

# FI-WARE Based Application Development

Prof. Flávio de Oliveira Silva, Ph.D.

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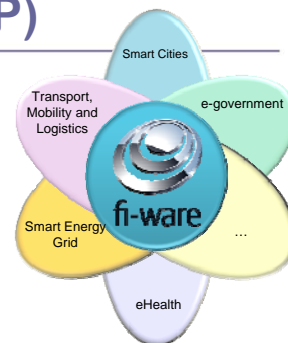
[www.fiware.org](http://www.fiware.org)  
@Fiware

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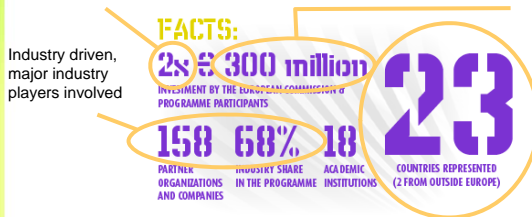
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## The Future Internet Public-Private Partnership (FI-PPP)

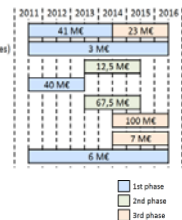
- **Goal:** capture new opportunities derived from Future Internet technology trends
  - Broadband connectivity, IoT, Cloud, Big Data, etc
- **Approach:** boost innovation by fostering industry-driven ecosystem
  - Generic Platform (FI-WARE)
  - Industry-specific platforms and trials ('Use-Cases')
  - Broader community of developers and entrepreneurs



EC provides half of the funding:

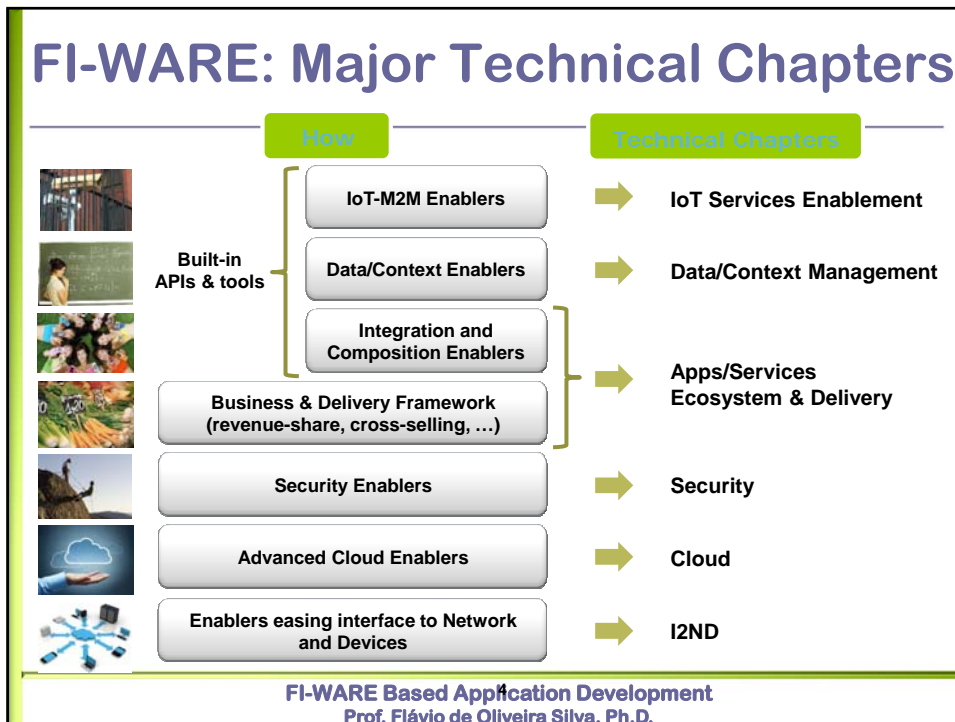


FI-WARE  
INFINITY (searching of infrastructures)  
XIFI (trials common facilities)  
8 Use Case Proof of Concepts  
5 Use Case Trials with real users  
Entrepreneurs involvement  
Ecosystem support  
CONCORD (Program Facilitation)



Pan-european dimension

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## FI-WARE Generic Enablers (GEs)

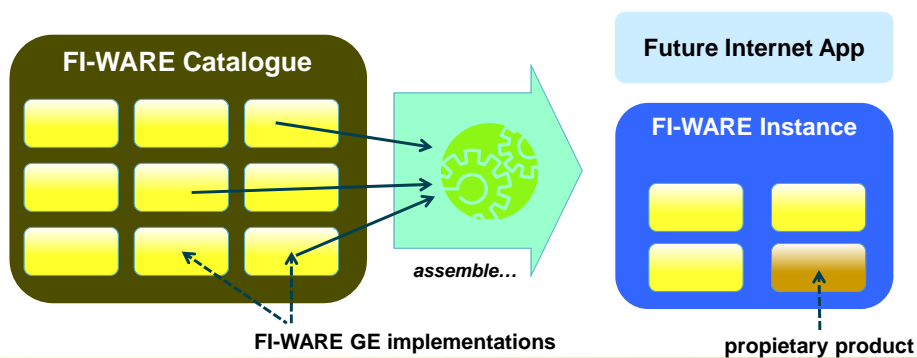
- A FI-WARE Generic Enabler (GE):
  - set of general-purpose **platform functions** available through **APIs**
  - Building with other GEs a [FI-WARE Reference Architecture](#)
- [FI-WARE GE Specifications](#) are open (public and royalty-free)
- **FI-WARE GE implementation (FI-WARE GEi):**
  - Platform product that implements a given GE Open Spec
  - There might be multiple compliant GEis of each GE Open Spec
  - Available FI-WARE GEis published on the [FI-WARE Catalogue](#)
- **The FI-WARE project will deliver at least one reference implementation** of FI-WARE GEs:
  - Based upon results of previous R&D projects
  - Publicly available [Technical Roadmap](#) updated in every release
  - Licensed with no costs within the FI-PPP program
  - Commercialized under FRAND conditions or license as open source



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## FI-WARE Instances

- Future Internet Applications run on top of “FI-WARE Instances” that are built by “FI-WARE Instance Providers” upon:
  - selection of FI-WARE GEis (products) from the FI-WARE Catalogue
  - assembly of selected FI-WARE GEis with proprietary added-value products



