



OCCI Walkthrough

About



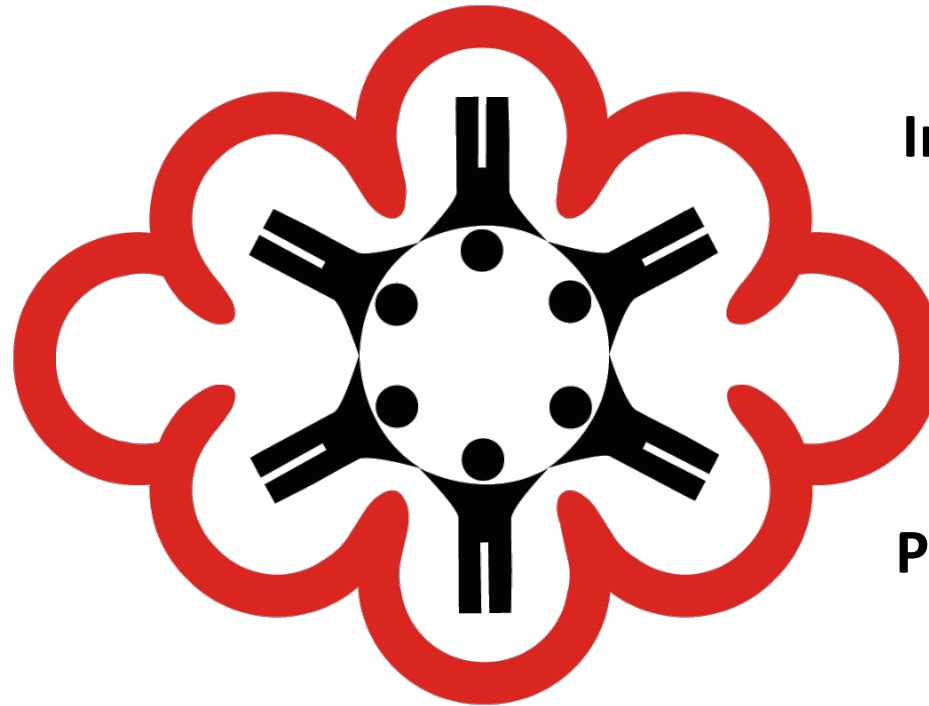
Truly Open & Defending it!

