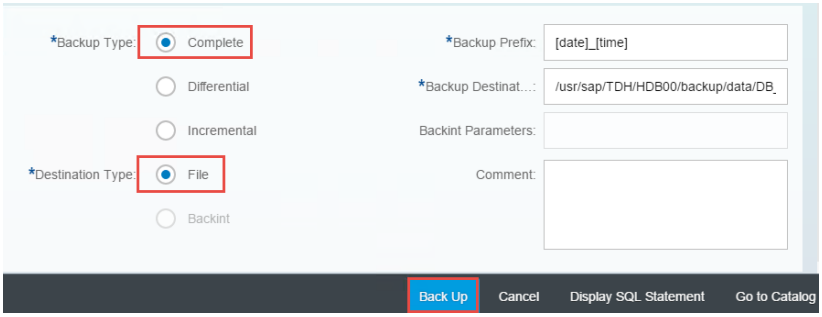
Explanation	Screenshot
43. Next, click on "**Go to Certificate Collections**"	
44. Click on **+** to add a Certificate Collection, enter **CollectionTarget**, and **OK**.	
45. Click "**Add Certificate**", add the **SAP HANA TechEd 2017 MDC Demo** certificate you imported in the previous step, and click **OK.**	

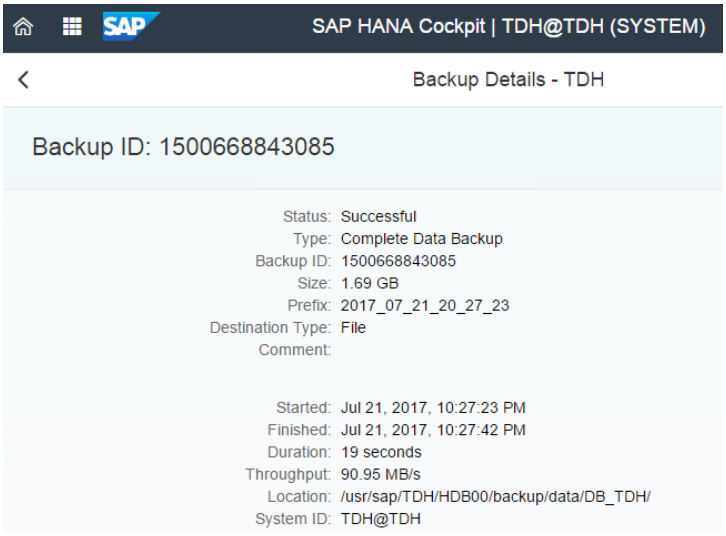
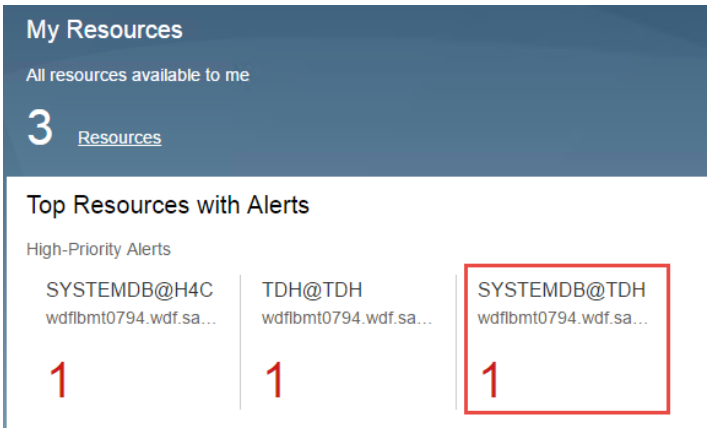
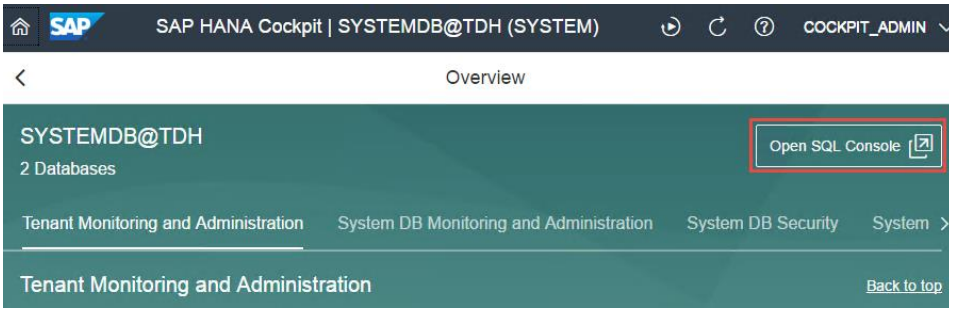
Explanation	Screenshot
	 Result: 
46. Now we must set a purpose for the CollectionTarget. Click **Edit**, select "**DATABASE REPLICATION**" and **Save**. Confirm with "**Yes**" when prompted.	

Explanation	Screenshot
	 Result: 

Explanation	Screenshot
47. Next, click on the **+** sign to add another Certificate Collection. Name the collection "**CollectionSource**" and click **OK**	 
48. Click on "**Set Own Certificate**", and browse to select "**HBD169_certificate_chain.pem**" from the student share, and then **OK.** The student share location is \\students.fair.sap.corp\Studentshare\HBD169\Certificates	 

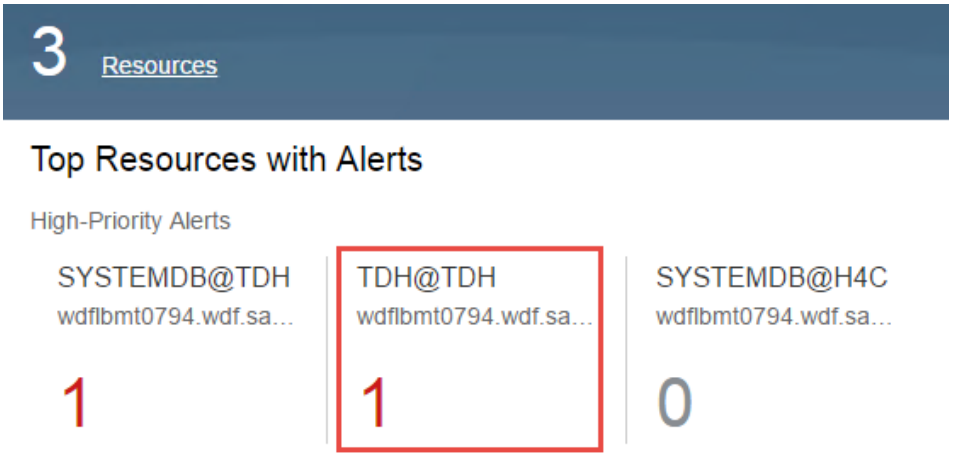
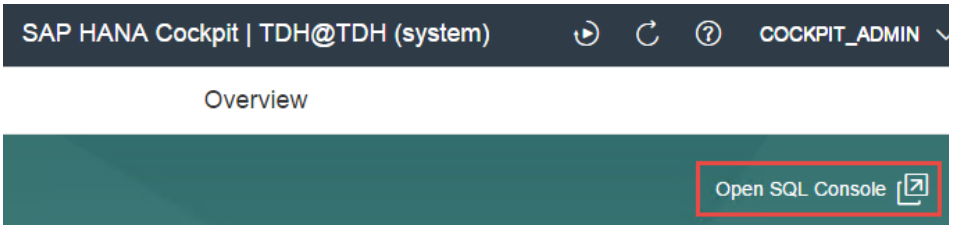
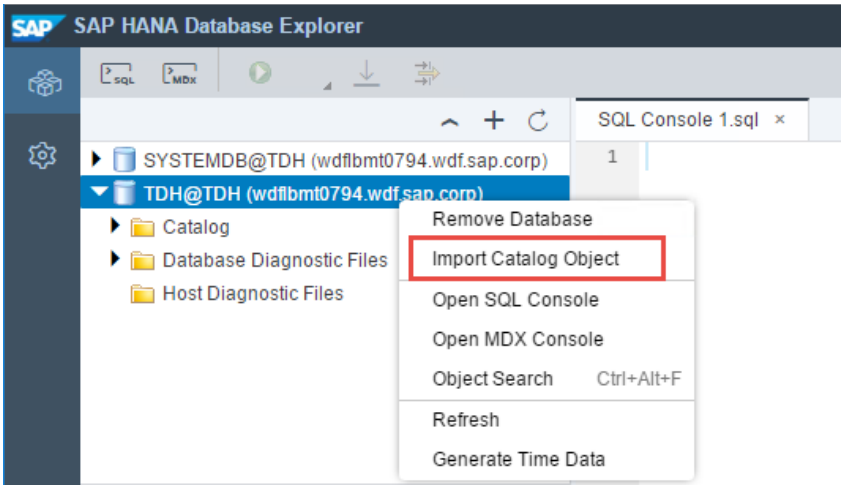
Explanation	Screenshot
49. In the result screen we have to set a purpose. Select “**Edit**”, and select **SSL/TLS** from the Purpose drop down. Click **Save** and confirm the popup. The result should show and the private key as available (see screen print).	 Result: 