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## FI-WARE major differential features

<b>Cloud</b>		<ul style="list-style-type: none"> <li>Federation of infrastructures (private/public regions)</li> <li>Automated GE deployment</li> </ul>
<b>Data</b>		<ul style="list-style-type: none"> <li>Complete Context Management Platform</li> <li>Integration of Data and Media Content</li> </ul>
<b>IoT</b>		<ul style="list-style-type: none"> <li>Easy plug&amp;play of devices using multiple protocols</li> <li>Automated Measurements/Action <math>\leftrightarrow</math> Context updates</li> </ul>
<b>Apps</b>		<ul style="list-style-type: none"> <li>Visualization of data (operation dashboards)</li> <li>Publication of data sets/services</li> </ul>
<b>MiWi</b>		<ul style="list-style-type: none"> <li>3D and AR visualization of context</li> <li>Advanced middleware</li> </ul>
<b>Security</b>		<ul style="list-style-type: none"> <li>Security Monitoring</li> <li>Built-in Identity/Access/Privacy Management</li> </ul>
<b>I2ND</b>		<ul style="list-style-type: none"> <li>QoS across datacenters (OpenFlow)</li> </ul>



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## FI-WARE Partners

Some project partners



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## FI-WARE Objectives (to UFU and USP)

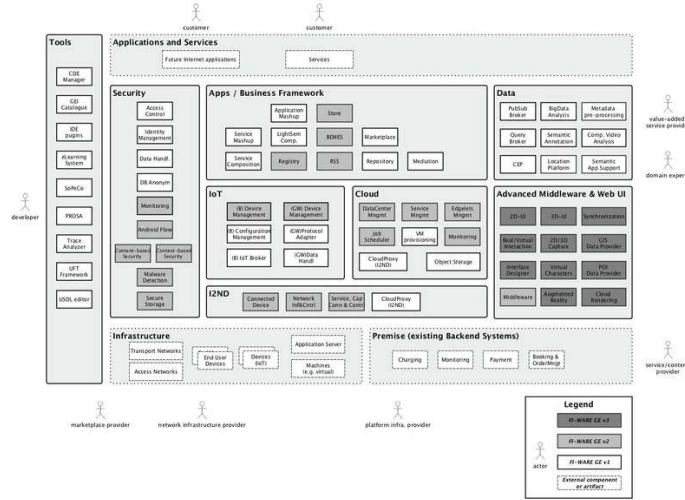
- Create the conditions, at each region where the FIILAB is deployed, to support the development of innovative services and applications by local entrepreneurs
- Explore FI-WARE Generic Enablers (GE), and Specific Enablers (SE) in order to reduce the time to market of these new services and applications
- Deploy FI-Lab Nodes in Brazil, creating the conditions for entrepreneurs to reach the market
- Collaborate with Future Internet initiatives fostering the use of technology that may help to provide a better living

## Dissemination Model

- Focus on the region's potential business models, according the local context and ecosystem
- Each FIILAB will have the participation of four stakeholders of the innovation process:
  - Higher Education Institutes (HEI)
  - Start-ups and Small and Medium Enterprises (SMEs);
  - Incubators and Accelerators
  - Funding agencies and financing entities.
- Explore opportunities regarding Smart Cities, Internet of things, Mobile devices and Applications

# FI-WARE Architecture

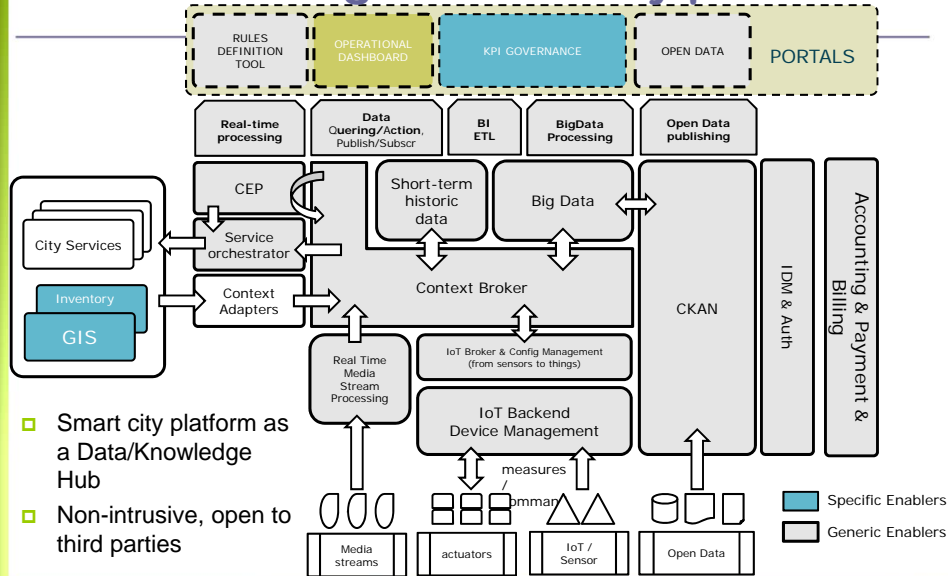
□ [http://forge.fi-ware.org/plugins/mediawiki/wiki/fiware/index.php/FI-WARE\\_Architecture](http://forge.fi-ware.org/plugins/mediawiki/wiki/fiware/index.php/FI-WARE_Architecture)



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# Envisioned target Smart City platform



- Smart city platform as a Data/Knowledge Hub
- Non-intrusive, open to third parties

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## Sample Application FI-GUARDIAN