Innovation

Interoperability

Integration

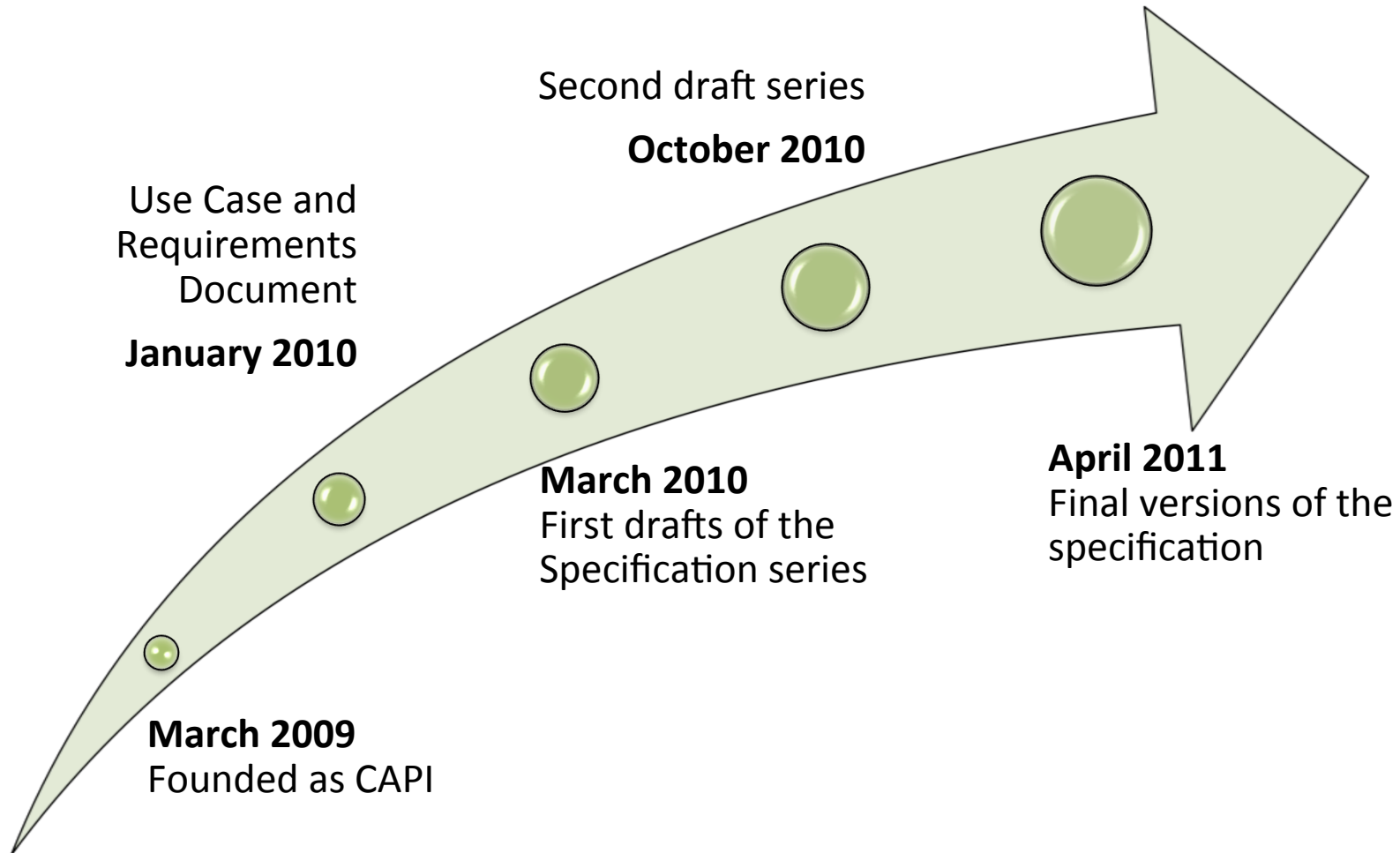
Portability



Occi

Open Cloud Computing Interface

History



Impact



NIST

**National Institute of
Standards and Technology**



**WIRTSCHAFT.
WACHSTUM.
WOHLSTAND.**

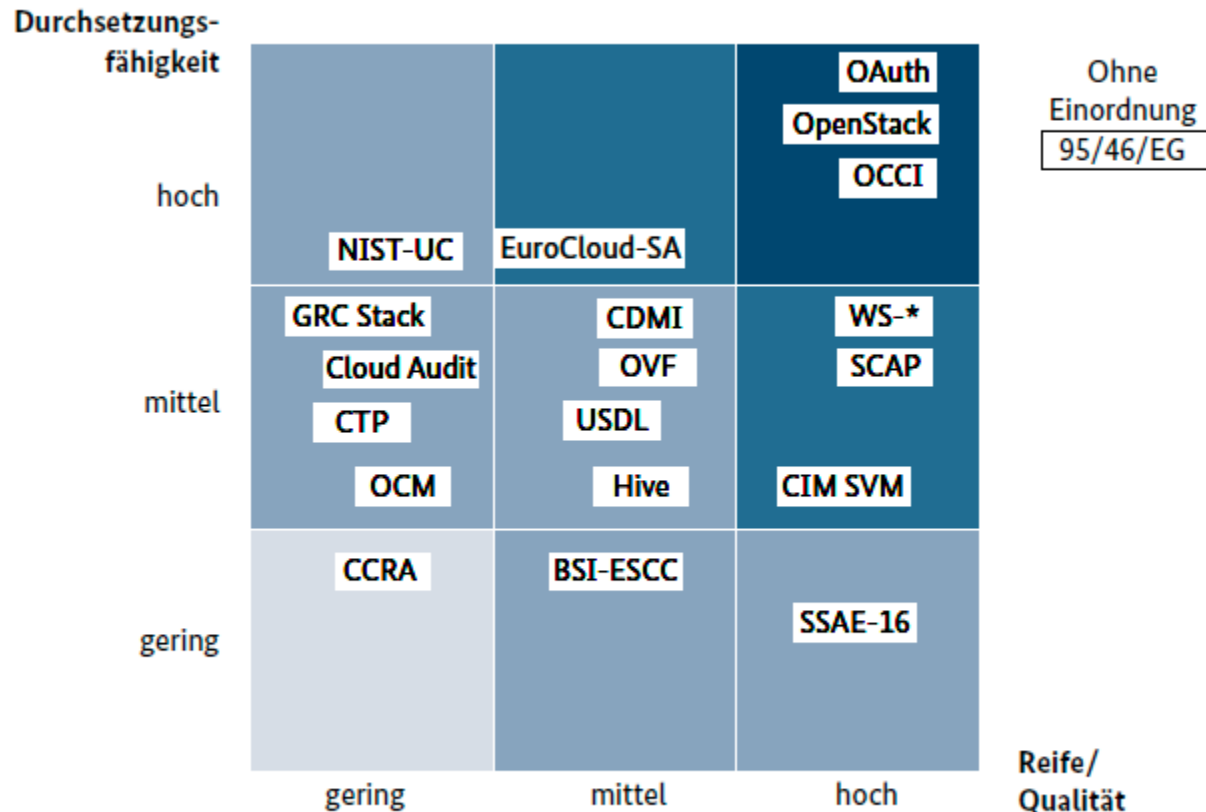
<http://www.cloud-standards.org>



CabinetOffice



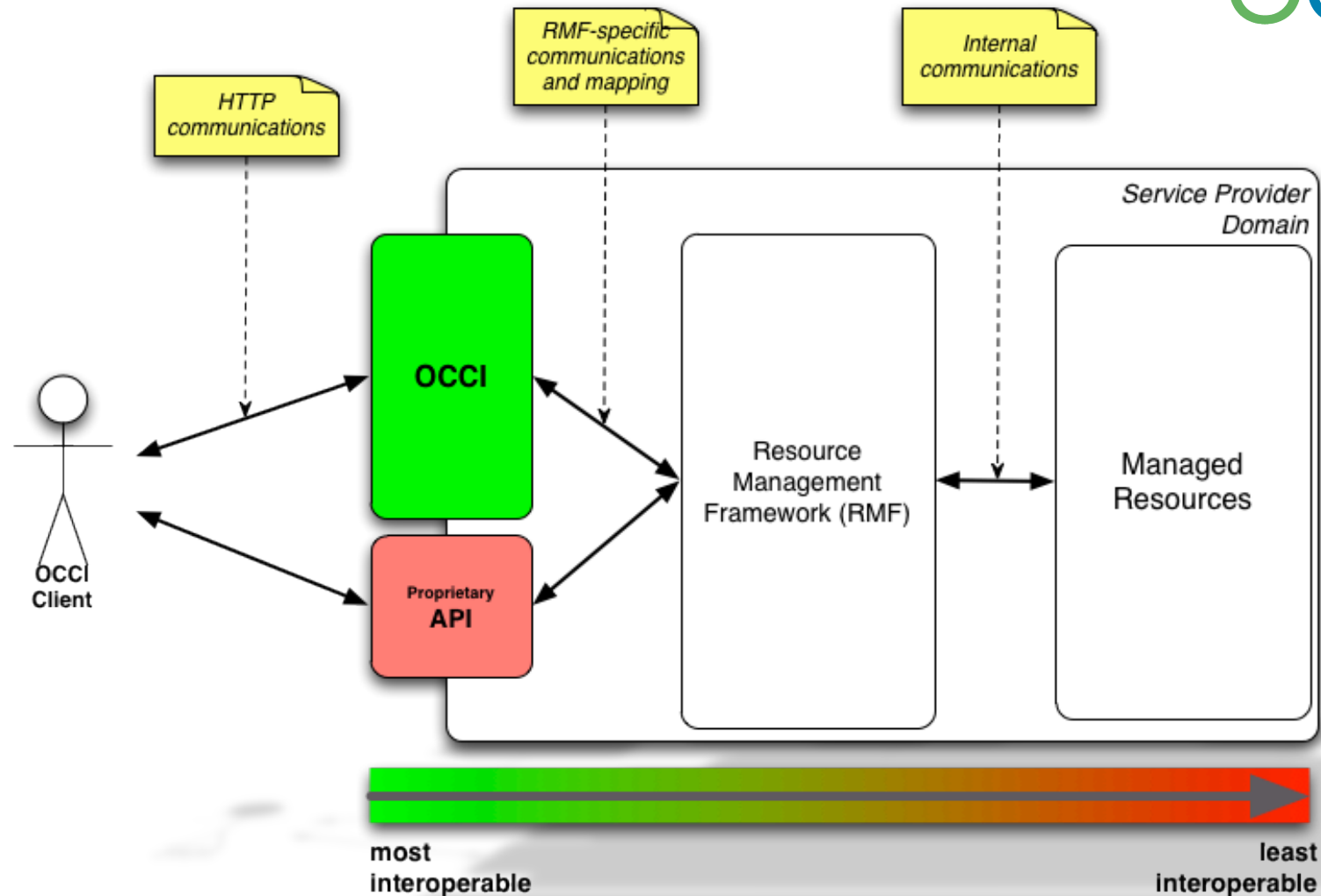
Abbildung 9: Bewertung der 20 „Cloud-Standards“