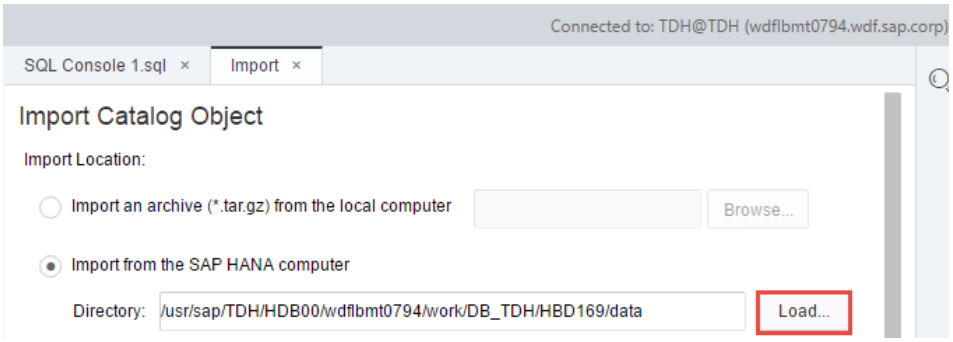
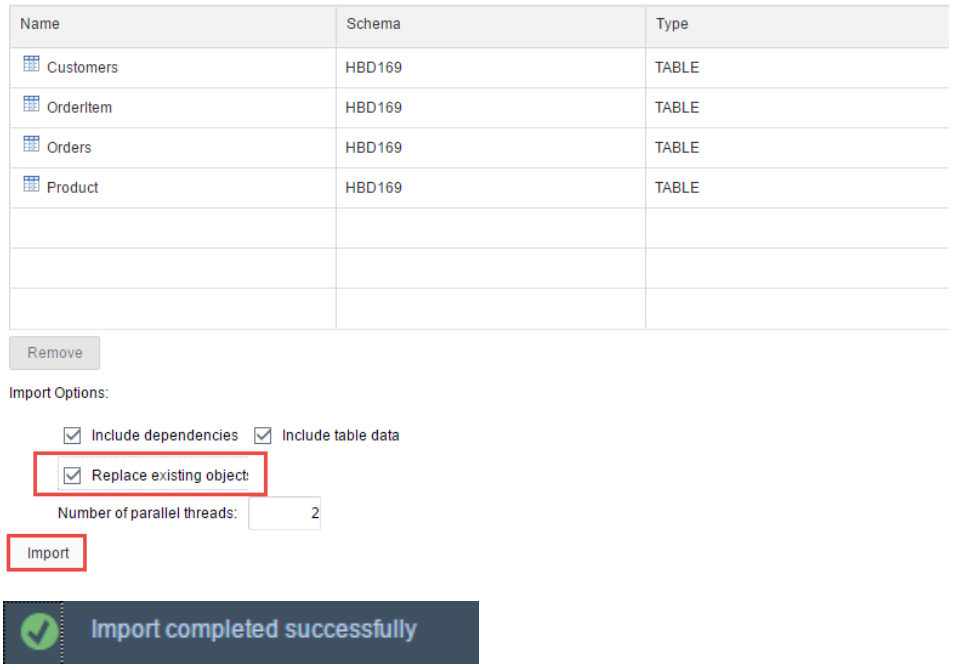
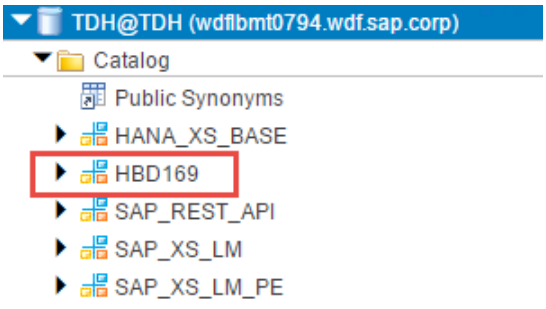
Explanation	Screenshot
50. Next, select the **home** screen, followed by tenant **TDH@TDH**.	
51. Scroll down and select "**Manage database backups**". In the next screen select "**Create Backup**"	
52. Now create a complete file backup of the TDH database tenant.	 Result:

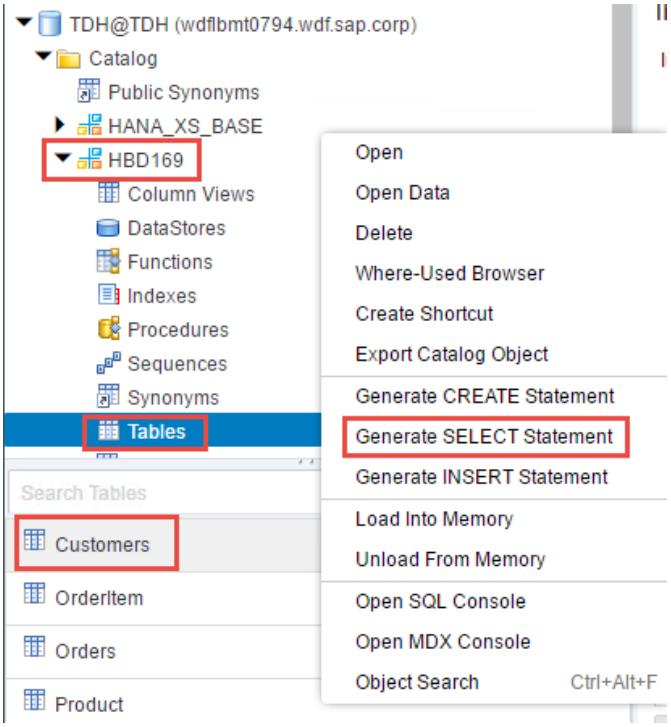
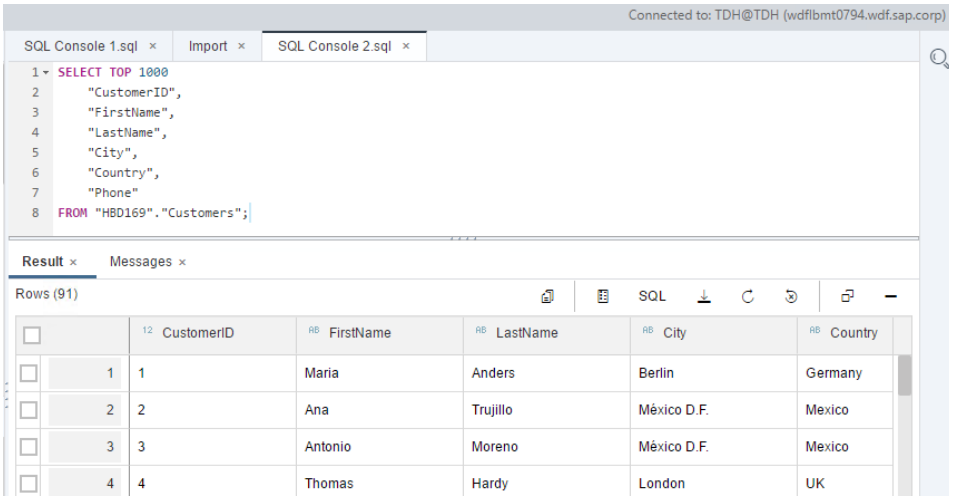
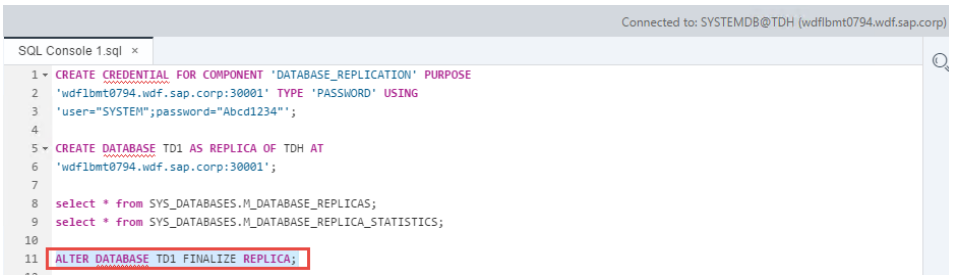
Explanation	Screenshot
	
53. Next, select the **home** screen, followed by **SYSTEMDB@TDH**.	
54. Select "**Open SQL Console**" for SYSTEMDB@TDH.	

Explanation	Screenshot
55. **Create a credential** for the Database Replication component. Make sure to enter the fully qualified hostname of the VM. Select the statement to execute and execute the SQL statement by selecting the statement and clicking execute ( ) *Note: copy the command from the provided SQL statements file in the session share.*	SQL Console 1.sql × 1 CREATE CREDENTIAL FOR COMPONENT 'DATABASE_REPLICATION' PURPOSE 2 'wdflbmt0794.wdf.sap.corp:30001' TYPE 'PASSWORD' USING 3 'user="SYSTEM";password="Abcd1234"'; 4 5 Generic Syntax: 6 CREATE CREDENTIAL FOR COMPONENT 'DATABASE_REPLICATION' PURPOSE 7 '<host_name>:3<instance_number>01' TYPE 'PASSWORD' USING 8 'user="<user_in system_DB_of_source_system_with_DATABASE_ADMIN>"; 9 password="<password>"'; Result: Messages × Statement 'CREATE CREDENTIAL FOR COMPONENT 'DATABASE_REPLICATION' PURPOSE 'wdflbmt0794.wdf.sap.corp:30001' ...' executed in 3 ms.
56. Next, execute the "**Create Database**" SQL statement to start the replication. Make sure to enter the fully qualified hostname of the VM. Execute the SQL statement by selecting the statement and clicking execute ( ) *Note: copy the command from the provided SQL statements file in the session share.*	11 CREATE DATABASE TD1 AS REPLICA OF TDH AT 12 'wdflbmt0794.wdf.sap.corp:30001'; 13 14 Generic Syntax: 15 CREATE DATABASE <new_tenant_database_name> 16 AS REPLICA OF <copied_tenant_database_name> AT 17 '<source_system_hostname>:3<source_system_instance_number>01'; Result: Messages × Statement 'CREATE DATABASE TD1 AS REPLICA OF TDH AT 'wdflbmt0794.wdf.sap.corp:30001'' executed in 57633 ms.

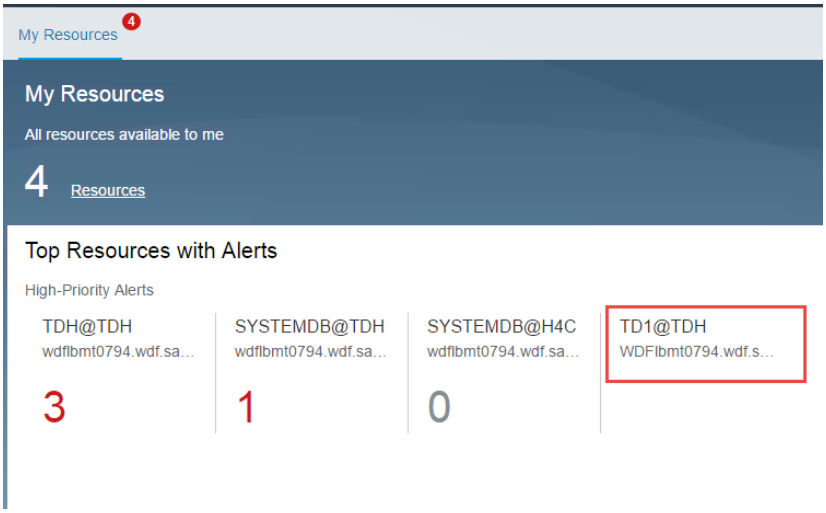
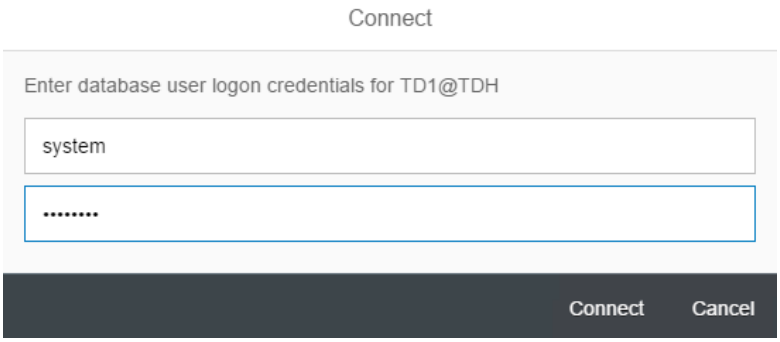
57. Run the monitoring statements from the same SQL Console. In the result window scroll over to the right and refresh a few times until the column "TARGET_FULLY_RECOVERABLE" is TRUE and column "REPLICATION_STATUS" is ACTIVE. Now you can move to the next step.	`select * from SYS_DATABASES.M_DATABASE_REPLICAS;`
	`select * from SYS_DATABASES.M_DATABASE_REPLICA_STATISTICS;`
	
