



OCCI Walkthrough

About



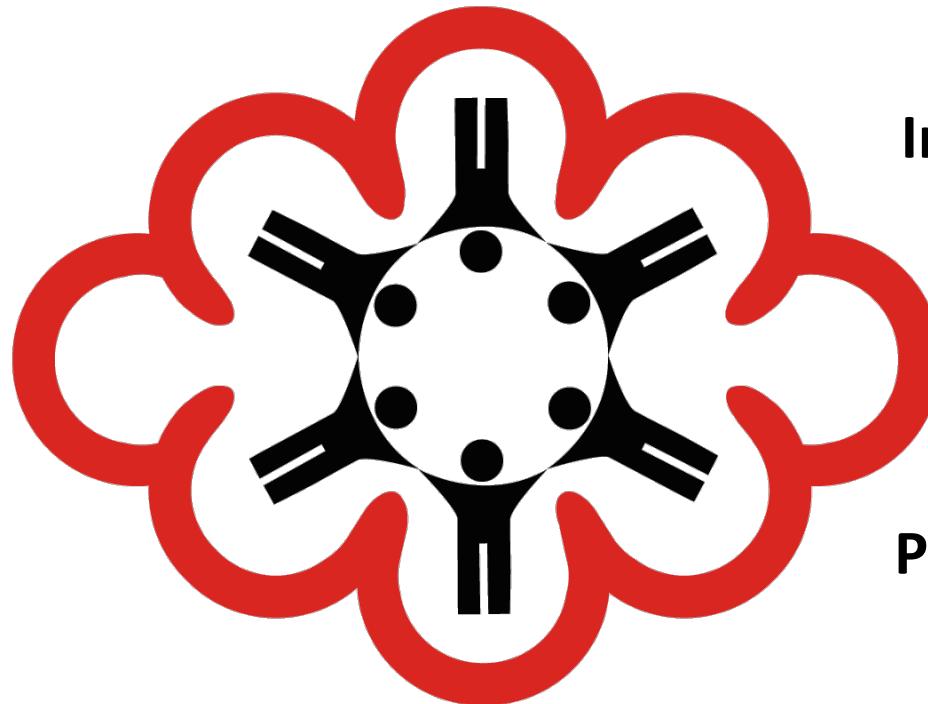
Truly Open & Defending it!

Innovation

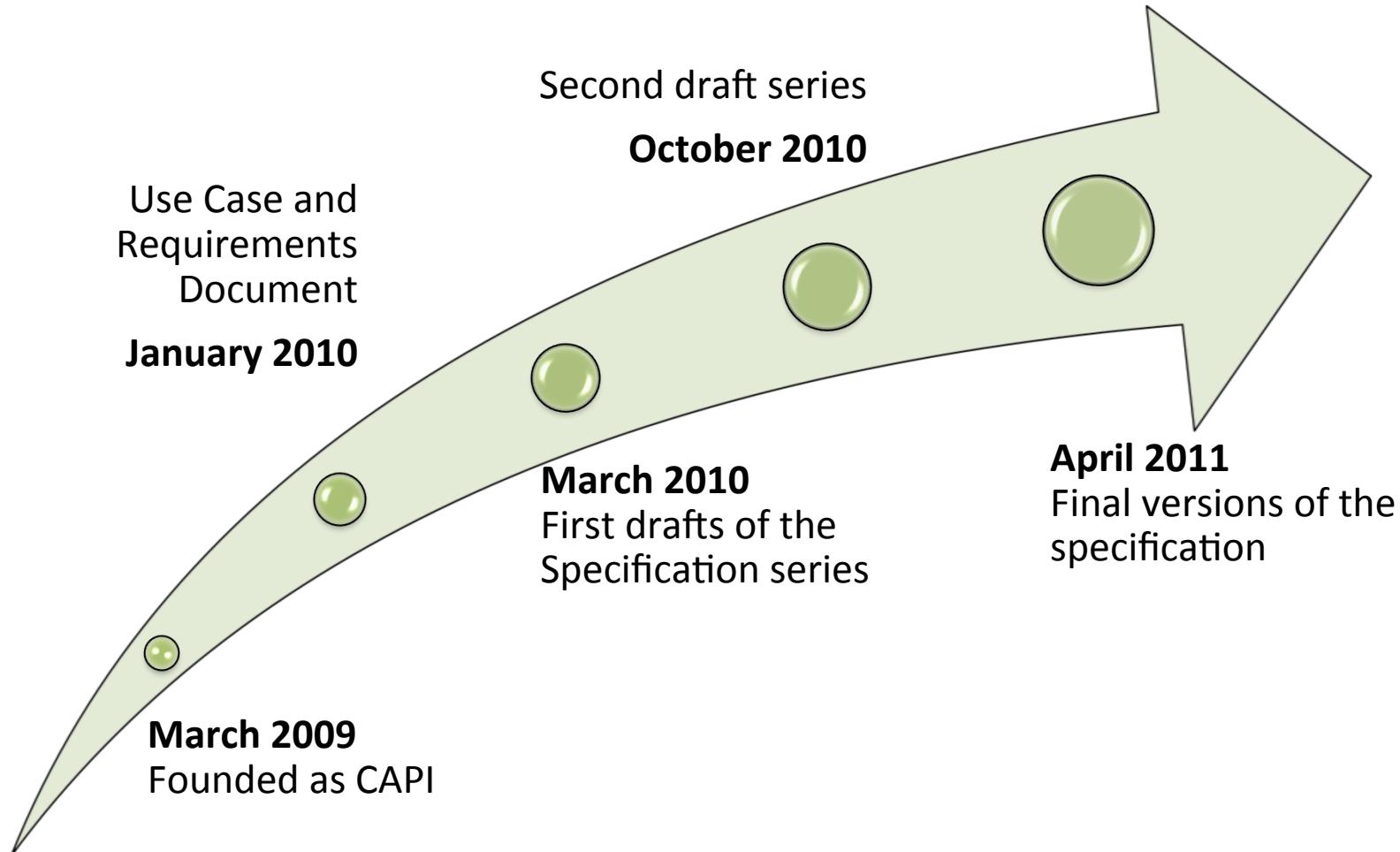
Interoperability

Integration

Portability



History



Impact



NIST

**National Institute of
Standards and Technology**

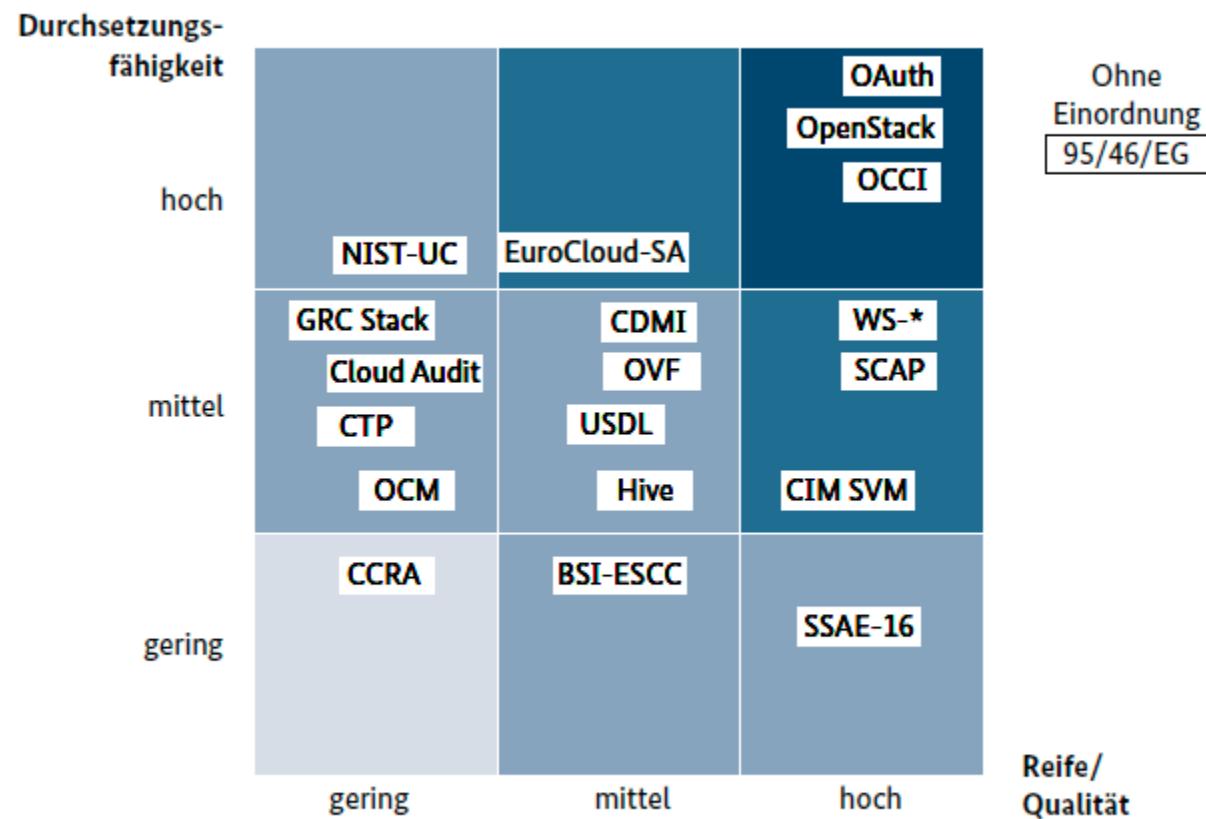


<http://www.cloud-standards.org>



WIRTSCHAFT.
WACHSTUM.
WOHLSTAND.

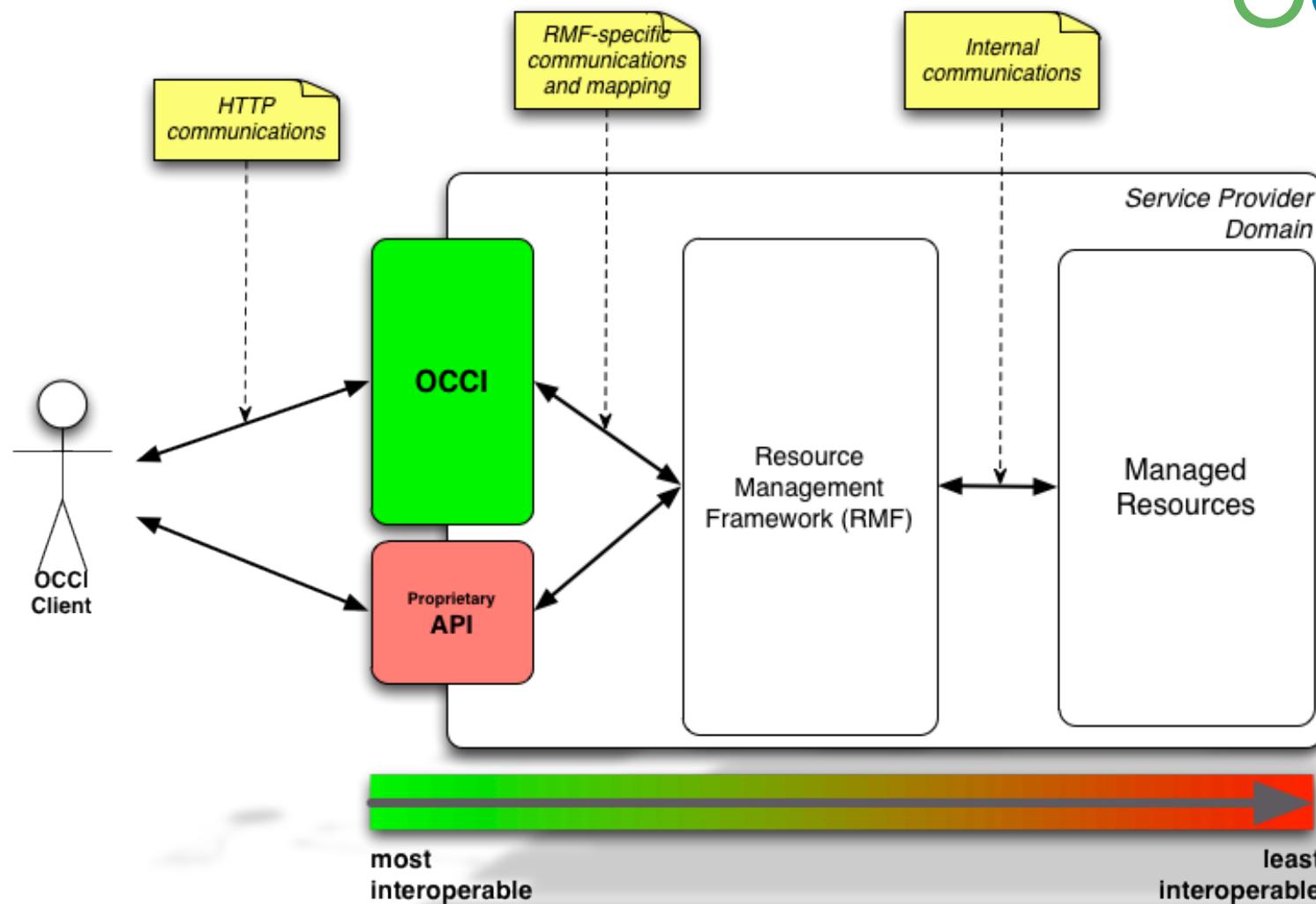
Abbildung 9: Bewertung der 20 „Cloud-Standards“