Quelle: Analyse von Booz & Company und FZI

Quelle: Das Normungs- und Standardisierungsumfeld von Cloud Computing

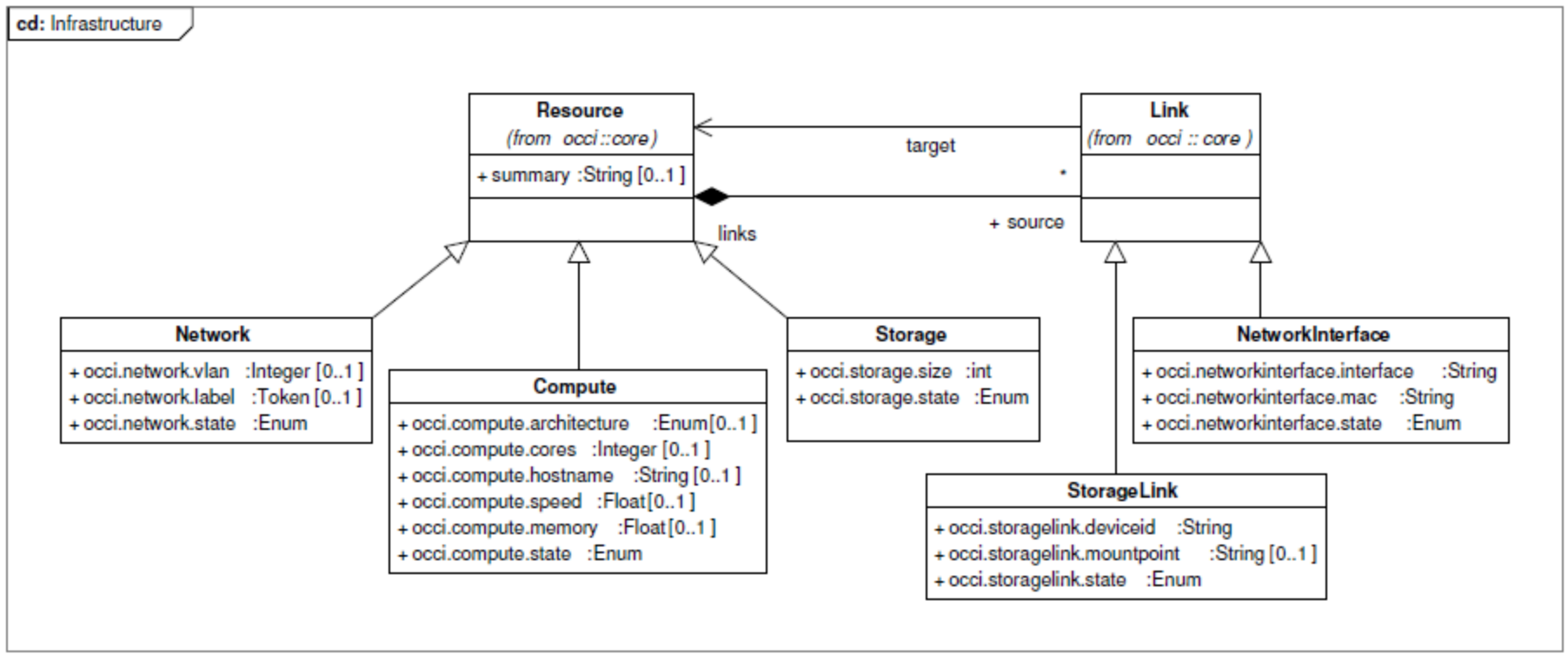
Positioning OCCI



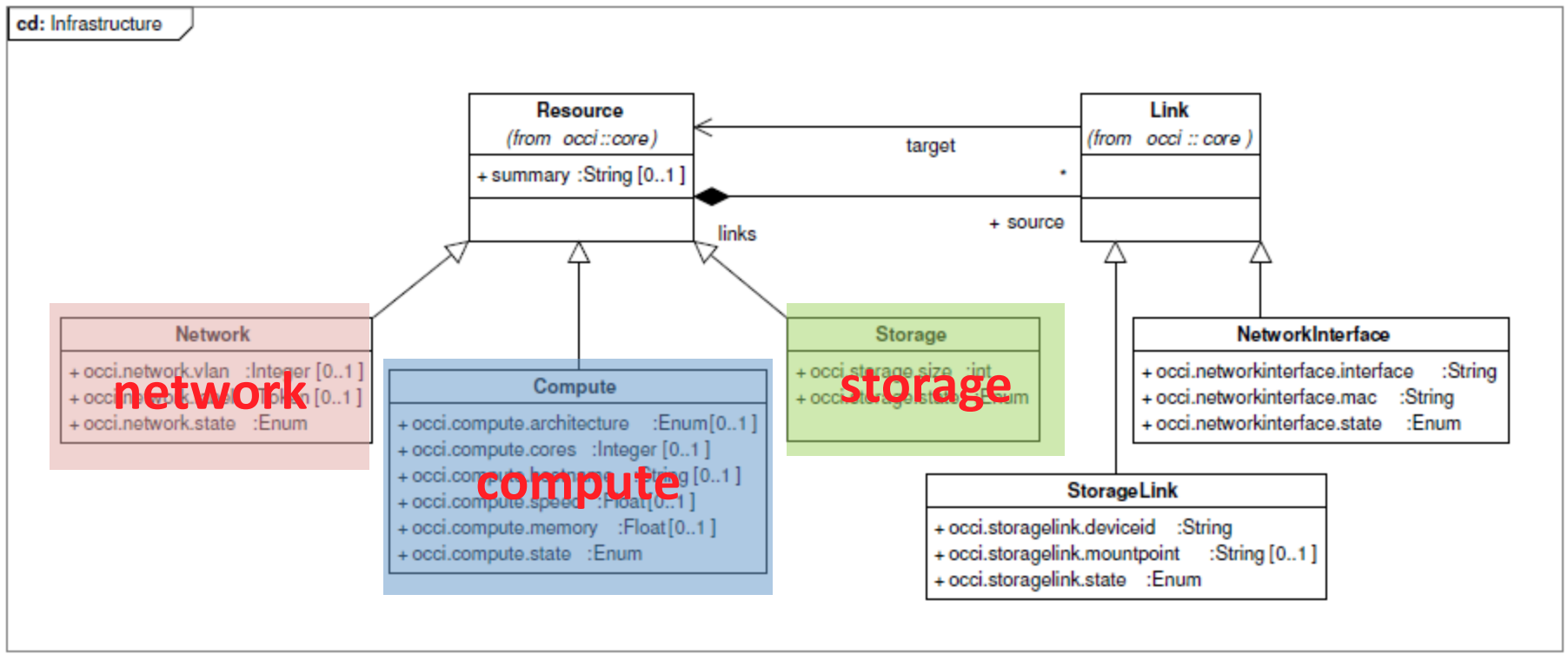


THE MODEL

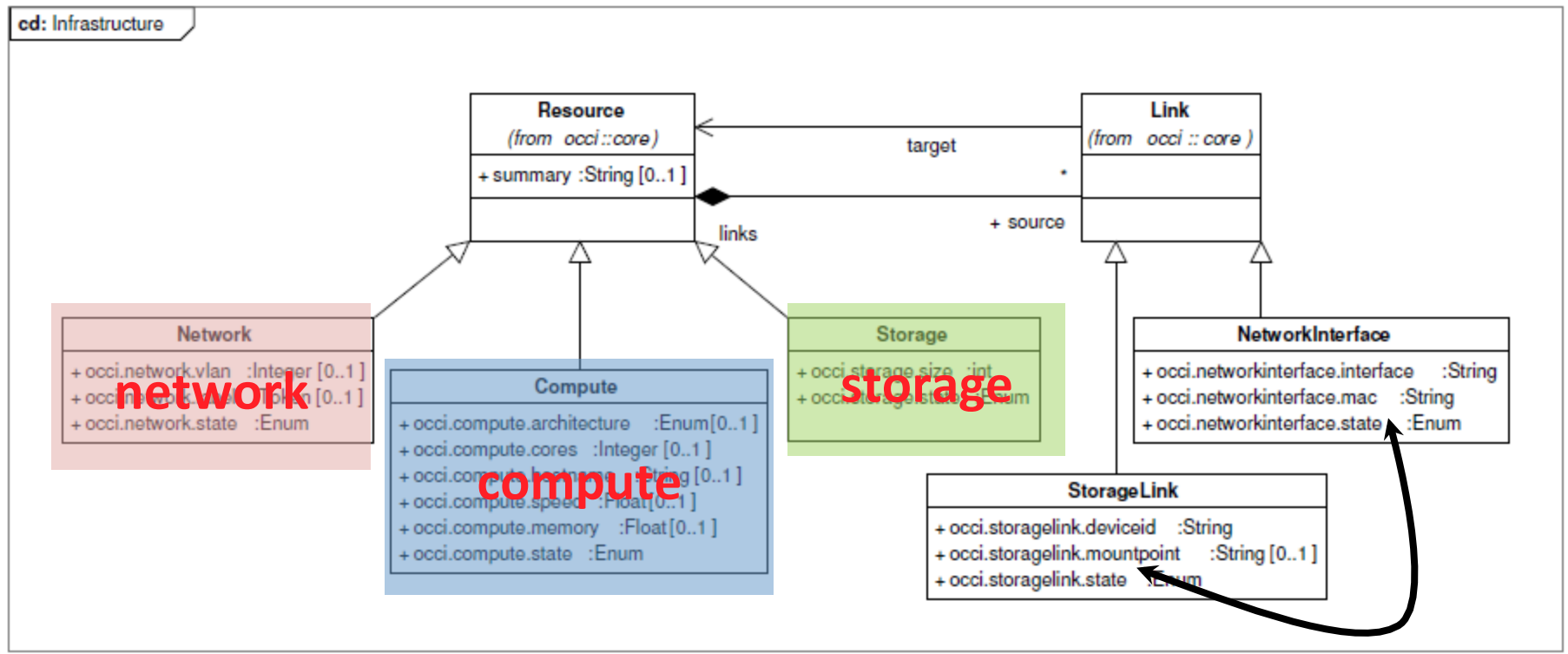
OCCL's Infrastructure Model Extension



OCCL's Infrastructure Model Extension



OCCL's Infrastructure Model Extension



Linking of the concrete 'resources'

How To Get There?



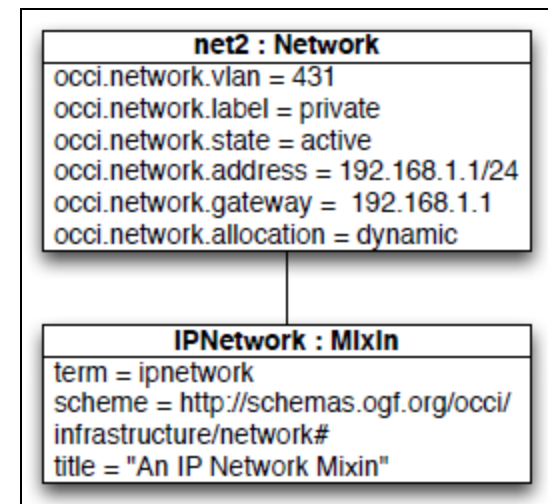
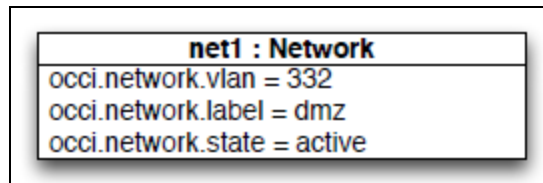
Mixin



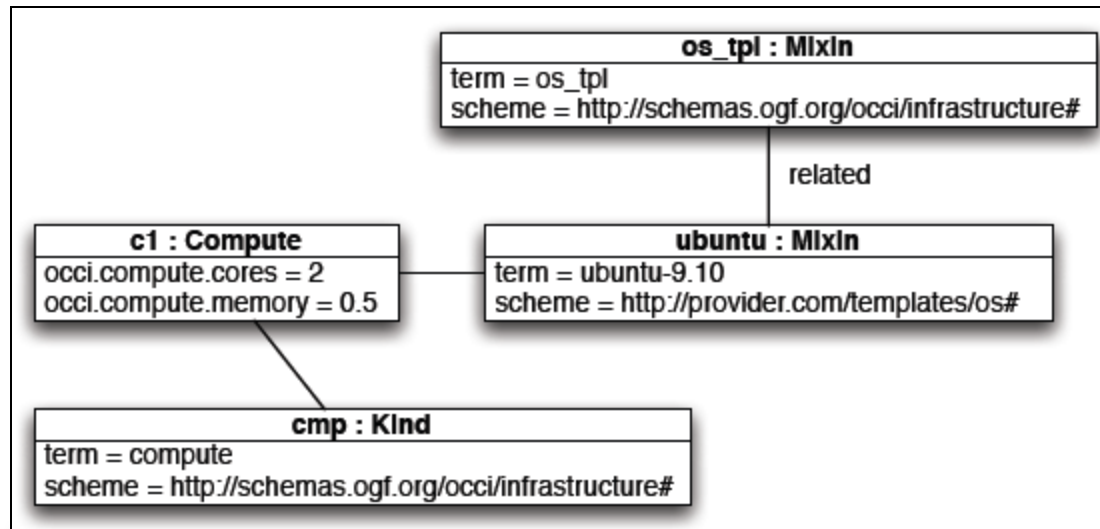
Mixins are an extension mechanism, which allows new resource capabilities to be added (dynamically) to resource instances.



