



# Interoperability and APIs in OpenStack

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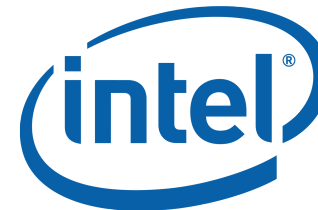
# Some Introductions...

Piyush Harsh



- Researcher @ ZHAW
- InIT Cloud Computing Lab
- Automation, Billing, Interop

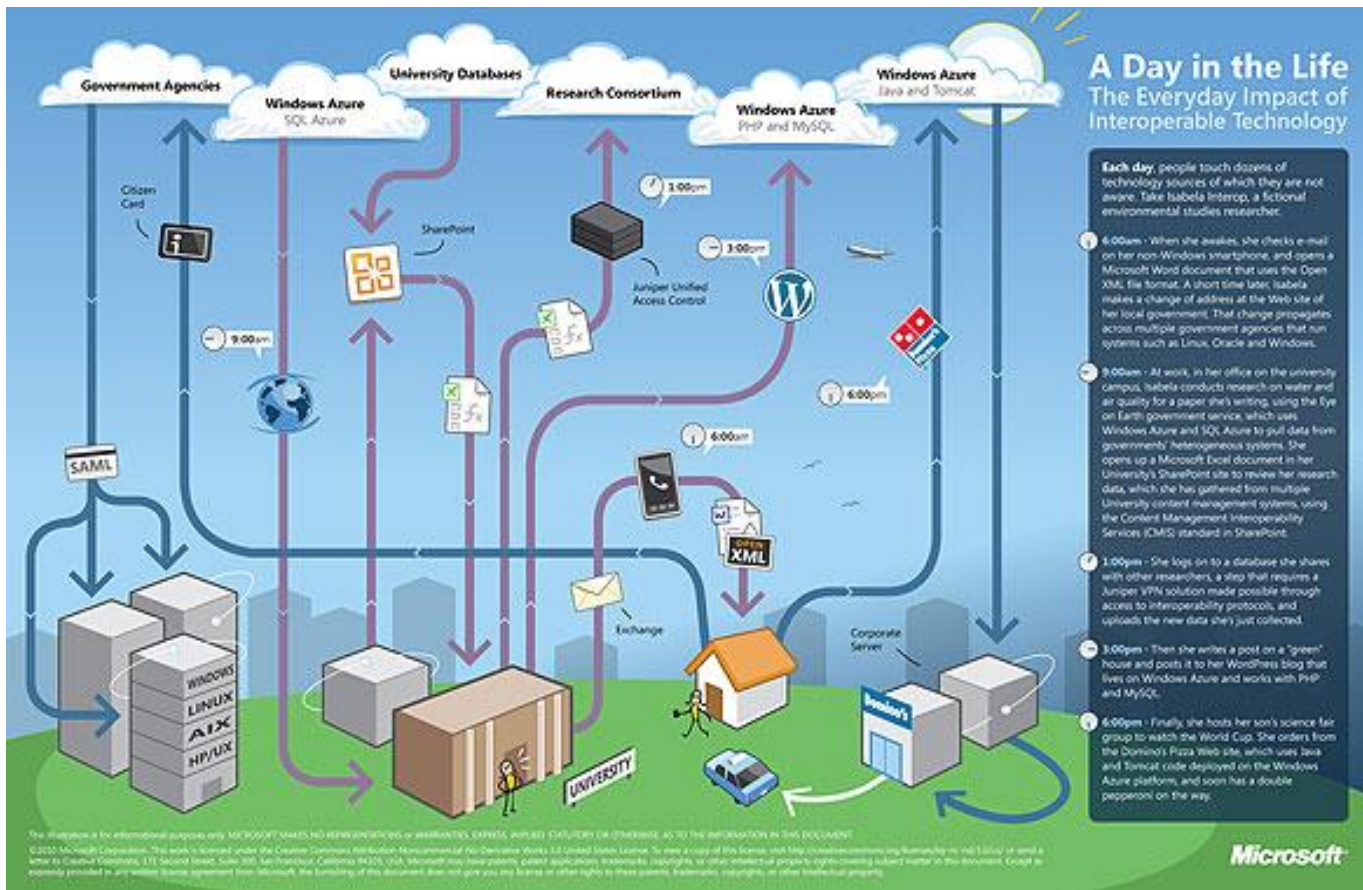
John Kennedy



- Researcher @ Intel Labs Europe
- Cloud Services Lab
- Interop, Dependability, Differentiation