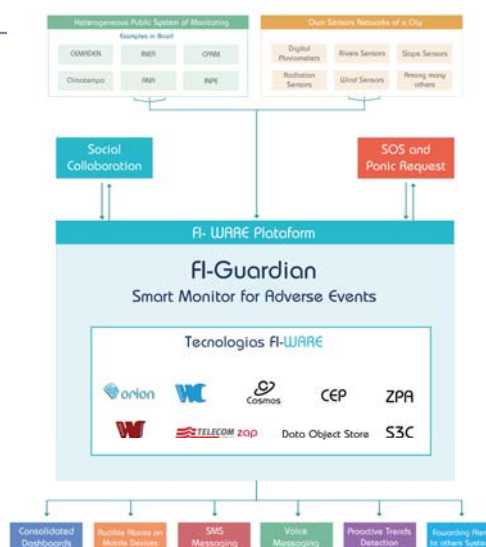
- Monitor for adverse events
- Created by VM9, an SME from Nova Friburgo, Brazil
- Short Presentation
  - <https://www.youtube.com/watch?v=UKfHfZRbZZA>
- Winner at the FI-WARE contest held at Campus Party 2014 in the Smart Cities category. Prize 75K €
  - <http://ec.europa.eu/digital-agenda/en/news/finals-fi-ware-challenges-campus-party-2014-brazil>

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## FI-GUARDIAN Building Blocks

- Based on several generic enablers

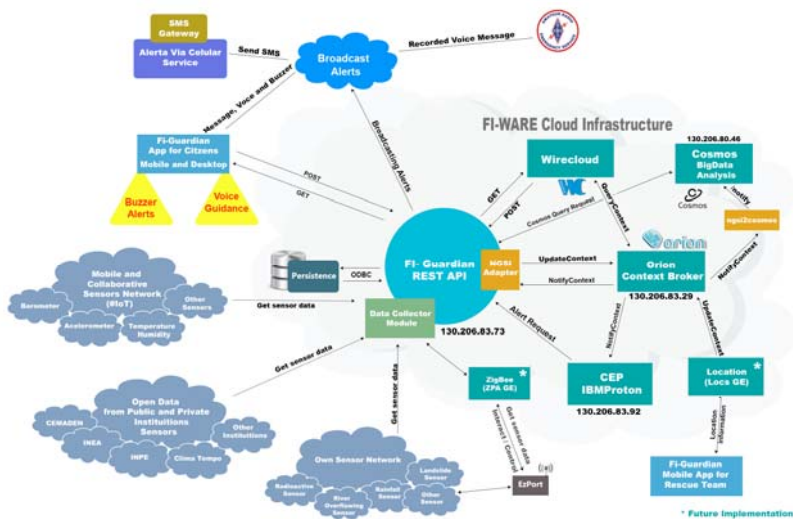


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## FI-GUARDIAN Architecture Overview



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## FI-WARE Resources

- Base Site
  - <http://www.fi-ware.org>
- FI-WARE Enablers Catalog
  - <http://catalogue.fi-ware.org/enablers>
- FI-WARE E-Learning Platform
  - <http://edu.fi-ware.org/>
- FI-WARE LAB
  - <http://lab.fi-ware.org>

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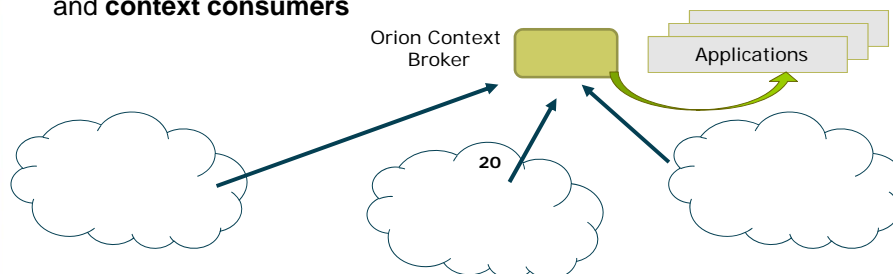
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## Publish/Subscribe Context Broker - Orion Context Broker

- Catalog
  - <http://catalogue.fi-ware.org/enablers/publishsubscribe-context-broker-orion-context-broker>
- Documentation
  - <http://catalogue.fi-ware.org/enablers/documentation-25>
- E-Learning Platform
  - <http://edu.fi-ware.org/course/view.php?id=44>
- Long video tutorial
  - <https://www.youtube.com/watch?v=tziCA1Uhhe8>
- Programmers Guide
  - [https://forge.fi-ware.org/plugins/mediawiki/wiki/fiware/index.php/Publish/Subscribe\\_Broker\\_-\\_Orion\\_Context\\_Broker\\_-\\_User\\_and\\_Programmers\\_Guide](https://forge.fi-ware.org/plugins/mediawiki/wiki/fiware/index.php/Publish/Subscribe_Broker_-_Orion_Context_Broker_-_User_and_Programmers_Guide)
- Quick Start
  - [https://forge.fi-ware.org/plugins/mediawiki/wiki/fiware/index.php/Publish/Subscribe\\_Broker\\_-\\_Orion\\_Context\\_Broker\\_-\\_Quick\\_Start\\_for\\_Programmers](https://forge.fi-ware.org/plugins/mediawiki/wiki/fiware/index.php/Publish/Subscribe_Broker_-_Orion_Context_Broker_-_Quick_Start_for_Programmers)

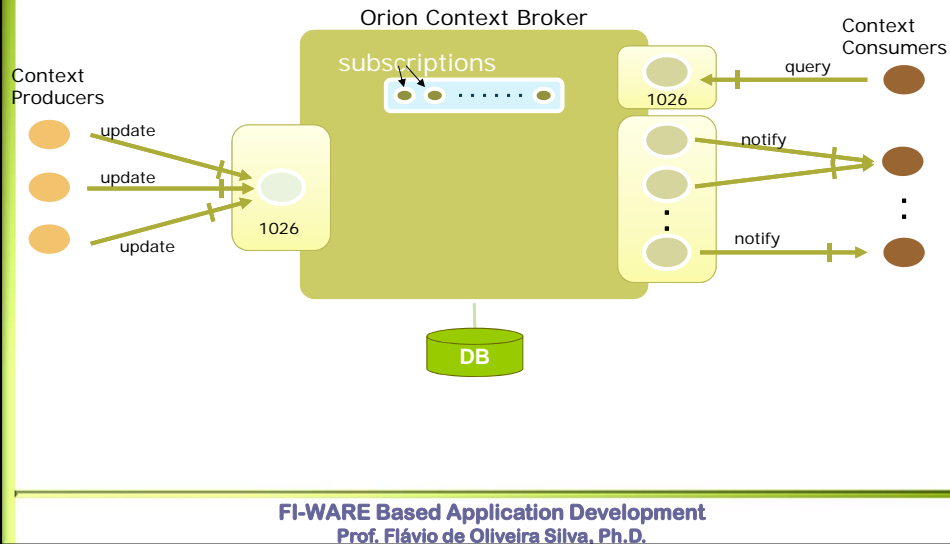
## Context management

- Context Management in FI-WARE is about management of Context data (aka Context Information)
- Context Information is always relevant to “entities”, although entities can be anything (applications, users, things, ...)
- Orion Context Broker intermediates between **context producers** and **context consumers**



