ExaCC quarterly maintenance reports using OCI Events and OCI Function

Author: Christophe.Pauliat@Oracle.com, Oracle Solution Center EMEA

Last update: July 13, 2022

See https://github.com/cpauliat/my-oci-functions/tree/main/ExaCC_maintenance

Table of Contents

1 Principles

1.1 Summary

The solution described in this document sends 2 emails to a group of people during the quarterly maintenance of a group of 1 or more Exadata Cloud at Customer machine(s) (aka ExaCC)

The first email indicates that the maintenance started (on at least 1 ExaCC machine) and provides a private https link to an auto-refreshing HTML report.

Example of first email below:

[External] : Maintenance STARTED for ExaCC Exadata infrastructures group sca-exacc-1-3-5-9

OE **OCI ExaCC patching reports (OSCNAS001) <noreply@oci-exacc-reports.com>**
To: Christophe PAULIAT

The quarterly maintenance for Exadata Cloud @ Customer group **sca-exacc-1-3-5-9** just STARTED.

You can follow the progress of the maintenance HERE

The second email indicates that the maintenance is completed (on all ExaCC machines in the group), contains the HTML report and also provides a link to all archived reports.

Example of second email below:

[External] : Maintenance COMPLETED for ExaCC Exadata infrastructures group sca-exacc-1-3-5-9

OE **OCI ExaCC patching reports (OSCNAS001) <noreply@oci-exacc-reports.com>**
To: Christophe PAULIAT

The quarterly maintenance for Exadata Cloud @ Customer group **sca-exacc-1-3-5-9** just COMPLETED.

The maintenance report is stored as object **ExaCC_maintenance_report_sca-exacc-1-3-5-9_2022-05-07.html** in OCI bucket **ExaCC_maintenance_reports**.

It is also shown below.

NOTE: You can browse all archived reports HERE

Maintenance report for ExaCC Exadata infrastructures group sca-exacc-1-3-5-9

Summary

Region	Compartment	Name	OCID	Maintenance status	Maintenance start	Maintenance end
us-ashburn-1	ExaCC:ExaCC1	osc-sca-exacc1	...rf3bka	SUCCEEDED	May 07 2022, 01:00 UTC	May 07 2022, 09:30 UTC
us-ashburn-1	ExaCC:ExaCC5	osc-sca-exacc5	...scnqla	SUCCEEDED	May 07 2022, 00:00 UTC	May 07 2022, 09:19 UTC
us-ashburn-1	ExaCC:ExaCC9	osc-sca-exacc9	...e46pxa	SUCCEEDED	May 07 2022, 04:00 UTC	May 07 2022, 15:10 UTC
us-ashburn-1	ExaCC:ExaCC3	osc-sca-exacc3	...y6d36a	SUCCEEDED	May 07 2022, 00:00 UTC	May 07 2022, 23:42 UTC

Date and time of report : ***Wed Jul 13 08:39:55 2022 UTC***

Detailed report for osc-sca-exacc1

Maintenance operation	Start	End
Entire maintenance	May 07 2022, 01:00 UTC	May 07 2022, 09:30 UTC
db server #1 : maintenance	May 07 2022, 01:00 UTC	May 07 2022, 02:03 UTC
db server #2 : maintenance	May 07 2022, 02:03 UTC	May 07 2022, 03:11 UTC
db server #3 : maintenance	May 07 2022, 03:11 UTC	May 07 2022, 04:24 UTC
db server #4 : maintenance	May 07 2022, 04:25 UTC	May 07 2022, 05:38 UTC
storage servers maintenance	May 07 2022, 05:38 UTC	May 07 2022, 09:23 UTC
network switches maintenance	May 07 2022, 09:23 UTC	May 07 2022, 09:30 UTC