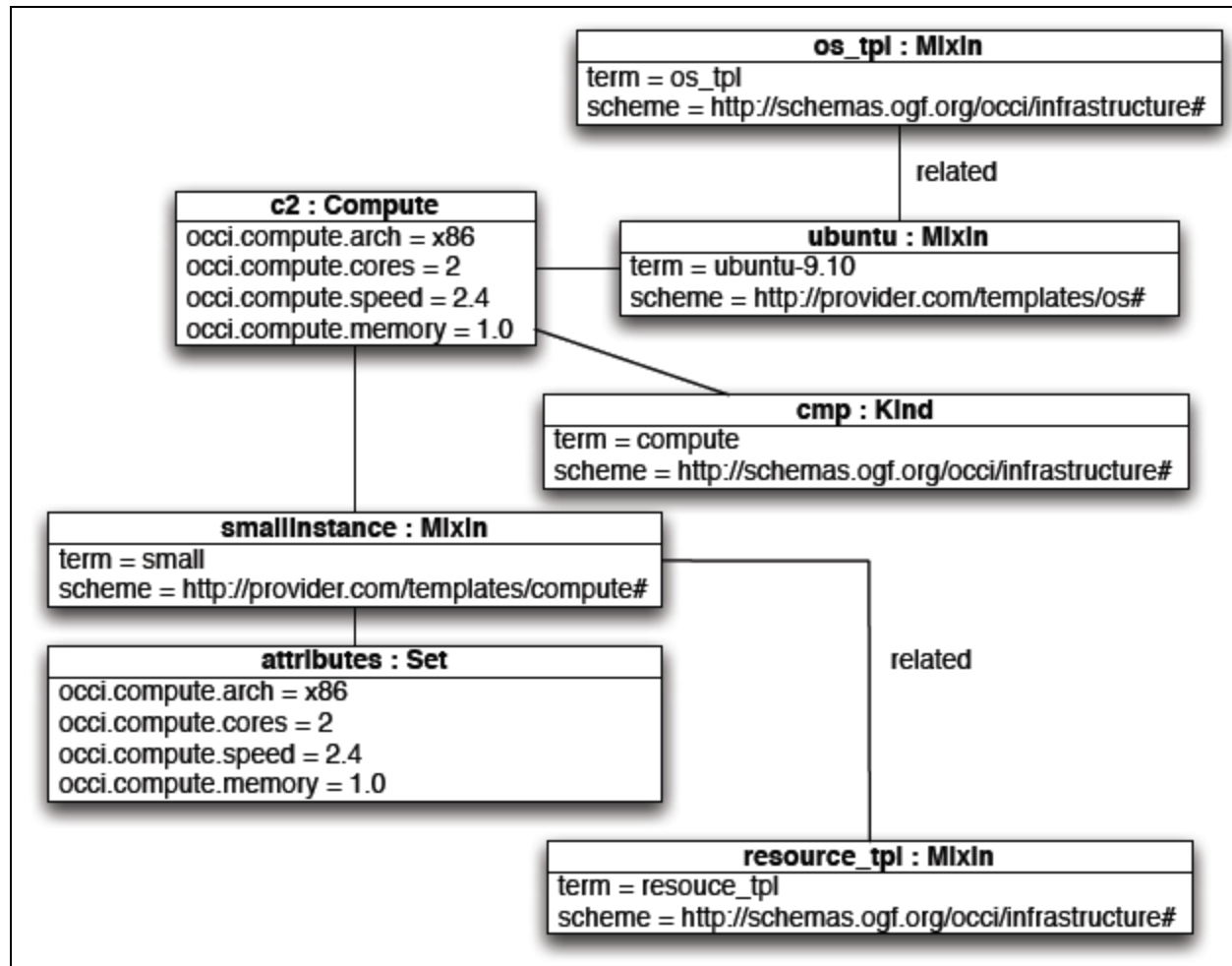
IPNetworking Mixin



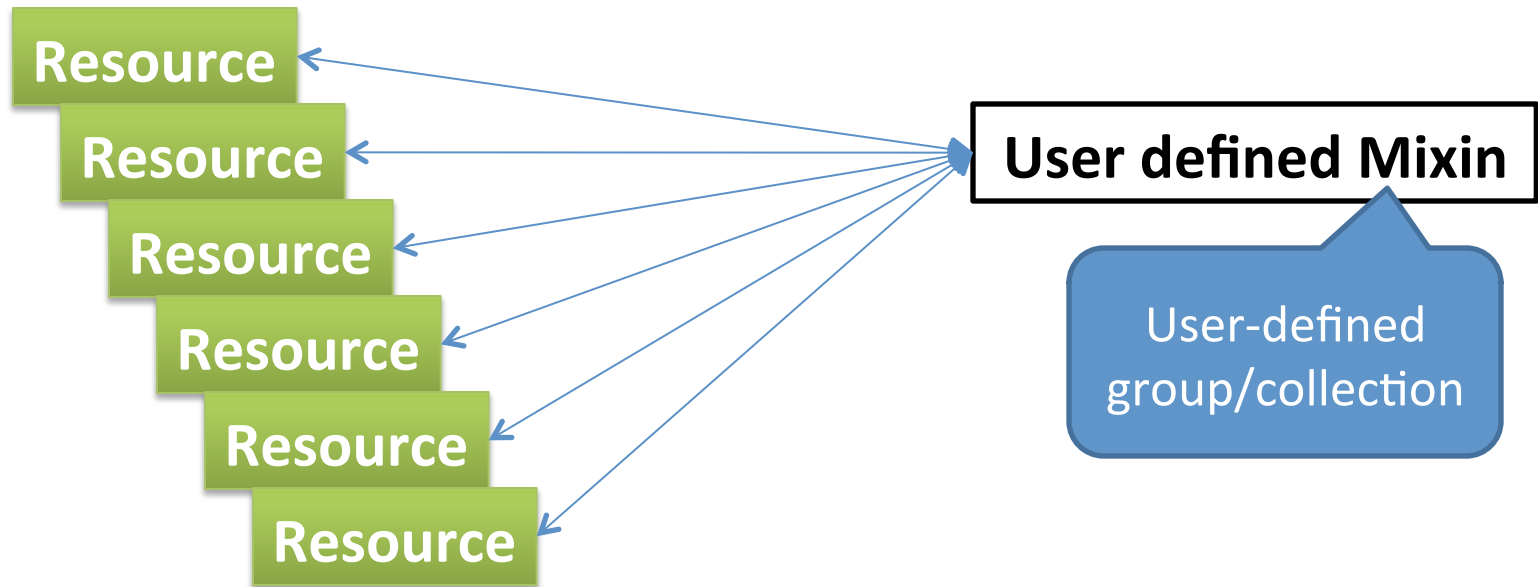
Mixins as Templates



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?

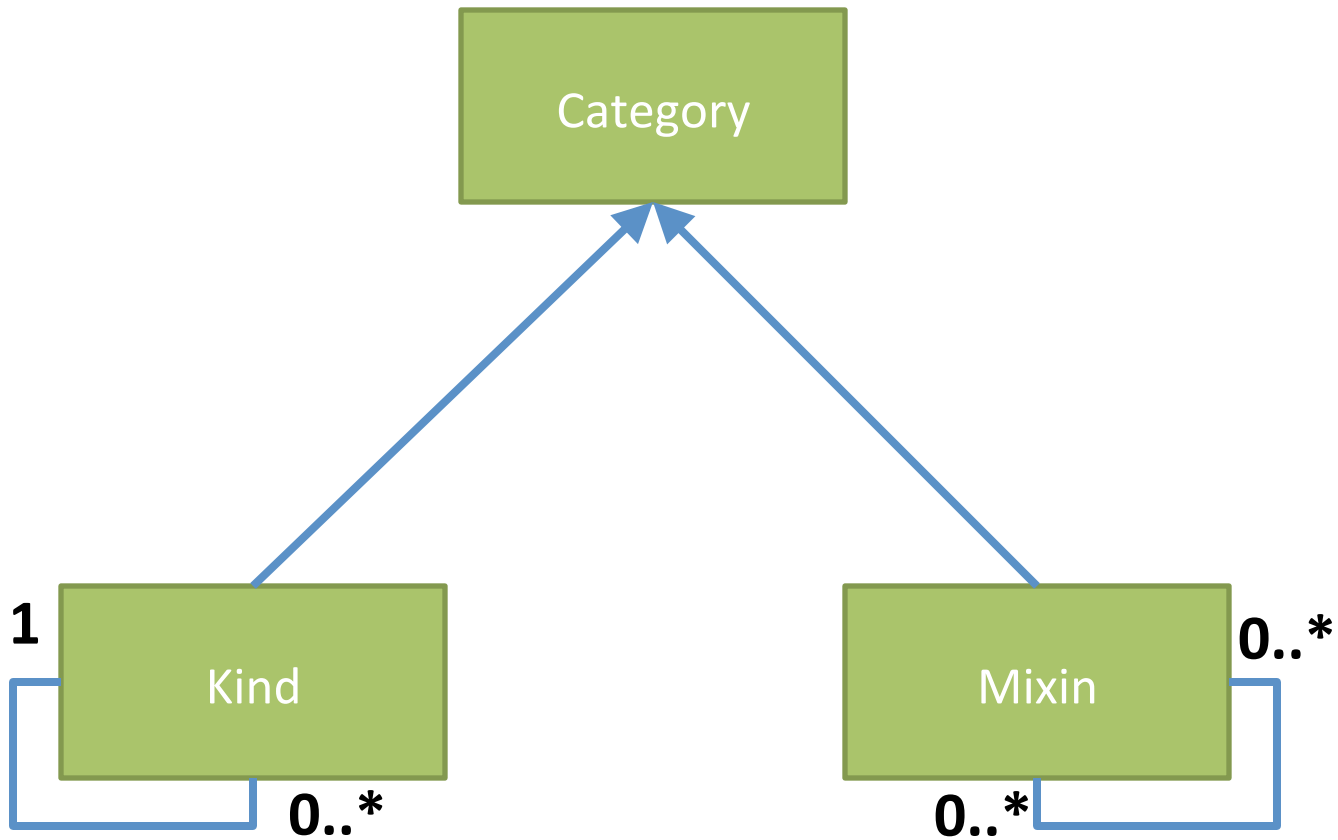
What about hierarchies?