# Interoperability! Who Cares?



“An interoperable cloud could help companies **cut costs** and governments **connect constituents**”

Microsoft  
April 2010

# ...Cloud Consumers Care...



Over 300 Cloud  
*Customers*

Their Concerns Include:

- Proprietary implementations
- Little commonality
- Potential for lock-in
- Lack of price-transparency

# ...Politicians Care



Neelie Kroes, Commissioner for Digital Agenda

**‘walls and limits  
in the cloud  
will make your  
life harder’**

“Standards, certification, data protection, interoperability, lock-in, legal certainty and others [...] where these barriers exist, I am determined to overcome them”



# Care about what?

Interoperability between Cloud Software Stacks:



(and many more)

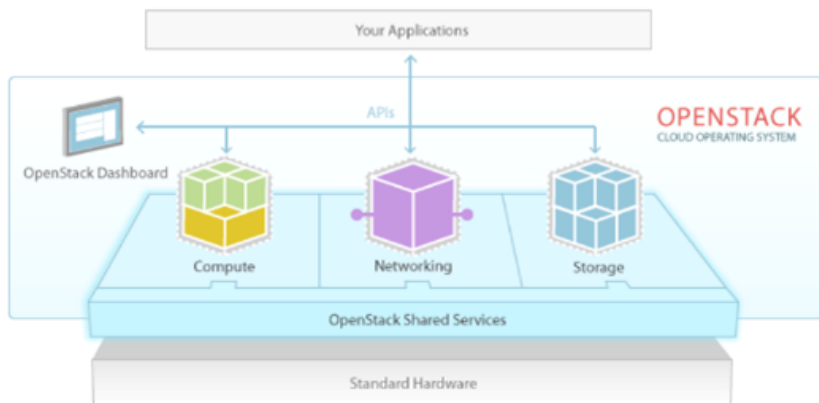
All with fundamental cloud services:

- Compute - VMs, containers
  - Network - e.g. SDN
- Storage - Block, Object Storage

# OpenStack



A global collaboration of developers & cloud computing technologists working to produce an ubiquitous Infrastructure as a Service (IaaS) open source cloud computing platform for public & private clouds.



