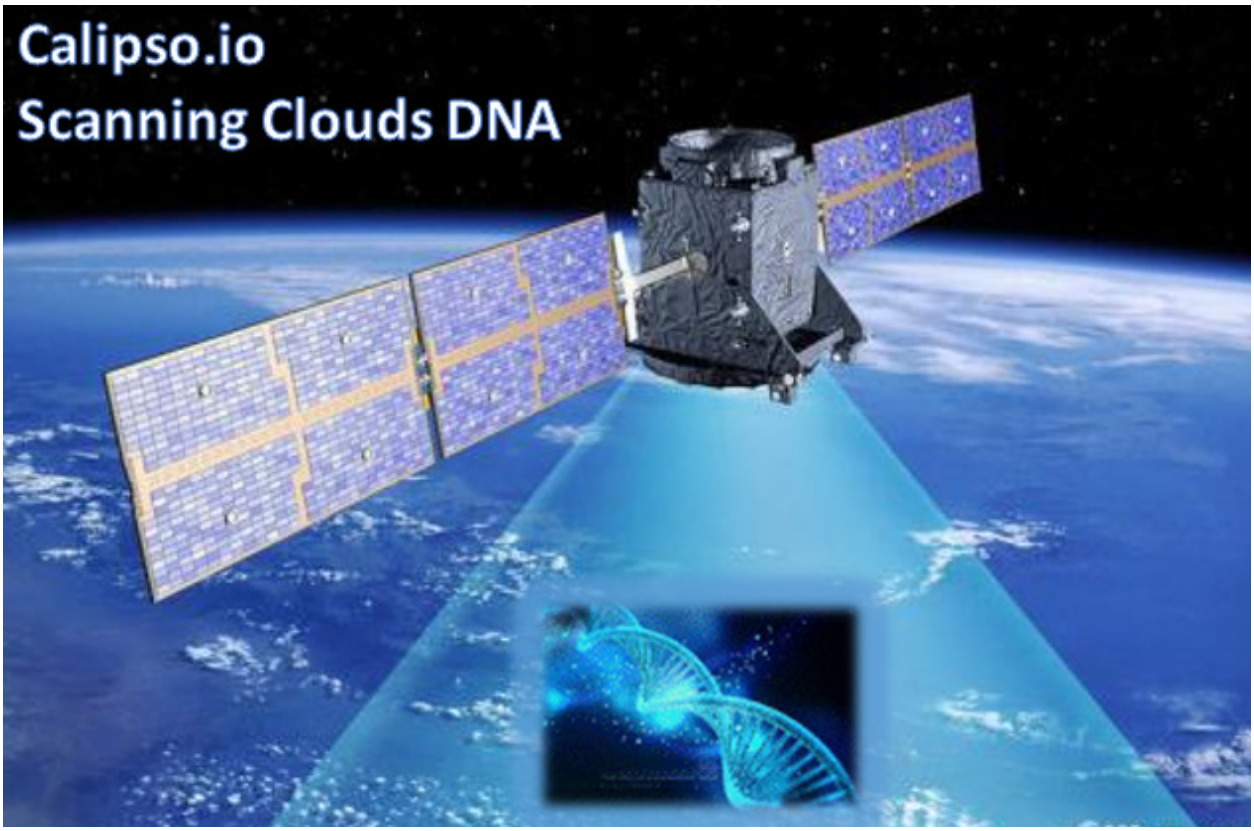
Calipso.io
Administration Guide



Project “Calipso” tries to illuminate complex virtual networking with real time operational state visibility for large and highly distributed Virtual Infrastructure Management (VIM).

Calipso provides visible insights using smart discovery and virtual topological representation in graphs, with monitoring per object in the graph inventory to reduce error vectors and troubleshooting, maintenance cycles for VIM operators and administrators.

Calipso model, described in this document, was built for multi-environment and many VIM variances, the model was tested successfully (as of Aug 27th) against 60 different VIM variances (Distributions, Versions, Networking Drivers and Types).

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1 Environments config

Environment is defined as a certain type of Virtual Infrastructure facility the runs under a single unified Management (like an OpenStack facility).
Everything in Calipso application rely on environments config, this is maintained in the **“environments_config”** collection in the mongo Calipso DB.
Environment configs are pushed down to Calipso DB either through UI or API (and only in OPNFV case Calipso provides an automated program to build all needed environments_config parameters for an ‘Apex’ distribution automatically).
When scanning and discovering items Calipso uses this configuration document for successful scanning results, here is an example of an environment config document:

```
{
  "name": "DEMO-ENVIRONMENT-SCHEME",
  "enable_monitoring": true,
  "last_scanned": "filled-by-scanning",
  "app_path": "/home/scan/calipso_prod/app",
  "type": "environment",
  "distribution": "Mirantis",
  "distribution_version": "8.0”,
  "mechanism_drivers": ["OVS”],
  "type_drivers": "vxlan"
  "operational": "stopped",
  "listen": true,
  "scanned": false,
  "configuration": [
    {
      "name": "OpenStack",
      "port":”5000”,
      "user": "adminuser",
      "pwd": "dummy_pwd",
      "host": "10.0.0.1",
      "admin_token": "dummy_token"
    },
    {
      "name": "mysql",
      "pwd": "dummy_pwd",
      "host": "10.0.0.1",
      "port": “3307”,
      "user": "mysqluser"
    },
    {
      "name": "CLI",
      "user": "sshuser",
      "host": "10.0.0.1",
      "pwd": "dummy_pwd"
    },
    {
```

```
            "name": "AMQP",
            "pwd": "dummy_pwd",
            "host": "10.0.0.1",
            "port": “5673”,
            "user": "rabbitmquser"
        },
        {
            "name": "Monitoring",
            "ssh_user": "root",
            "server_ip": "10.0.0.1",
            "ssh_password": "dummy_pwd",
            "rabbitmq_pass": "dummy_pwd",
            "rabbitmq_user": "sensu",
            "rabbitmq_port": “5671”,
            "provision": "None",
            "env_type": "production",
            "ssh_port": “20022”,
            "config_folder": "/local_dir/sensu_config",
            "server_name": "sensu_server",
            "type": "Sensu",
            "api_port": NumberInt(4567)
        },
        {
            "name": "ACI",
            "user": "admin",
            "host": "10.1.1.104",
            "pwd": "dummy_pwd"
        }
    ],
    "user": "wNLeBJxNDyw8G7Ssg",
    "auth": {
        "view-env": [
            "wNLeBJxNDyw8G7Ssg"
        ],
        "edit-env": [
            "wNLeBJxNDyw8G7Ssg"
        ]
    },
}
```

Here is a brief explanation of the purpose of major keys in this environment configuration doc:
Distribution: captures type of VIM, used for scanning of objects, links and cliques.
Distribution_version: captures version of VIM distribution, used for scanning of objects, links and cliques.
Mechanism_driver: captures virtual switch type used by the VIM, used for scanning of objects, links and cliques.
Type_driver: captures virtual switch tunneling type used by the switch, used for scanning of objects, links and cliques.
Listen: defines whether or not to use Calipso listener against the VIM BUS for updating inventory in real-time from VIM events.
Scanned: defines whether or not Calipso ran a full and a successful scan against this environment.
Last_scanned: end time of last scan.
Operational: defines whether or not VIM environment endpoints are up and running.
Enable_monitoring: defines whether or not Calipso should deploy monitoring of the inventory objects running inside all environment hosts.
Configuration-OpenStack: defines credentials for OpenStack API endpoints access.
Configuration-mysql: defines credentials for OpenStack DB access.
Configuration-CLI: defines credentials for servers CLI access.
Configuration-AMQP: defines credentials for OpenStack BUS access.
Configuration-Monitoring: defines credentials and setup for Calipso sensu server (see monitoring-guide for details).
Configuration-ACI: defines credentials for ACI switched management API, if exists.
User and auth: used for UI authorizations to view and edit this environment.
App-path: defines the root directory of the scanning application.

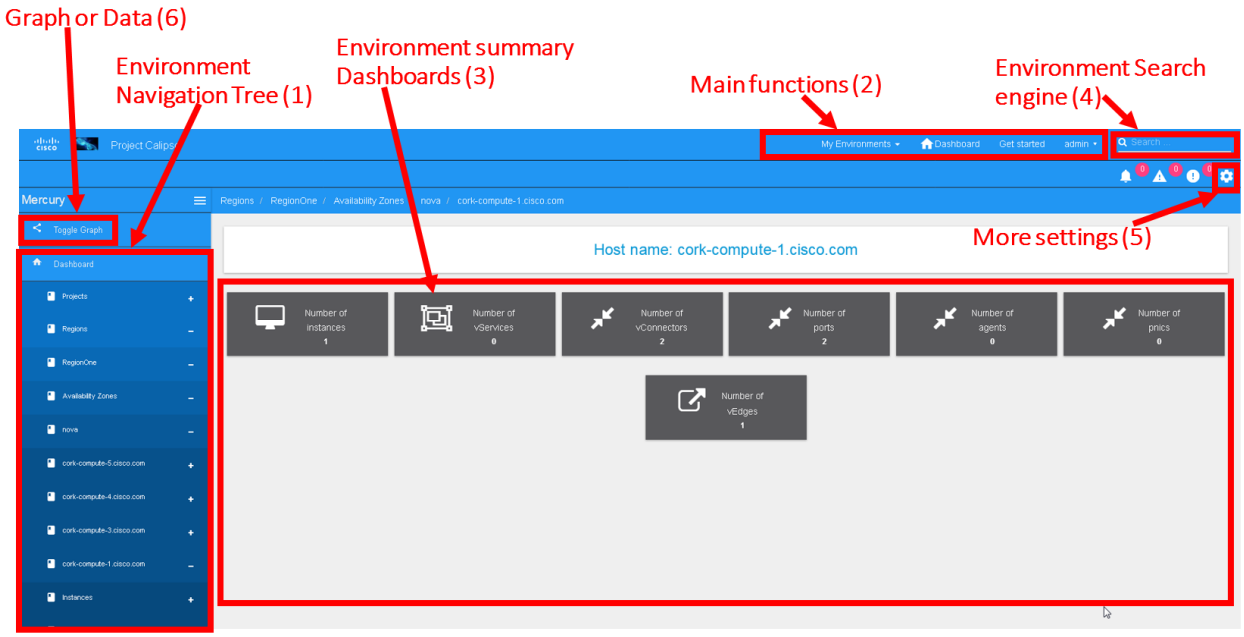
* This guide will help you understand how-to add new environment through the provided Calispo UI module and then how-to use this environment (and potentially many others) for scanning and real-time inventories collection.