Quelle: Analyse von Booz & Company und FZI

Quelle: Das Normungs- und Standardisierungsumfeld von Cloud Computing

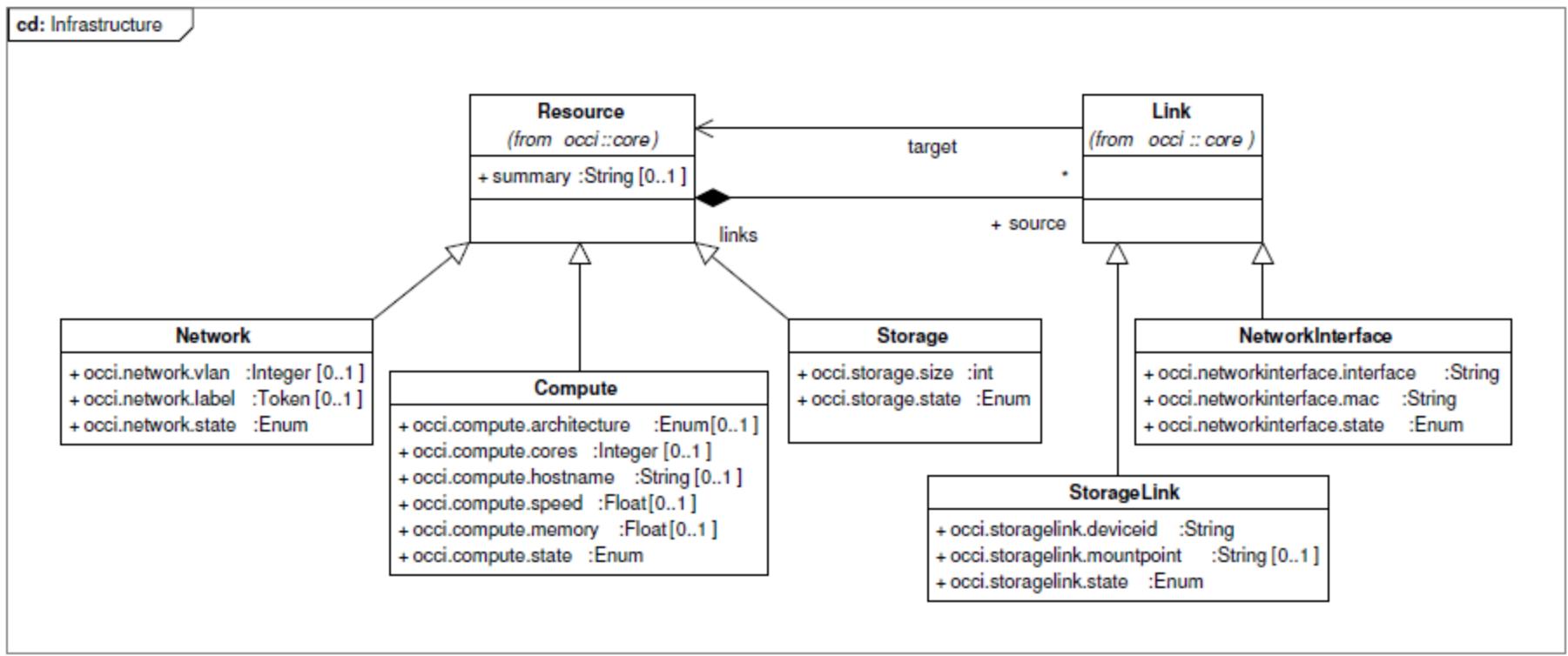
Positioning OCCI



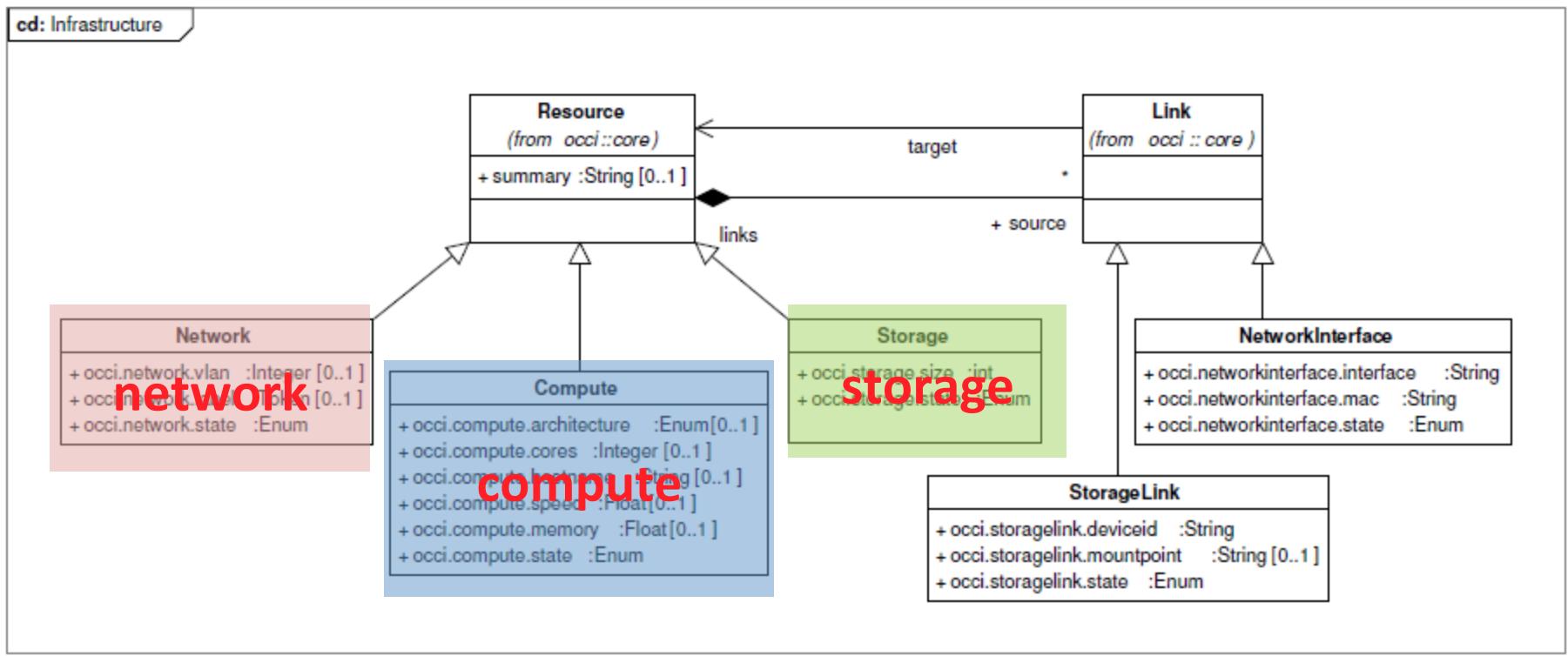


THE MODEL

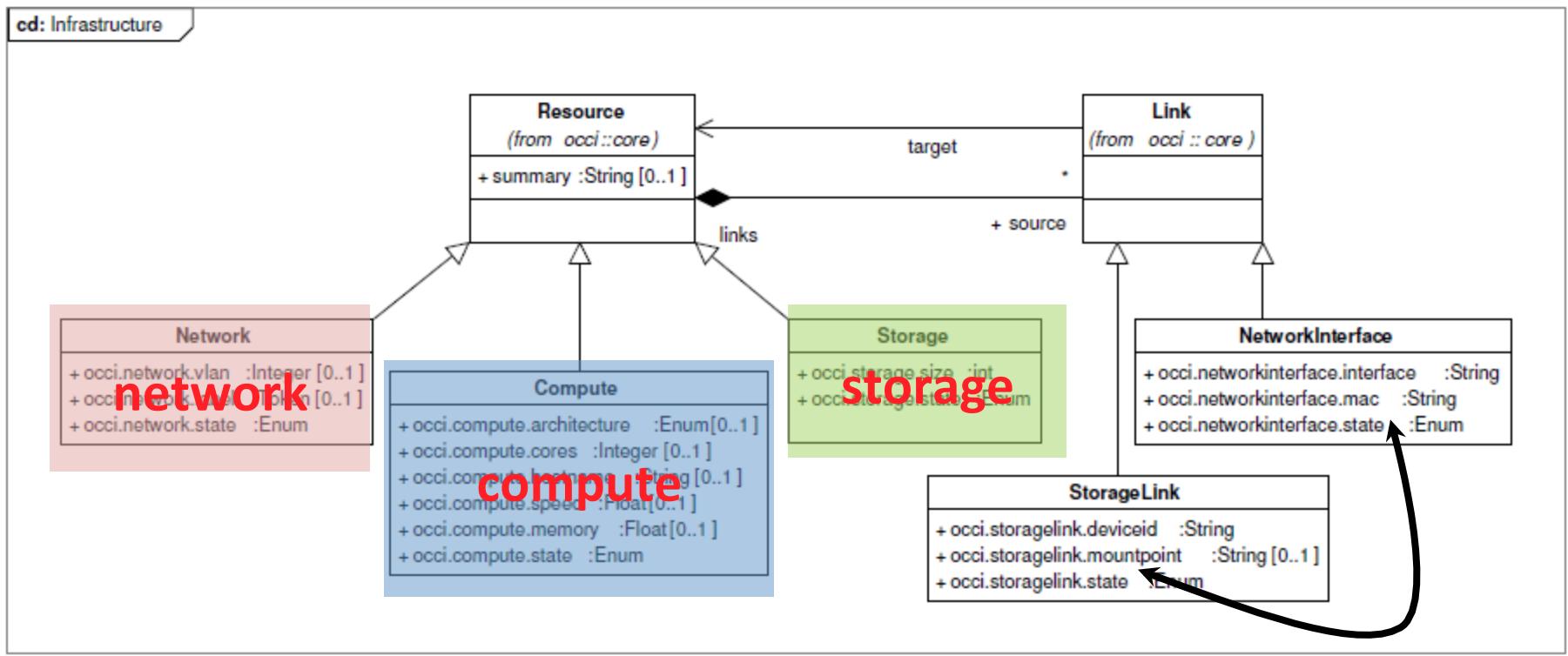
OCCI's Infrastructure Model Extension



OCCI's Infrastructure Model Extension



OCCI's Infrastructure Model Extension



Linking of the concrete 'resources'



How To Get There?