Date and time of report : ***Wed Jul 13 08:39:55 2022 UTC***

Detailed report for osc-sca-exacc5

Maintenance operation	Start	End
Entire maintenance	May 07 2022, 00:00 UTC	May 07 2022, 09:19 UTC
db server #1 : maintenance	May 07 2022, 00:01 UTC	May 07 2022, 01:19 UTC
db server #2 : maintenance	May 07 2022, 01:20 UTC	May 07 2022, 02:33 UTC
db server #3 : maintenance	May 07 2022, 02:33 UTC	May 07 2022, 03:41 UTC
db server #4 : maintenance	May 07 2022, 03:41 UTC	May 07 2022, 04:54 UTC
storage servers maintenance	May 07 2022, 04:54 UTC	May 07 2022, 09:11 UTC
network switches maintenance	May 07 2022, 09:11 UTC	May 07 2022, 09:18 UTC

*Date and time of report : **Wed Jul 13 08:39:55 2022 UTC***

Detailed report for osc-sca-exacc9

Maintenance operation	Start	End
Entire maintenance	May 07 2022, 04:00 UTC	May 07 2022, 15:10 UTC
db server #1 : maintenance	May 07 2022, 04:01 UTC	May 07 2022, 05:29 UTC
db server #2 : maintenance	May 07 2022, 05:29 UTC	May 07 2022, 06:58 UTC
db server #3 : maintenance	May 07 2022, 06:58 UTC	May 07 2022, 08:26 UTC
db server #4 : maintenance	May 07 2022, 08:27 UTC	May 07 2022, 10:00 UTC
storage servers maintenance	May 07 2022, 10:00 UTC	May 07 2022, 15:02 UTC
network switches maintenance	May 07 2022, 15:03 UTC	May 07 2022, 15:10 UTC

*Date and time of report : **Wed Jul 13 08:39:55 2022 UTC***

Detailed report for osc-sca-exacc3

Maintenance operation	Start	End
Entire maintenance	May 07 2022, 00:00 UTC	May 07 2022, 23:42 UTC
db server #1 : maintenance	May 07 2022, 00:02 UTC	May 07 2022, 01:56 UTC
db server #2 : maintenance	May 07 2022, 01:59 UTC	May 07 2022, 03:41 UTC
db server #3 : maintenance	May 07 2022, 03:44 UTC	May 07 2022, 05:42 UTC
db server #4 : maintenance	May 07 2022, 08:39 UTC	May 07 2022, 10:07 UTC
db server #5 : maintenance	May 07 2022, 10:10 UTC	May 07 2022, 11:53 UTC
db server #6 : maintenance	May 07 2022, 11:55 UTC	May 07 2022, 13:33 UTC
db server #7 : maintenance	May 07 2022, 13:36 UTC	May 07 2022, 15:09 UTC
db server #8 : maintenance	May 07 2022, 15:11 UTC	May 07 2022, 16:49 UTC
storage servers maintenance	May 07 2022, 16:51 UTC	May 07 2022, 23:28 UTC
network switches maintenance	May 07 2022, 23:30 UTC	May 07 2022, 23:42 UTC

*Date and time of report : **Wed Jul 13 08:39:55 2022 UTC***

1.2 OCI Cloud services used

The following OCI Cloud services are used by the solution:

1. OCI Event service (to execute an OCI Function when ExaCC maintenance events occur)
2. OCI Function (to store the ExaCC maintenance events in an OCI Bucket, use them to generate an HTML report and send emails)
3. OCI Container registry service (private Docker registry) to store the code of the Function
4. OCI Object Storage (to store HTML reports in an OCI bucket and provides HTTPS access to them)
5. OCI Email Delivery to send emails (optional: non-OCI SMTP server can be used)

Notes: multiple regions

- If you have ExaCC machines in 2 or more regions in your OCI tenant, you must create OCI ressources in each region, except for the object storage bucket and vault secret that must be created in a single region.