## Platinum Sponsors



## Gold Sponsors



## OpenStack Foundation: exponential growth



### OpenStack Compute (Nova)

Provision and manage large networks of virtual machines



### OpenStack Storage (Cinder, Swift)

Object and Block storage for use with servers and applications



### OpenStack Networking ( Neutron )

Pluggable, scalable, API-driven network and IP management



### OpenStack Image Service

Catalog and manage massive libraries of server images

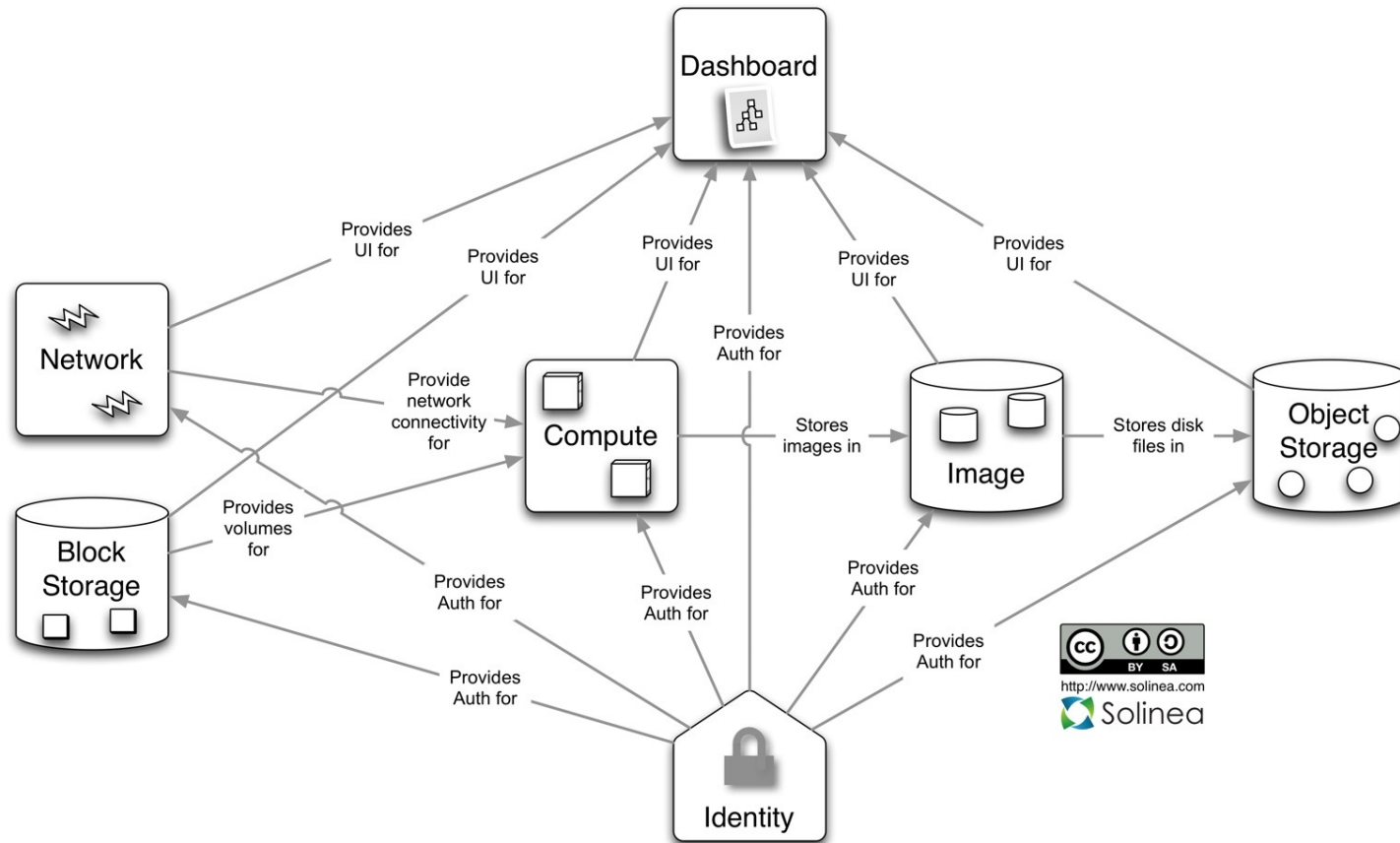


### OpenStack Identity Service

Unified authentication across all OpenStack projects and integrates with existing authentication systems.