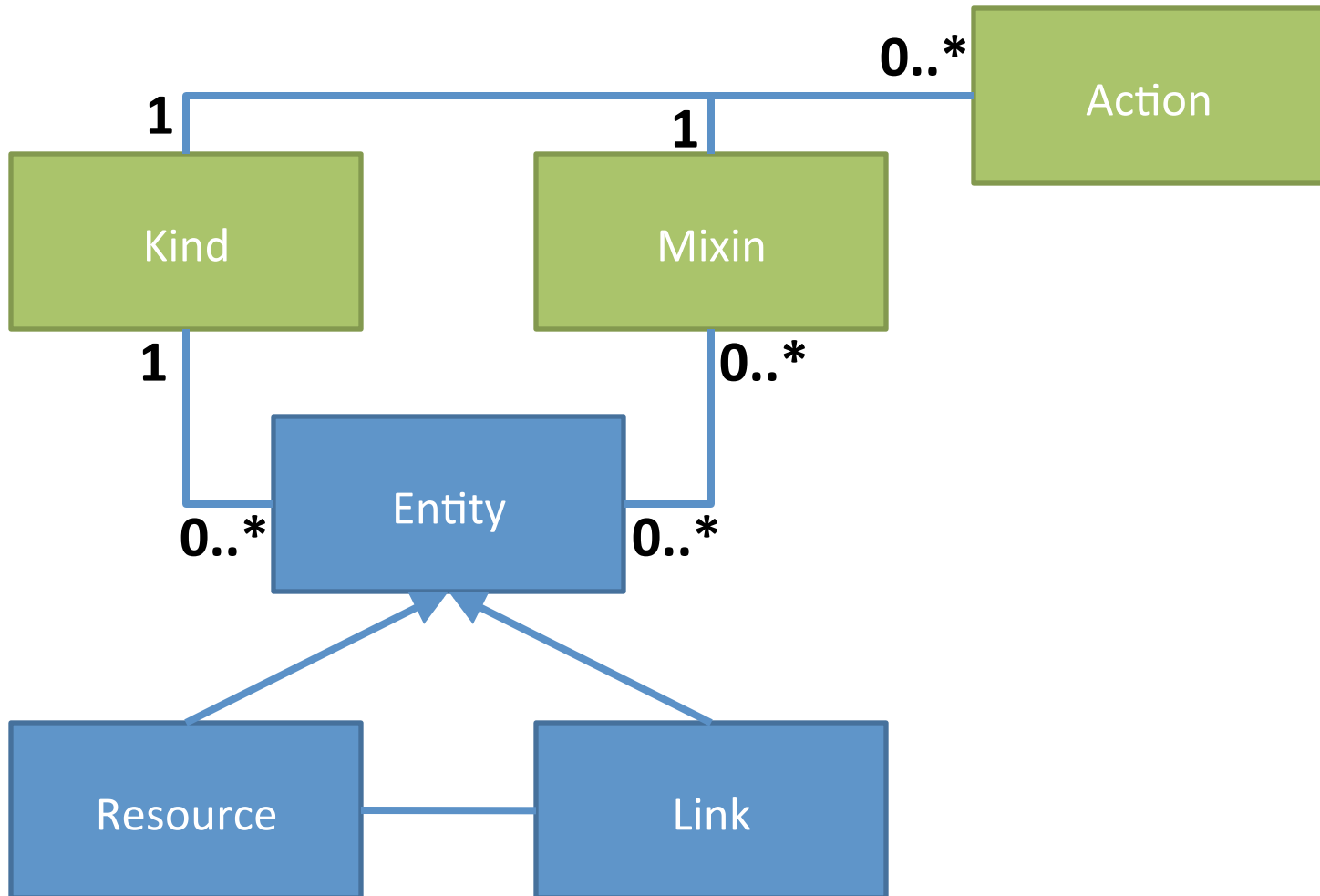
The solutions for all these questions...