2 Installation on an OCI tenancy

2.1 Summary of the steps:

1. Get details of ExaCC machines (OCID of Exadata infrastructure, compartment) and group ExaCC machines

2. Create a private bucket in OCI Object Storage

3. Create a Virtual Cloud Network with one subnet (repeat for every region containing ExaCC machines)

4. Create an Application in OCI Function service (repeat for every region containing ExaCC machines)

5. If using OCI container registry to store the code for OCI Function:

    a. Create a Container registry (private Docker registry). (repeat for every region containing ExaCC machines)

6. Deploy the OCI Function into the Application (repeat for every region containing ExaCC machines)

7. Configure the OCI Function (give key, value pairs) (repeat for every region containing ExaCC machines)

8. Create a rule in the Events service to call the OCI Function for ExaCC maintenance events (repeat for every region containing ExaCC machines)

9. Create a dynamic group and an IAM policy to give required OCI permissions to the OCI Function(s)

10. If using OCI Email delivery service to send emails:

    a. Create an approved sender in OCI Email Delivery service
    b. Create a dedicated user in OCI for emails sending.
    c. Create SMTP credentials for this OCI user

2.2 Detailed steps

2.2.1 Get details of ExaCC machines

Use OCI console or OCI CLI to get details for ExaCC machines.

Here is an example of OCI CLI command to get ExaCC details

```
oci --profile <profile> search resource structured-search \
    --query-text "query exadatainfrastructure resources" \
    --query 'data.items[].{"Name":"display-name", "OCID":"identifier"}' \
    --output table \
    --region uk-london-1
```

Notes:

- the --region parameter is optional (default is to use the region in the OCI profile)

2.2.2 Create a private bucket

Make sure to create a PRIVATE bucket

Note the OCID of compartment in which you created the bucket: <**bucket_compartment_id**>
Note the name of the private bucket: **<bucket_name>**
Reminder: this name must be unique inside the tenancy.

2.2.3 Create a Virtual Cloud Network with one subnet

Note the OCID of compartment in which you created the VCN and subnet (may be the same as the bucket_compartment_id): **<network_compartment_id>**

2.2.4 Create an Application in OCI Function service

Create an application in OCI Function service, using the subnet created previously.
You can name it **ExaCC_app** (or any other name)

Note the OCID of the compartment in which you created Application (may be the same as the bucket_compartment_id) **<function_compartment_id>**

2.2.5 Create a Container registry (private Docker registry)

See https://docs.oracle.com/en-us/iaas/Content/Registry/home.htm

Note the repository path (see https://docs.oracle.com/en-us/iaas/Content/Registry/Concepts/registryconcepts.htm)

```
<region-key>.ocir.io/<tenancy-namespace>/<repo-name>
```

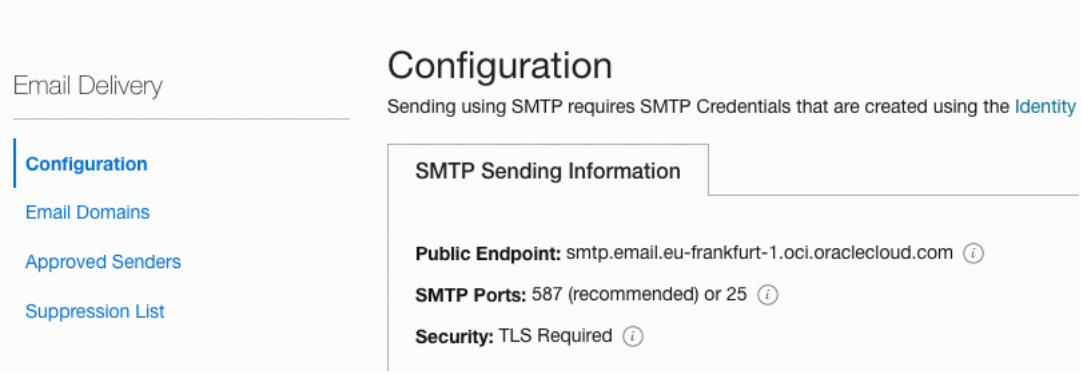
2.2.6 Create an Auth Token for the OCI user you want to use to access the container registry

See https://docs.oracle.com/en-us/iaas/Content/Registry/Tasks/registrygettingauthtoken.htm

2.2.7 Configure OCI Email delivery service

Note: This is required if you want to use OCI Email delivery service to send emails

1. Select a compartment
2. Create an approved sender using a non-existing email address with non-existing domain name (for example: **noreply@oci-exacc-reports.com**)
3. Note the public endpoint for and port for the SMTP server