Slides prepared by Fermín Galán Márquez (fermin@tid.es) Telefónica I+D

## Orion Context Broker in a nutshell



## NGSI API

- Based on Next Generation Services Interface (NGSI), published by Open Mobile Alliance (OMA)
  - <http://technical.openmobilealliance.org/Technical/technical-information/release-program/current-releases/ngsi-archive>
- REST API (XML & JSON rendering)
- Additional “convenience” operations to ease some operations

### Context Availability Management (NGSI9)

- Register context sources (`registerContext`)
- Search for context sources (`discoverContextAvailability`)
- Subscribe to context sources availability notifications (`subscribeContextAvailability`, `updateContextAvailabilitySubscription` & `unsubscribeContextAvailability`)

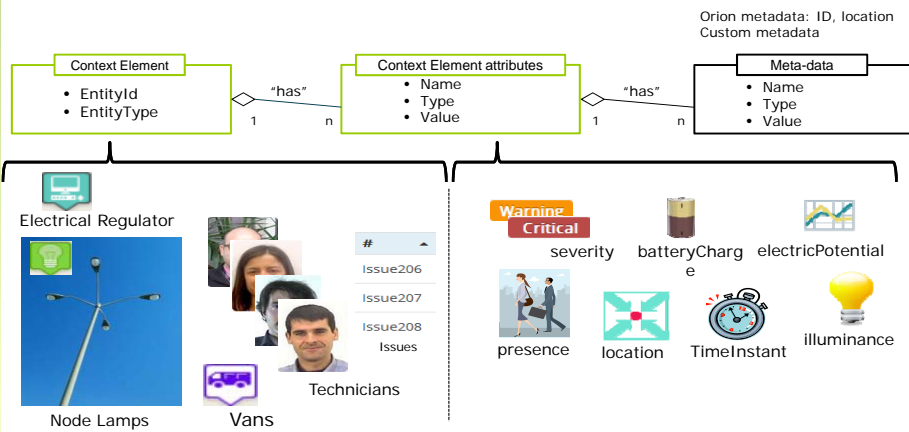
### Context Management (NGSI10)

- Update context information (`updateContext`)
- Query context information (`queryContext`)
- Subscribe to context information notifications (`subscribeContext`, `updateContextSubscription` & `unsubscribeContext`)

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# The NGSI information model



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# Entity Creation (Request)

Using an updateContext

XML

JSON (since release 0.9.0)

```
(curl localhost:1026/NGSI10/updateContext -s -S --header 'Content-Type: application/xml' -d @- | xmllint --format -) <<EOF
<?xml version="1.0" encoding="UTF-8"?>
<updateContextRequest>
  <contextElementList>
    <contextElement>
      <entityId type="Room" isPattern="false">
        <id>Room1</id>
      </entityId>
      <contextAttributeList>
        <contextAttribute>
          <name>temperature</name>
          <type>centigrade</type>
          <contextValue>23</contextValue>
        </contextAttribute>
        <contextAttribute>
          <name>pressure</name>
          <type>mmHg</type>
          <contextValue>720</contextValue>
        </contextAttribute>
      </contextAttributeList>
    </contextElement>
  </contextElementList>
  <updateAction>APPEND</updateAction>
</updateContextRequest>
EOF
```

```
(curl localhost:1026/NGSI10/updateContext -s -S --header 'Content-Type: application/json' --header 'Accept: application/json' -d @- | python -mjson.tool) <<EOF
{
  "contextElements": [
    {
      "type": "Room",
      "isPattern": "false",
      "id": "Room1",
      "attributes": [
        {
          "name": "temperature",
          "type": "centigrade",
          "value": "23"
        },
        {
          "name": "pressure",
          "type": "mmHg",
          "value": "720"
        }
      ]
    }
  ],
  "updateAction": "APPEND"
}
EOF
```

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## Entity Creation (Response)

- Using an updateContext

XML

JSON (since release 0.9.0)

```
<?xml version="1.0"?>
<updateContextResponse>
  <contextResponseList>
    <contextElementResponse>
      <contextElement>
        <entityId type="Room" isPattern="false">
          <id>Room1</id>
        </entityId>
        <contextAttributeList>
          <contextAttribute>
            <name>temperature</name>
            <type>centigrade</type>
            <contextValue/>
          </contextAttribute>
          <contextAttribute>
            <name>pressure</name>
            <type>mmHg</type>
            <contextValue/>
          </contextAttribute>
        </contextAttributeList>
      </contextElement>
    </contextResponseList>
    <statusCode>
      <code>200</code>
      <reasonPhrase>OK</reasonPhrase>
    </statusCode>
  </contextElementResponse>
</updateContextResponse>
```

```
{
  "contextResponses": [
    {
      "contextElement": {
        "attributes": [
          {
            "name": "temperature",
            "type": "centigrade",
            "value": ""
          },
          {
            "name": "pressure",
            "type": "mmHg",
            "value": ""
          }
        ]
      },
      "id": "Room1",
      "isPattern": "false",
      "type": "Room"
    }
  ],
  "statusCode": {
    "code": "200",
    "reasonPhrase": "OK"
  }
}
```

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## Query Context (request)

XML

JSON (since release 0.9.0)

```
(curl localhost:1026/NGSI10/queryContext -s -S --
header 'Content-Type: application/xml' -d @- |
xmlint --format -) <<EOF
<?xml version="1.0" encoding="UTF-8"?>
<queryContextRequest>
  <entityIdList>
    <entityId type="Room" isPattern="false">
      <id>Room1</id>
    </entityId>
  </entityIdList>
  <attributeList/>
</queryContextRequest>
EOF
```

```
(curl localhost:1026/NGSI10/queryContext -s -S --header 'Content-
Type: application/json' --header 'Accept: application/json' -d @- |
python -mjson.tool) <<EOF
{
  "entities": [
    {
      "type": "Room",
      "isPattern": "false",
      "id": "Room1"
    }
  ]
}
EOF
```