	8 select * from SYS_DATABASES.M_DATABASE_REPLICAS;
	9 select * from SYS_DATABASES.M_DATABASE_REPLICA_STATISTICS;
	10
	Result1 × Result2 × Messages ×
	Rows (4)
	TARGET_FULLY_RECOVERABLE / REPLICATION_MODE / REPLICATION_STATUS
	1 TRUE ASYNC ACTIVE
	2 TRUE ASYNC ACTIVE
	3 TRUE ASYNC ACTIVE
	4 TRUE ASYNC ACTIVE

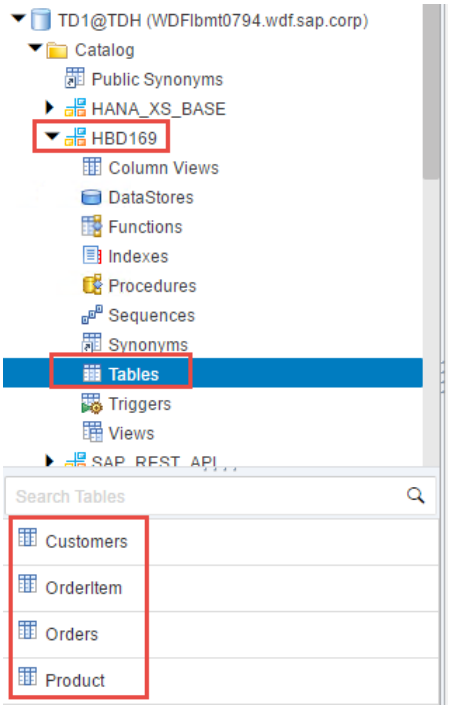
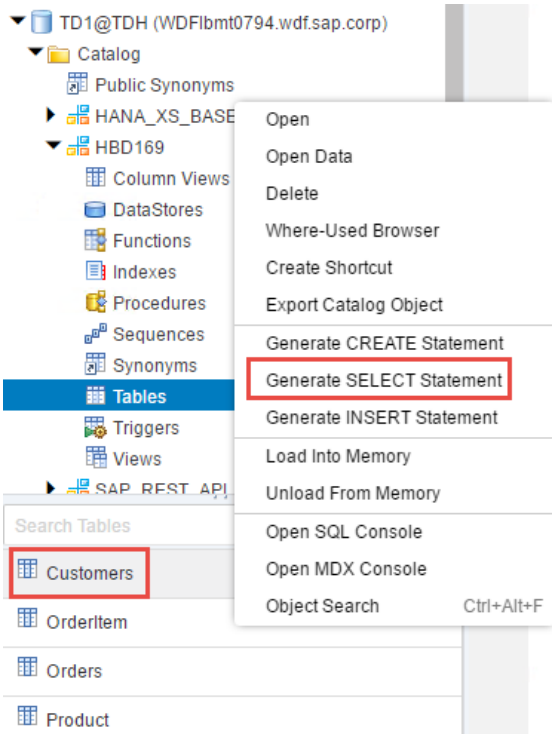
Explanation	Screenshot
Note: copy the command from the provided SQL statements file in the session share.	
58. To prove that replication is working we will load some data in the TDH tenant. Switch back to the SAP HANA Cockpit tab, navigate to the home page ( ), and click on the **TDH@TDH** resource	
59. Select "**Open SQL Console**" for TDH@TDH. This opens the SAP HANA Database Explorer in a new tab.	
60. Right-click on TDH@TDH and select "**Import Catalog Object**".	

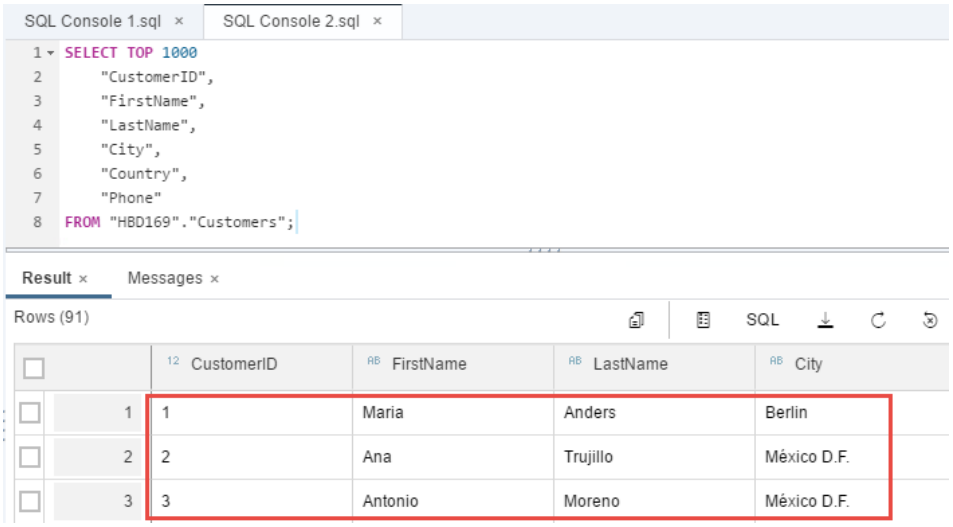
Explanation	Screenshot
61. We will import objects from the SAP HANA computer. Enter the path **/usr/sap/TDH/HDB00/wdflbmt0794/work/DB_TDH/HBD169/data**, and click **Load**	
62. Now the tables are visible, enable "**Replace existing object**", and click on **Import**. In the upper right, there will be a message "Import completed successfully".	
63. **Expand** the TDH@TDH, catalog tree. The imported tables should be in schema HBD169. If schema HBD169 is not visible, right click on TDH@TDH and select refresh.	

Explanation	Screenshot
64. When you click on **Tables**, the 4 imported tables are visible in the pane right below. **Right click** on the Customers table and select "**Generate SELECT Statement**".	
65. **Execute** the query	
66. Go back to the SQL Console for connection SYSTEMDB@TDH and execute SQL statement: **ALTER DATABASE TD1 FINALIZE REPLICA;**	

Explanation	Screenshot
The command creates a clone, if you would want to move the tenant instead of a clone, the command would have been "**ALTER DATABASE** TD1 FINALIZE REPLICA **DROP** SOURCE". **Note: this may take a few minutes, so wait for the command to finish.** *When executing this statement, HANA goes through several steps:* *1. Check replication status* *2. Switch from async to sync replication* *3. Wait for re-syncing* *4. Stop replication* *5. Trigger takeover (i.e. start database)*	Result: Messages × Statement 'ALTER DATABASE TD1 FINALIZE REPLICA' executed in 98402 ms.
67. Verify database TD1 is running. In the same SQL Console window execute: **Select * from m_databases;**	12 13 select * from m_databases; Result × Messages × Rows (3) DATABASE_NAME / DESCRIPTION / ACTIVE_STATUS 1 SYSTEMDB SystemDB-TDH-00 YES 2 TDH TDH-00 YES 3 TD1 YES

Explanation	Screenshot
68. **Register** the new tenant TD1 in the SAP HANA Cockpit Manager (see steps 5 – 12). Once registered switch the SAP HANA Cockpit tab, after refresh the TD1 tenant should be visible. Click on **TD1@TDH**.	
69. Authenticate using the **SYSTEM** user.	
70. Open the **SQL Console** for tenant TD1@TDH.	