4. Choose an OCI user that will be used with OCI Email delivery service
5. Create a SMTP credential for this OCI user (see https://docs.oracle.com/en-us/iaas/Content/Email/Tasks/generatesmtpcredentials.htm)
   Note the **Username** and **Password** to authentication to SMTP server

2.2.8 Create a Vault secret to store the SMTP password

1. Select a compartment to create an OCI Vault and secret
2. Create an OCI Vault if you don't have one yet (see https://docs.oracle.com/en-us/iaas/Content/KeyManagement/home.htm)
3. Create a master key with AES algorithm
4. Create a secret to store the SMTP password
5. Note the OCID of the secret **<secret_id>**
6. Note the OCID of the vault **<vault_id>**
7. Note the OCID of the compartment used by the Vault **<vault_compartment_id>**

2.2.9 Deploy the OCI Function into the Application

On a Linux machine (for example an OCI compute instance with Oracle Linux 7.x):

1. Install the fn client (see https://docs.oracle.com/en-us/iaas/Content/Functions/Tasks/functionsinstallfncli.htm)
2. Install OCI CLI command (see https://docs.oracle.com/en-us/iaas/Content/API/SDKDocs/cliinstall.htm#Quickstart)
3. Install Docker
4. Create 1 or more OCI profiles in OCI CLI config file (~/.oci/config)
5. Create a new context in fn client (see https://docs.oracle.com/en-us/iaas/Content/Functions/Tasks/functionscreatefncontext.htm)

```
fn create context <name> --provider oracle
fn use context <name>

CPT=ocid1.compartment.oc1..aaaaaa…      (OCID of the function_compartment)
fn update context oracle.compartment-id $CPT
fn update context api-url https://functions.eu-frankfurt-1.oraclecloud.com
fn update context registry fra.ocir.io/<tenancy-namespace>/<repo-name>
fn update context oracle.profile <OCI_profile>
```

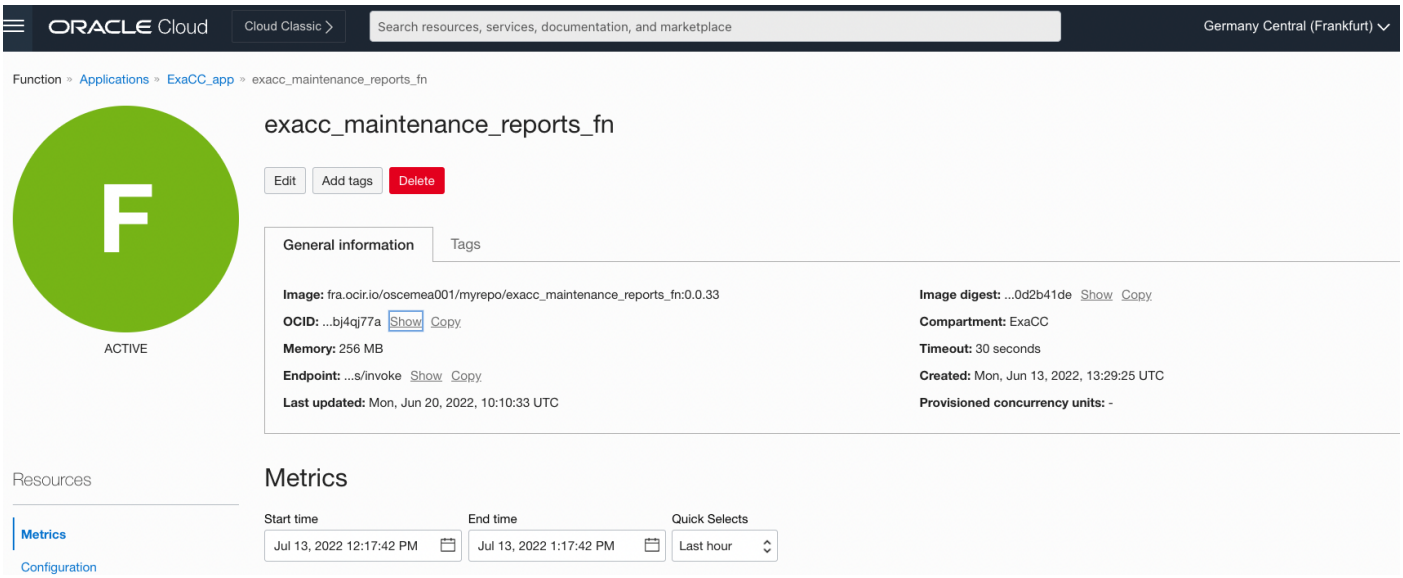
6. Connect to your private container registry with docker CLI

```
docker login fra.ocir.io -u /<tenancy-namespace>/<oci_user>
```
(passwd is Auth Token for OCI user <oci_user>)