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## Query Context (response)

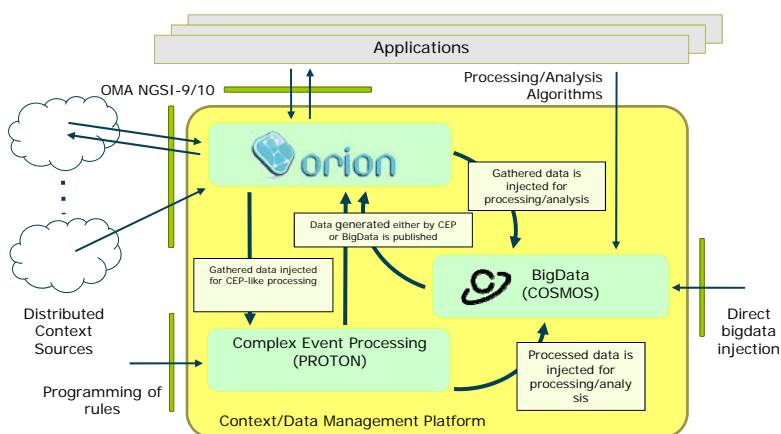
XML

```
<?xml version="1.0"?>
<queryContextResponse>
  <contextResponseList>
    <contextElementResponse>
      <contextElement>
        <entityId type="Room" isPattern="false">
          <id>Room1</id>
        </entityId>
        <contextAttributeList>
          <contextAttribute>
            <name>temperature</name>
            <type>centigrade</type>
            <contextValue>23</contextValue>
          </contextAttribute>
          <contextAttribute>
            <name>pressure</name>
            <type>mmHg</type>
            <contextValue>720</contextValue>
          </contextAttribute>
        </contextAttributeList>
      </contextElement>
      <statusCode>
        <code>200</code>
        <reasonPhrase>OK</reasonPhrase>
      </statusCode>
    </contextElementResponse>
  </contextResponseList>
</queryContextResponse>
```

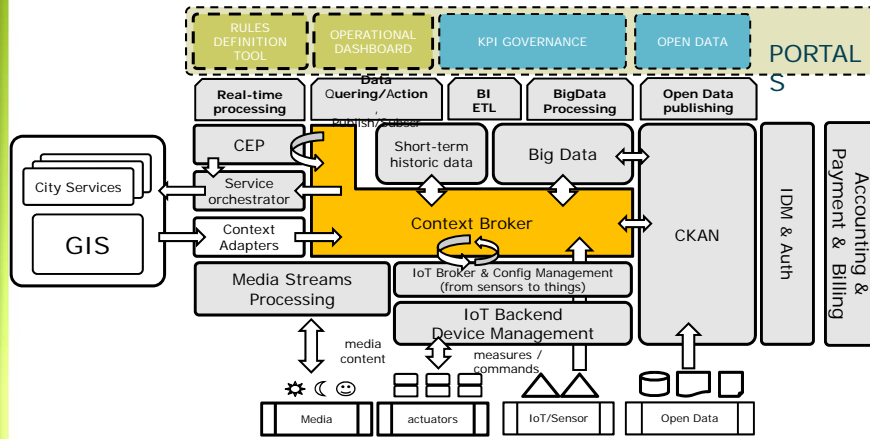
JSON (since release 0.9.0)

```
{
  "contextResponses": [
    {
      "contextElement": {
        "attributes": [
          {
            "name": "temperature",
            "type": "centigrade",
            "value": "23"
          },
          {
            "name": "pressure",
            "type": "mmHg",
            "value": "720"
          }
        ],
        "id": "Room1",
        "isPattern": "false",
        "type": "Room"
      },
      "statusCode": {
        "code": "200",
        "reasonPhrase": "OK"
      }
    }
  ]
}
```

## FI-WARE Context/Data Management Platform



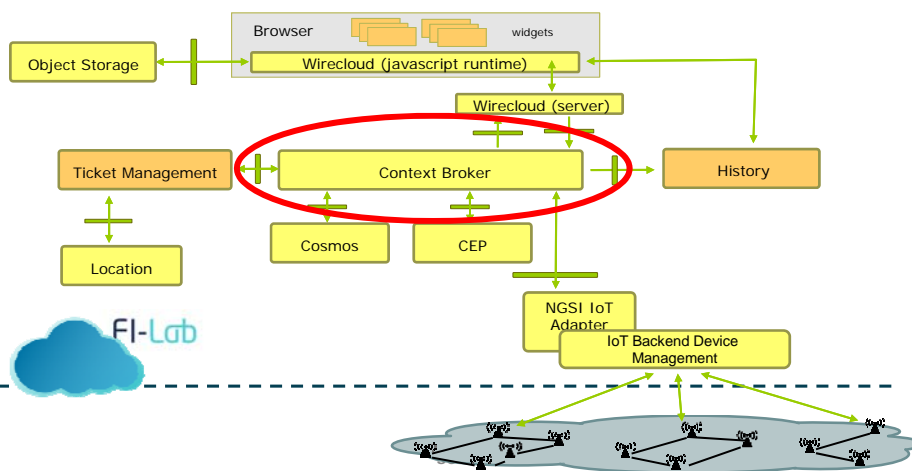
## How Orion fits in the FI-WARE overall platform



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## Orion in LiveDemo application

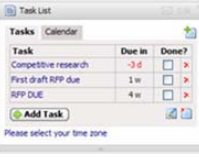
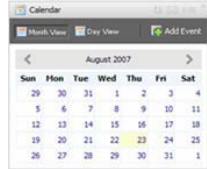



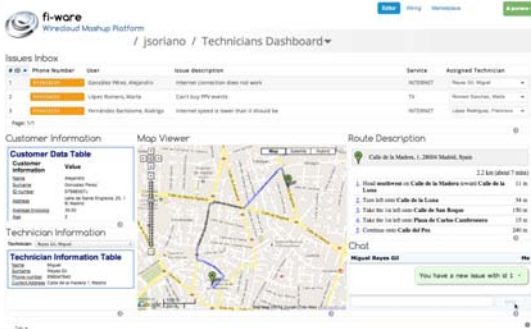
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# Application Mashup - Wirecloud