Mixin

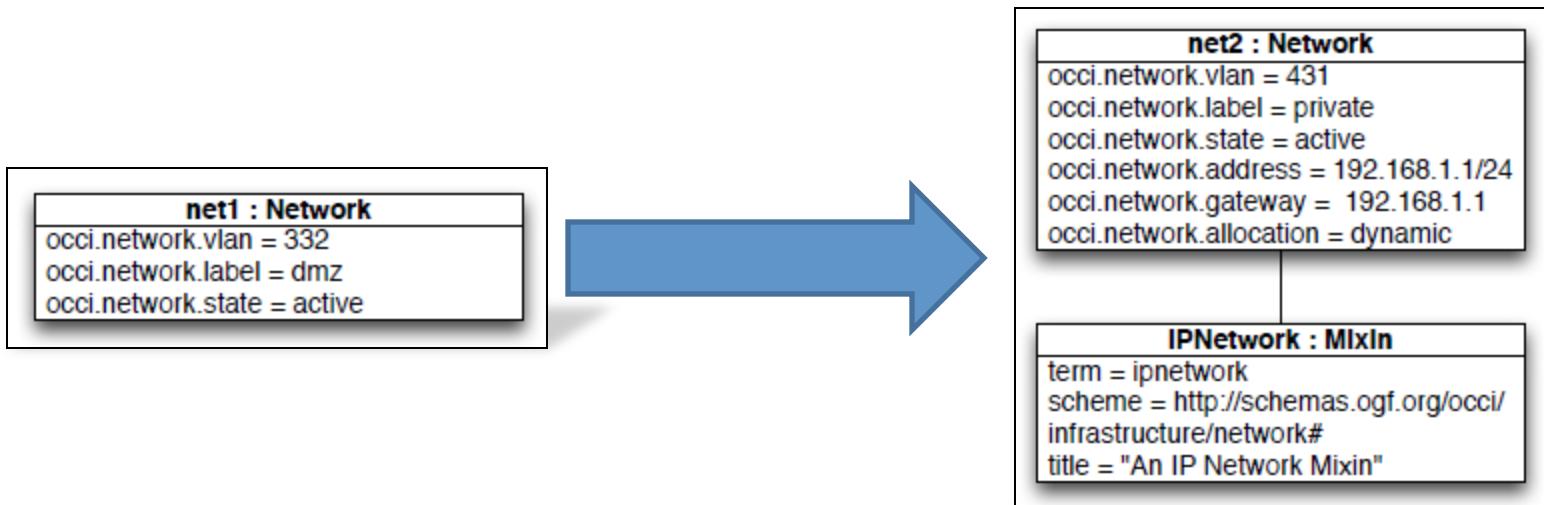


Mixins are an extension mechanism, which allows new resource capabilities to be added (dynamically) to resource instances.

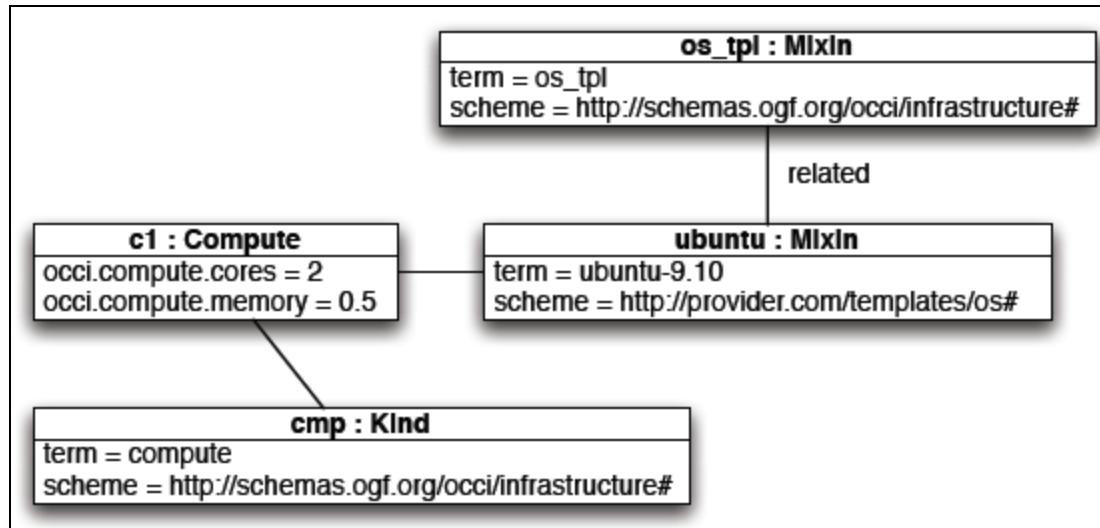




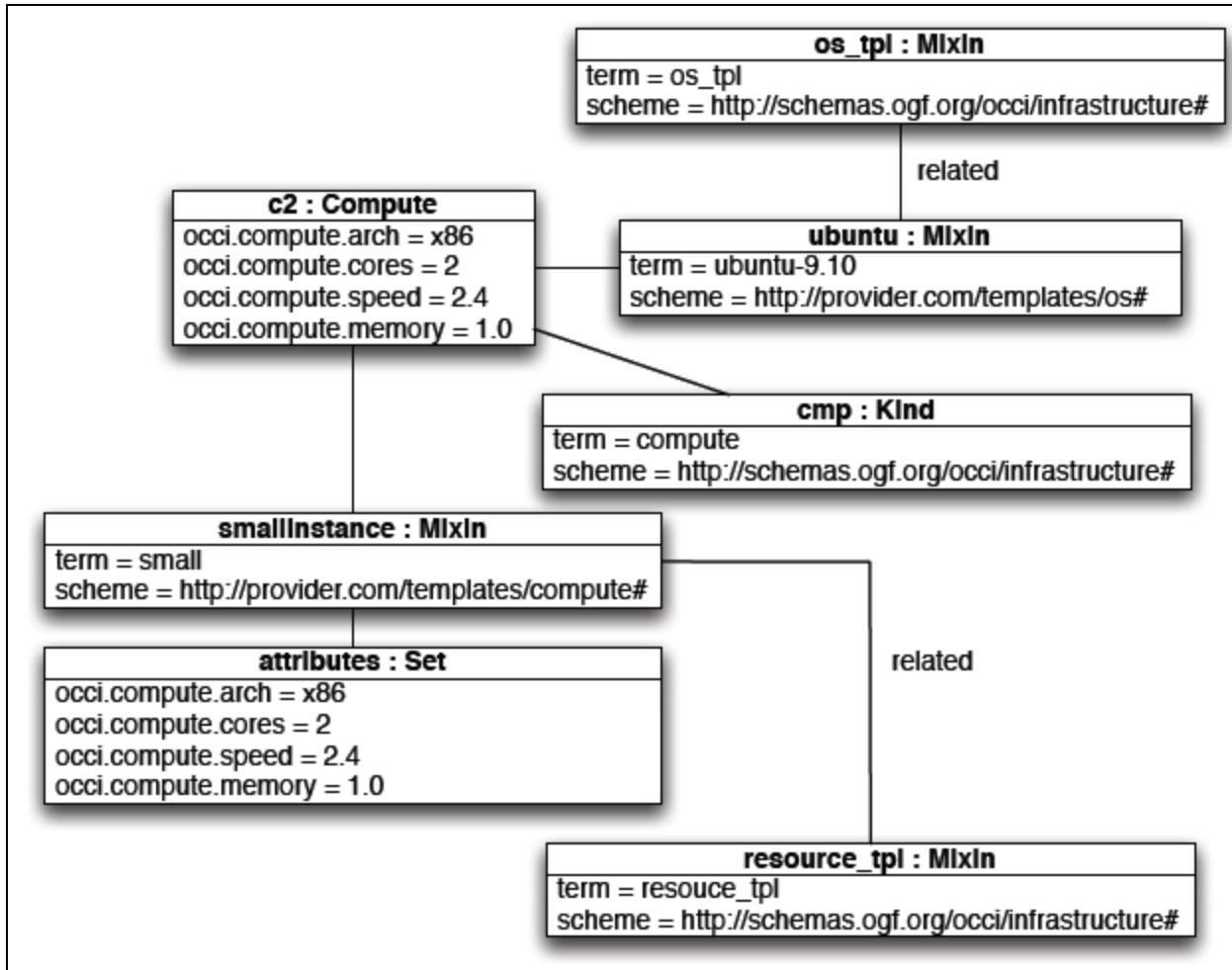
IPNetworking Mixin



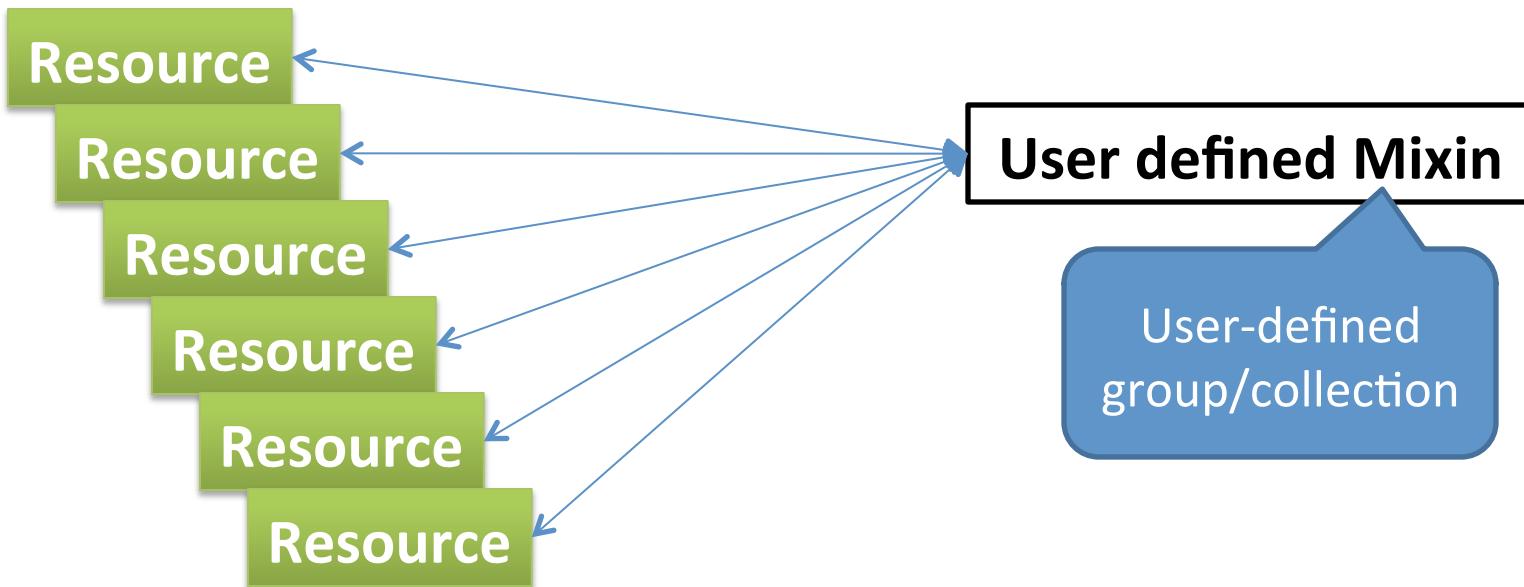
Mixins as Templates



Mixins as Templates (2)



Mixins as Tags





But...

**How to prevent
Racecar capabilities (define by a Mixin) added to an SUV
(Which is impossible)?**

How do we define the Type of a resource?