OCCI'S CORE MODEL

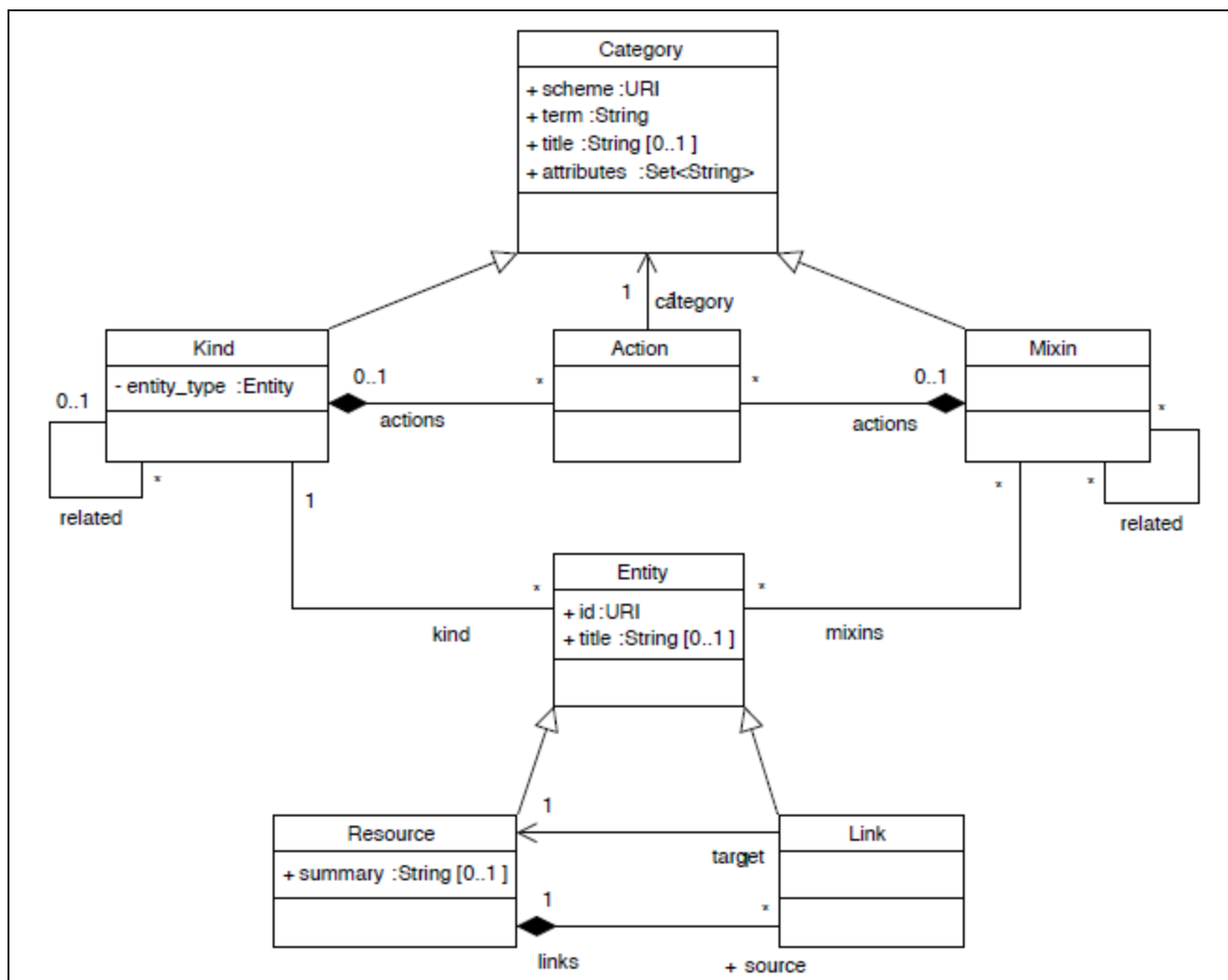
Categories



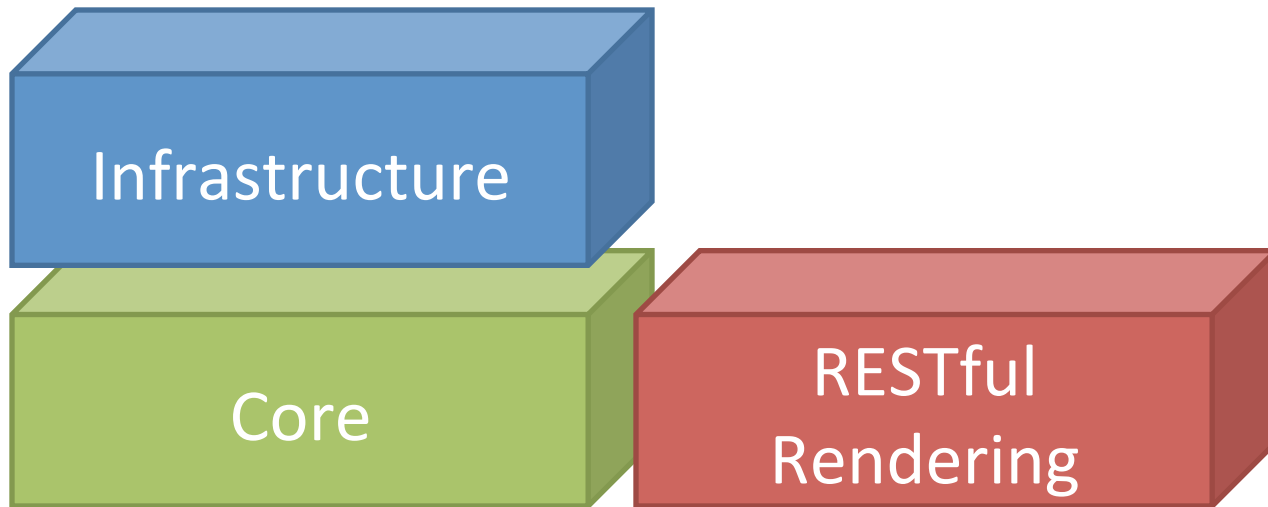
Entities



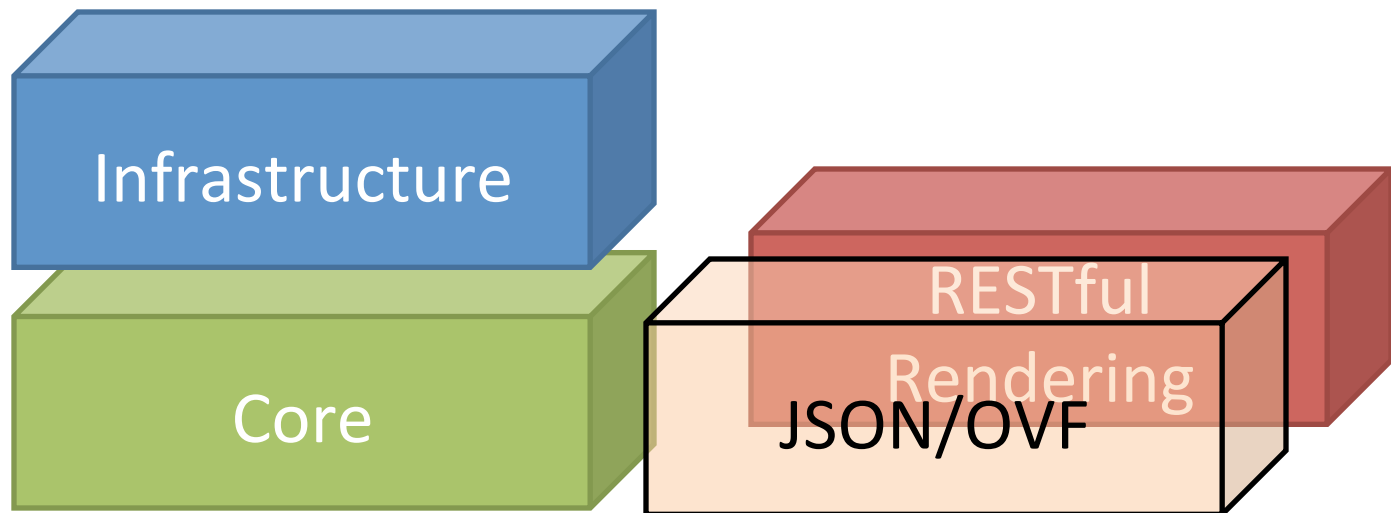
Core model



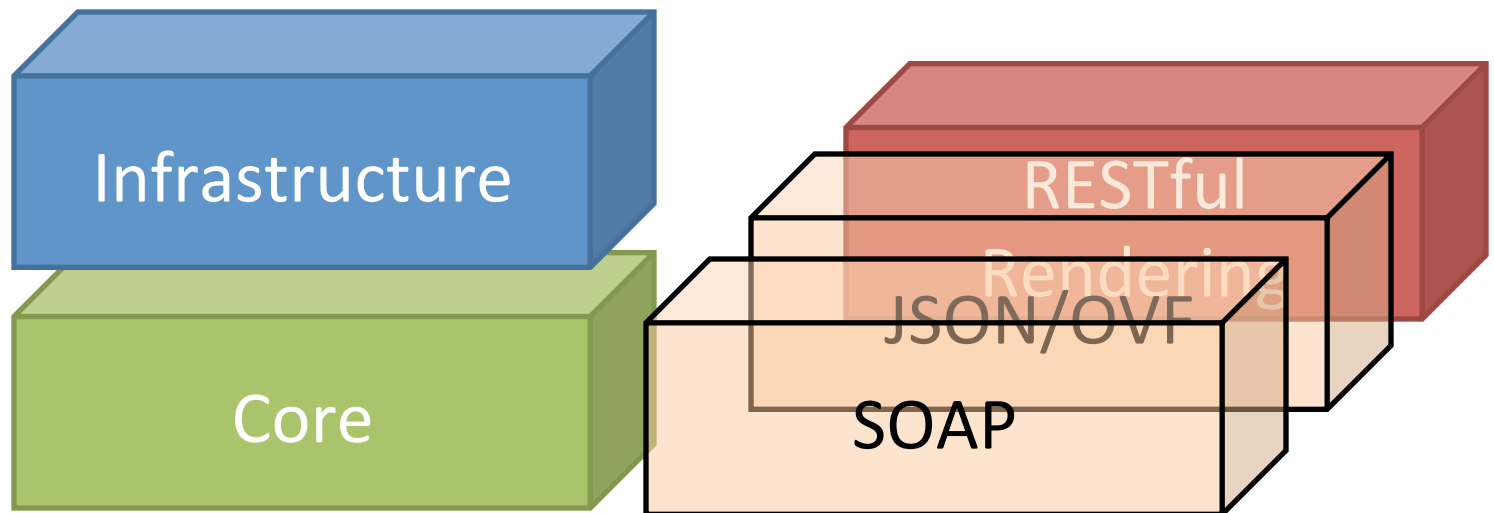
Building Blocks



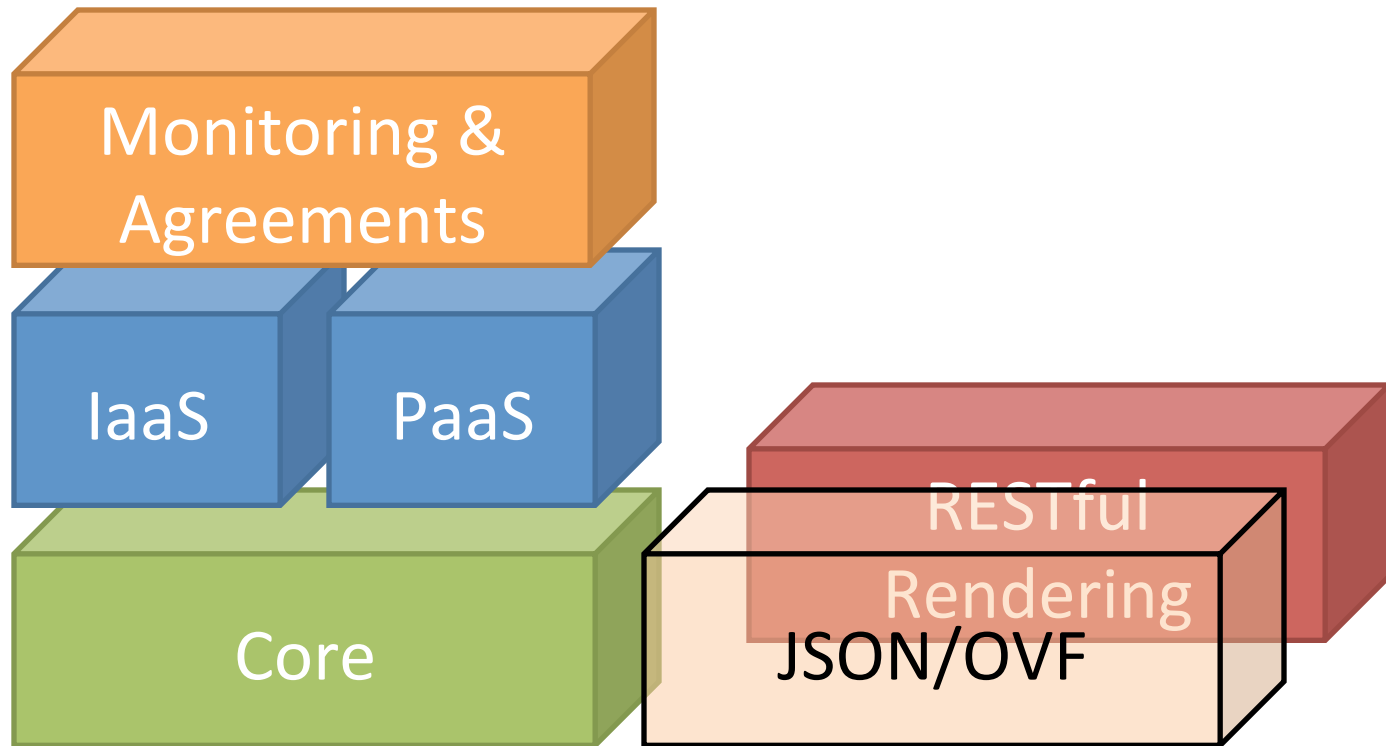
Building Blocks



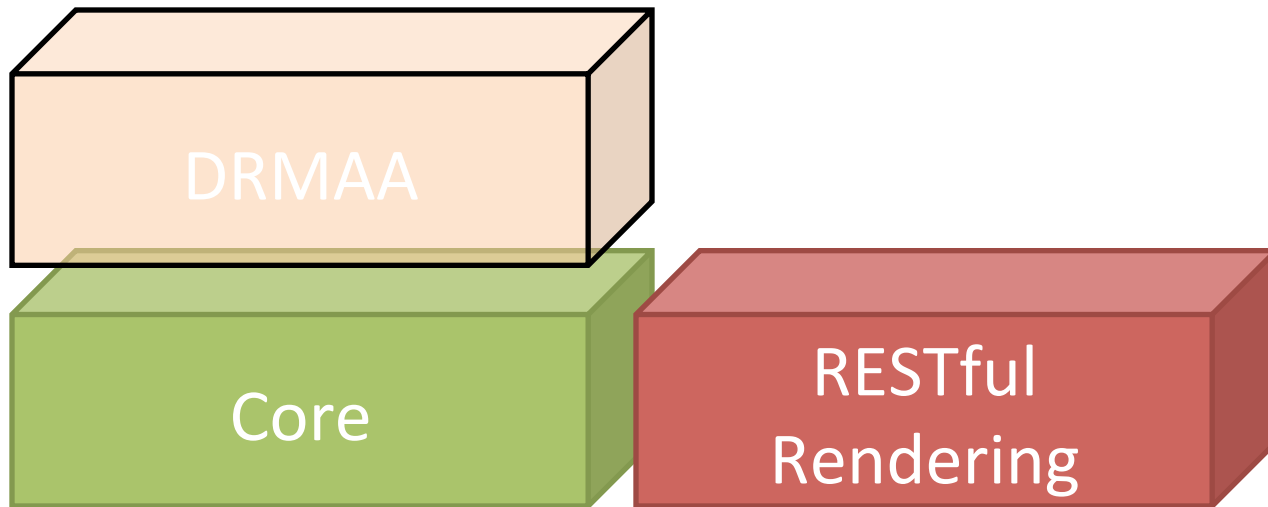
Building Blocks



Building Blocks



Building Blocks

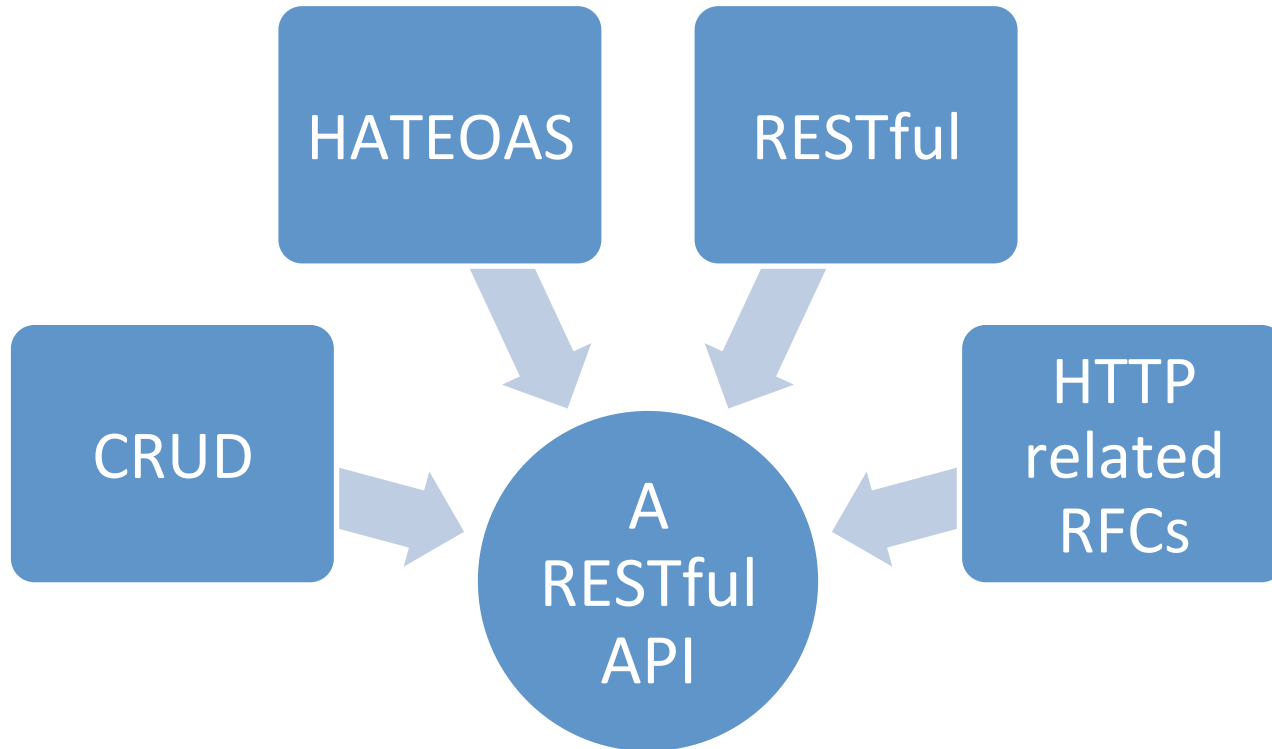


Query Interface

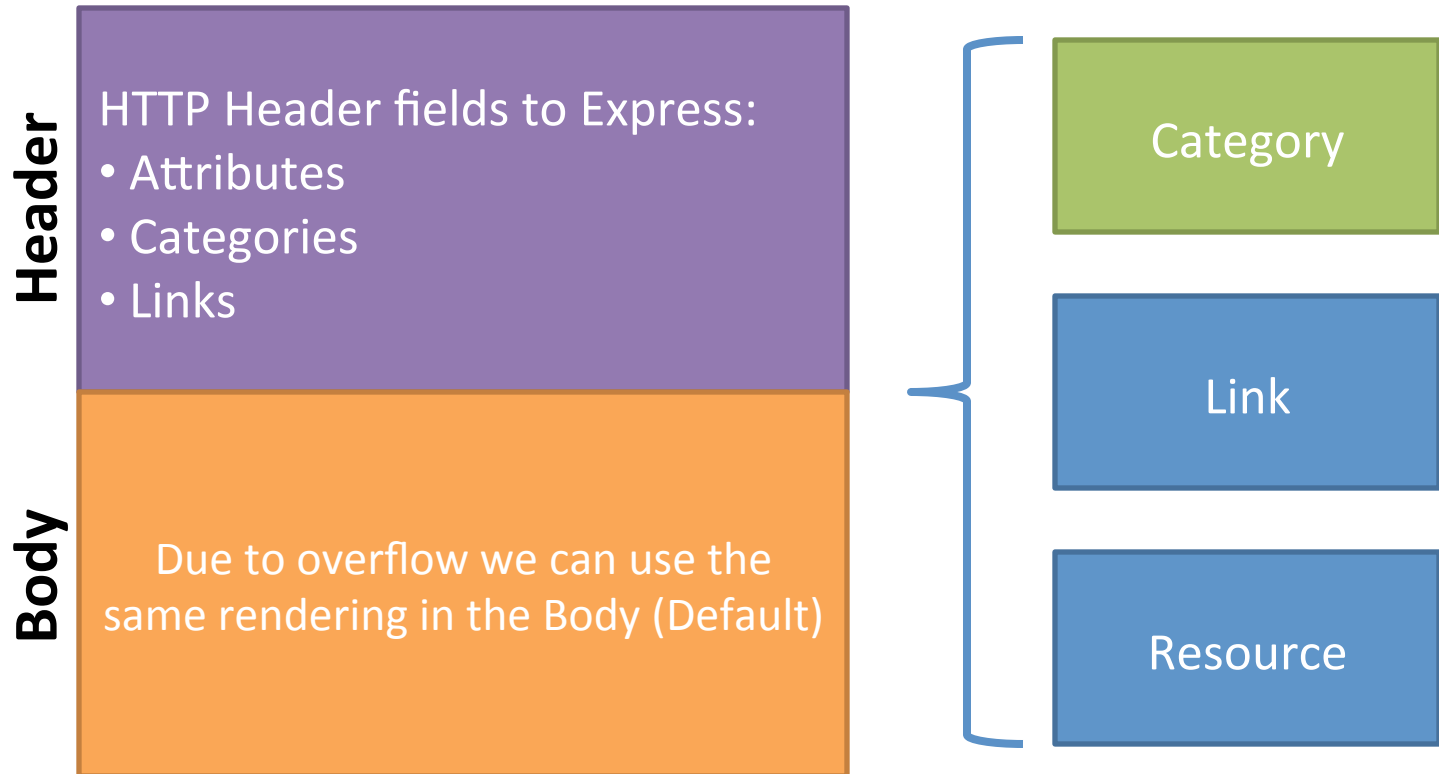


<http://www.example.com/.well-known/org/ogf/occi/>

A Rendering



Renderings



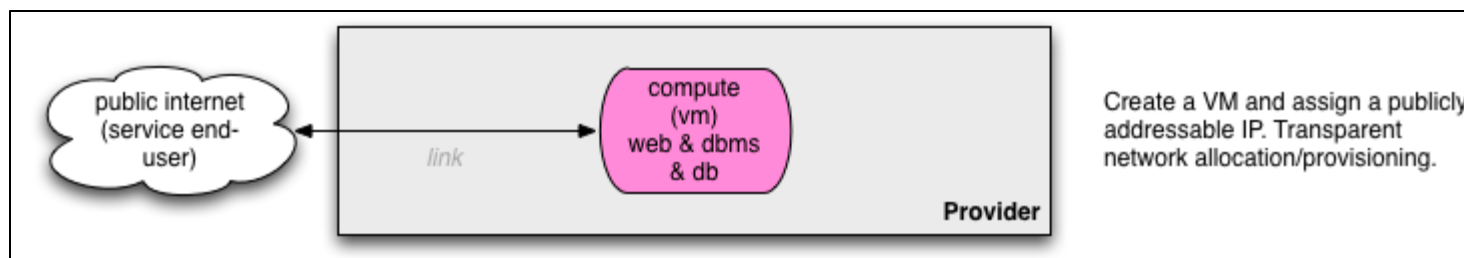
HTTP



| | | |
|-------|--|----|
| 3.6 | General HTTP Behaviors Adopted by OCCI | 22 |
| 3.6.1 | Security and Authentication | 22 |
| 3.6.2 | Additional Headers (Caching Headers) | 22 |
| 3.6.3 | Asynchronous Operations | 23 |
| 3.6.4 | Batch operations | 23 |
| 3.6.5 | Versioning | 23 |
| 3.6.6 | Content-type and Accept headers | 23 |
| 3.6.7 | RFC5785 Compliance | 25 |
| 3.6.8 | Return Codes | 25 |



EXAMPLES

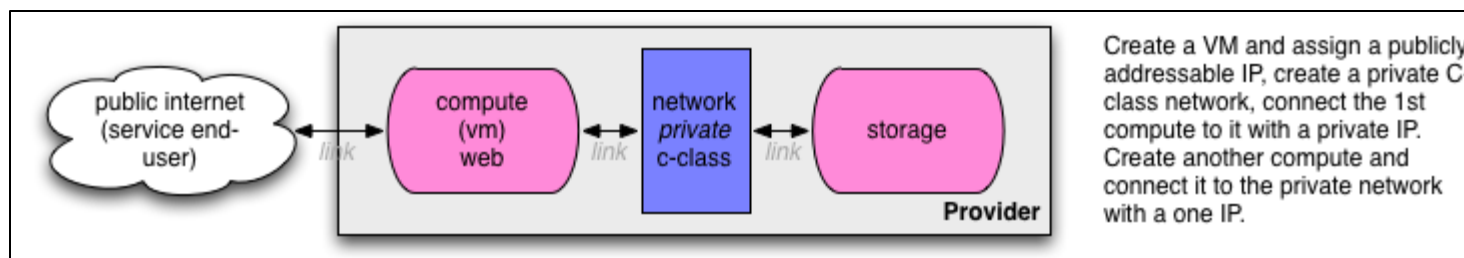


Very simple VM



```
> 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-OCCT-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-OCCE-Attribute: occi.storagelink.mountpoint="/mnt/"