- End-user UI development by using Widget and Mashups
- Widget
  - A small application or piece of dynamic content that can be easily placed into a web page
  - Often encapsulate a Web API (directly or through an operator)
  - Can be easily embedded into webpages (HTML snippets)
  - "Mashable" widgets generate/consume events, so that they can be wired together to create a lightweight application mashup
  - This requires a widget platform
- Mashup
  - Lightweight application combining data, services and UIs from multiple sources
  - Developed by either IT or business staff, as well as by end users
  - Created in hours or days, not months
  - Uses a Web Oriented Architecture (WOA)
  - Often relies on internal + external web services (Web APIs)
  - Done at data, logic and/or presentation layers

# Widgets and Mashups

- Widgets
  - 
  - 
  - 
- Mashups

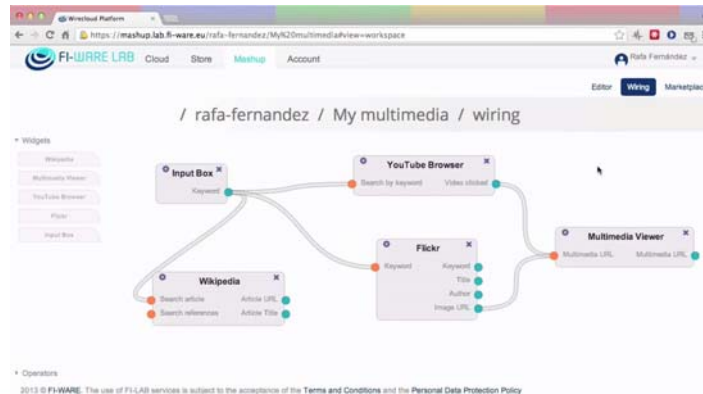


The screenshot shows a web-based dashboard for technicians. At the top, there's a navigation bar with 'Home', 'Help', and 'Logout' buttons. Below that, the 'Issues Inbox' table lists several issues with columns for phone number, user, issue description, service, and assigned technician. The main area is divided into several sections: 'Customer Information' with a data table, a 'Map Viewer' showing a route on a map, a 'Route Description' with a list of steps and durations, and a 'Technician Information Table'.



## Mashups and Operators

- Operators represents functionality managed at the presentation layer
- Empower the user to create data mashups (Access + Transform data sources) by piping + Web API wrapping
- Enhance widget functionality by wiring them each other



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## Application Mashup – Wirecloud Resources

- Catalog
  - <http://catalogue.fi-ware.org/enablers/application-mashup-wirecloud>
- Documentation
  - <http://catalogue.fi-ware.org/enablers/application-mashup-wirecloud/documentation>
- E-Learning Platform
  - <http://edu.fi-ware.org/course/view.php?id=53>
- Short video tutorial
  - <https://www.youtube.com/watch?v=yzQqstBAUe0>

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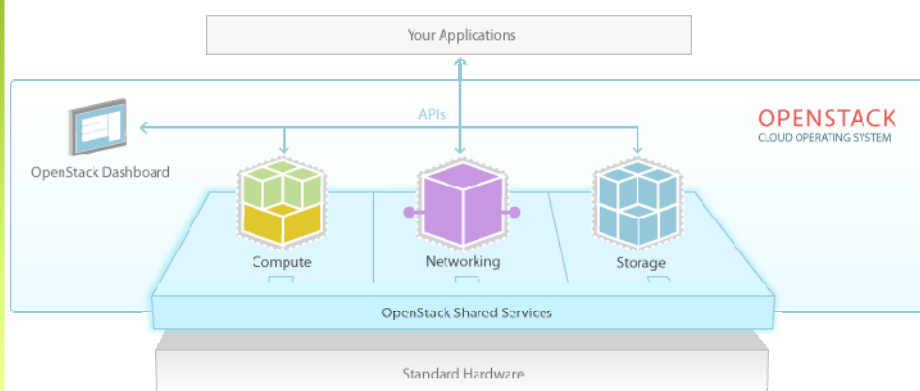
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## Setting up your virtual infrastructure using FI-LAB Cloud

- Introduction to FI-LAB Cloud Hosting
- Deploying your first VM
- Deploying components for your application
- Object Storage API
- Reference Information

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## FI-LAB Cloud Hosting



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## FI-LAB Cloud Hosting

- ❑ Create your account in lab.fi-ware.eu
- ❑ Enter in the Cloud Portal
- ❑ Create your keypair (private/private key)
- ❑ Deploy your instance
- ❑ Add a public IP
- ❑ Open ports to the VM

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The screenshot shows the FI-WARE Identity Manager login interface. The browser address bar displays 'https://account.lab.fi-ware.eu'. The page title is 'FI-WARE Identity Manager' and the URL is 'https://account.lab.fi-ware.eu'. The main content area features the 'Identity Manager' logo and a description: 'The platform contains lots of users and organizations working together to achieve this great infrastructure.' Below this is a login form with fields for 'Email' and 'Password', a 'Remember me' checkbox, and a 'Sign In' button. A 'Sign up' link is also present. A callout bubble points to the login form with the text: 'Enter your email and password to access to the FI-LAB.' Another callout bubble points to the 'Sign up' link with the text: 'If you do not have it or forgot it, sign up or request for a new one.' At the bottom of the page, there is a status bar indicating 'Signed out successfully' and a navigation bar with 'My profile' and 'Logout' buttons.

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You must create a keypair to access the servers.

**Create Keypair**

Keypair Name \*  
Keypair Name

Description  
Keypairs are ssh credentials which are injected into images when they are launched. Creating a new key pair registers the public key and downloads the private key (a .pem file).  
Protect and use the key as you would any normal ssh private key.

\* Mandatory fields. Cancel **Create Keypair**

Success: Keypair nuevo deleted.

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**Launch Instances**

1. Details 2. Access & Security 3. Post-Creation 4. Summary

Keypair  
fivare

Description  
Control access to your instance via keypairs, security groups, and other mechanisms.