**Since this is all dynamic – how does the client
a) know what's supported and b) when?**

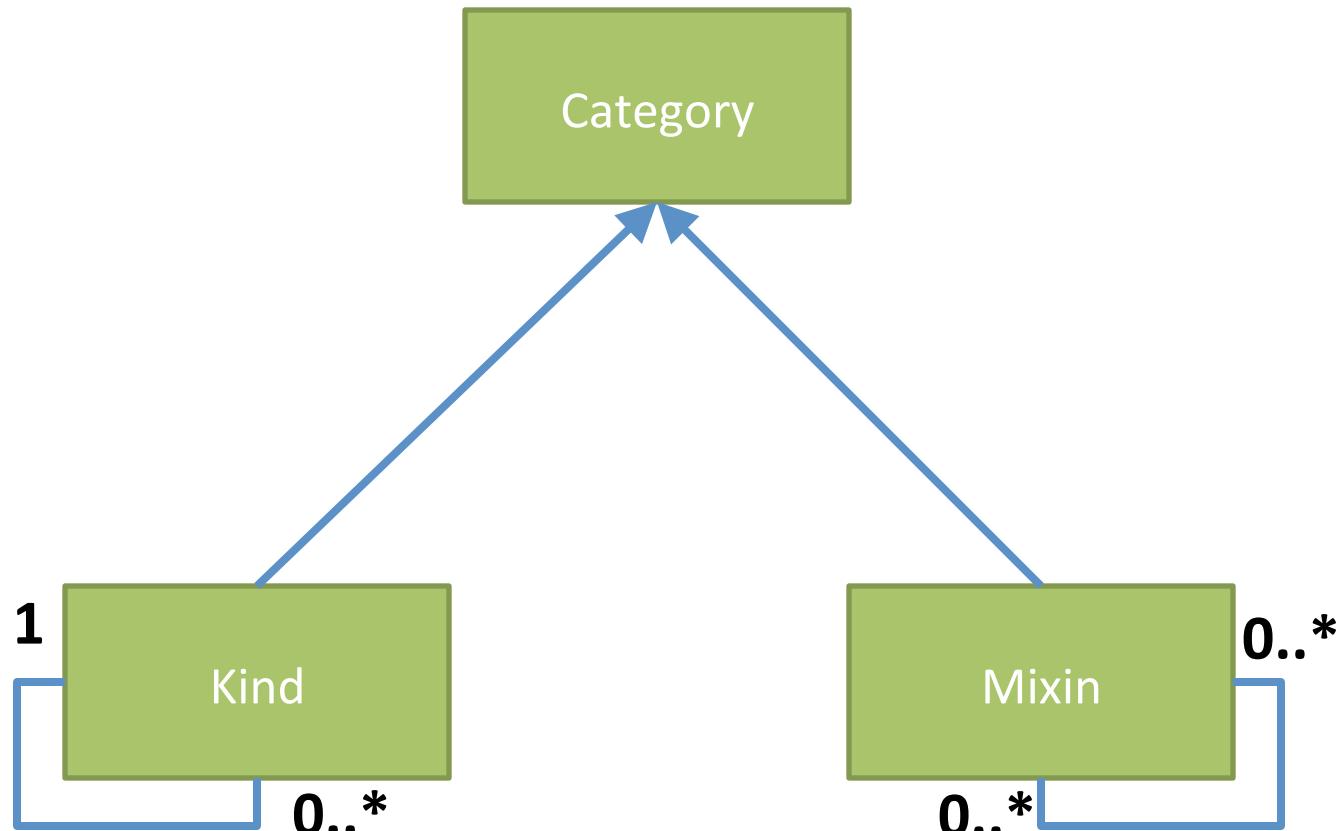
What about hierarchies?



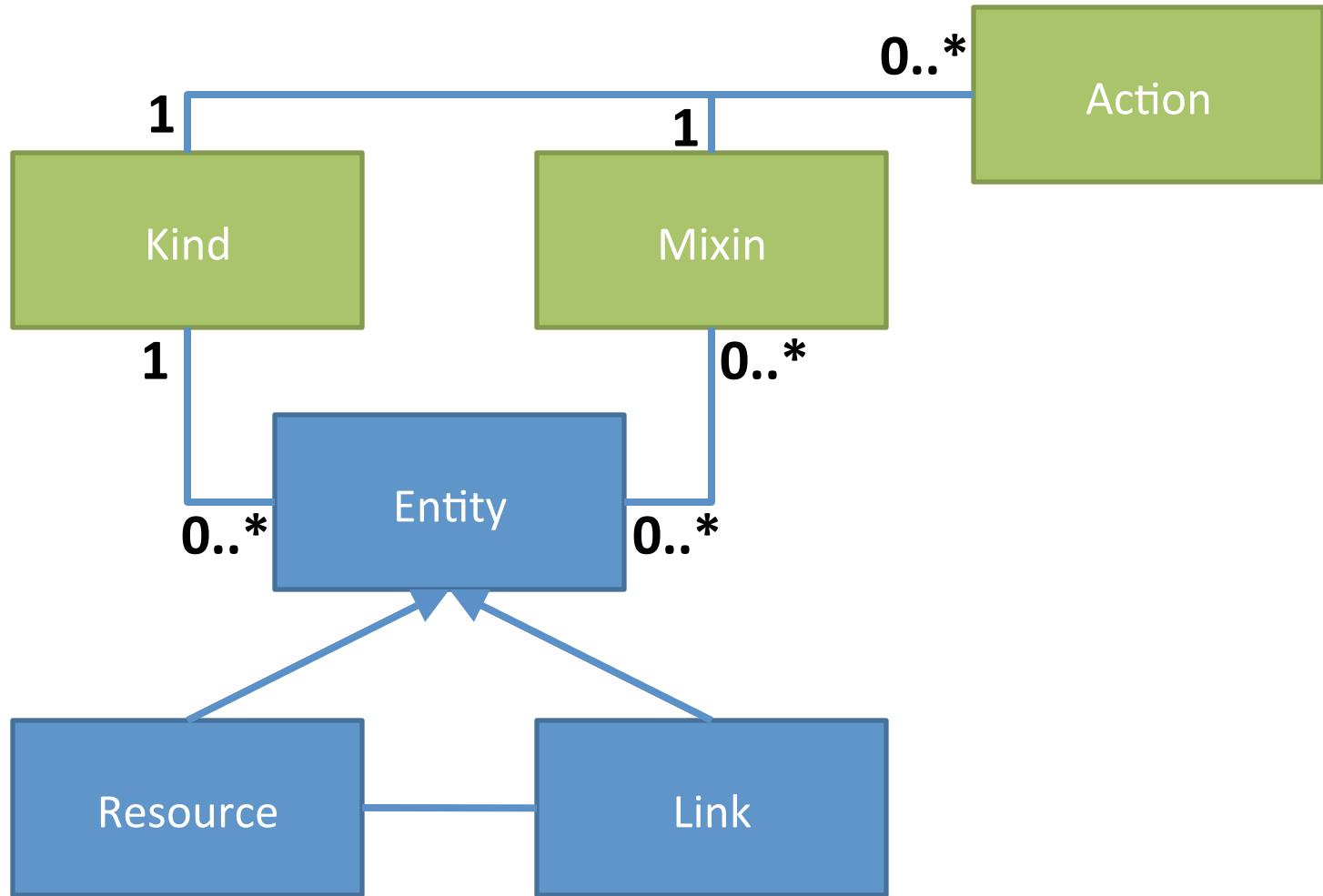
The solutions for all these questions...