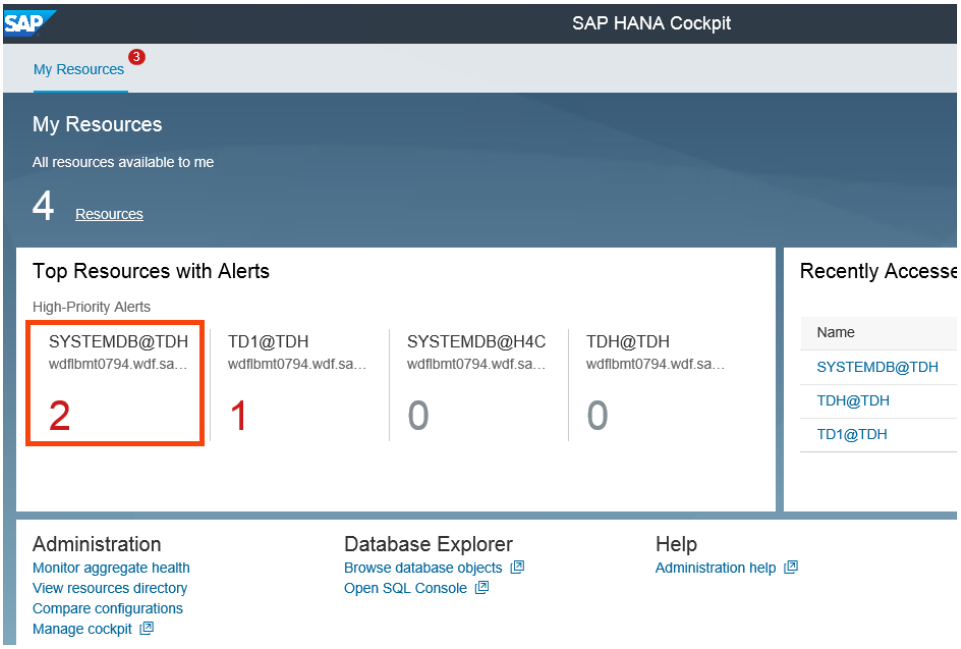
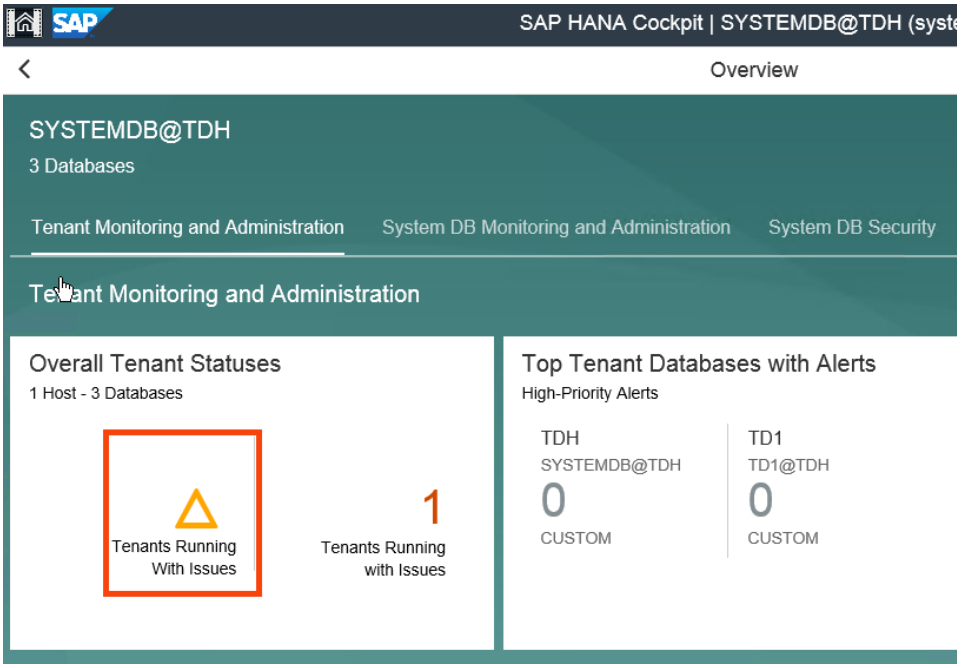
Explanation	Screenshot
71. **Verify** the table imported in source database TDH are present in target database TD1.	
72. Right click on table Customers, select "**Generate SELECT Statement**" and verify the data was replicated/copied.	

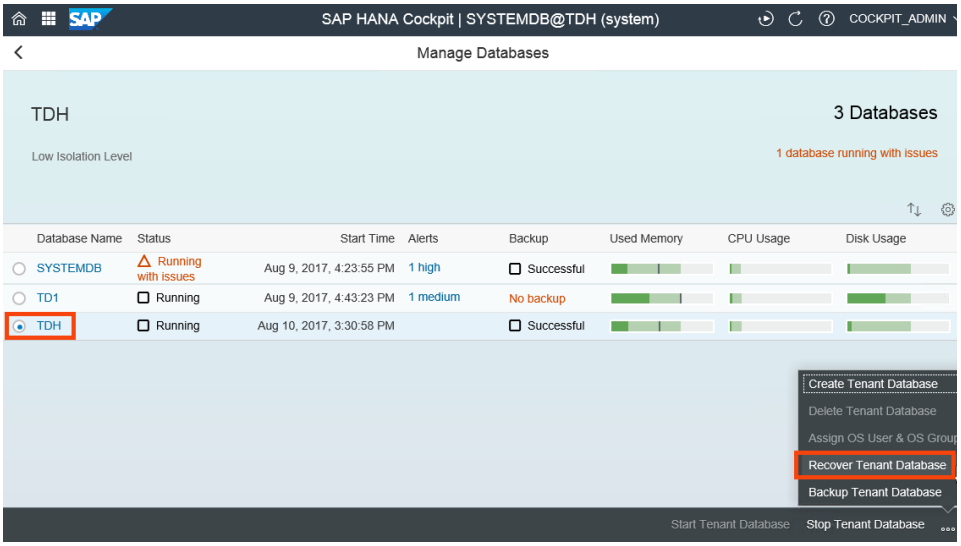
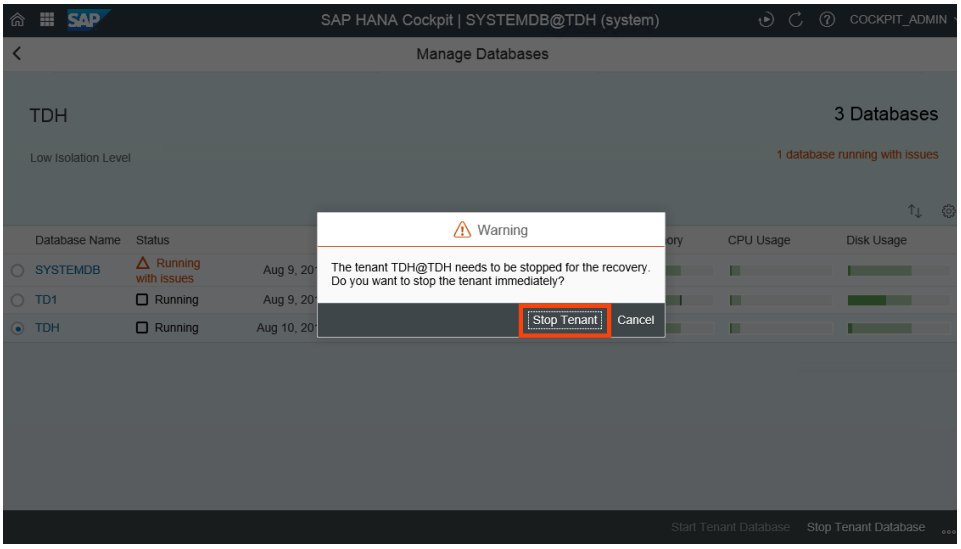
Explanation	Screenshot
73. Result.	