2 UI overview

Cloud administrator can use the Calipso UI for he's daily tasks. Once Calipso containers are running (see quickstart-guide) the UI will be available at: http://server-ip:80 , default login credentials: admin/123456.
Before logging in, while at the main landing page, a generic information is provided. Post login, at the main dashboard you can click on "Get started" and view a short guide for using some of the basic UI functions, available at: server-ip/getstarted.

The main areas of interest are shown in the following screenshot:

Main areas on UI:



Main areas details:

Navigation Tree(1): Hierarchy searching through the inventory using objects and parents details, to lookup a focal point of interest for graphing or data gathering.

Main functions (2): Jumping between highest level dashboard (all environments), specific environment and some generic help is provided in this area.

Environment Summary (3): The central area where the data is exposed, either through graph or through widget-attribute-listing.

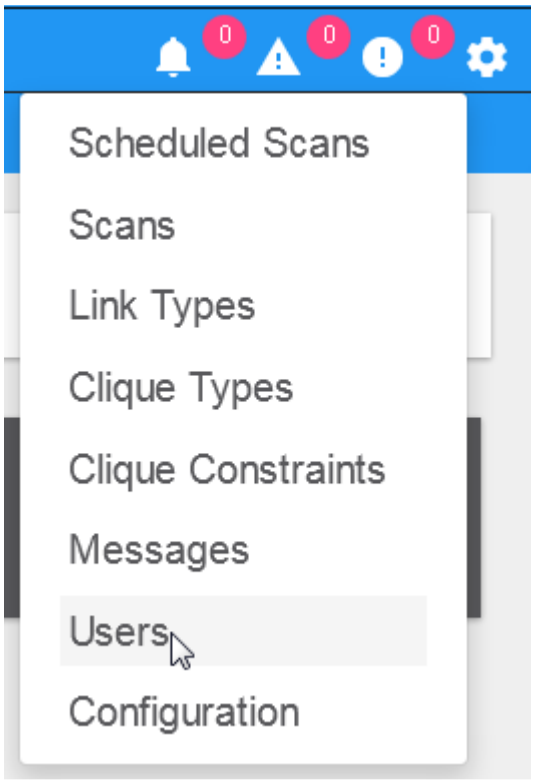
Search engine (4): Finding interesting focal points faster through basic object naming lookups, then clicking on results to get transferred directly to that specific object dashboard. Searches are conducted across all environments.

More settings (5): In this area the main collections of data are exposed, like scans, schedules, messaging, clique_types, link_types and others.

Graph or Data toggle (6): When focusing on a certain focal point, this button allows changing from a graph-view to simple data-view per request, if no graph is available for a certain object the data-view is used by default, if information is missing try this button first to make sure the correct view is chosen.

2.1 User management

The first place an administrator might use is the user's configurations, this is where a basic RBAC is provided for authorizing access to the UI functions. Use the 'settings' button and choose 'users' to access:



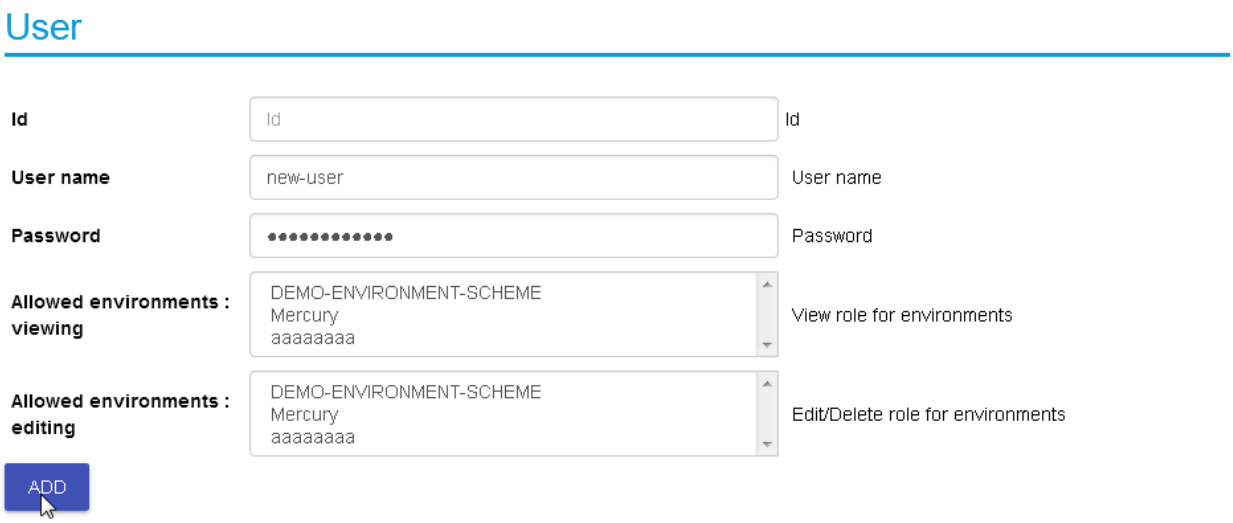
Editing the admin user password is allowed here:

User Name	Emails	Profile	Roles
admin	[{"address": "admin@example.com", "verified": false}]	{"name": "admin"}	{"__global_roles__": ["manage-users", "manage-link-types", "manage-clique-types", "manage-clique-constraints", "view-env", "edit-env"]}

Note:
The 'admin' user is allowed all functions on all environments, you shouldn't change this behavior and you should never delete this user, or you'll need re-install Calipso.

Adding new user is provided when clicking the "Create new user" option:

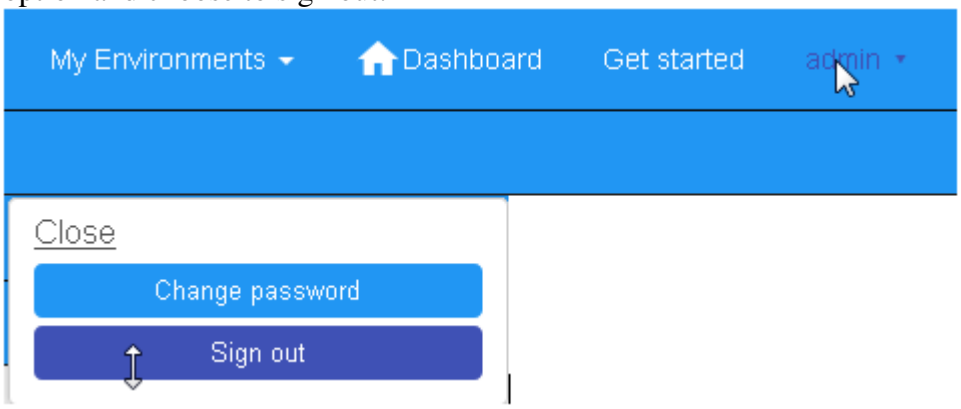
Creating a new user:



Before environments are configured there is not a lot of options here, once environments are defined (one or more), users can be allowed to edit or view-only those environments.

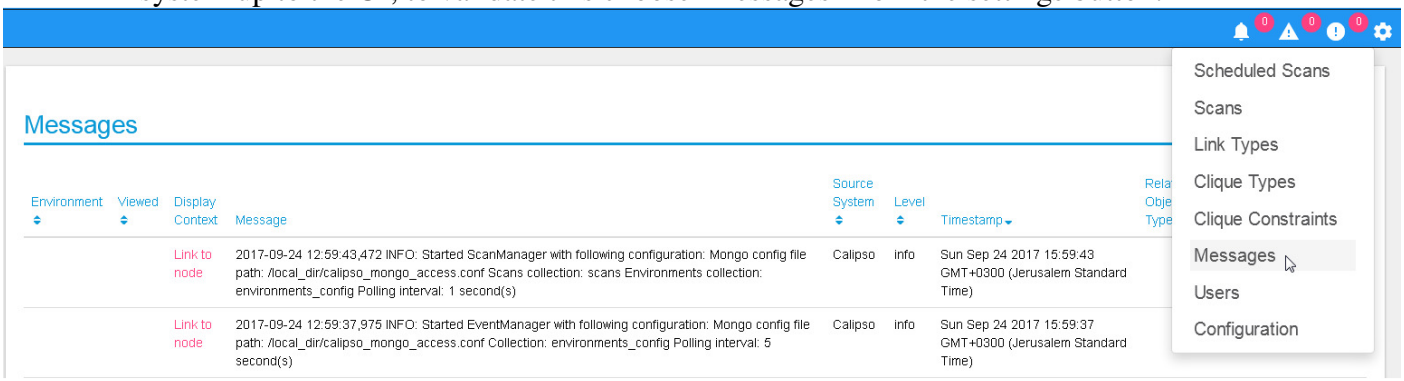
2.2 Logging in and out

To logout and re-login with different user credentials you can click the username option and choose to sign out:



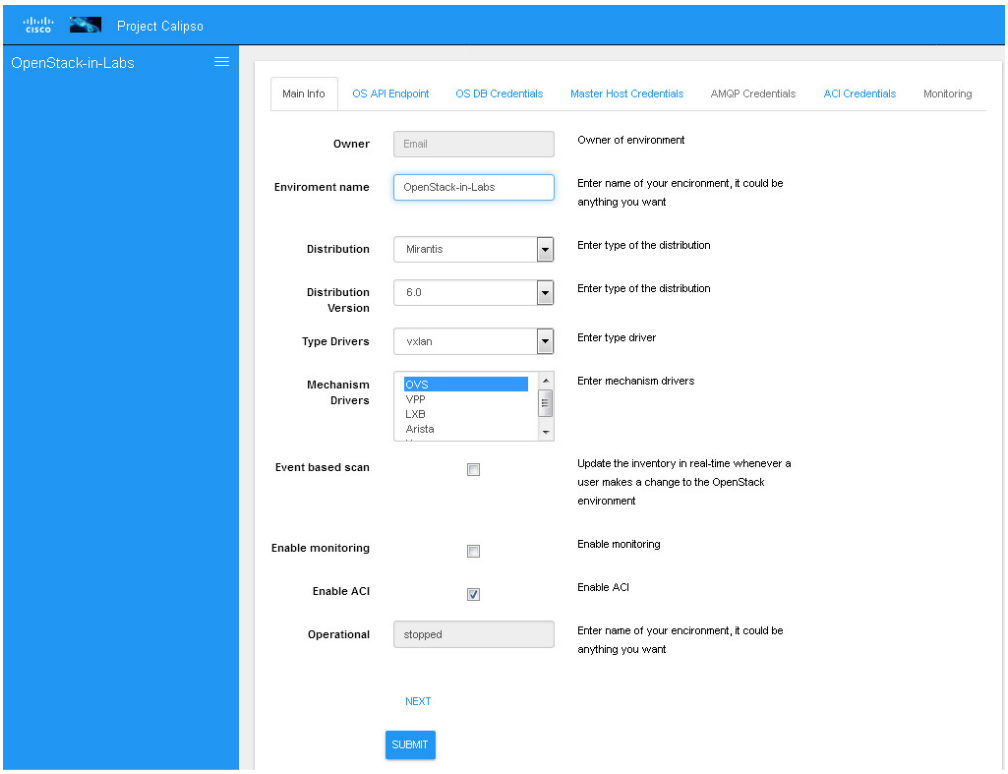
2.3 Messaging check

When calispo-scan and calipso-listen containers are running, they provide basic messages on their processes status, this should be exposed thorough the messaging system up to the UI, to validate this choose ‘messages’ from the settings button:



2.4 Adding a new environment

As explained above, environment configuration is the pre requisite for any Calipso data gathering, goto “My Environments” -> and “Add new Environment” to start building the environment configuration scheme:



Note: this is automated with OPNFV apex distro, where Calipso auto-discovers all credentials

3 Preparing an environment for scanning

Some preparation is needed for allowing Calipso to successfully gather data from the underlying systems running in the virtual infrastructure environment. This chapter explain the basic requirements and provide recommendations.