> X-OCCE-Attribute: source=/compute/2741e6f3-84bb-4bfb-a0a5-
c5787e49065e
> X-OCCE-Attribute: target=/storage/123
>

< HTTP/1.1 200 OK
< Content-Length: 2
< Content-Type: text/html; charset=UTF-8
< Server: pyocci OCCE/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-OCCEI-Attribute: occi.compute.architecture="x86"
X-OCCEI-Attribute: occi.compute.state="inactive"
X-OCCEI-Attribute: occi.compute.speed="1"
X-OCCEI-Attribute: occi.compute.memory="2"
X-OCCEI-Attribute: occi.compute.cores="2"
X-OCCEI-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";occ
i.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-OCCT-Attribute: source="http://localhost:8888/compute/aa22d620-ced4-e66a-a0ce-
f3c4777c93cf"
X-OCCT-Attribute: target="http://localhost:8888/network/b3a59cbc-6715-624e-8f67-
d221d18815b7"
X-OCCT-Attribute: occi.networkinterface.ip="10.0.0.1"
X-OCCT-Attribute: occi.networkinterface.gateway="10.0.0.11"
X-OCCT-Attribute: occi.networkinterface.mac="aa:bb:cc:dd:ee:ff"
X-OCCT-Attribute: occi.networkinterface.interface="eth0"
X-OCCT-Attribute: occi.networkinterface.state="up"