OCCI'S CORE MODEL

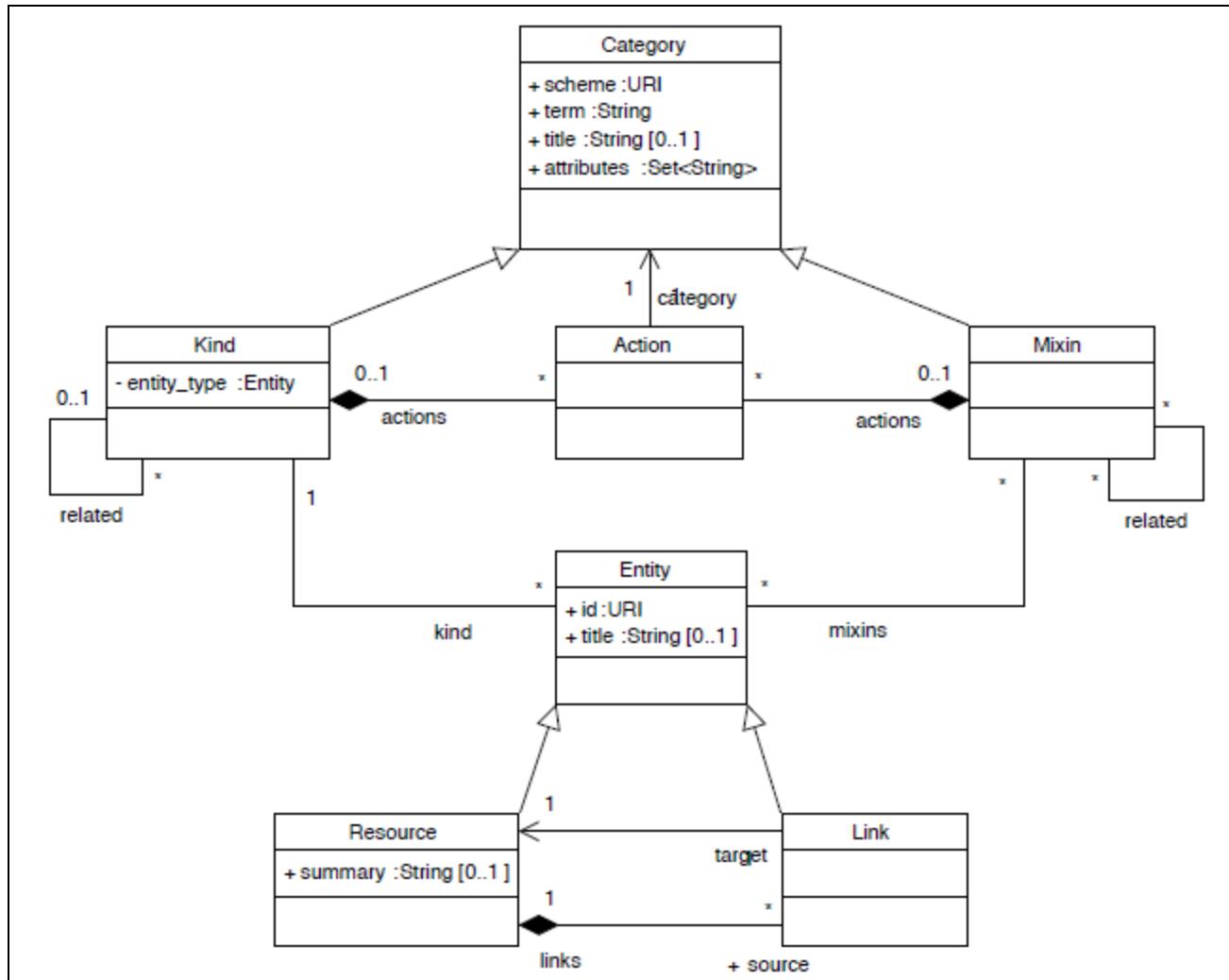
Categories



Entities

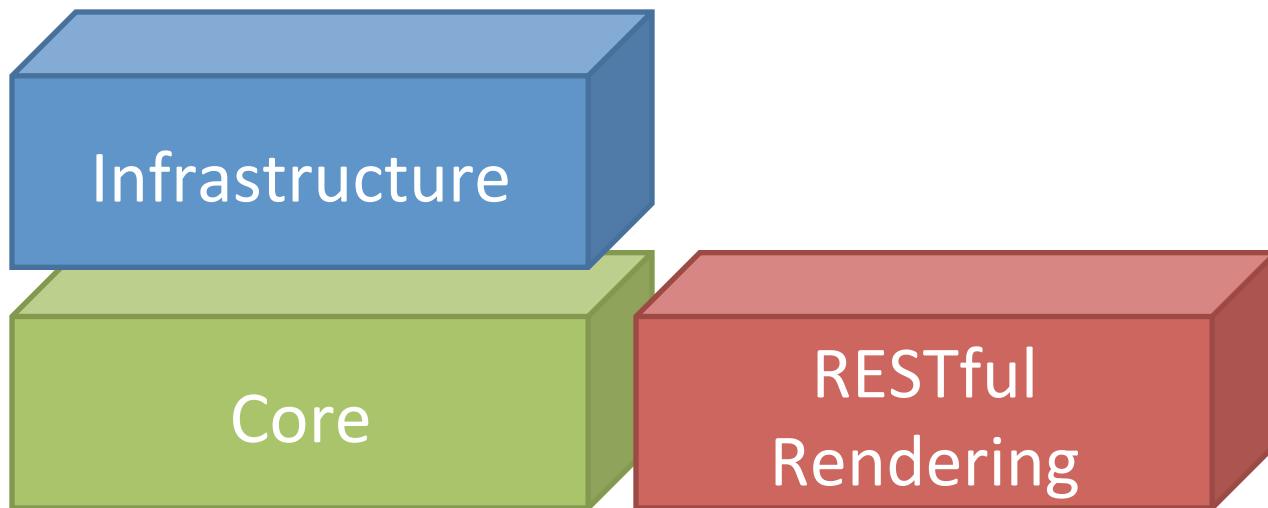


Core model



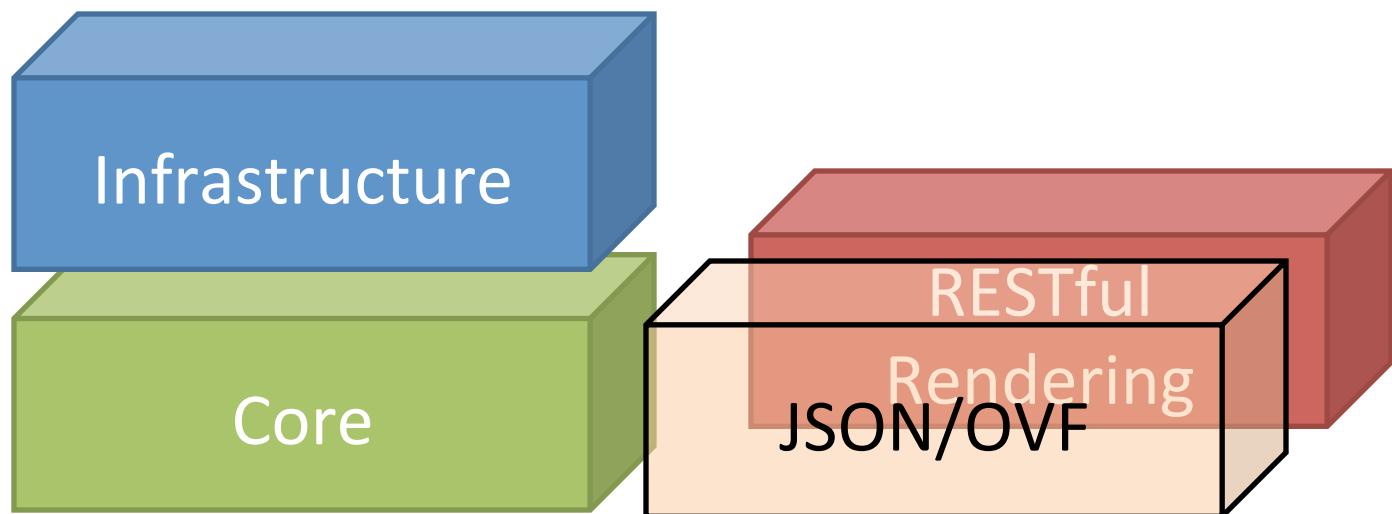


Building Blocks



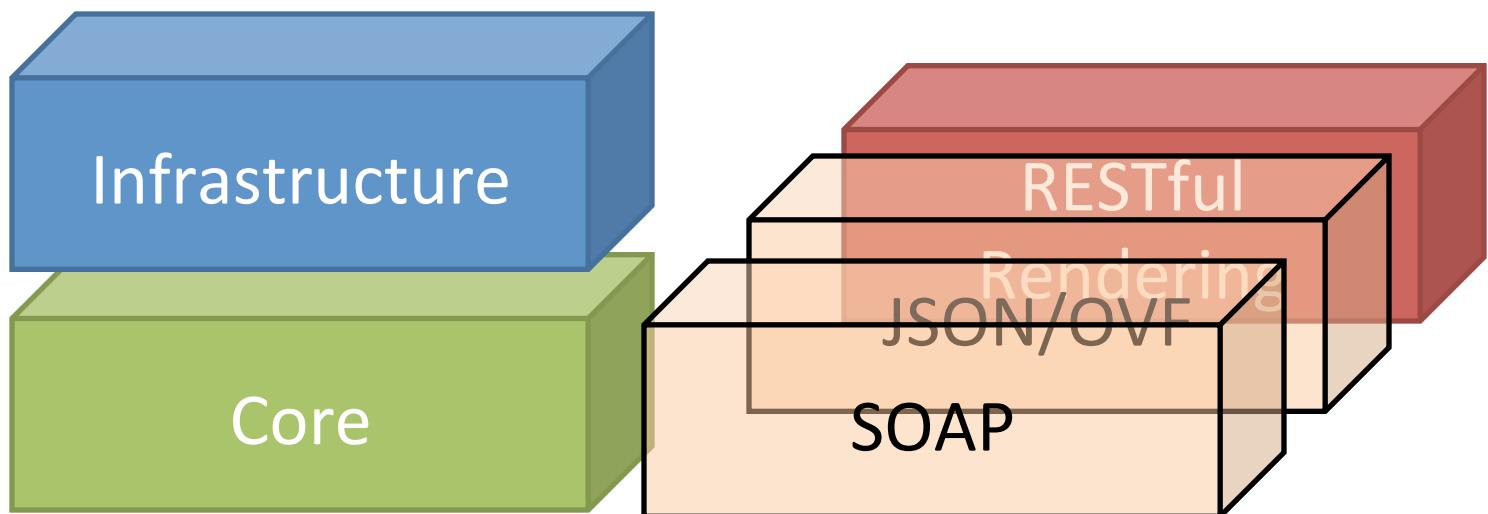


Building Blocks



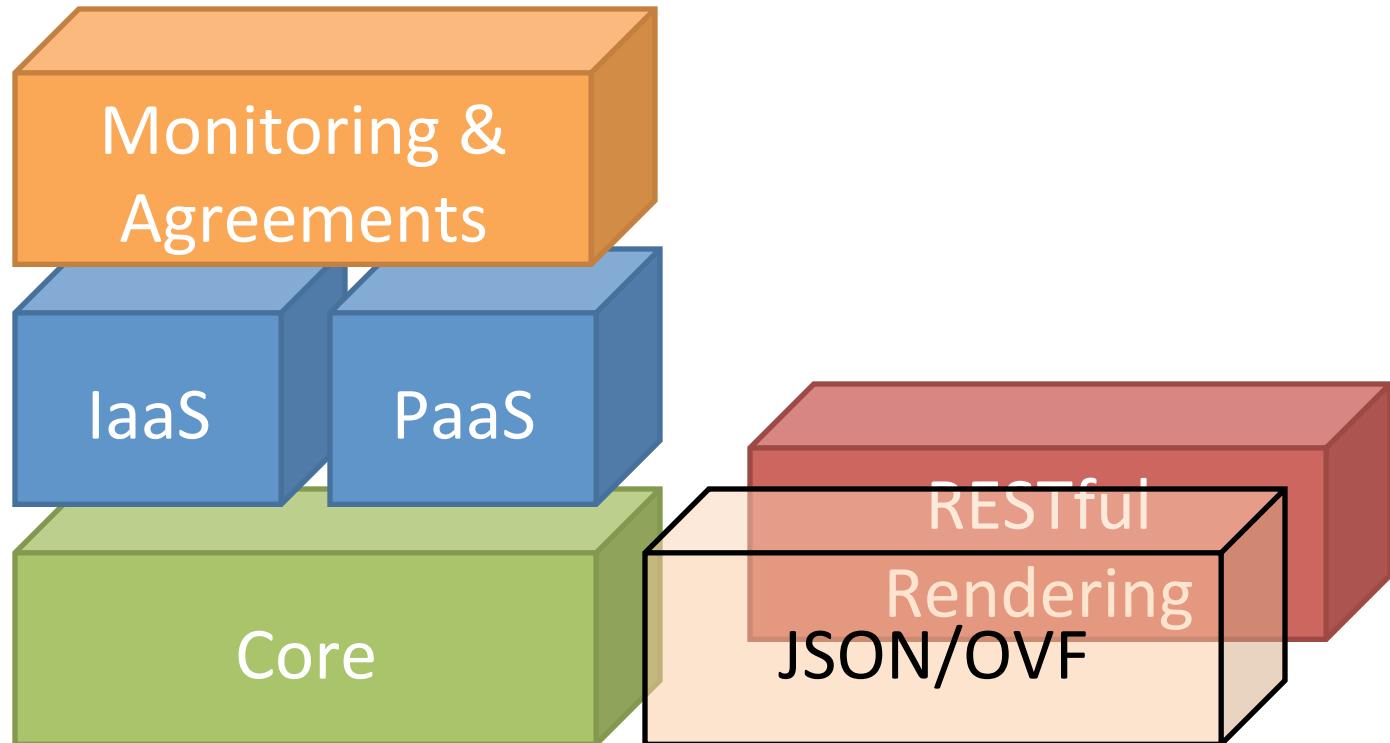


Building Blocks



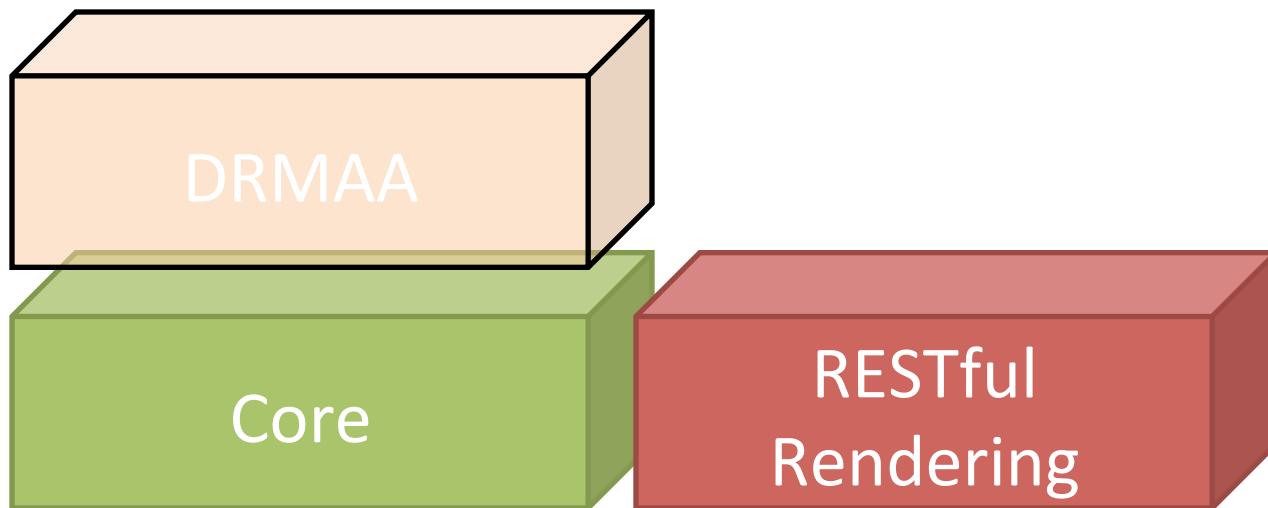


Building Blocks





Building Blocks

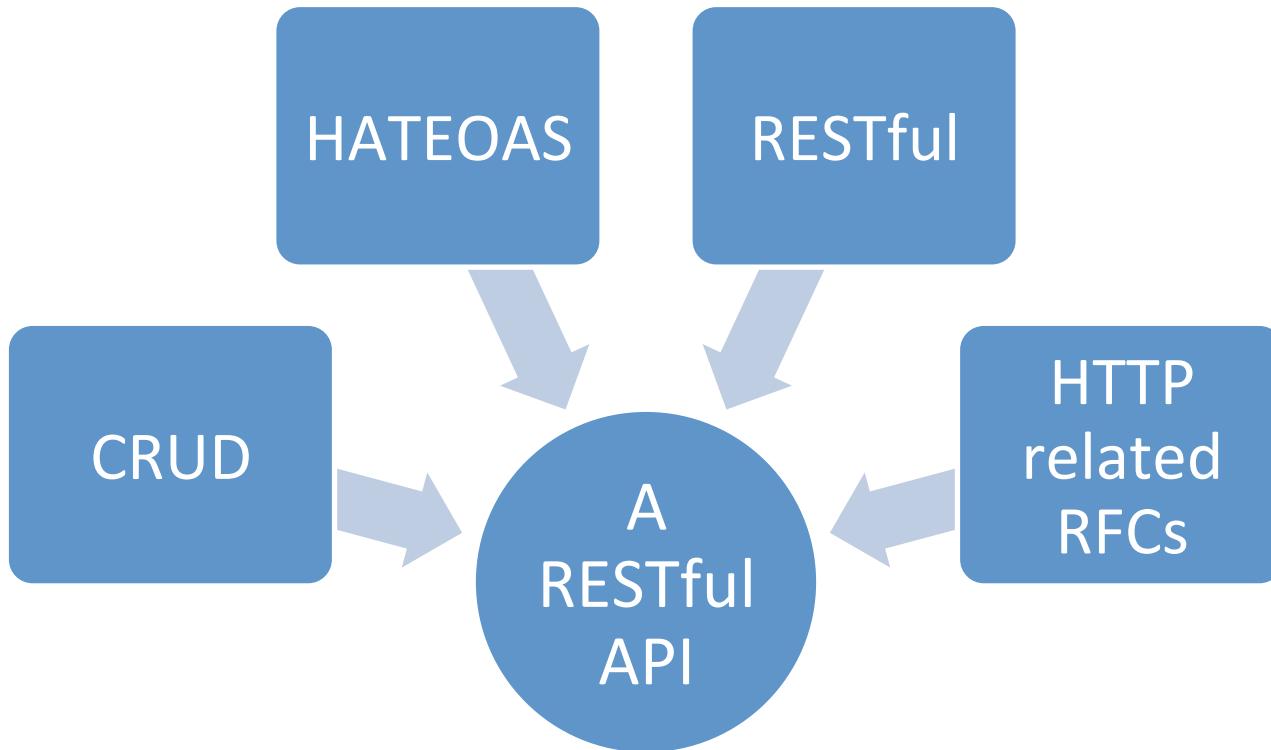


Query Interface

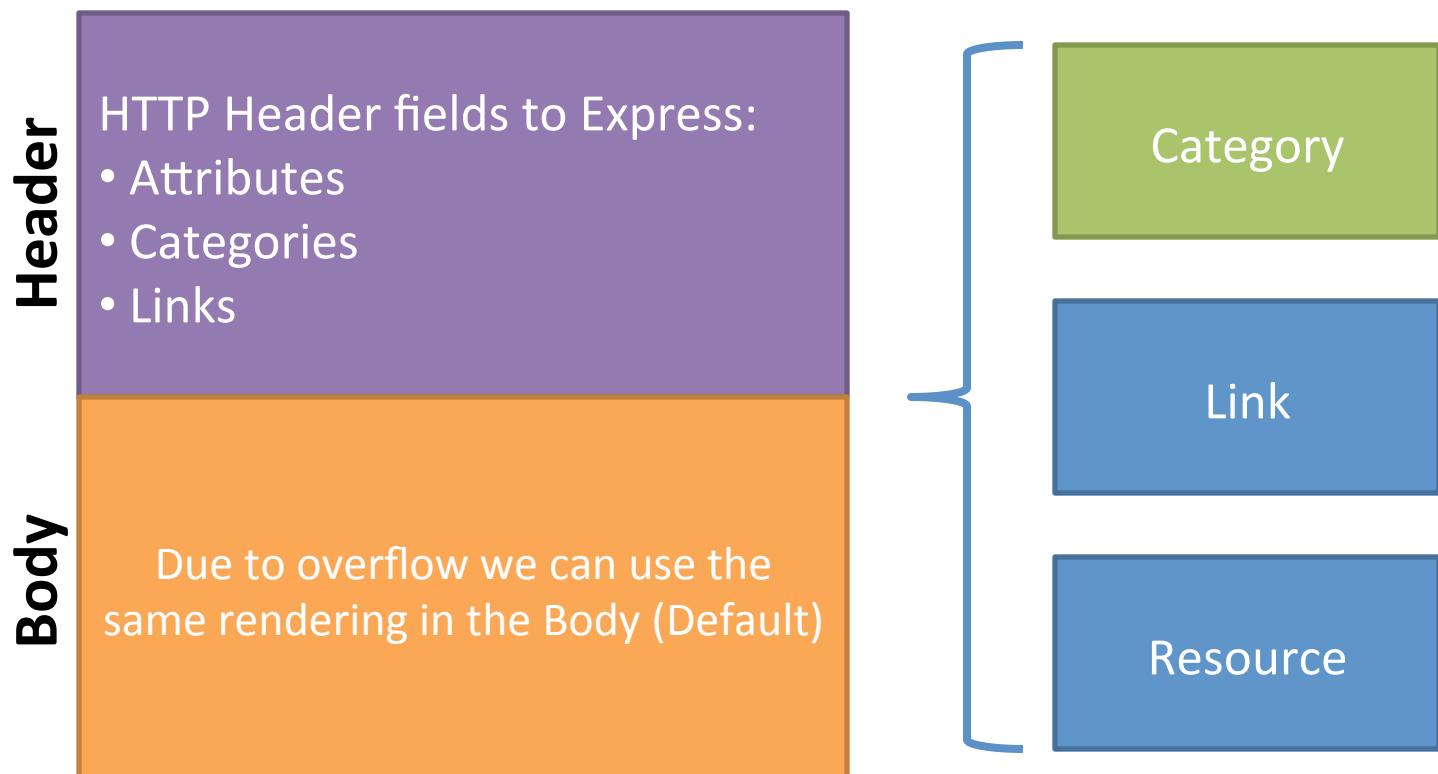


<http://www.example.com/.well-known/org/ogf/occi/>

A Rendering



Renderings



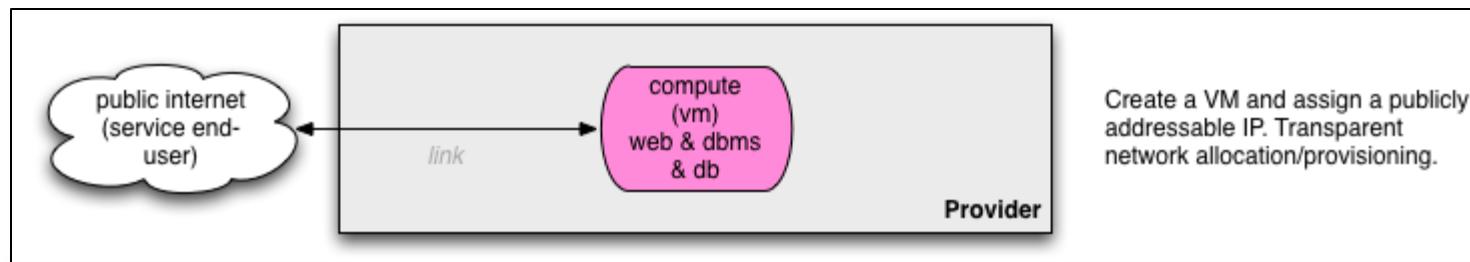
HTTP



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EXAMPLES

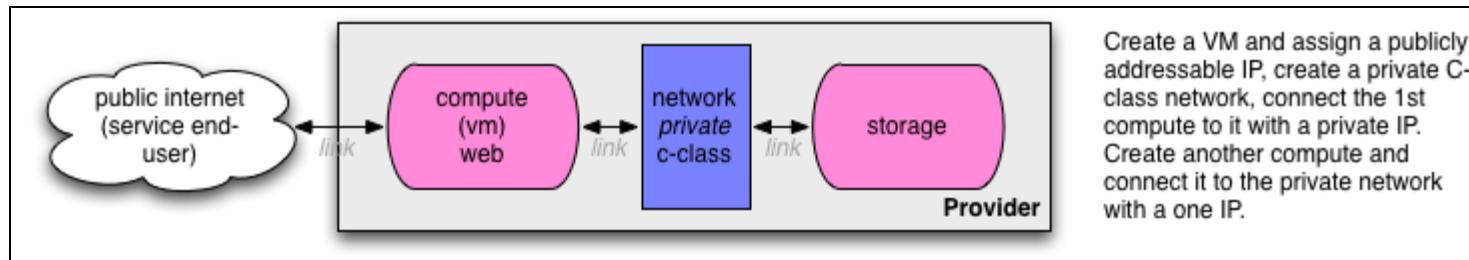




Very simple VM

```
> POST /compute/ HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
  OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
> Content-type: text/occi
> Category: compute; scheme="http://schemas.ogf.org/occi/
  infrastructure#"
> Category: ubuntu; scheme="http://example.com/templates/os#"
> Category: small; scheme="http://example.com/templates/compute#"
>

< HTTP/1.1 201 OK
< Content-Length: 2