3.1 Where to deploy Calipso application

Calipso application replaces the manual discovery steps typically done by the administrator on every maintenance and troubleshooting cycles, It needs to have the administrators privileges and is most accurate when placed on one of the controllers or a“jump server” deployed as part of the cloud virtual infrastructure, Calipso calls this server a “Master host”.

Consider Calipso as yet another cloud infrastructure module, similar to neutron, nova.

Per supported distributions we recommend installing the Calipso application at:

1. Mirantis: on the ‘Fuel’ or ‘MCP’ server.
2. RDO/Packstack: where the ansible playbooks are deployed.
3. Canonical/Ubuntu: on the juju server.
4. Triple-O/Apex: on the jump host server.

3.2 Environment setup

The following steps should be taken to enable Calispo’s scanner and listener to connect to the environment controllers and compute hosts:

1. OpenStack API endpoints : Remote access user accessible from the master host with the required credentials and allows typical ports: 5000, 35357, 8777, 8773, 8774, 8775, 9696
2. OpenStack DB (MariaDB or MySQL): Remote access user accessible from the master host to ports 3306 or 3307 allowed access to all Databases as read-only.
3. Master host SSH access: Remote access user with sudo privileges accessible from the master host through either user/pass or rsa keys, the master host itself should then be allowed access using rsa-keys (password-less) to all other infrastructure hosts, all allowing to run sudo CLI commands over tty, when commands entered from the master host source itself.
4. AMQP message BUS (like Rabbitmq): allowed remote access from the master host to listen for all events generated using a guest account with a password.
5. Physical switch controller (like ACI): admin user/pass accessed from master host.

Note: The current lack of operational toolsets like Calipso forces the use of the above scanning methods, the purpose of Calipso is to deploy its scanning engine as an agent on all environment hosts, in such scenario the requirements above might be deprecated and the scanning itself can be made more efficient.

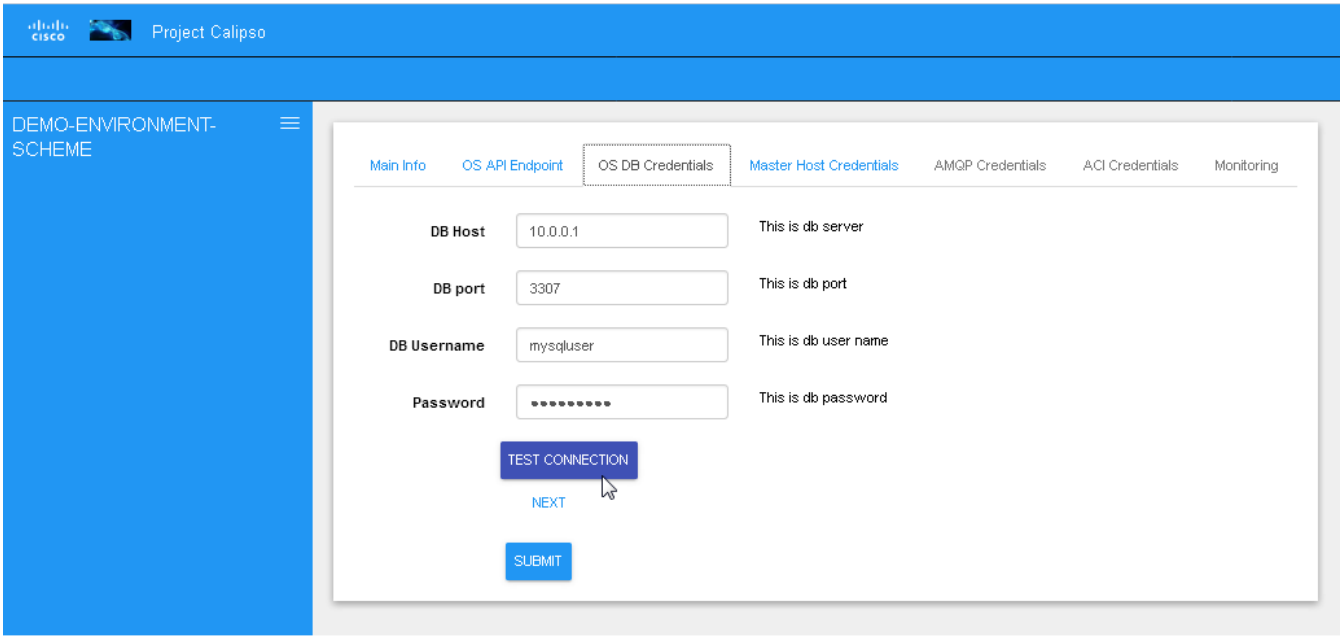
3.3 Filling the environment config data

As explained in chapter 1 above, environment configuration is the pre requisite and all data required is modeled as described. See api-guide for details on submitting those details through calispo api module. When using the UI module, follow the sections tabs and fill the needed data per help messages and the explanations in chapter 1. Only the AMQP, Monitoring and ACI sections in environment_config documents are optional, per the requirements detailed below on this guide.

3.4 Testing the connections

Before submitting the environment_config document it is wise to test the connections. Each section tab in the environment configuration has an optional butting for testing the connection tagged “test connection”. When this button is clicked, a check is made to make sure all needed data is entered correctly, then a request is sent down to mongoDB to the “connection_tests” collection. Then the calispo scanning module will make the required test and will push back a response message alerting whether or not this connection is possible with the provided details and credentials.

Test connection per configuration section:

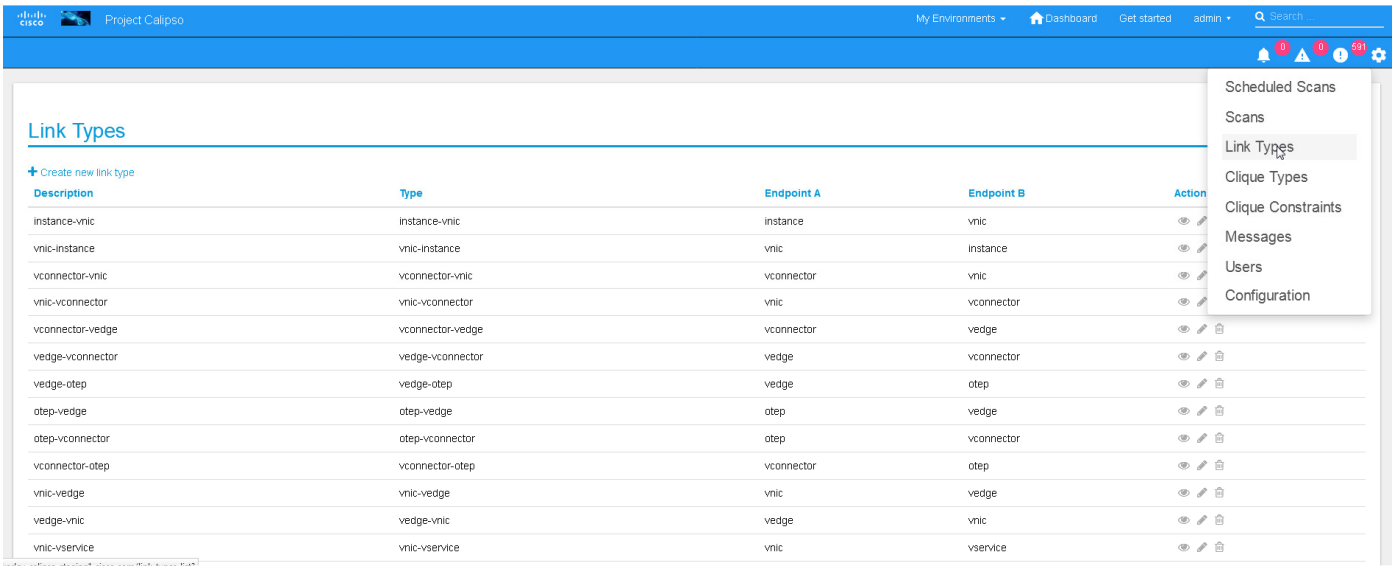


With the above tool, the administrator can be assured that Calipso scanning will be successful and the results will be an accurate representation of the state of he's live environment.

4 Links and Cliques

A very powerful capability in Calipso allows it to be very adaptive and support many variances of VIM environments, this capability lies in its objects, links and cliques models enabling the scanning of data and analysis of inter-connections and creation of many types of topology graphs..
Please refer to calipso-model document for more details.
The UI allows viewing and editing of Link types and Clique types through the settings options:

Link types:

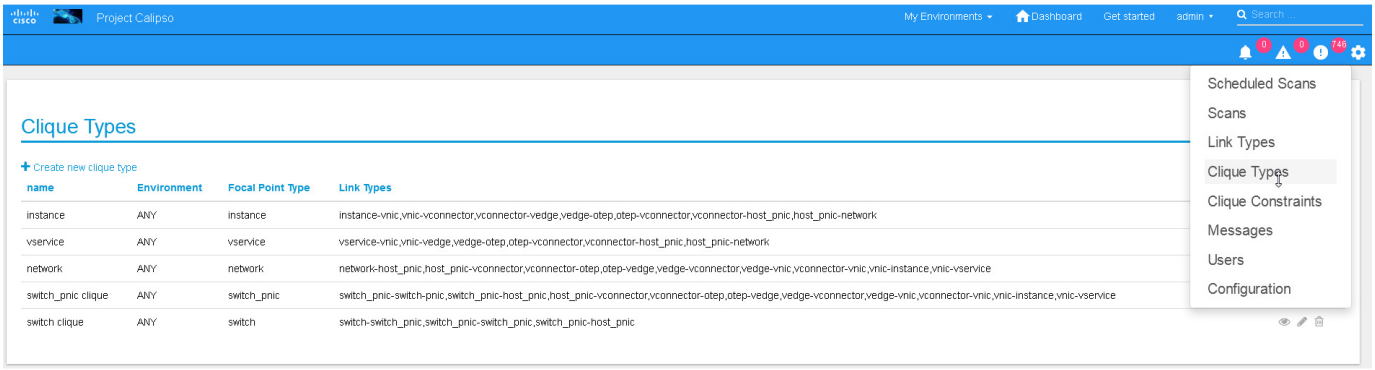


Note:
We currently recommend not to add nor edit the Link types pre-built in Calipso's latest release (allowed only for the 'admin' user), as it is tested and proven to support more than 60 popular VIM variances.
An administrator might choose to define several environment specific **Clique types** for creating favorite graphs using the focal_point objects and link_types lists already built-in:

4.1 Adding environment clique_types

Use either the API or the UI to define specific environment clique_types.
For adding clique_types, use settings menu and choose "Create new clique type" option, then provide a specific environment name (per previous environment configurations), define a focal_point (like: instance, or other object types) and a list of resulted link_types to include in the final topology graph. Refer to calipso-model document for more details.
Clique_types are needed for accurate graph buildup, before sending a scan request.
Several defaults are provided with each new Calipso release.