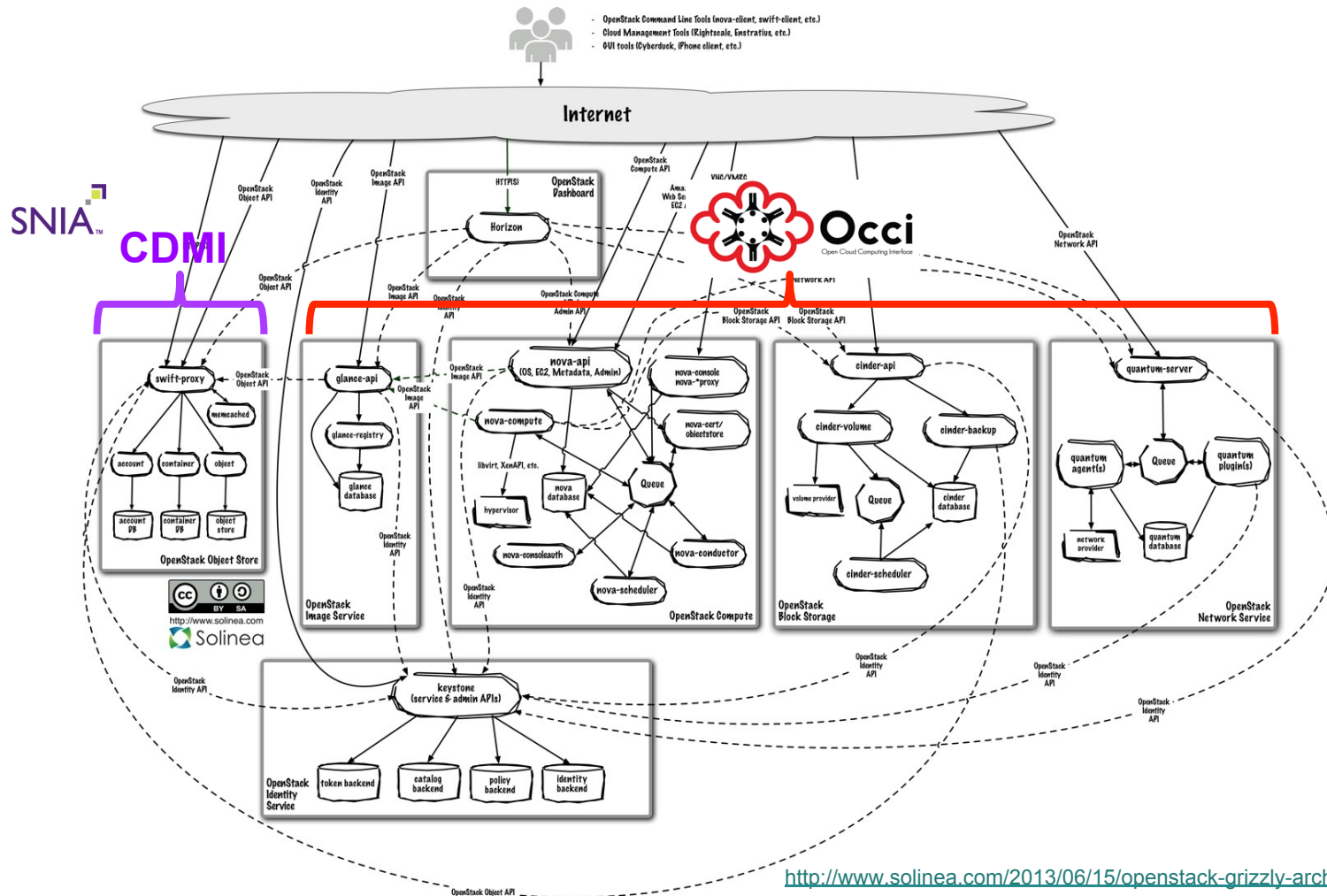
Code available under Apache 2.0 license. Design tenets – scale & elasticity, share nothing & distribute everything

# OpenStack





# OpenStack & APIs



# CDMI for OpenStack

- OpenStack Swift: powerful, highly-available, scalable open-source object storage, implements its own API
- A standards-based interface now a possibility: CDMI
- Storage Networking Industry Association
  - 400 member companies
  - April 2010 released CDMI V1.0
  - Sept 2011 released CDMI V1.0.1
  - June 2012 released CDMI V1.0.2
- CDMI: Cloud Data Management Interface
  - Recently designated by ISO as an international standard
  - See <http://cdmi.sniacloud.org/>
- CDMI for OpenStack:
  - Originally developed by IBM, being enhanced and extended by Intel in FI-WARE  
<https://github.com/osaddon/cdmi>