X-OCCT-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-OCCHI-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, ...)
- ...

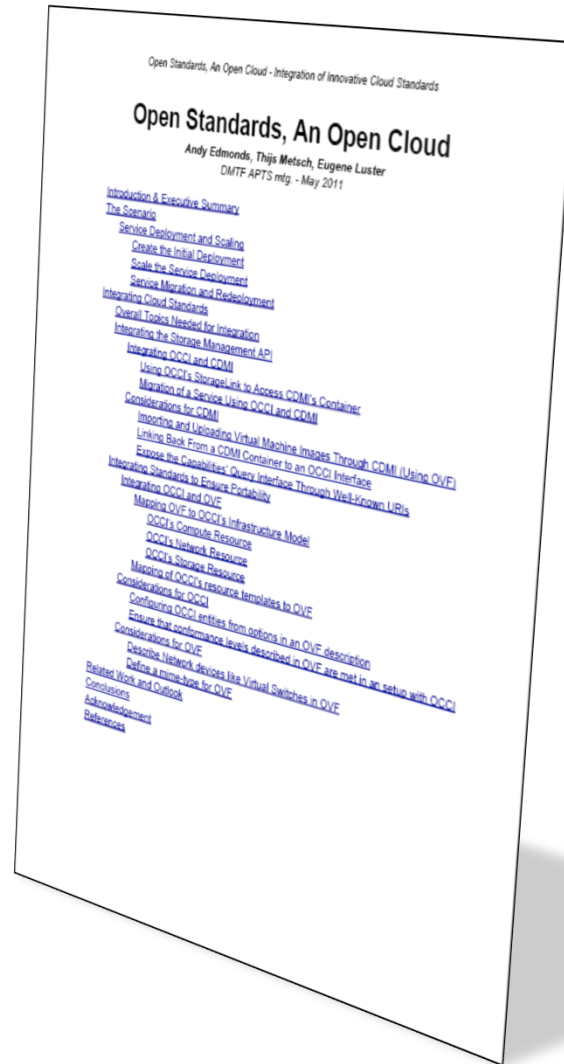


WRAP-UP & CONCLUSIONS

Collaborations



OVF, CDMI and OCCI



Future Work



Enhancement on the Query Interface

Monitoring

SLAs

Different Renderings

Agreements

Billing Interface

Website



[Home](#) [About](#) [Community](#) [Blog](#)



OCCI & R2AD

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



An Open Community Leading Cloud Standards

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**.

One of the first Standards in Clouds

Implementations



RESERVOIR



jclouds™



Eucalyptus



openstack™



OpenNebula.org

∴ R2AD®



INFN



Morfeo Claudia

Tools



OCCI compliance test

OCCI service URL:

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!



😊 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



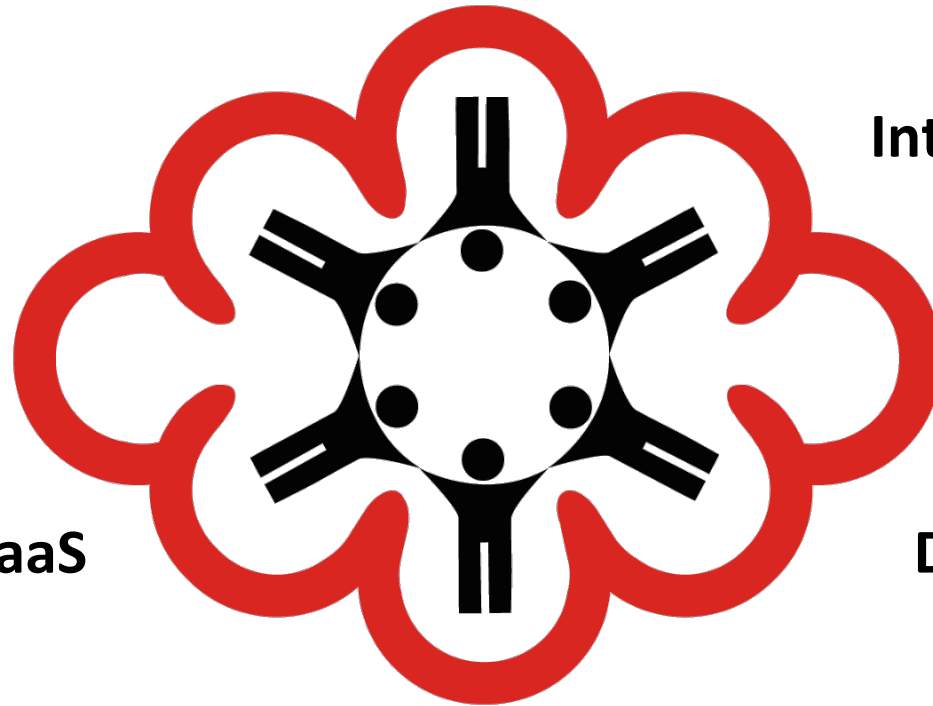
Flexible & Extensible

RESTful

Interoperability

Not bound to IaaS

Discoverable



Occi

Open Cloud Computing Interface



<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-OCCTI-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-OCCTI-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**