Clique types:



Note: ask calipso developers for recommended clique_types (pre-built in several Calipso deployments), per distribution variance, fully tested by Calipso developers:

5 Environment scanning

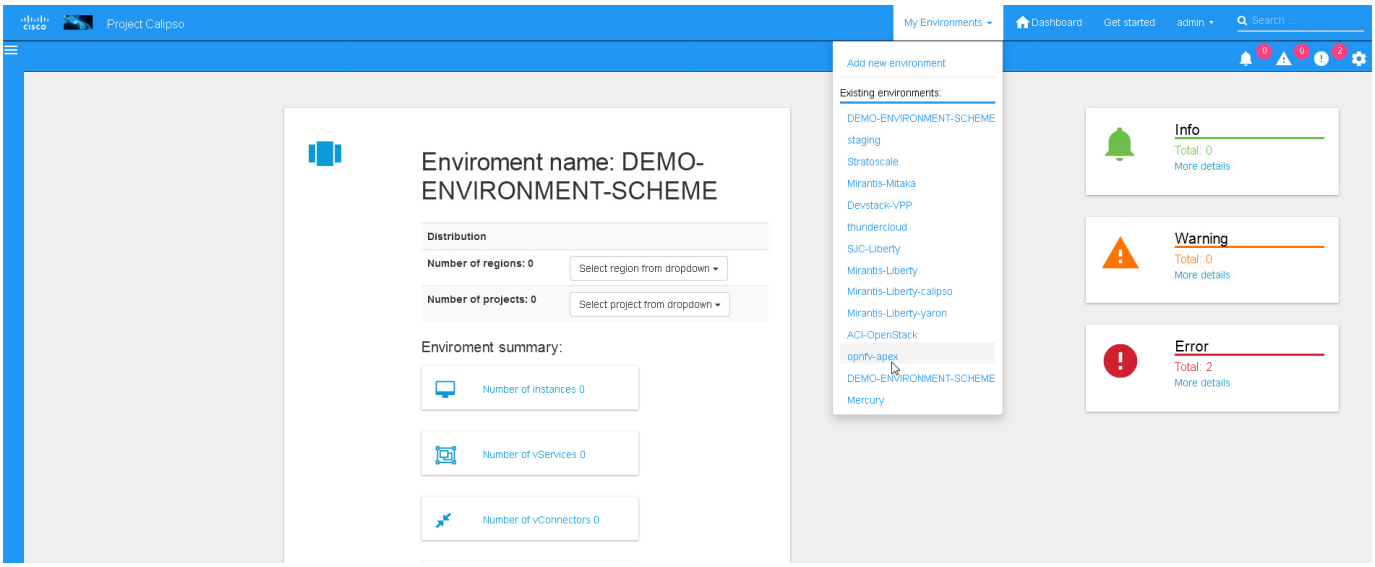
Once environment is setup correctly, environment_config data is filled and tested, scanning can start. This is can be done with the following four options:

1. UI scanning request
2. UI scan schedule request
3. API scanning or scheduling request.
4. CLI scanning in the calipso-scan container.

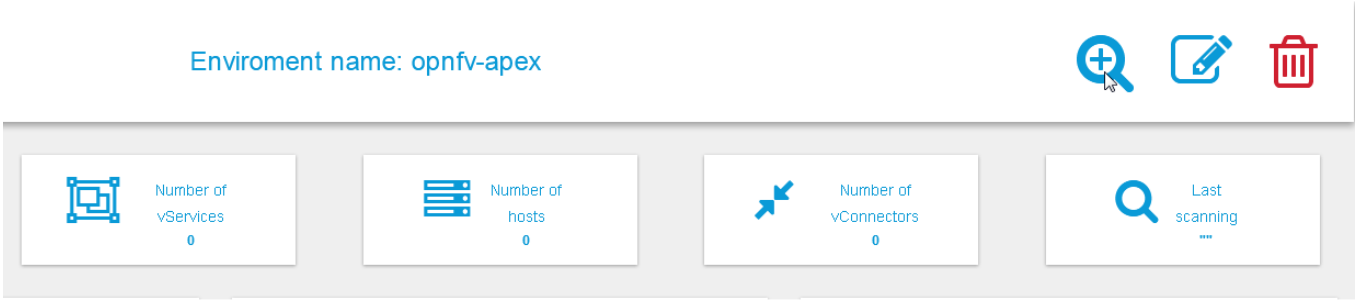
The following sections with describe those scanning options.

5.1 UI scanning request

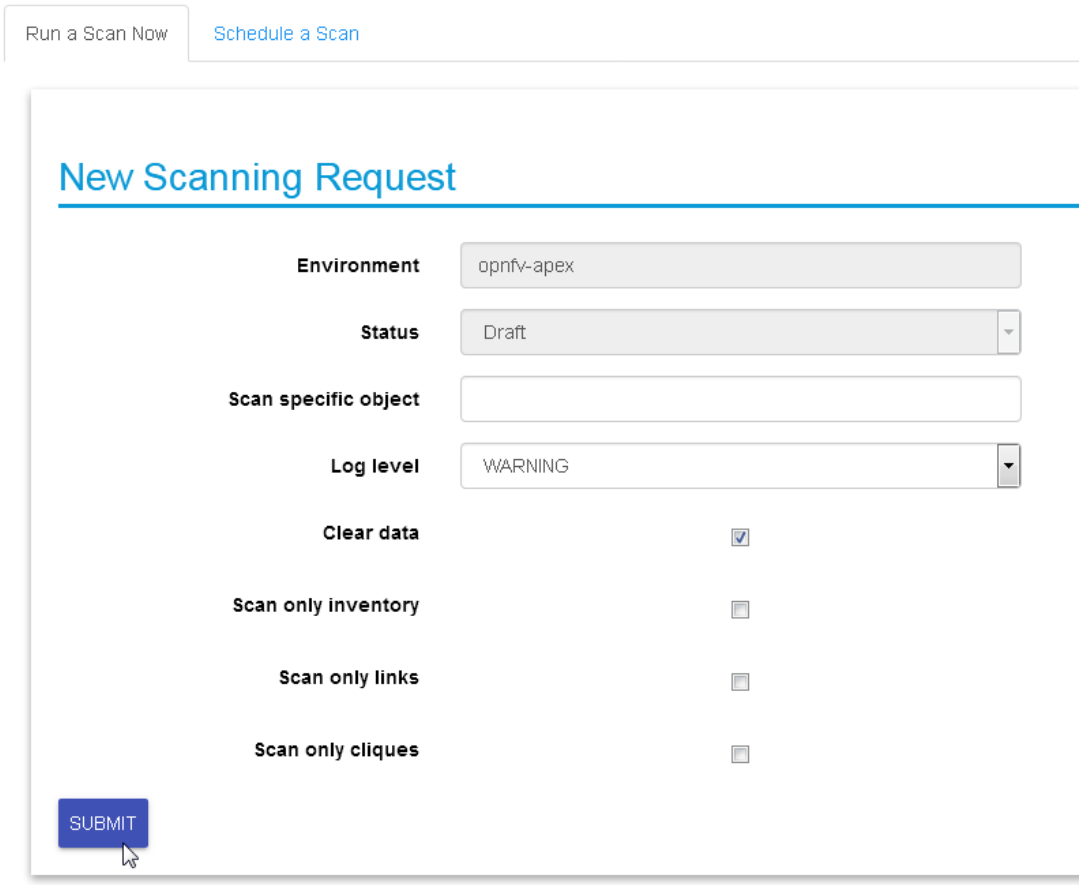
This can be accomplished after environment configuration has been submitted, the environment name will be listed under “My environment” and the administrator can choose it from the list and login to the specific environment dashboard:



Onces inside a specific environment dashboard the administrator can click the scanning button the go into scanning request wizards:



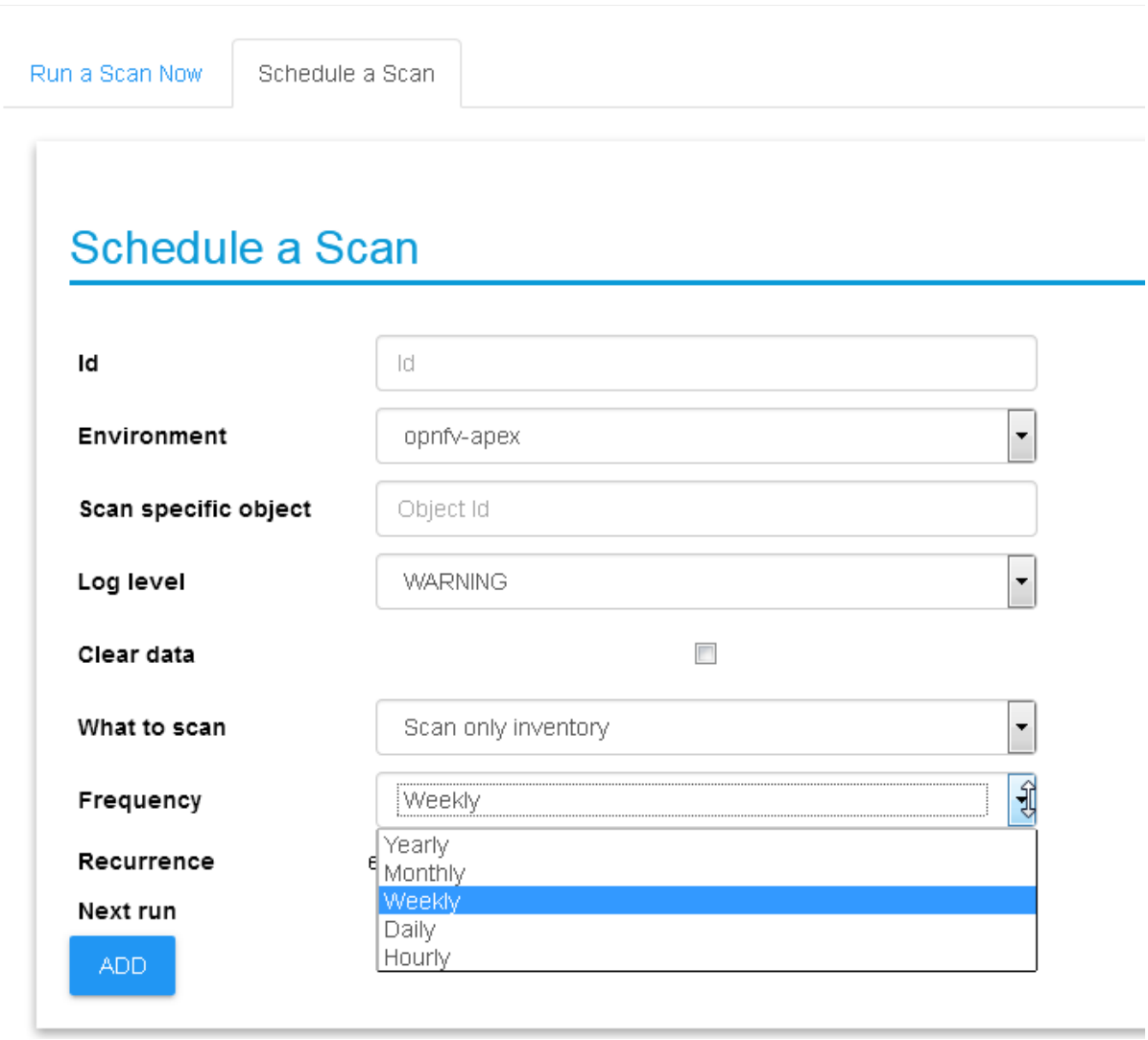
In most cases, the only step needed to send a scanning request is to use all default options and click the “Submit” button:



Scanning request will propagate into the "scans" collection and will be handled by scan_manager in the calipso-scan container.
Scan options:
Log level: determines the level and details of the scanning logs.
Clear data: empty historical inventories related to that specific environment, before scanning.
Only inventory: creates inventory objects without analyzing for links.
Only links: create links from pre-existing inventory, does not build graph topologies.
Only Cliques: create graph topologies from pre-existing inventory and links.

5.2 UI scan schedule request

Scanning can be used periodically to dynamically update the inventories per changes in the underlying virtual environment infrastructure. This can be defined using scan scheduling and can be combined with the above one time scanning request.



Scheduled scans has the same options as in single scan request, while choosing a specific environment to schedule on and providing frequency details, timer is counted from the submission time, scan scheduling requests are propagated to the "scheduled_scans" collection in the Calispo mongoDB and handled by scan_manager in the calispo-scan container.

5.3 API scanning request

Follow api-guide for details on submitting scanning request through Calipso API.

5.4 CLI scanning in the calipso-scan container

When using the UI for scanning messages are populated in the "Messages" menu item and includes several details for successful scanning and some alerts. When more detailed debugging of the scanning process is needed, administrator can login directly to the calispo-scan container and run the scanning manually using CLI:

- Login to calispo-scan container running on the installed host:
  ssh scan@localhost –p 3002 , using default-password: 'scan'
- Move to the calipso scan application location:
  cd /home/scan/calipso_prod/app/discover
- Run the scan.py application with the basic default options:
  python3 ./scan.py -m /local_dir/calipso_mongo_access.conf -e Mirantis-8

Default options: -m points to the default location of mongoDB access details, -e points to the specific environment name, as submitted to mongoDB through UI or API.
Other optional scanning parameters, can be used for detailed debugging:

The scan.py script is located in directory app/discover in the Calipso repository.
To show the help information, run scan.py with –help option, here is the results
:

```
Usage: scan.py [-h] [-c [CGI]] [-m [MONGO_CONFIG]] [-e [ENV]] [-t [TYPE]]
               [-y [INVENTORY]] [-s] [-i [ID]] [-p [PARENT_ID]]
               [-a [PARENT_TYPE]] [-f [ID_FIELD]] [-l [LOGLEVEL]]
               [--inventory_only] [--links_only] [--cliques_only] [--clear]
```

Optional arguments:

```
 -h, --help            show this help message and exit
 -c [CGI], --cgi [CGI]
                       read argument from CGI (true/false) (default: false)
 -m [MONGO_CONFIG], --mongo_config [MONGO_CONFIG]
                       name of config file with MongoDB server access details
 -e [ENV], --env [ENV]
                       name of environment to scan (default: WebEX-
                       Mirantis@Cisco)
 -t [TYPE], --type [TYPE]
                       type of object to scan (default: environment)
 -y [INVENTORY], --inventory [INVENTORY]
                       name of inventory collection (default: 'inventory')
 -s, --scan_self       scan changes to a specific object (default: False)
 -i [ID], --id [ID]    ID of object to scan (when scan_self=true)
 -p [PARENT_ID], --parent_id [PARENT_ID]
                       ID of parent object (when scan_self=true)
 -a [PARENT_TYPE], --parent_type [PARENT_TYPE]
                       type of parent object (when scan_self=true)
 -f [ID_FIELD], --id_field [ID_FIELD]
```

```
                    name of ID field (when scan_self=true) (default: 'id',
                    use 'name' for projects)

  -l [LOGLEVEL], --loglevel [LOGLEVEL]
                    logging level (default: 'INFO')
  --inventory_only      do only scan to inventory (default: False)
  --links_only          do only links creation (default: False)
  --cliques_only        do only cliques creation (default: False)
  --clear               clear all data prior to scanning (default: False)
```

A simple scan.py run will look, by default, for a local MongoDB server. Assuming running this from within the scan container running, the administrator needs to point it to use the specific MongoDB server. This is done using the Mongo access config file created by the installer (see install-guide for details)::

./scan.py -m your_mongo_access.conf

Environment needs to be specified explicitly, no default environment is used by scanner.

By default, the inventory collection, named 'inventory', along with the accompanying collections: "links", "cliques", "clique_types" and "clique_constraints" are used to place initial scanning data results.

As a more granular scan example, for debugging purposes, using environment "RDO-packstack-Mitaka", pointing scanning results to an inventory collection named "RDO": The accompanying collections will be automatically created and renamed accordingly: "RDO_links", "RDO_cliques", "RDO_clique_types" and "RDO_clique_constraints".

Another parameter in use here is --clear, which is good for development: it clears all the previous data from the data collections (inventory, links & cliques).

scan.py -m your_mongo_access.conf -e RDO-packstack-Mitaka -y RDO –clear

Log level will provide the necessary details for cases of scan debugging.

5.4.1 Clique Scanning

For creating cliques based on the discovered objects and links, clique_types must be defined for the given environment (or a default “ANY” environment clique_types will be used)
A clique type specifies the link types used in building a clique (graph topology) for a specific focal point object type.
For example, it can define that for instance objects we want to have the following link types:

- instance-vnic
- vnic-vconnector
- vconnector-vedge

- vedge-host_pnic
- host_pnic-network

See calipso-model guide for more details on cliques and links.

As in many cases the same clique types are used, we can simply copy the clique_types documents from an existing clique_types collection. For example, using MongoChef:

- Click the existing clique types collection
- Right click the results area
- Choose export
- Click 'next' all the time (JSON format, to clipboard)
- Select JSON format and "Overwrite document with the same _id"
- Right click the target collection
- Choose import, then JSON and clipboard
- Note that the name of the target collection should have the prefix name of your collection's name. For example, you create a collection named your_test, then your clique types collection's name must be your_test_clique_types.

Now run scan.py again to have it create cliques-only from that data.

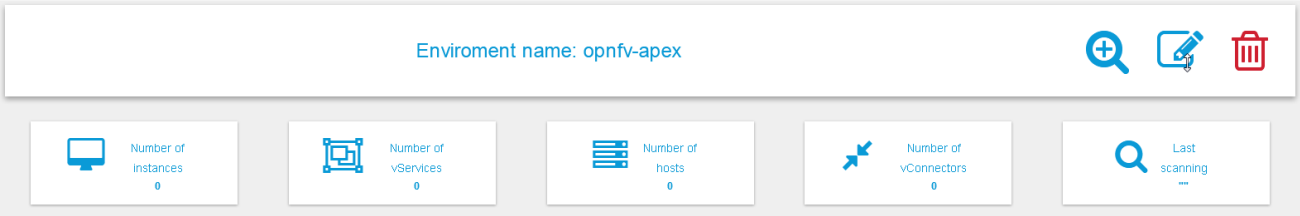
5.4.2 Viewing results

Scan results are written into the collections in the 'Calispo' DB on the MongoDB database.

In our example, we use the MongoDB database server on "install-hostname"http://korlev-osdna-devtest.cisco.com/, so we can connect to it by Mongo client, such as Mongochef and investigate the specific collections for details.