# CDMI – Supported features...

OpenStack CDMI implementation supports

- Authentication (Keystone)
- List Provider Capabilities
- List Container Contents
- Create Container
- Upload Object
- Retrieve Object
- Delete Object
- Delete Container
- Get Container Capabilities
- Get Object Details
- ...

```
$ curl -v -X PUT -H 'X-Auth-Token:
8197f75188304431bd3181ca79b0b884' -H
'Content-Type: application/directory'-
H 'Content-Length: 0' http://
130.206.80.102:8080/cdmi/
AUTH_d418851c6d294381bbe6e082849686d6/
foo/
```

```
< HTTP/1.1 201 Created
< Content-Length: 18
< Content-Type: text/html;
charset=UTF-8
< X-Trans-Id:
tx63ffae10c01542ca8c8b07b130d0387c
< Date: Tue, 06 Nov 2012 13:59:27 GMT
<
201 Created
```

# OCCI for OpenStack

- OCCI Open Cloud Computing Interface : <http://occi-wg.org/>
  - a working group under the Open Grid Forum (OGF)
  - a living, open specification
  - RESTful, extensible by design
    - e.g. community work on Monitoring and SLA Awareness
  - proven interoperability in cloud management – over 20 implementations
  - providing interoperability insurance



- OCCI for OpenStack:
  - Intel, ZHAW and many others contributing via Mobile Cloud Networking, FI-WARE and other supporting initiatives
  - <https://github.com/tmetsch/occi-os>



# OCCI – Supported features...

OpenStack OCCI implementation supports

- Authentication (Keystone)
- Create Security Group
- Create Security Rule
- List Provider Capabilities
- Create Instance
- Get Instance Details
- List Instances
- Start Instance
- Stop Instance
- Create Volume
- Attach Volume
- Manage IP addresses
- ...

```
$ curl -v -X GET 130.206.80.11:8787/  
compute/edaab8cd-20a3-4639-8ea2-  
fb89c89f5107 -H 'X-Auth-Token: '$KID
```

```
[...]  
Category: m1.small; scheme="http://  
schemas.openstack.org/template/resource#";  
  
[...]  
Category: Ubuntu_12.04_clouimg_amd64_VNC;  
scheme="http://schemas.openstack.org/template/os#";  
class="mixin";  
  
[...]  
Link: </storage/10>; rel="http://schemas.ogf.org/  
occi/infrastructure#storage"; self="/storage/link/  
6cec11d1-4873-43cc-a85d-532a665cf1ad";  
  
[...]
```

# Worried about compliance?

## OCCI

- OCCI Testing Tool
  - <http://occi-wg.org/2011/01/18/occi-compliance-testing-tool/>
- ETSI Cloud Testing Suite for OCCI
  - [http://www.etsi.org/deliver/etsi\\_ts/103100\\_103199/103142/01.01.01\\_60/ts\\_103142v010101p.pdf](http://www.etsi.org/deliver/etsi_ts/103100_103199/103142/01.01.01_60/ts_103142v010101p.pdf)
- Currently no reference implementation decided

## CDMI

- SNIA Reference implementation

# So... Interoperability and APIs in OpenStack?



**Not** just paper specs...

**Open Specs** with **Open Implementations!**

# What is an open spec?

	EC2	OCCI	CIMI/OVF	OpenStack	CDMI
Open Meeting	No	Yes	No	Yes	No
Consensus	No	Yes	Yes	Yes	Yes
Due Process	No	Yes	Yes	Yes	Yes
Open IPR	No	Yes	Yes	Yes	Yes
One World	Yes	Yes	Yes	Yes	Yes
Open Change	No	Yes	Yes	Yes	Yes
Open Documents	Yes	Yes	Yes	Yes	Yes
Open Interface	Yes	Yes	Yes	Yes	Yes
Open Access	Yes	Yes	Yes	Yes	Yes
Ongoing support	Yes	Yes	Yes	Yes	Yes
Open Formats	Yes	Yes	Yes	Yes	Yes
Implementations	> 2	> 2	2	1*	>2



# Should you care?

SDO specs are essential but know where they fit in!