Security Groups  
 default

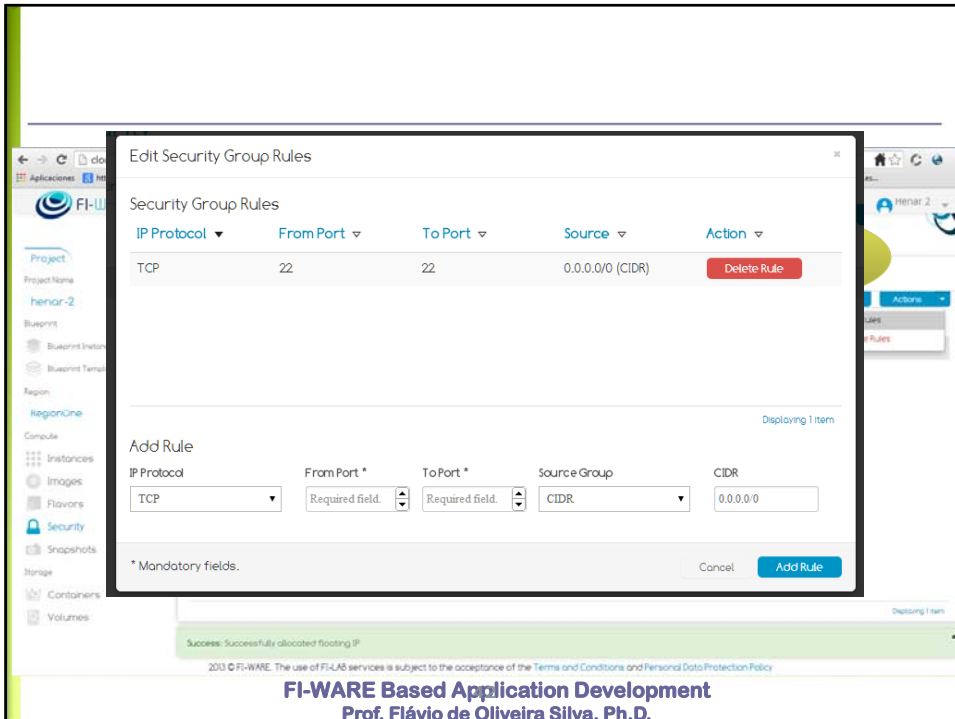
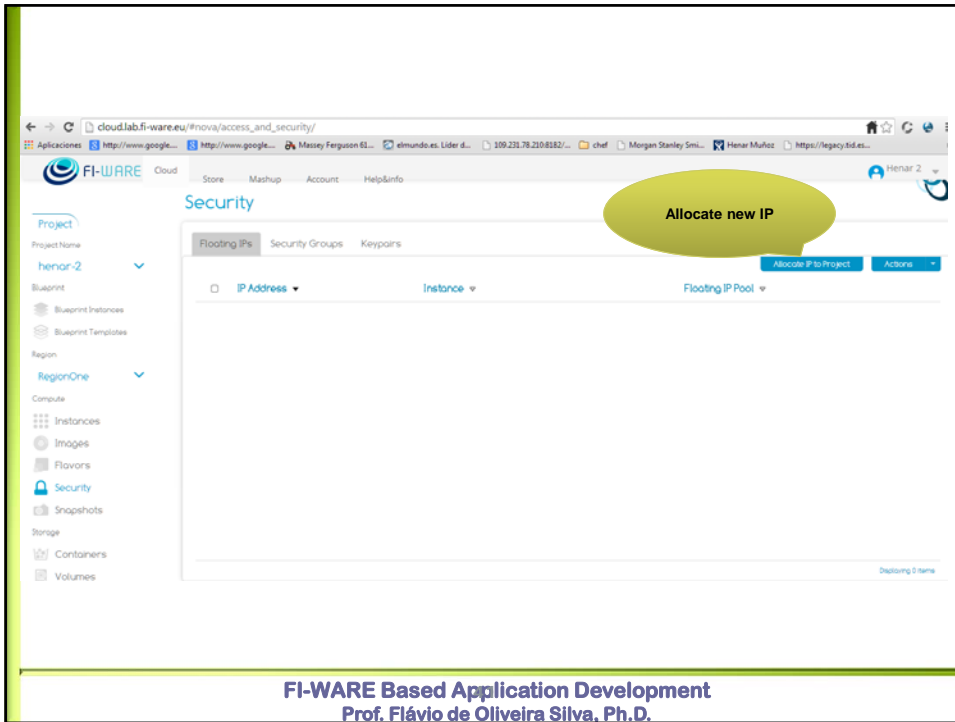
\* Mandatory fields. Back **Next**

Memory (MiB)  
25000 MB Available

\* Mandatory fields. Cancel **Next**

Success: Keypair fivare created.

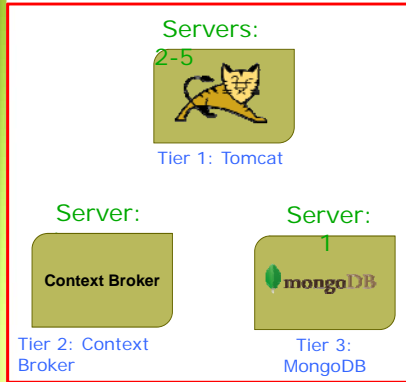
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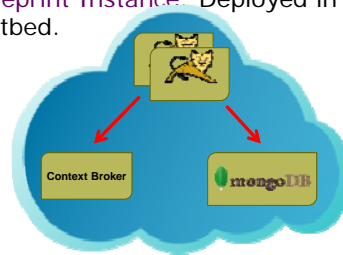