6 Editing or deleting environments

Inside a specific environment dashboard optional buttons are available for deleting and editing the environment configurations:



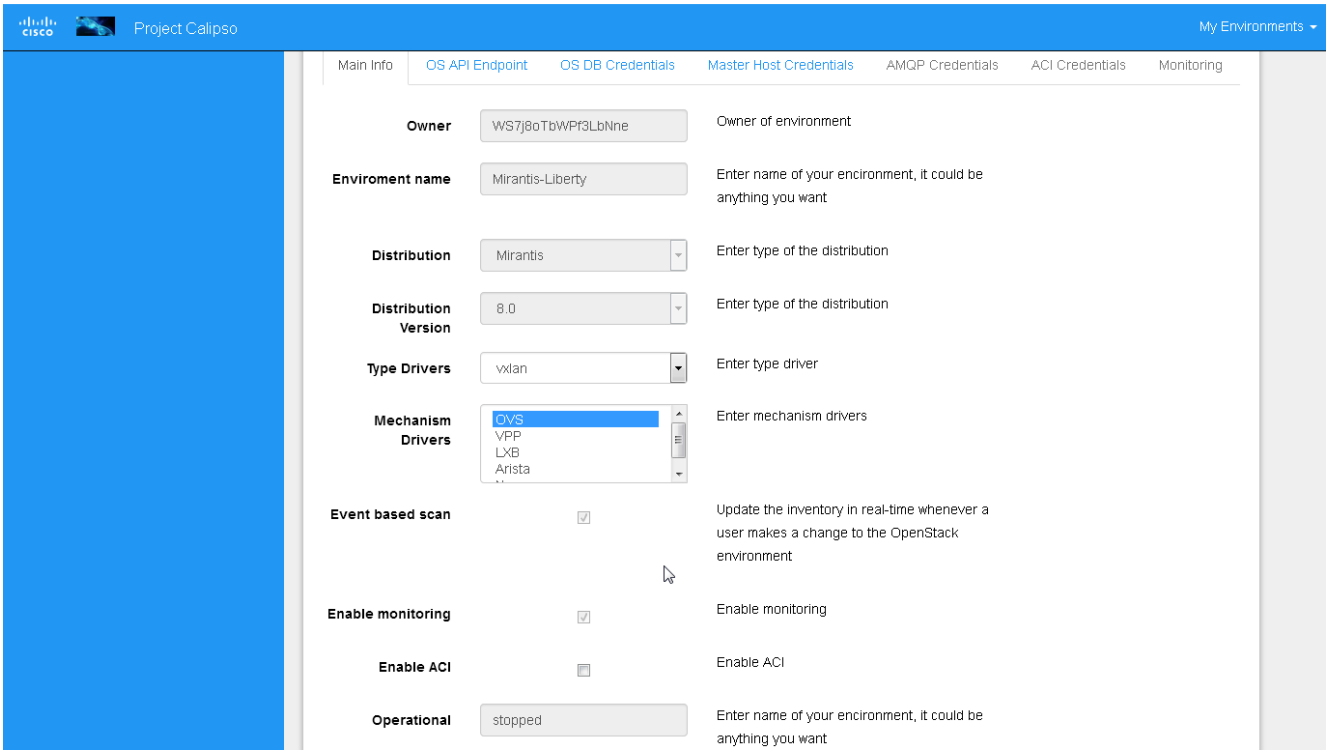
Note: Deleting an environment does not empty the inventories of previous scan results, this can be accomplished in future scans when using the --clear options.

7 Event-based scanning

For dynamic discovery and real-time updates of the inventories Calipso also provides event-based scanning with event_manager application in the calipso-listen container.
Event_manager listens to the VIM AMQP BUS and based on the events updates the inventories and also kickoff automatic scanning of a specific object and its dependencies.

7.1 Enabling event-based scanning

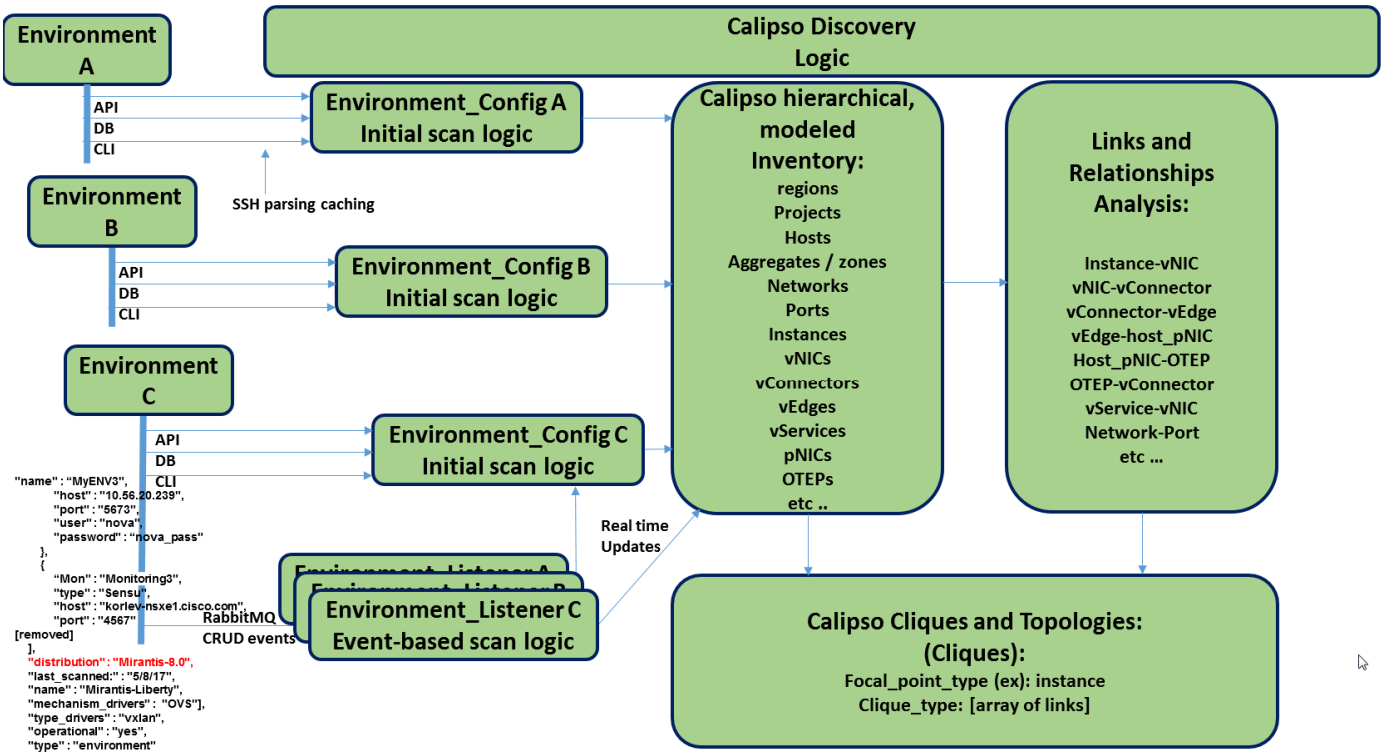
Per environment, administrator can define the option of event-based scanning, using either UI or API to configure that parameter in the specific environment configuration:



In cases where event-based scanning is not supported for a specific distribution variance the checkbox for event based scan will be grayed out. When checked, the AMQP section becomes mandatory.
This behavior is maintained through the “supported_environments” collection and explained in more details in the calipso-model document.

7.2 Event-based handling details

The event-based scanning module needs more work to adapt to the changes in any specific distribution variance, this is where we would like some community support to help us maintain data without the need for full or partial scanning through scheduling.
The following diagram illustrates event-based scanning module functions on top of the regular scanning module functions:



In the following tables, some of the current capabilities of event-handling and event-based scanning in Calipso are explained:

#	Event name	AMQP event	Handler	Workflow	Scans	Notes
Instance						
1	Create Instance	compute.instance.create.end	EventInstanceAdd	1. Get *instances_root* from inventory 2. If *instance_root* is None, log error, **return None** 3. Create ScanInstancesRoot object.	**Yes** {by object id: 2, links: 1, cliques: 1, from queue: ?}	

				4. Scan instances root (and only new instance as a child) 5. Scan from queue 6. Get *host* from inventory 7. Scan host (and only children of types 'vconnectors_folder' and 'vedges_folder' 8. Scan from queue 9. Scan links 10. Scan cliques 11. **Return True**		
2	Update Instance	compute.instance.rebuild.end compute.instance.update	EventInstanceUpdate	1. If state == 'building', **return None** 2. If state == 'active' and old_state == 'building', call *EventInstanceAdd* (see #1), **return None** 3. If state == 'deleted' and old_state == 'active', call *EventInstanceDelete* (see #2), **return None** 4. Get *instance* from inventory 5. If *instance* is None, log error, **return None** 6. Update several fields in *instance*. 7. If *name_path* has changed, update relevant names and *name_path* for descendants	**Yes** (if #1 is used) **No** (otherwise)	The only fields that are updated: *name*, *object_name* and *name_path*

				8. Update *instance* in db 9. **Return None**		
3	Delete Instance	compute.instance.delete.end	EventInstanceDelete (EventDeleteBase)	1. Extract *id* from payload 2. Execute *self.delete_handler()*	**No**	delete_handler() is expanded later
Instance Lifecycle						
4	Instance Down	compute.instance.shutdown.start compute.instance.power_off.start compute.instance.suspend.start	**Not implemented**			
5	Instance Up	compute.instance.power_on.end compute.instance.suspend.end	**Not implemented**			
Region						
6	Add Region	servergroup.create	**Not implemented**			
7	Update Region	servergroup.update servergroup.addmember	**Not implemented**			
8	Delete Region	servergroup.delete	**Not implemented**			
Network						
9	Add Network	network.create.end	EventNetworkAdd	1. If network with specified *id* already	**No**	

				exists, log error and **return None** 2. Parse incoming data and create a *network* dict 3. Save *network* in db 4. **Return None**		
10	Update Network	network.update.end	EventNetworkUpdate	1. Get *network_document* from db 2. If *network_document* doesn't exist, log error and **return None** 3. If name has changed, update relevant names and *name_path* for descendants 4. Update *admin_state_up* from payload 5. Update *network_document* in db	**No**	The only fields that are updated: *name*, *object_name*, *name_path* and *admin_state_up*
11	Delete Network	network.delete.end	EventNetworkDelete (EventDeleteBase)	1. Extract *network_id* from payload 2. Execute *self.delete_handler()*	**No**	delete_handler() is expanded later
Subnet						
12	Add Subnet	subnet.create.end	EventSubnetAdd	1. Get *network_document* from db 2. If *network_document* doesn't exist, log error and **return None** 3. Update *network_document* with new subnet	**Yes** {cliques: 1}	1. I don't fully understand what these lines do. We make sure *ApiAccess.regions* variable

				4. If *dhcp_enable* is *True*, we update parent network (**note 1**) and add the following children docs: *ports_folder*, *port_document*, *network_services_folder*, *dhcp_document*, *vnic_folder* and *vnic_document*. 5. Add links for *pnics* and *vservice_vnics* (**note 2**) 6. Scan cliques 7. **Return None**		is not empty, but why? The widespread usage of static variables is not a good sign anyway. 2. For some reason the comment before those lines states we "scan for links" but it looks like we just add them.
13	Update Subnet	subnet.update.end	EventSubnetUpdate	1. Get *network_document* from db 2. If *network_document* doesn't exist, log error and **return None** 3. If we don't have a matching subnet in *network_document['subnets']*, **return None** 4. If subnet has *enable_dhcp* set to True and it wasn't so before: 4.1. Add dhcp document	**Yes** {cliques: 1} (only if dhcp status has switched to True)	1. If subnet name has changed, we set it in *subnets* object inside *network_document* by new key, but don't remove the old one. A bug?