## No

Standards are not needed for many activities related to:

- Start-ups
- Prototyping

## Yes

- Interoperability
- Look at EGI FedCloud, CompatibleOne...
- Compliance, Large IT organisations, Government

# Summing Up ...

- There are native APIs for your initial OpenStack explorations
- But for **interoperability insurance** there are standardized API implementations...



- These APIs being **actively developed** to meet Industry, Consumer and Regulatory Interoperability Needs

# More Information...

## Open Stack

- <http://www.openstack.org/>

## Object Storage

- CDMI: <http://cdmi.sniacloud.org/>
- CDMI for OpenStack: <https://github.com/osaddon/cdmi>
- FI-WARE Object Storage Generic Enabler:  
<http://catalogue.fi-ware.eu/enablers/object-storage-ge-fi-ware-implementation>

## Cloud Management

- OCCl: <http://occi-wg.org/>
- OCCl for OpenStack: <https://github.com/tmetsch/occi-os>
- FI-WARE Data Centre Generic Enabler:  
[http://catalogue.fi-ware.eu/enablers?chapter\\_tid=2&=Apply](http://catalogue.fi-ware.eu/enablers?chapter_tid=2&=Apply) (to appear)

# Thank You!

## Any Questions?

Projects referred to in this presentation have received funding from the European Union  
Seventh Framework Programme under grant agreements 318109 and 285248



**Backup...**



# CDMI Authenticate...

```
$ curl -d '{"auth": {"project": "admin", "passwordCredentials": {"username": "admin",  
  "password": "....."}, "tenantId": "d418851c6d294381bbe6e082849686d6"}}' -H"Content-  
type: application/json" http://130.206.80.100:5000/v2.0/tokens
```

```
{"access":  
  {"token": {"expires": "2012-11-07T13:39:12Z", "id":  
    "ea379b97b79c4f1bbaaedfa58ad48e82",  
    [...]  
  "endpoints": [  
    {"adminURL": "http://130.206.80.102:8080/v1", "region": "RegionOne",  
      "internalURL": "http://130.206.80.102:8080/v1/  
AUTH_d418851c6d294381bbe6e08284_9686d6", "publicURL": "http://  
130.206.80.102:8080/v1/AUTH_d418851c6d294381bbe6e08284_9686d6"}],  
    [...]
```

# CDMI Create Container...

```
$ curl -v -X PUT -H 'X-Auth-Token: 8197f75188304431bd3181ca79b0b884' -H 'Content-Type: application/directory' -H 'Content-Length: 0' http://130.206.80.102:8080/cdmi/AUTH_d418851c6d294381bbe6e082849686d6/foo/
```

```
< HTTP/1.1 201 Created
< Content-Length: 18
< Content-Type: text/html; charset=UTF-8
< X-Trans-Id: tx63ffae10c01542ca8c8b07b130d0387c
< Date: Tue, 06 Nov 2012 13:59:27 GMT
<
201 Created
```

# CDMI Upload Object...

```
$ curl -v -X PUT -d '{"mimetype":"text/plain", "metadata":{}, "value":"bar"}' -H 'X-Auth-Token: 8197f75188304431bd3181ca79b0b884' -H 'Accept: application/cdm-object' -H 'Content-Type: application/cdm-object' -H 'X-CDMI-Specification-Version: 1.0.1' http://130.206.80.102:8080/[...]/foo/text_doc
```

```
< HTTP/1.1 201 Created
< Content-Type: text/html; charset=UTF-8
< Etag: 37b51d194a7513e45b56f6524f2d51f2
< Last-Modified: Tue, 06 Nov 2012 14:00:17 GMT
< Content-Length: 155
< X-Trans-Id: tx03b9cb0122754b118e9fd7d927d1cf4c
< Date: Tue, 06 Nov 2012 14:00:17 GMT
<
{
  "parentURI": "AUTH_d418851c6d294381bbe6e082849686d6/foo/",
  "metadata": {},
  "objectName": "text_doc",
  "objectType": "application/cdm-object"
}
```