# Deploy example

Blueprint template: fiware1



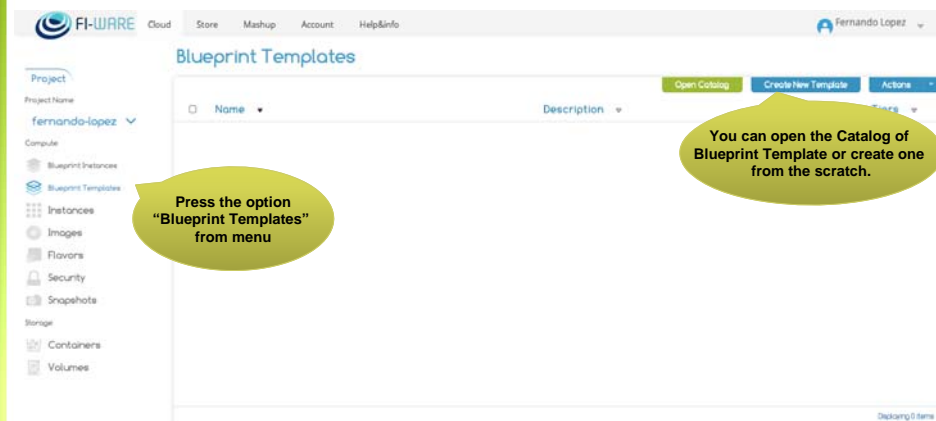
- **Blueprint Template**: platform specification to be deployed.
- **Tier**: Each kind of software and server to be deployed.
- Each Tier can be deployed in one or **several servers** (e.g. tomcat, 2-5 servers).
- **Blueprint Instance**: Deployed in the testbed.



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# Demo



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Create Blueprint

Name \*  
DemoSantander

Description \*  
Despliegue de un blueprint con 2 capas.

Description  
From here you can create a new blueprint.

\* Mandatory fields.

Cancel Create Blueprint

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## Blueprint Templates

Open Catalog Create New Template Actions

Name	Description	Tiers
DemoSantander	Despliegue de un blueprint con 2 capas.	0

Deploying 1 item

To add new Tier, press "DemoSantander" name.

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After press "Add Tier" you see this windows to define the servers of this tier.

The 'Add Tier' dialog box for 'TierApache' includes the following fields and options:

- Name \***: TierApache
- Flavor \***: m1.small (1VCPU / 10GB Disk / 2048MB)
- Image \***: chef\_aware
- Icon**: <http://upload.wikimedia.org/w> (with a 'View' button)
- Keypair**: keypairfla
- Public IP**:
- Software in Tier**: tomcat 6
- Software in Catalogue**: mongos 2.2.3, mysql 1.2.4, nodejs 0.6.15, tomcat 6

Annotations:

- A callout bubble points to the server count controls (2, 1, 1) and says: "After press 'Add Tier' you see this windows to define the servers of this tier."
- A callout bubble points to the 'Keypair' field and says: "You must define a Keypair to access to those servers."
- A callout bubble points to the 'Software in Tier' list and says: "Install software pressing the mouse right click."

\* Mandatory fields. [Cancel] [Create Tier]

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You should specify the maximum, minimum and current number of servers

The 'Add Tier' dialog box for 'TierMySQL' includes the following fields and options:

- Name \***: TierMySQL
- Flavor \***: m1.small (1VCPU / 10GB Disk / 2048MB)
- Image \***: chef\_aware
- Icon**: <http://www.siliconweek.es/wp> (with a 'View' button)
- Keypair**: keypairfla
- Public IP**:
- Software in Tier**: mysql 1.2.4
- Software in Catalogue**: mongos 2.2.3, mysql 1.2.4, nodejs 0.6.15, tomcat 6

Annotations:

- A callout bubble points to the server count controls (1, 1, 1) and says: "You should specify the maximum, minimum and current number of servers"

\* Mandatory fields. [Cancel] [Create Tier]

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Press "Action" and select "Launch Template" to launch the Instance.

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You should specify the "Name" and "Description" for your blueprint.

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# Demo

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## Blueprint Instances

Launch New Blueprint    Actions

Name	Description	Tiers	Status
DemoSantanderInstance	La instancia correspondiente al template creado.	2	DEPLOYING

Displaying 1 item

Firstly, we need to instantiate the servers.

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# Demo

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## Blueprint Instances

Launch New Blueprint    Actions

Name	Description	Tiers	Status
DemoSantanderInstance	La instancia correspondiente al template creado.	2	INSTALLING

Displaying 1 item

Secondly, the installation of the software.

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## Blueprint Instances

Name	Description	Tiers	Status
DemoSantanderInstance	La instancia correspondiente al template creado.	2	INSTALLED

Pressing the name you can see the tiers of this blueprint.

Finally, if all was ok.

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## Blueprint Instances / DemoSantanderInstance

Press it to get information of your server.

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## Instances

Overview Log VNC

Info	Specs	IP Addresses
Name: DemoSantanderInstance-TierApache-1 ID: 2d5ca03c-fc3a-488b-b81e-d920eb382b64 Status: ACTIVE	RAM: 2048MB VCPU: 1VCPU Disk: 10GB	10.0.0.10 192.206.63.37
Security Groups	Meta	Volumes
sg_DemoSantander_000000000000000000000000...	Key name: keypairfia Image Name: chef_oware	No volumes attached.
Installed Software	<a href="#">Edit</a>	
tomcat 6	INSTALLED	

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Apache Tomcat

The Apache Software Foundation  
<http://www.apache.org/>

If you're seeing this page via a web browser, it means you've setup Tomcat successfully. Congratulations!

As you may have guessed by now, this is the default Tomcat home page. It can be found on the local filesystem at:

`SCATALINA_HOME/webapps/ROOT/index.html`

where "SCATALINA\_HOME" is the root of the Tomcat installation directory. If you're seeing this page, and you don't think you should be, then you're either a user who has arrived at new installation of Tomcat, or you're an administrator who hasn't got his/her setup quite right. Providing the latter is the case, please refer to the [Tomcat Documentation](#) for more detailed setup and administration information than is found in the INSTALL file.

**NOTE: For security reasons, using the manager webapp is restricted to users with role "manager".** Users are defined in `SCATALINA_HOME/conf/tomcat-users.xml`.

Included with this release are a host of sample Servlets and JSPs (with associated source code), extensive documentation, and an introductory guide to developing web applications.

Tomcat mailing lists are available at the Tomcat project web site:

- [users@tomcat.apache.org](mailto:users@tomcat.apache.org) for general questions related to configuring and using Tomcat
- [dev@tomcat.apache.org](mailto:dev@tomcat.apache.org) for developers working on Tomcat

Thanks for using Tomcat!

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