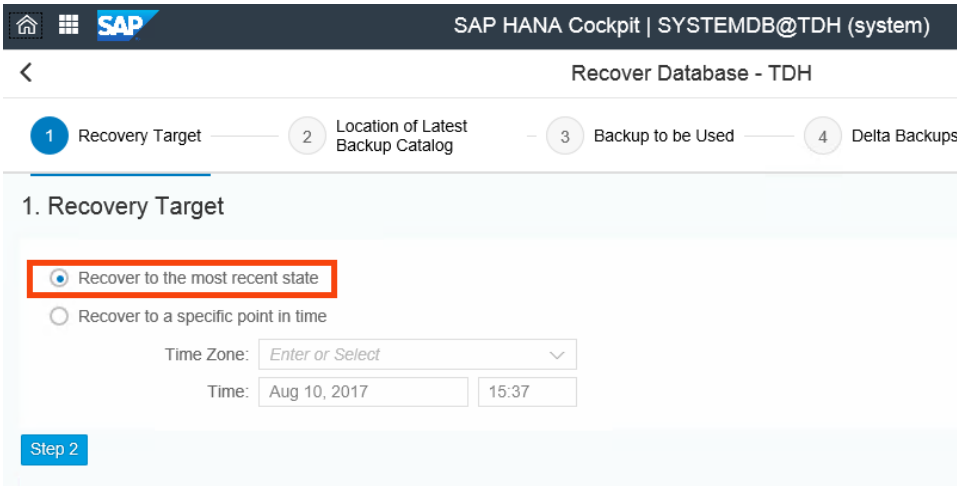
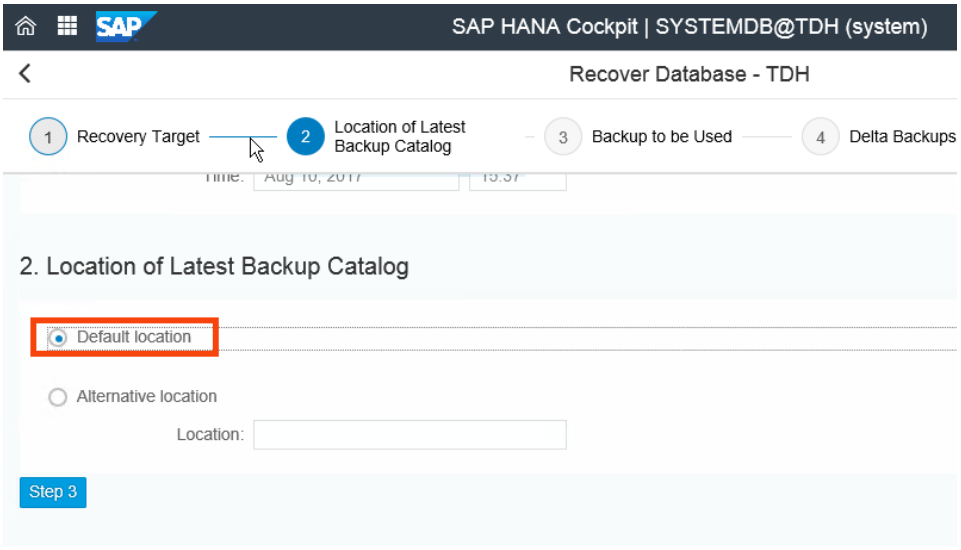
The results show that the copy of tenant TDH to tenant TD1 worked. The tables were replicated from tenant TDH to tenant TD1 successfully.

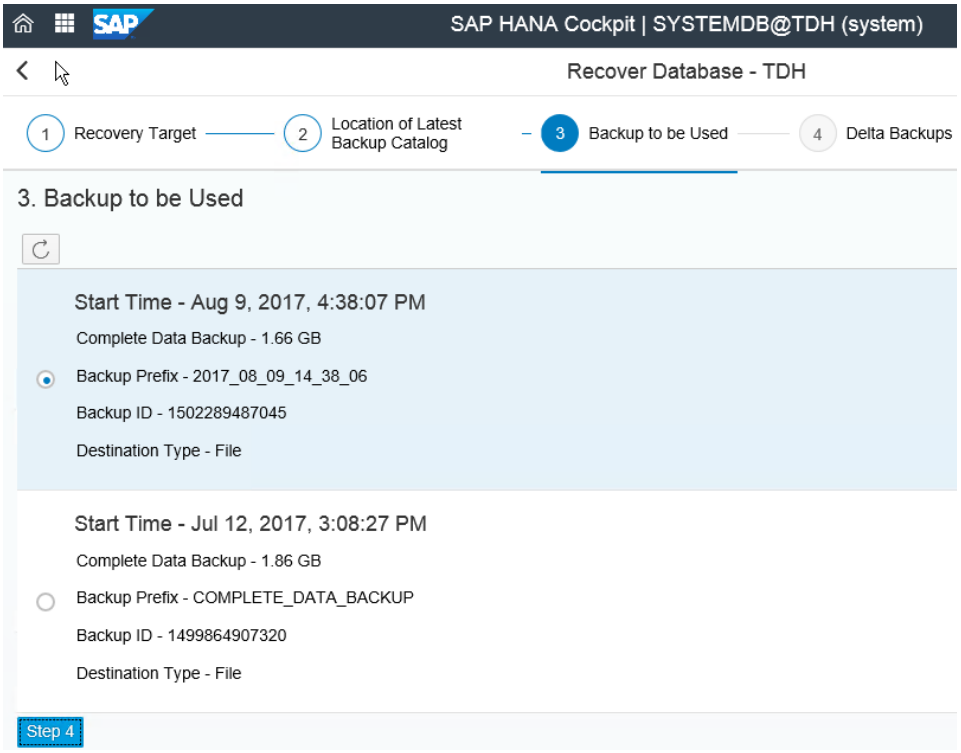
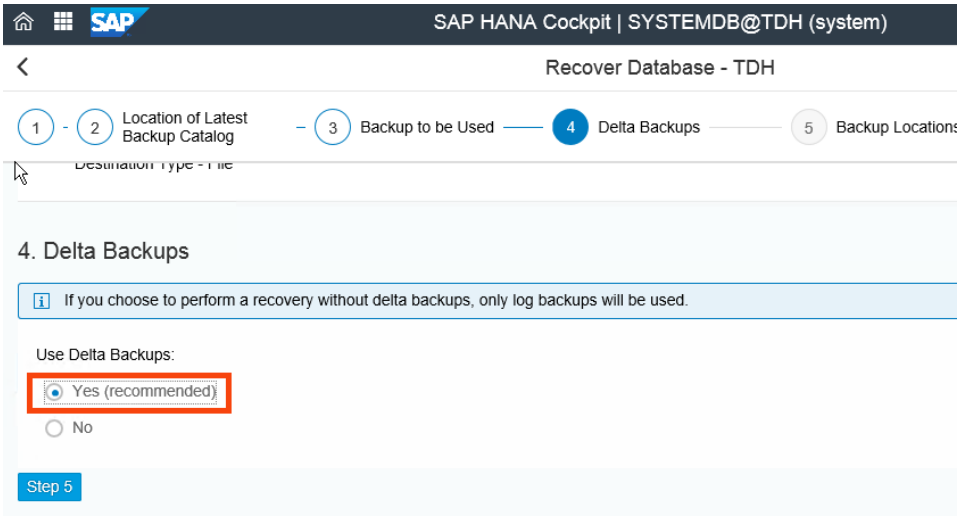
EXERCISE 3 (OPTIONAL): RECOVER TENANT DATABASE