< Content-Type: text/html; charset=UTF-8
< Location: http://localhost:8888/compute/ec7e854d-5b1c-cb24-
  cb57-875b0a404fd1
< Server: pyocci OCCI/1.1
<
OK
```





Querying the capabilities

```
> GET /.well-known/org/ogf/occi/ HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1 OpenSSL/
0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
> Content-type: text/occi
> Category: compute; scheme="http://schemas.ogf.org/occi/infrastructure"
>

< HTTP/1.1 200 OK
< Content-Length: 592
< Etag: "1fb0432a8222fb441a6cbf5e6acb02b701a2ed94"
< Content-Type: text/plain
< Server: pyocci OCCI/1.1
<
Category: compute; scheme="http://schemas.ogf.org/occi/infrastructure#";
class="kind"; title="A compute instance"; rel="http://schemas.ogf.org/occi/
core#resource"; location=/compute/; attributes="occi.compute.architecture
occi.compute.cores occi.compute.hostname occi.compute.speed
occi.compute.memory occi.compute.state"; actions="http://schemas.ogf.org/
occi/infrastructure/compute/action#start http://schemas.ogf.org/occi/
infrastructure/compute/action#stop http://schemas.ogf.org/occi/
infrastructure/compute/action#restart http://schemas.ogf.org/occi/
infrastructure/compute/action#suspend"
```