7. Copy the 3 source files for the OCI function (**func.py**, **func.yaml** and **requirements.txt**) to a new directory named **exacc_maintenance_reports_fn**
   Notes:
   - if you want to use a different name for the function, rename the directory and also change name in file func.yaml
   - Those 3 files are available at https://github.com/cpauliat/my-oci-functions/tree/main/ExaCC_maintenance/exacc_maintenance_reports_fn

8. Finally deploy the function using fn client
```
$ cd exacc_maintenance_reports_fn
$ fn -v deploy --app ExaCC_app
```
(name of your application may be different)

9. In OCI console, check the OCI function was deployed successfully by looking at the Functions in the Application and **note the function OCID**.



2.2.10 Configure the OCI Function (give key-value pairs)

This OCI functions uses the following parameters:

- **bucket_name** : the name of the bucket created in OCI object storage
- **bucket_region** : the OCI region containing the object storage bucket
- **par_for_bucket_read** : the object storage PAR (pre-auth request) allowing read on the bucket
- **email_recipients** : comma separated list of email addresses that will receive mails
- **email_sender** : email address of sender (from field)
- **email_sender_name** : name of the email address
- **email_smtp_host** : hostname of SMTP server
  (for example smtp.email.us-ashburn-1.oci.oraclecloud.com)
- **email_stmp_port** : incoming port for SMTP server (usually 587 for TLS access)
- **email_smtp_user** : user used for SMTP authentication
- **email_smtp_pwd_secret_id** : OCID of the OCI vault secret containing the SMTP auth password
- **vault_secret_region** : the OCI region containing the vault secret
- **exainfra_group1_name** : name of the first group of Exadata Infrastructures (ExaCC)
- **exainfra_group1_ids** : comma separated list of OCIDs for Exadata infrastructures for this group

Optionally, you can create other groups (group2 to group9)

- **exainfra_group2_name** : name of the second group of Exadata Infrastructures (ExaCC)

- **exainfra_group2_ids** : comma separated list of OCIDs for Exadata infrastructures for this group

You must create those keys with associated values in OCI console or OCI CLI

See below an example of OCI CLI command to do this:

```
FUNC_ID="ocid1.fnfunc.oc1.eu-frankfurt-1.aaaaaaaa4dhpcakufymlhmdfxxxxxx"
PROFILE=<OCI-profile>
CONFIG='{
  "bucket_name": "ExaCC_maintenance_reports",
  "bucket_region": "us-ashburn-1",
  "par_for_bucket_read": "https://objectstorage.us-ashburn-
1.oraclecloud.com/p/xxxxxxxxxxxxxxxxxxx/n/tenant/b/ExaCC_maintenance_reports/o/",
  "email_sender": "noreply@oci-exacc-reports.com",
  "email_sender_name": "OCI ExaCC maintenance reports",
  "email_recipients": "christophe.pauliat@oracle.com,anotheremail@blabla.com",
  "email_smtp_user":
"ocid1.user.oc1..aaaaaaaamotj4cs75a2royihvyzbxxx@ocid1.tenancy.oc1..aaaaaaaafipe4lmow7r
frn5f3eyyyyymb5q.kk.com",
  "email_smtp_host": "smtp.email.us-ashburn-1.oci.oraclecloud.com",
  "email_smtp_port": "587",
  "email_smtp_pwd_secret_id": "ocid1.vaultsecret.oc1.eu-frankfurt-1.amaaaanmvyyyyfbda",
  "vault_secret_region": "eu-frankfurt-1",
  "exainfra_group1_name": "ecck",
  "exainfra_group1_ids": "ocid1.exadatainfrastructure.oc1.eu-frankfurt-
1.abtheljr5wz37qsqc7axxxxxida",
  "exainfra_group2_name": "ecch-ecce",
  "exainfra_group2_ids": "ocid1.exadatainfrastructure.oc1.eu-frankfurt-1.abtheljtz5vuq,
ocid1.exadatainfrastructure.oc1.eu-frankfurt-1.abtheljtknwyj3mzzzzzzzengyyglpa"
}'

oci --profile $PROFILE fn function update --function-id $FUNC_ID --config "$CONFIG"
```