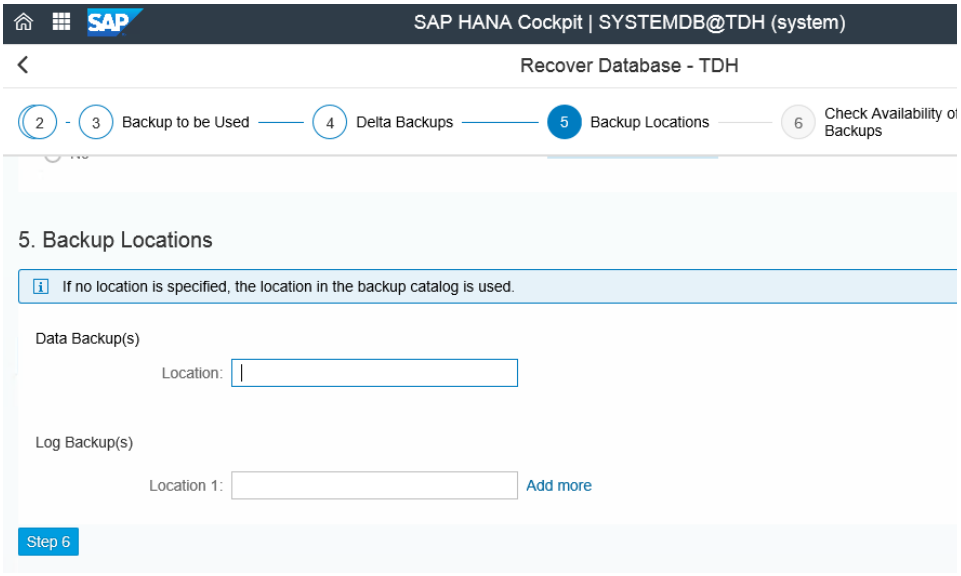
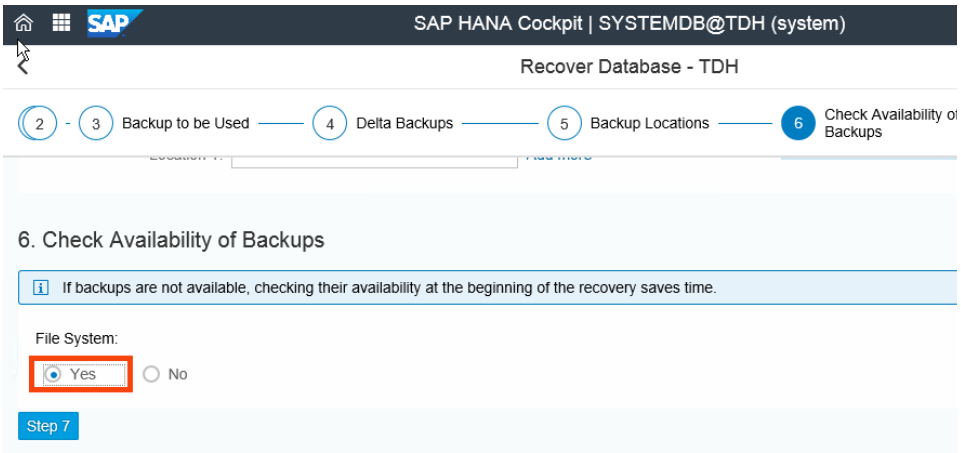
In this exercise, you will use an existing backup to recover a tenant as an example of a tenant refresh. The steps to copy a tenant will be similar, but requires downtime on the source tenant.

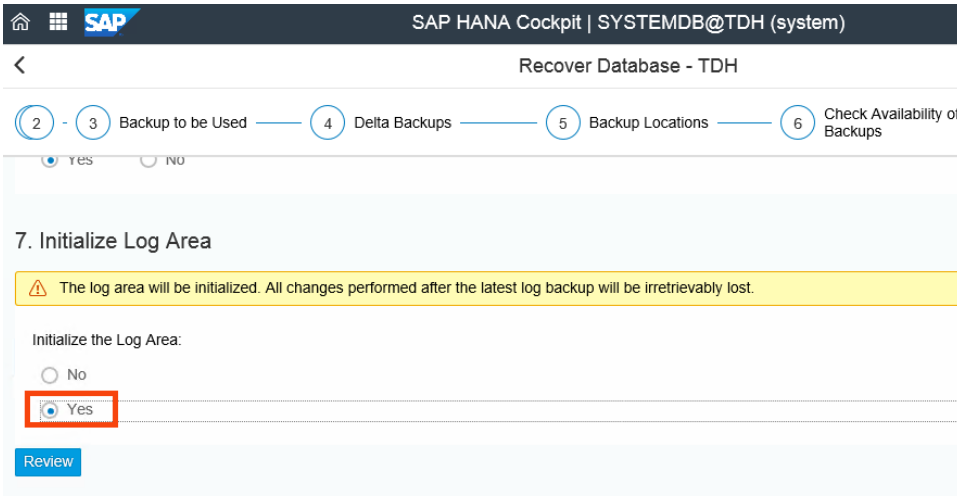
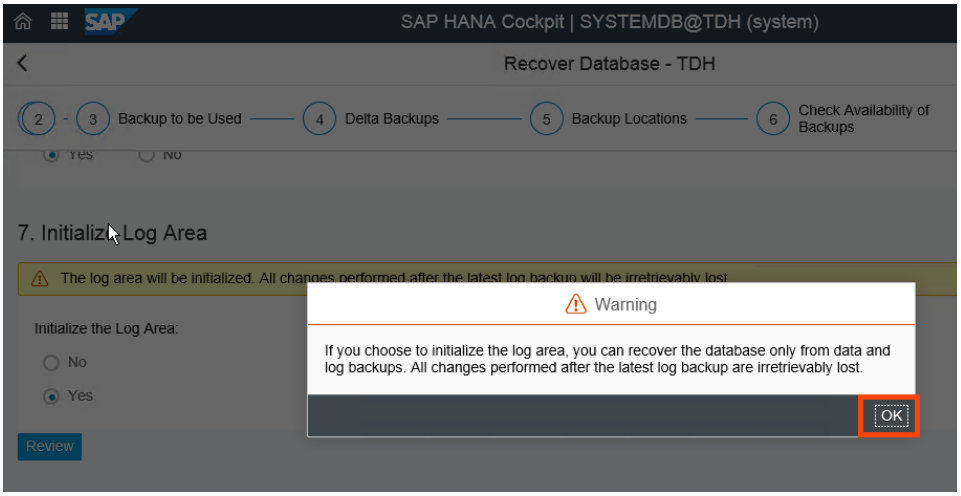
Explanation	Screenshot
74. Start logged in as **COCKPIT_ADMIN** user in the SAP HANA Cockpit (https://wdflbmt0794.wdf.sap.corp:51021). Click on **SYSTEMDB@TDH**. If you are challenged for database credentials, use the **SYSTEM** user	
75. Click on **Tenants Running With Issues** icon.	