Create a compute resource

```
> POST /compute/ HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
> Content-type: text/occi
> Category: compute; scheme="http://schemas.ogf.org/occi/
infrastructure"
> X-OCCI-Attribute: occi.compute.speed=2
> Link: </network/123>; rel="http://schemas.ogf.org/occi/
infrastructure#network"; category="http://schemas.ogf.org/occi/
infrastructure#networkinterface";
occi.networkinterface.interface="eth0";
occi.networkinterface.mac="00:11:22:33:44:55"
>

< HTTP/1.1 200 OK
< Content-Length: 2
< Content-Type: text/html; charset=UTF-8
< Location: http://localhost:8888/compute/40675abc-c4ca-e6dd-ac7e-
fa057cd5b164
< Server: pyocci OCCI/1.1
<
OK
```



Add a mixin to the net res.

```
> POST /network/link/c23b558b-8a17-4feb-82b5-b72c86865855 HTTP/
1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
> Content-Type: text/occi
> Category: ipnetworkinterface; scheme="http://schemas.ogf.org/
occi/infrastructure"
>

< HTTP/1.1 200 OK
< Content-Length: 2
< Content-Type: text/html; charset=UTF-8
< Server: pyocci OCCI/1.1
<
OK
```



Create a StorageLink

```
> PUT /storage/link/1 HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
  OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
> Content-type: text/occi
> Category: storagelink; scheme="http://schemas.ogf.org/occi/
  infrastructure"
> X-OCCI-Attribute: occi.storagelink.mountpoint="/mnt/"
> X-OCCI-Attribute: source=/compute/2741e6f3-84bb-4bfb-a0a5-
  c5787e49065e
> X-OCCI-Attribute: target=/storage/123
>

< HTTP/1.1 200 OK
< Content-Length: 2
< Content-Type: text/html; charset=UTF-8
< Server: pyocci OCCI/1.1
<
OK
```



Review the compute res.

```
> GET /compute/fadd66a1-e5be-6cbd-a598-c994e48201b8 HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1 OpenSSL/0.9.8o zlib/1.2.3
libidn/1.9
> Host: localhost:8888
> Accept: text/plain
>

< HTTP/1.1 200 OK
< Content-Length: 887
< Etag: "6dc31e0fff62b2f9f5adf8e427eb56e82c25dde8"
< Content-Type: text/plain
< Server: pyocci OCCI/1.1
<
Category: compute; scheme="http://schemas.ogf.org/occi/infrastructure#"; class="kind"
X-OCCI-Attribute: occi.compute.architecture="x86"
X-OCCI-Attribute: occi.compute.state="inactive"
X-OCCI-Attribute: occi.compute.speed="1"
X-OCCI-Attribute: occi.compute.memory="2"
X-OCCI-Attribute: occi.compute.cores="2"
X-OCCI-Attribute: occi.compute.hostname="dummy"
Link: <http://localhost:8888/compute/fadd66a1-e5be-6cbd-a598-c994e48201b8?action=start>;
rel="http://schemas.ogf.org/occi/infrastructure/compute/action#start"
Link: <http://localhost:8888/network/123>; rel="http://schemas.ogf.org/occi/
infrastructure#network"; self="http://localhost:8888/network/link/40675abc-c4ca-e6dd-
ce7e-fa057cd5b164"; category="http://schemas.ogf.org/occi/
infrastructure#networkinterface";
occi.networkinterface.interface="eth0"; occi.networkinterface.mac="aa:bb:cc:dd:ee:ff"; occi.
networkinterface.state="up";
```



Retrieve the NetworkLink

```
> GET /network/link/4494908b-26b6-c9e5-b09e-9255ecdc7cdb HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1 OpenSSL/0.9.8o zlib/1.2.3
libidn/1.9
> Host: localhost:8888
> Accept: */*
>

< HTTP/1.1 200 OK
< Content-Length: 728
< Etag: "f1b486ae2987cb69b920efd9b67b4f196948c797"
< Content-Type: text/plain
< Server: pyocci OCCI/1.1
<
Category: networkinterface; scheme="http://schemas.ogf.org/occi/infrastructure#";
class="kind"
Category: ipnetworkinterface; scheme="http://schemas.ogf.org/occi/infrastructure#";
class="mixin"
X-OCCI-Attribute: source="http://localhost:8888/compute/aa22d620-ced4-e66a-a0ce-
f3c4777c93cf"
X-OCCI-Attribute: target="http://localhost:8888/network/b3a59cbc-6715-624e-8f67-
d221d18815b7"
X-OCCI-Attribute: occi.networkinterface.ip="10.0.0.1"
X-OCCI-Attribute: occi.networkinterface.gateway="10.0.0.11"
X-OCCI-Attribute: occi.networkinterface.mac="aa:bb:cc:dd:ee:ff"
X-OCCI-Attribute: occi.networkinterface.interface="eth0"
X-OCCI-Attribute: occi.networkinterface.state="up"
X-OCCI-Attribute: occi.networkinterface.allocation="dynamic"
```



Trigger the „start“ action

```
> POST /compute/2741e6f3-84bb-4bfb-a0a5-c5787e49065e?action=start
HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
  OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
> Content-type: text/occi
> Category: start; scheme="http://schemas.ogf.org/occi/
  infrastructure/compute/action"
>

< HTTP/1.1 200 OK
< Content-Length: 2
< Content-Type: text/html; charset=UTF-8
< Server: pyocci OCCI/1.1
<
OK
```



Add a user-defined Tag

```
> POST /.well-known/org/ogf/occi/ HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
> Content-Type: text/occi
> Category: my_tag; scheme="http://example.com/tag"; location="/tag/"
>

< HTTP/1.1 200 OK
< Content-Length: 0
< Content-Type: text/html; charset=UTF-8
< Server: pyocci OCCI/1.1
<
```



Update the Tag collection

```
> PUT /tag/ HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
> Content-Type: text/occi
> X-OCCI-Location: /storage/abc,/network/123
>

< HTTP/1.1 200 OK
< Content-Length: 0
< Content-Type: text/html; charset=UTF-8
< Server: pyocci OCCI/1.1
<
```



Reviewing the Storage res.

```
> GET /storage/abc HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
>

< HTTP/1.1 200 OK
< Content-Length: 367
< Etag: "b3aaa18bc4e751205a3c6ea07a6b564a0d746741"
< Content-Type: text/plain
< Server: pyocci OCCI/1.1
<
Category: storage; scheme="http://schemas.ogf.org/occi/
infrastructure#"; class="kind"
Category: my_tag; scheme="http://example.com/tag#"; class="mixin"
X-OCCI-Attribute: occi.storage.state="offline"
X-OCCI-Attribute: occi.storage.size="1"
Link: <http://localhost:8888/storage/abc?action=online>; rel="http://
schemas.ogf.org/occi/infrastructure/storage/action#online"
```



Reviewing the Tag coll.

```
> GET /tag/ HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: text/uri-list
>

< HTTP/1.1 200 OK
< Content-Length: 68
< Etag: "c87c7be990dc34e7b230ba3eea970cd4674ef78b"
< Content-Type: text/uri-list
< Server: pyocci OCCI/1.1
<
http://localhost:8888/network/123
http://localhost:8888/storage/abc
```



Destroying res. instance

```
> DELETE /storage/abc HTTP/1.1#
> User-Agent: curl/7.21.1 (i386-pc-solaris2.11) libcurl/7.21.1
OpenSSL/0.9.8o zlib/1.2.3 libidn/1.9
> Host: localhost:8888
> Accept: */*
>

< HTTP/1.1 200 OK
< Content-Length: 2
< Content-Type: text/html; charset=UTF-8
< Server: pyocci OCCI/1.1
<
OK
```



Some things we couldn't demo

- Templates (a requirement for the compute resource)
- support for partial / full updates
- Filtering mechanisms based on Attributes & Categories
- Tags - lets tag the compute with “my-blog” and storage with “static-content”
- Handling of collection of Kinds and Mixins
 - adding, removing, updating collections
 - Performing actions on collections
- Batch operation (Multipart)
- Return code handling (200, 201, 202, and Error codes)
- All the nice HTTP stuff (Versioning, Caching, security, etc etc, etc, ...)
- ...