				4.2. Make sure ApiAccess.regions is not empty 4.3. Add port document 4.4. If port has been added, add vnic document, add links and scan cliques. 5. Is subnet has *enable_dhcp* set to False and it wasn't so before: 5.1. Delete dhcp document 5.2. Delete port binding to dhcp server if exists 6. If name hasn't changed, update it by its key in *subnets*. Otherwise, set it by the new key in *subnets*. (**note 1**)		
14	Delete Subnet	subnet.delete.end	EventSubnetDelete	1. Get *network_document* from db 2. If *network_document* doesn't exist, log error and **return None** 3. Delete subnet id from *network_document['subnet_ids']* 4. If subnet exists in *network_document['subnets']*, remove its cidr from *network_document['cidrs']*	**No**	

				and remove itself from *network_document['subnets']* 5. Update *network_document* in db 6. If no subnets are left in *network_document*, delete related vservice dhcp, port and vnic documents		
Port						
15	Create Port	port.create.end	EventPortAdd	1. Check if ports folder exists, create if not. 2. Add port document to db 3. If 'compute' is <u>not</u> in port['device_owner'], **return None** 4. Get *old_instance_doc* (updated instance document) from db 5. Get *instances_root* from db 6. If *instances_root* is None, log error and **return None** (**<u>note 1</u>**) 7. Use an *ApiFetchHostInstances* fetcher to get data for instance with id equal to the device from payload. 8. If such instance exists, update *old_instance_doc*'s fields *network_info*, *network* and possibly *mac_address* with their	**Yes** {cliques: 1} (only if 'compute' is in port['device_owner'] and instance_root is not None (see steps 3 and 6))	1. The port and (maybe) port folder will still persist in db even if we abort the execution on step 6. See idea 1 for details.

				counterparts from fetched instance. Update *old_instance_doc* in db 9. Use a *CliFetchInstanceVnics/CliFetchInstanceVnicsVpp* fetcher to get *vnic* with *mac_address* equal to the port's mac address 10. If such vnic exists, update its data and update in db 11. Add new links using *FindLinksForInstanceVnics* and *FindLinksForVedges* classes 12. Scan cliques 13. **Return True**		
16	Update Port	port.update.end	EventPortUpdate	1. Get *port* from db 2. If *port* doesn't exist, log error and **return None** 3. Update port data (*name*, *admin_state_up*, *status*, *binding:vnic_type*) in db 4. **Return None**	**No**	
17	Delete Port	port.delete.end	EventPortDelete (EventDeleteBase)	1. Get *port* from db 2. If *port* doesn't exist, log error and **return None**	**No**	delete_handler() is expanded later

				3. If 'compute' is in port['device_owner'], do the following: 3.1. Get *instance* document for the port from db. If it doesn't exist, to step 4. 3.2. Remove port from *network_info* of *instance* 3.3. If it was the last port for network in instance doc, remove network from the doc 3.4. If port's *mac_address* is equal to *instance_doc*'s one, then fetch an *instance* with the same id as *instance_doc* using *ApiFetchHostInstances* fetcher. If *instance* exists and 'mac_address' not in *instance*, set *instance_doc*'s mac_address to None 3.5. Save *instance_docs* in db 4. Delete port from db 5. Delete related vnic from db 6. Execute *self.delete_handler(vnic)* for vnic		
Router						
18	Add Router	router.create.end	EventRouterAdd	1. Get *host* by id from db	**Yes** {cliques: 1}	1. Looks like code author confused

				2. Fetch *router_doc* using a *CliFetchHostVservice* 3. If *router_doc* contains *'external_gateway_info'*: 3.1. Add router document (with network) to db 3.2. Add children documents: 3.3. If no ports folder exists for this router, create one 3.4. Add router port to db 3.5. Add vnics folder for router to db 3.6. If port was successfully added (**3.4**), try to add vnic document for router to db two times (??) 3.7. If port wasn't successfully added, try adding vnics_folder again (???) (**note 1**) 3.8. If step **3.7** returned False (**Note 2**), try to add vnic_document again (??) 4. Add router document (without network) to db (**Note 3**) 5. Add relevant links for the new router 6. Scan cliques 7. **Return None**		a lot of stuff here. This class needs to be reviewed thoroughly. 2. Step **3.7** never returns anything for some reason (a bug?) 3. Why are we adding router document again? It shouldn't be added again on step **4** if it was already added on step **3.1**. Probably an 'else' clause is missing

19	Update Router	router.update.end	EventRouterUpdate	1. Get *router_doc* from db 2. If *router_doc* doesn't exist, log error and **return None** 3. If payload router data doesn't have *external_gateway_info*, do the following: 3.1. If *router_doc* has a *'gw_port_id'* key, delete relevant port. 3.2. If *router_doc* has a *'network'*: 3.2.1. If a port was deleted on step **3.1**, remove its *'network_id'* from *router_doc['network']* 3.2.2. Delete related links 4. If payload router data has *external_gateway_info*, do the following: 4.1. Add new network id to *router_doc* networks 4.2. Use *CliFetchHostVservice* to fetch gateway port and update it in *router_doc* 4.3. Add children documents for router (see **#18** steps **3.2**-**3.8**) 4.4. Add relevant links	**Yes** {cliques: 1}	

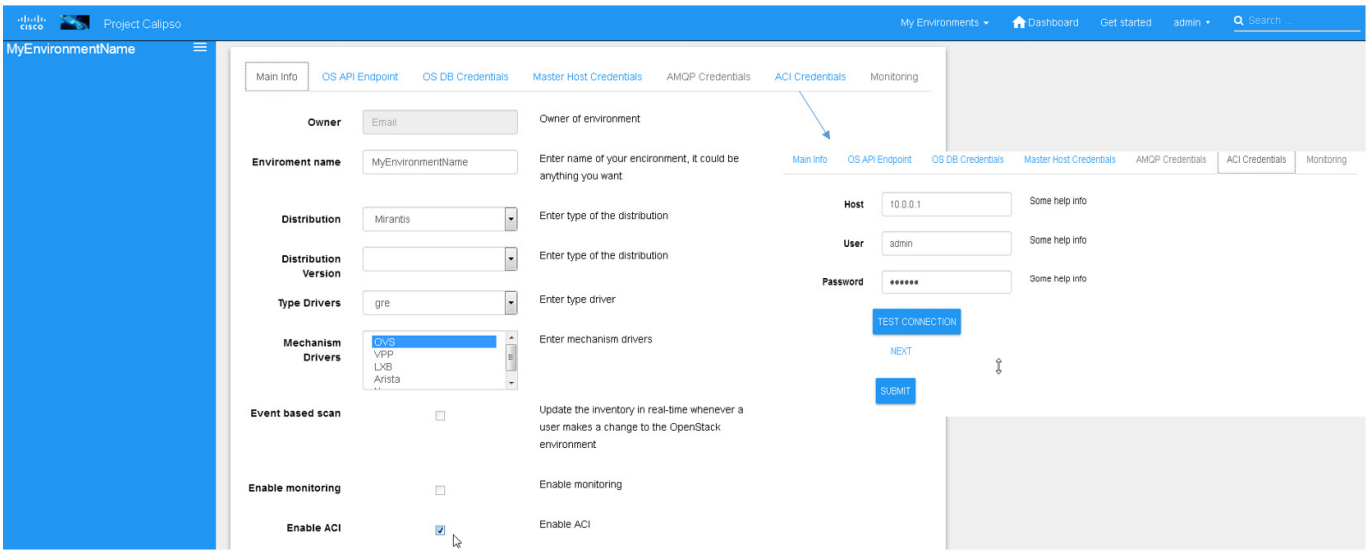
				5. Update *router_doc* in db 6. Scan cliques 7. **Return None**		
20	Delete Router	router.delete.end	EventRouterDelete (EventDeleteBase)	1. Extract *router_id* from payload 2. Execute *self.delete_handler()*	**No**	delete_handler() is expanded later
Router Interface						
21	Add Router Interface	router.interface.create	EventInterfaceAdd	1. Get *network_doc* from db based on subnet id from interface payload 2. If *network_doc* doesn't exist, **return None** 3. Make sure ApiAccess.regions is not empty (?) 4. Add router-interface port document in db 5. Add vnic document for interface. If unsuccessful, try again after a small delay 6. Update router: 6.1. If router_doc is an empty type, log an error and continue to step **7** (**Note 1**) 6.2. Add new network id to *router_doc* network list 6.3. If gateway port is in both router_doc and db, continue to step **6.7**	**Yes** {cliques: 1}	1. Log message states that we should abort interface adding, though the code does nothing to support that. Moreover, router_doc can't be empty at that moment because it's referenced before.

				6.4. Fetch *router* using *CliFetchHostVservice*, set gateway port in *router_doc* to the one from fetched *router* 6.5. Add gateway port to db 6.6. Add vnic document for router. If unsuccessful, try again after a small delay 6.7. Update *router_id* in db 7. Add relevant links 8. Scan cliques 9. **Return None**		
22	Delete Router Interface	router.interface.delete	EventInterfaceDelete	1. Get *port_doc* by payload port id from db 2. If *port_doc* doesn't exist, log an error and **return None** 3. Update relevant router by removing network id of *port_doc* 4. Delete port by executing *EventPortDelete().delete_port()*	**No**	