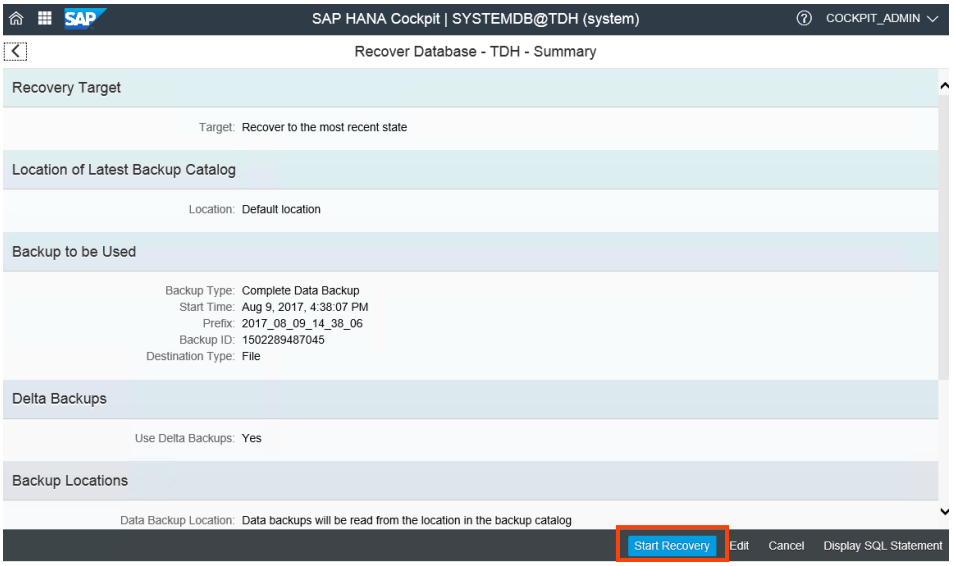
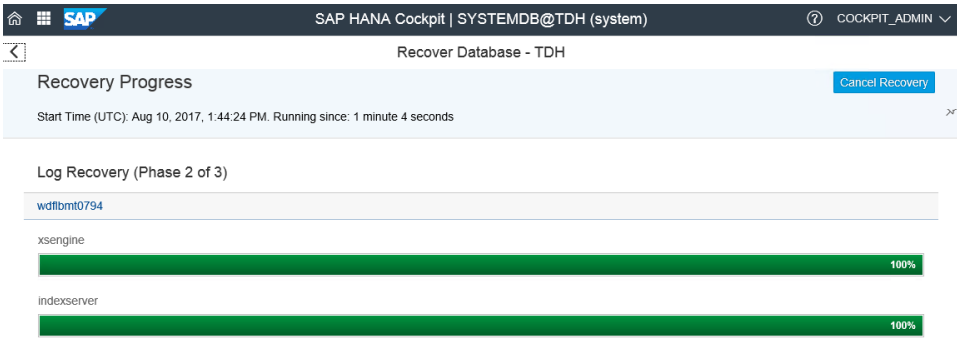
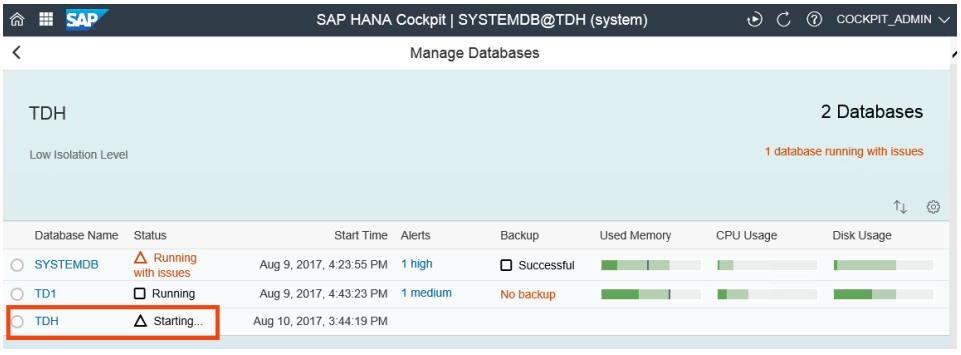
Explanation	Screenshot
76. Select tenant **TDH**. In the lower right corner click on the **three dots**, and select **Recover Tenant Database**.	
77. Click on **Stop Tenant**.	

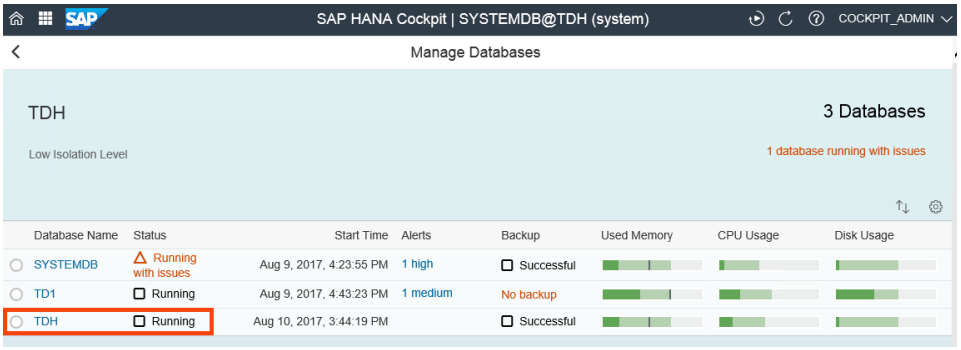
Explanation	Screenshot
78. Select **Recover to the most recent state** and click on **Step 2**.	
79. Select **Default location** and click on **Step 3**.	

Explanation	Screenshot
80. Select a backup (if more than one is available choose the most recent one) and click on **Step 4.**	
81. Select **Yes** and click on **Step 5**.	

Explanation	Screenshot
82. Click on **Step 6**.	
83. Select **Yes** and click on **Step 7**.	

Explanation	Screenshot
84. Select **Yes**.	
85. Confirm Warning with **OK** and click on **Review**.	

Explanation	Screenshot
86. Check Summary and click on **Start Recovery**.	
87. Check result and click on the back (‹) button in the upper left.	
88. Check that tenant TDH is starting.	

Explanation	Screenshot
89. Check that tenant TDH is running.	

Congrats!! You completed the exercises. Please fill out the evaluation for session HBD169.

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