# CDMI Retrieve Object...

```
$ curl -v -X GET -H 'X-Auth-Token: 8197f75188304431bd3181ca79b0b884' -H 'Accept: application/cdm-object' -H 'X-CDMI-Specification-Version: 1.0.1' http://130.206.80.102:8080/cdm/AUTH_d418851c6d294381bbe6e082849686d6/foo/text_doc
```

```
[...]
{
  "completionStatus": "Complete",
  "mimetype": "text/plain",
  "valuetransferencoding": "utf-8",
  "objectName": "text_doc",
  "capabilitiesURI": "cdmi_capabilities/AUTH_d418851c6d294381bbe6e082849686d6/foo/text_doc/",
  "parentURI": "AUTH_d418851c6d294381bbe6e082849686d6/",
  "value": "bar",
  "valuerange": "0-3",
  "objectType": "application/cdm-object",
  "metadata": {}
}
```

# OCCI Authenticate...

```
curl -d '{"auth": {"project": "admin", "passwordCredentials": {"username": "admin",  
"password": "....."}, "tenantId": "d418851c6d294381bbe6e082849686d6"}}' -H"Content-  
type: application/json" http://130.206.80.100:5000/v2.0/tokens
```

```
{"access":  
  {"token": {"expires": "2012-11-07T13:39:12Z", "id":  
"ea379b97b79c4f1bbaaedfa58ad48e82",  
  [...]  
[...]
```

# OCCI Create VM...

```
curl -v -X POST 130.206.80.11:8787/compute/ -H 'Category: compute; scheme="http://schemas.opengroup.org/occi/infrastructure#";' -H 'Content-Type: text/occi' -H 'X-Auth-Token: '$KID -H 'Category: m1.small; scheme="http://schemas.openstack.org/template/resource#"; class="mixin"' -H 'Category: Ubuntu 12.04 cloudimg amd64 VNC; [...]'
```

```
< HTTP/1.1 201 Created
< Content-Length: 2
< Content-Type: text/plain
< Location: http://130.206.80.11:8787/compute/edaab8cd-20a3-4639-8ea2-fb89c89f5107
< Server: pyssf OCCI/1.1
< Date: Wed, 07 Aug 2012 13:48:45 GMT
<
OK
```

# OCCI List instance...

```
curl -v -X GET 130.206.80.11:8787/compute/edaab8cd-20a3-4639-8ea2-fb89c89f5107  
-H 'X-Auth-Token: '$KID
```

```
[...]  
Category: compute; scheme="http://schemas.ogf.org/occi/infrastructure#";  
class="kind"; [...]  
Category: m1.small; scheme="http://schemas.openstack.org/template/resource#";  
[...]  
Category: Ubuntu_12.04_clouddimg_amd64_VNC; scheme="http://  
schemas.openstack.org/template/os#"; class="mixin";  
[...]  
Link: </storage/10>; rel="http://schemas.ogf.org/occi/infrastructure#storage";  
self="/storage/link/6cec11d1-4873-43cc-a85d-532a665cf1ad";  
[...]  
X-OCCI-Attribute: occi.compute.memory="2.0"
```

# OCCI Stop a VM...

```
curl -v -X POST "130.206.80.11:8787/compute/edaab8cd-20a3-4639-8ea2-  
fb89c89f5107?action=stop" -H 'Content-Type: text/occi' -H 'X-Auth-Token:  
'$KID -H 'Category: stop; scheme="http://schemas.ogf.org/occi/  
infrastructure/compute/action#"; class="action"'
```

```
< HTTP/1.1 200 OK  
< Content-Length: 4359  
< Content-Type: text/plain  
< Server: pyssf OCCI/1.1  
< Date: Wed, 07 Nov 2012 14:01:37 GMT  
<  
Category: compute; scheme="http://schemas.ogf.org/occi/infrastructure#";  
class="kind"; title="Compute Resource"; rel="http://schemas.ogf.org/occi/  
core#resource";  
[...]
```