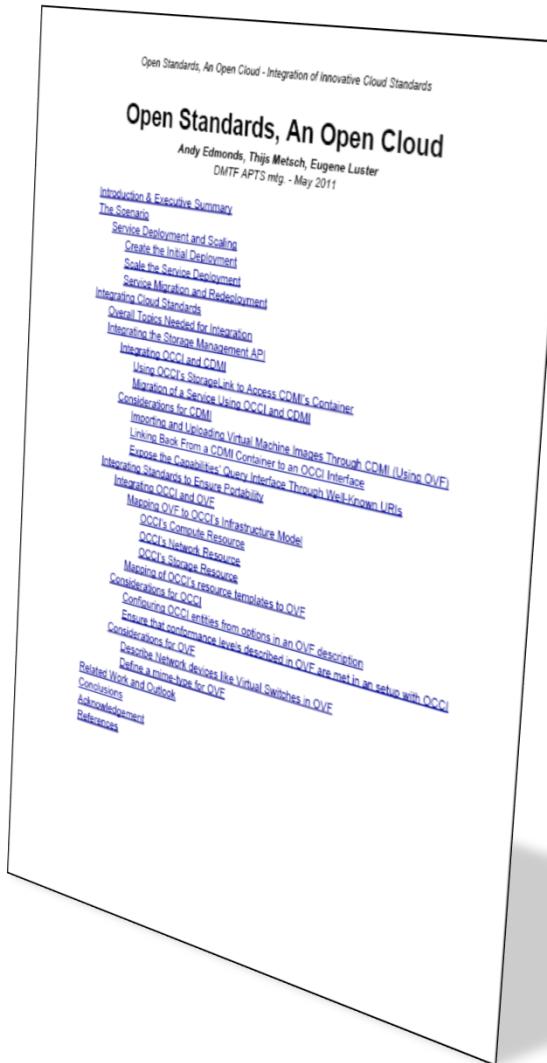
WRAP-UP & CONCLUSIONS

Collaborations

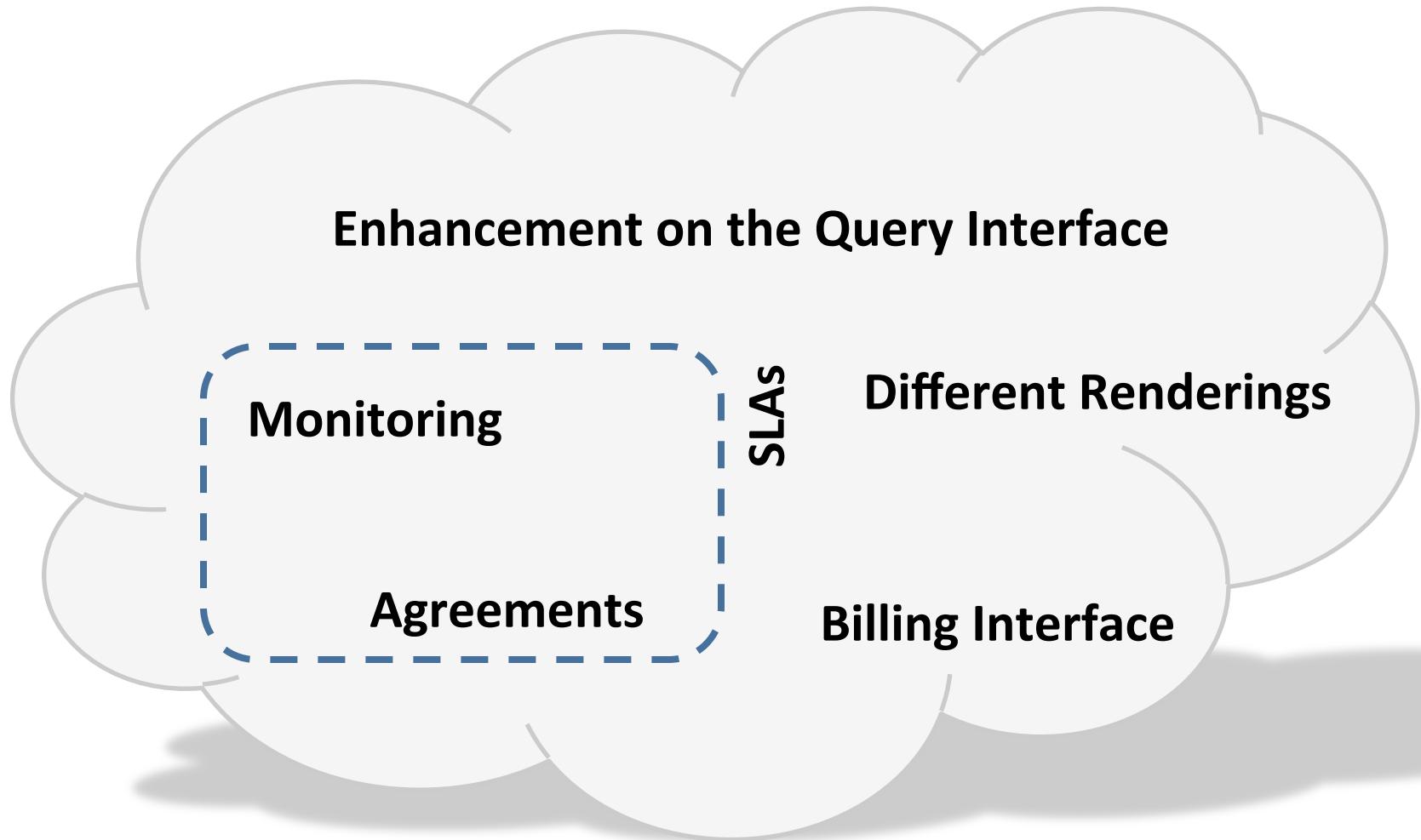




OVF, CDMI and OCCI



Future Work





Website

The screenshot shows the Occi website. At the top left is the Occi logo, which features a red cloud-like shape containing three stylized human figures. To the right of the logo is the word "Occi" in a large, bold, black font, with "Open Cloud Computing Interface" in smaller text below it. On the far right of the header is a navigation bar with links: Home, About, Community, and Blog, all in red text. Below the header is a large banner for "R2AD". The banner has a dark background with the text "OCCI & R2AD" and a link to "http://www.r2ad.com/cloudclient.html". To the right of the banner is a screenshot of a mobile device displaying the R2AD Cloud Client interface, showing a list of compute resources. Below the banner is a section titled "An Open Community Leading Cloud Standards" in red text. A red button to the right contains the text "One of the first Standards in Clouds". At the bottom, there is descriptive text about the Open Cloud Computing Interface and its history.

Occi
Open Cloud Computing Interface

Home About Community Blog

R2AD®

OCCI & R2AD
For more information on R2AD's OCCI/CDMI client visit: <http://www.r2ad.com/cloudclient.html>

An Open Community Leading Cloud Standards

One of the first Standards in Clouds

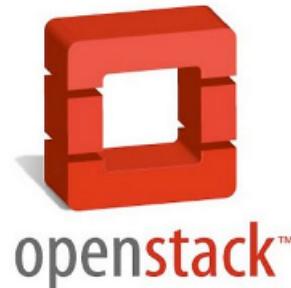
The Open Cloud Computing Interface comprises a set of open community-lead specifications delivered through the [Open Grid Forum](#).

OCCI is a Protocol and API for all kinds of Management tasks. OCCI was originally initiated to create a remote management API for IaaS model based Services, allowing for the development of interoperable tools for common tasks including deployment, autonomic scaling and monitoring. It has since evolved into a flexible API with a strong focus on **integration, portability, interoperability and innovation** while still offering a high degree of extensibility. The current release of the Open Cloud Computing Interface is suitable to serve many other models in addition to **IaaS**, including e.g. **PaaS** and **SaaS**.

Implementations



jclouds™



BiG Grid
the dutch e-science grid

OpenNebula.org

∴ R2AD®



INFN



CompatibleOne



Morfeo Claudia



Tools

OCCI compliance test

OCCI service URL: Go Reset

Session information

Login required?

Username:

Password:

Service information

Server version:
pyocci OCCI/1.1

Number of registered categories:
18

Tests

Checking for correct version information:	OK
Checking completeness of infrastructure model:	OK
Checking correct handling of Content-type/Accept headers:	OK
Testing instantiation of compute/storage/network kinds:	OK
Testing correct handling of user-defined mixins (tagging/grouping):	OK
Testing links between compute/storage compute/network:	OK
Triggering actions on compute/network/storage kinds:	OK
Testing filter mechanisms using Categories:	OK
Testing correct behaviour on location and "normal" paths:	OK
Simple syntax checks:	OK

NOTE: Passing all tests only indicates that the service you are testing is OCCI compliant - IT DOES NOT GUARANTEE IT!

Quit



☺ dizz / [occi-grammar](#)

[Source](#) [Commits](#) [Network](#) [Pull Requests \(0\)](#) [Issues \(6\)](#)

[Switch Branches \(3\) ▾](#) [Switch Tags \(0\)](#) [Branch List](#)

ANTLR Grammar for the OCCI HTTP Text Rendering — [Read more](#)
<http://www.occi-wg.org>

HTTP [Git Read-Only](#) <https://github.com/dizz/occi-grammar.git>

Conclusions



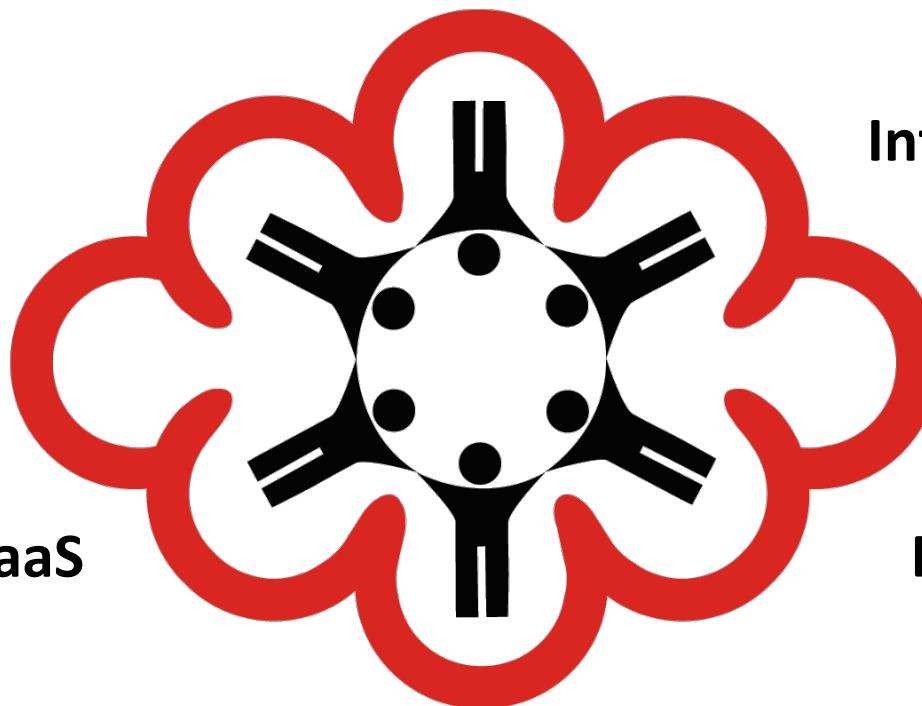
Flexible & Extensible

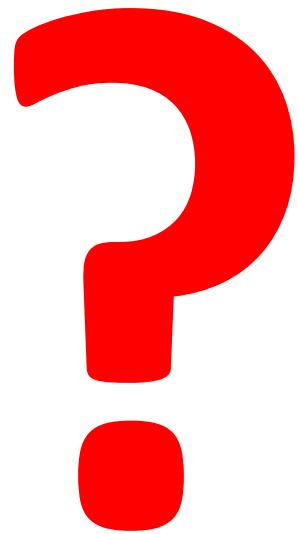
RESTful

Interoperability

Not bound to IaaS

Discoverable





<http://www.occi-wg.org>

@occiwg

#occi on irc.freenode.org

occi-wg@ogf.org



BACKUP



Multipart Create Request

```
> POST /compute/ HTTP/1.1
> Content-Length: 774
> Content-Type: multipart/form-data; boundary=--Xr4lz31I-C82sMQDIH3xPJkHf1cAMPdD
> Host: localhost:8080
> Connection: Keep-Alive
> User-Agent: Apache-HttpClient/4.1.1 (java 1.5)
>
> --Xr4lz31I-C82sMQDIH3xPJkHf1cAMPdD
> Content-Disposition: form-data; name="2"
> Content-Type: text/plain; charset=US-ASCII
> Content-Transfer-Encoding: 8bit
>
> Category: compute; scheme='http://schemas.ogf.org/occi/infrastructure#'; class='kind'
> X-OCCI-Attribute: occi.compute.hostname='multi2', occi.compute.cores=1,
occi.compute.memory=256
> --Xr4lz31I-C82sMQDIH3xPJkHf1cAMPdD
> Content-Disposition: form-data; name="3"
> Content-Type: text/plain; charset=US-ASCII
> Content-Transfer-Encoding: 8bit
>
> Category: compute; scheme='http://schemas.ogf.org/occi/infrastructure#'; class='kind'
> X-OCCI-Attribute: occi.compute.hostname='multi2', occi.compute.cores=1,
occi.compute.memory=256
> --Xr4lz31I-C82sMQDIH3xPJkHf1cAMPdD--
```

Creation of 2 Computes
Boundary separates the parts



Multipart Retrieve Request

```
> GET /compute/ HTTP/1.1
> User-Agent: curl/7.21.6 (x86_64-apple-
darwin10.7.0) libcurl/7.21.6 OpenSSL/1.0.0d zlib/
1.2.5 libidn/1.22
> Host: localhost:8080
> Accept: multipart/form-data; boundary=123-my-
boundary-456
```

Client specifies the boundary



Multipart Retrieve Response

```
< HTTP/1.1 200 OK
< Server: Apache-Coyote/1.1
< Server: OCCI/1.1
< Content-Type: multipart/form-data; boundary=123-my-boundary-456
< Content-Length: 1842
< Date: Wed, 08 Jun 2011 09:37:41 GMT
<
< --123-my-boundary-456
< Content-Disposition: form-data; name="1"
< Content-Type: text/plain; charset=US-ASCII
< Content-Transfer-Encoding: 8bit
<
< Category: compute; scheme='http://schemas.ogf.org/occi/infrastructure#'; class='kind', ubuntu_10-11;
scheme='http://sla-at-soi.eu/occi/templates#'; class='mixin'
< X-OCCI-Attribute: occi.compute.architecture='x86', occi.core.summary='Summary', occi.compute.hostname='multi2',
occi.core.title='Title', occi.compute.state='active', occi.core.id='123-123-123'
< Link: </compute/234-234-234?action=suspend>; rel='http://schemas.ogf.org/occi/infrastructure/compute/
action#suspend', [...]
< --123-my-boundary-456
< Content-Disposition: form-data; name="1"
< Content-Type: text/plain; charset=US-ASCII
< Content-Transfer-Encoding: 8bit

< Category: compute; scheme='http://schemas.ogf.org/occi/infrastructure#'; class='kind', ubuntu_10-11;
scheme='http://sla-at-soi.eu/occi/templates#'; class='mixin'
< X-OCCI-Attribute: occi.compute.architecture='x86', occi.compute.state='active', occi.core.summary='Summary',
occi.compute.hostname='multi2', occi.core.title='Title', occi.core.id='456-456-456'
< Link: </compute/123-123-123?action=suspend>; rel='http://schemas.ogf.org/occi/infrastructure/compute/
action#suspend' [...]
< --123-my-boundary-456--
```

Note Boundary
Note **occi.core.id**