2.2.11 Create a rule in the Events service to call the OCI Function for ExaCC maintenance events

Now that the OCI Function is created, you can create a rule in the OCI Events service to automatically execute this Function when ExaCC maintenance events occur.

Name of the rule: **ExaCC-Maintenance-Events** (can be different)

List of 15 event types: (in **database** service Name)

- ☐ Exadata Infrastructure - Maintenance Begin
- ☐ Exadata Infrastructure - Maintenance End
- ☐ Exadata Infrastructure - Maintenance Reminder
- ☐ Exadata Infrastructure - Maintenance Rescheduled
- ☐ Exadata Infrastructure - Maintenance Scheduled
- ☐ Exadata Infrastructure - Storage server maintenance Begin
- ☐ Exadata Infrastructure - Storage server maintenance End
- ☐ Exadata Infrastructure - Virtual Machines Maintenance Begin
- ☐ Exadata Infrastructure - Virtual Machines Maintenance End
- ☐ Exadata Infrastructure - Custom action time Begin
- ☐ Exadata Infrastructure - Custom action time End
- ☐ Exadata Infrastructure - IB Switch maintenance Begin
- ☐ Exadata Infrastructure - IB Switch maintenance End
- ☐ Exadata Infrastructure - Maintenance Method Change
- ☐ Exadata Infrastructure - Maintenance Rescheduled With Reason

Action:

Functions, select your Function

2.2.12 Create a dynamic group and an IAM policy to give required OCI permissions to the OCI Function

Now, you need to give the required permissions to the OCI Function.
This is done using an OCI dynamic group to identify the resource principal (the OCI Function) and then by creating an identity policy to give permissions to the dynamic group

2.2.12.1 Dynamic group

Create a new dynamic group named **ExaCC-maintenance** with following matching rule:

```
resource.id = '<function_OCID>'
```

Example:

```
resource.id = 'ocid1.fnfunc.oc1.eu-frankfurt-1.aaaaaaaa4dhpcakufymlhmdfzzzzzzzzzzzzzzzzzz4fvrka'
```

2.2.12.2 IAM policy

You can use any name here (for example: **ExaCC-maintenance**)

You need to use the following statements:

```
Allow dynamic-group ExaCC-maintenance to use secret-family in compartment id
<vault_compartment_id>

Allow dynamic-group ExaCC-maintenance to read vaults in compartment id
<vault_compartment_id> where target.vault.id='<vault_id>'

Allow dynamic-group ExaCC-maintenance to read secrets in compartment id
<vault_compartment_id> where target.secret.id='<secret_id>'

Allow dynamic-group ExaCC-maintenance to read exadata-infrastructures in tenancy

Allow dynamic-group ExaCC-maintenance to read buckets in compartment id
<bucket_compartment_id> where target.bucket.name='<bucket_name>'

Allow dynamic-group ExaCC-maintenance to manage buckets in compartment id
<bucket_compartment_id> where all { target.bucket.name='<bucket_name>',
request.permission='PAR_MANAGE'  }

Allow dynamic-group ExaCC-maintenance to manage objects in compartment id
<bucket_compartment_id> where target.bucket.name='<bucket_name>'

Allow service FaaS to use virtual-network-family in compartment id
<network_compartment_id>

Allow service FaaS to read repos in tenancy
```

Note : if you used a different name for the dynamic group, use this name here instead of ExaCC-maintenance

IMPORTANT: this IAM policy must be created in a compartment which is a common parent to all compartments used (for example the root compartment).