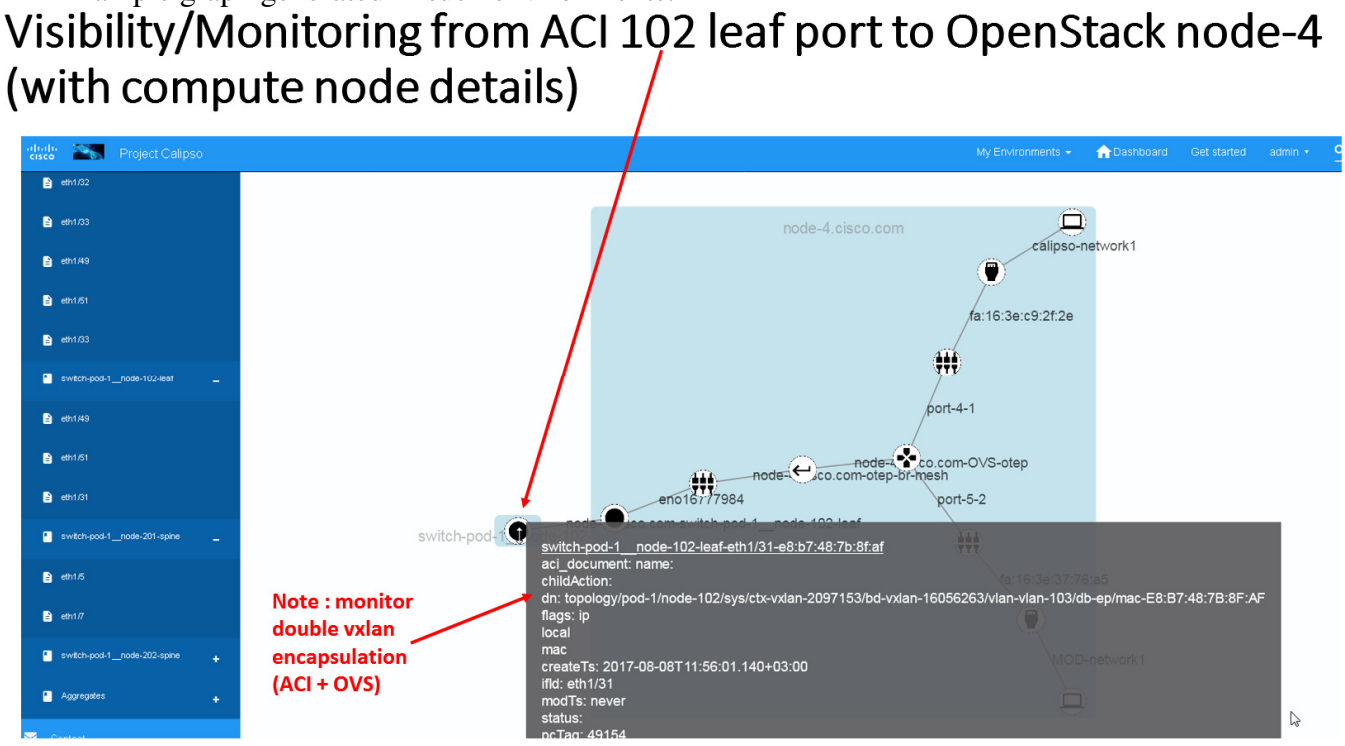
8 ACI scanning

For dynamic discovery and real-time updates of physical switches and connections between physical switches ports and host ports (pNICs), Calispo provides an option to integrate with the Cisco data center switches controller called "ACI APIC".

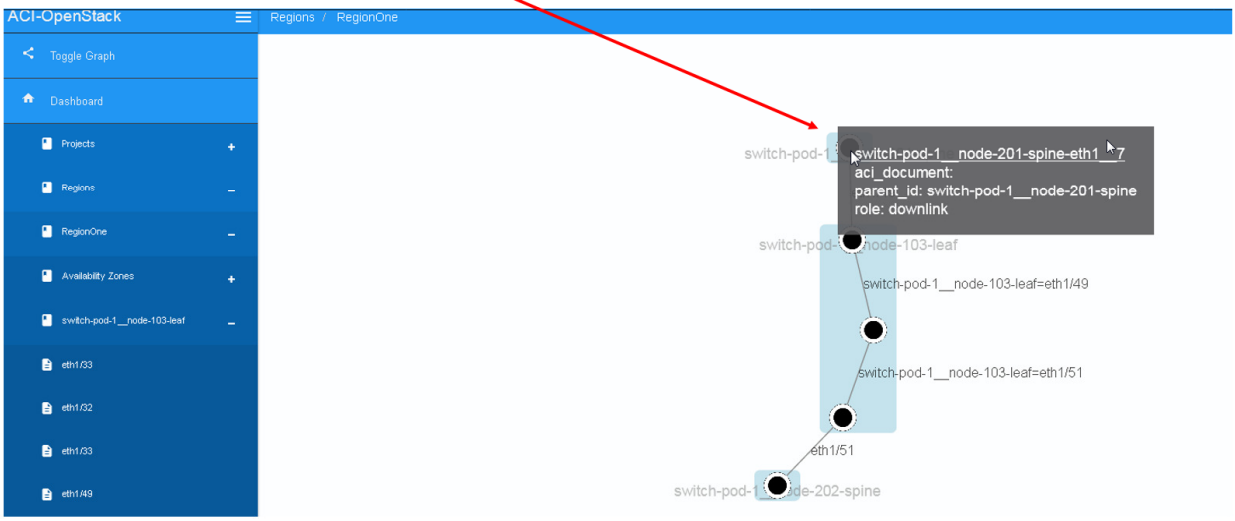
This is an optional parameter and once checked details on the ACI server and API credentials needs to be provided:



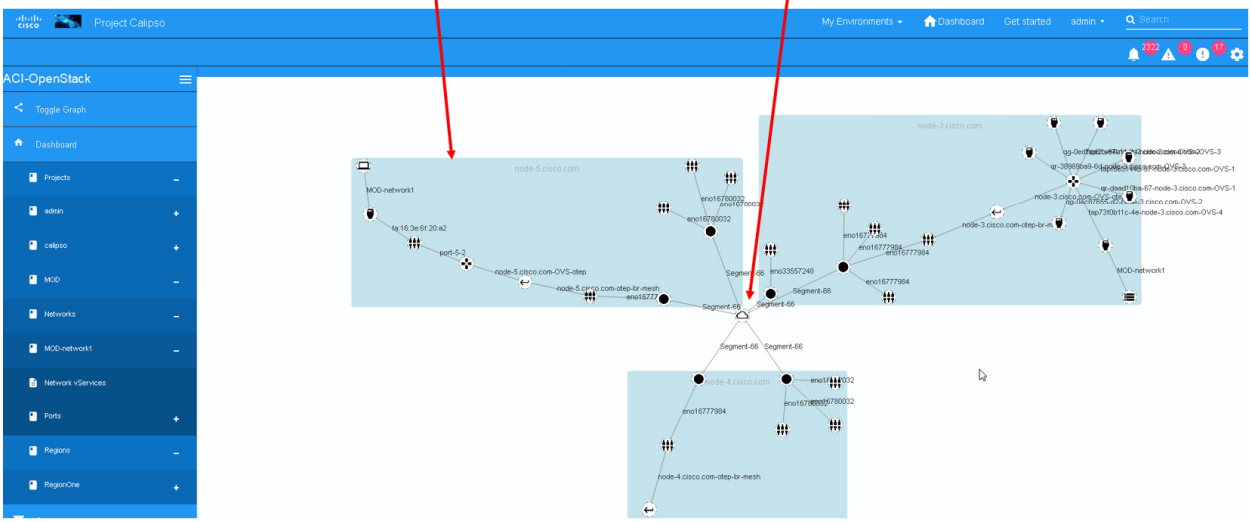
The results of this integration (when ACI switches are used in that specific VIM environment) are extremely valuable as it maps out and monitors virtual-to-physical connectivity across the entire data center environment, both internal and external. Example graph generated in such environments:



Visibility/Monitoring from ACI 103 leaf ports to ACI 202 Spine Ports (downlinks and uplinks)



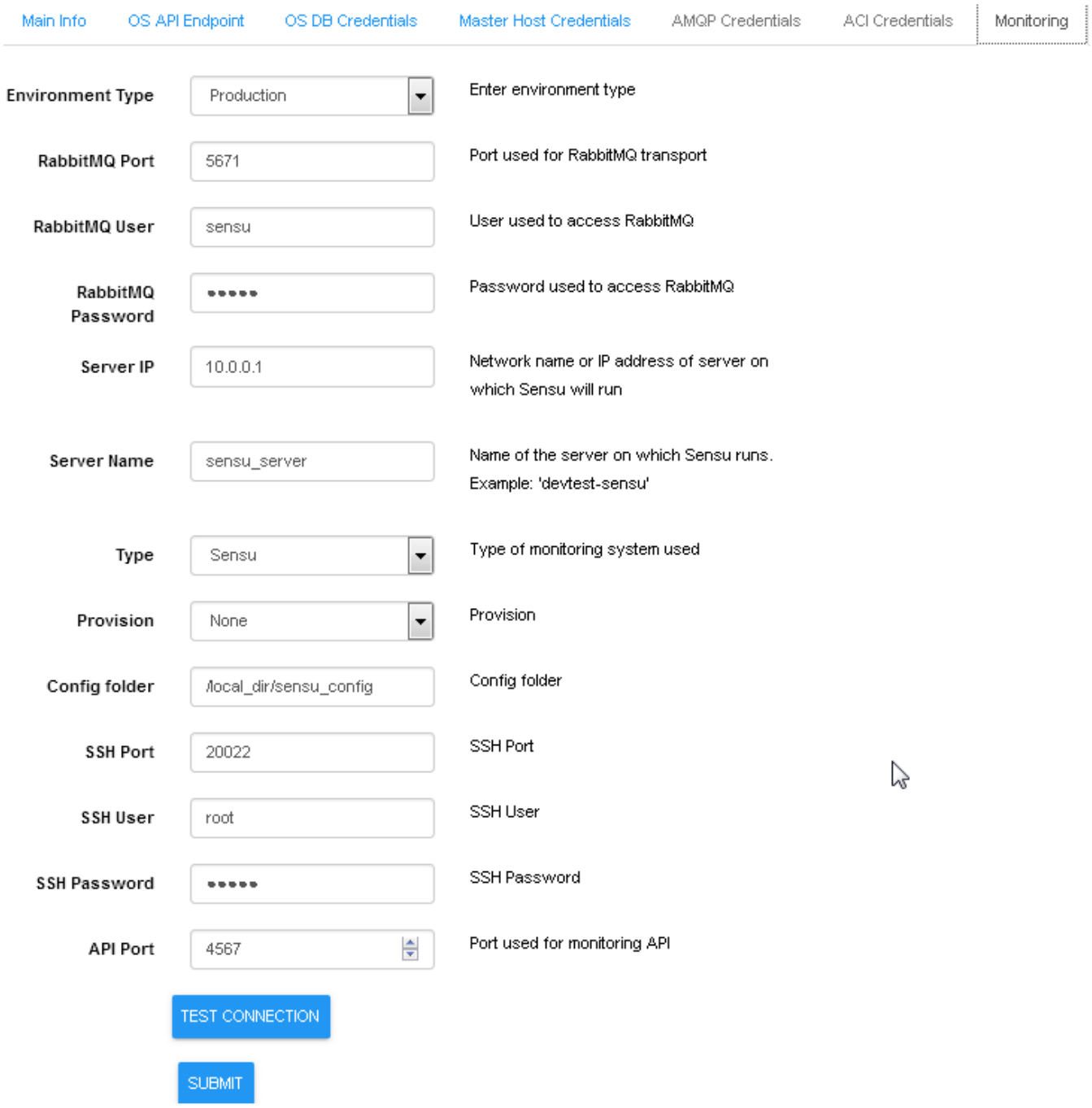
Visibility/Monitoring of a simple/single 'network-wide' topology (host details extended, fabric details collapsed):



9 Monitoring enablement

For dynamic discovery of real-time statuses and states of physical and virtual components and thier connections Calispo provides an option to automatically integrate with the Sensu framework, customized and adapted from the Calispo model and design concepts. Follow the monitoring-guide for details on this optional module.

Enabling Monitoring through UI, using environment configuration wizard:



10 Modules data flows

Calipso modules/containers and the VIM layers have some inter-dependencies, illustrated in the following diagram: