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Guidelines for Developers

Introduction

The iCenter OS aims to provide a software platform that can be used to remotely meter energy consumptions at homes, schools, buildings and factories. Note that the term energy consumption is used loosely and can be used to mean electrical consumption, water consumption or gas consumption.

The platform is able to receive data readings from thousands of sensors placed in several different geographical locations. The kinds of readings that are received vary from device to device, for example in the case of electricity one could expect to receive readings regarding the energy consumed (kW/h) among others.

iCenter OS receives these data, stores it and processes it providing its clients with higher level analytics. The main goals of the iCenter platform are:

- Acquire data from remote sensors.
- Store and process these data.
- Provide third party systems with a web API that can be used to retrieve data from iCenter OS.

Architecture

The main idea to grasp at this point is that iCenter OS receives several thousand streams of data from sensors, stores the data and processes it allowing (software and human) clients to access the processed information.

The architecture used in the iCenter OS solution has a classic layered design approach. At a higher level, it's composed of three layers, as shown below:

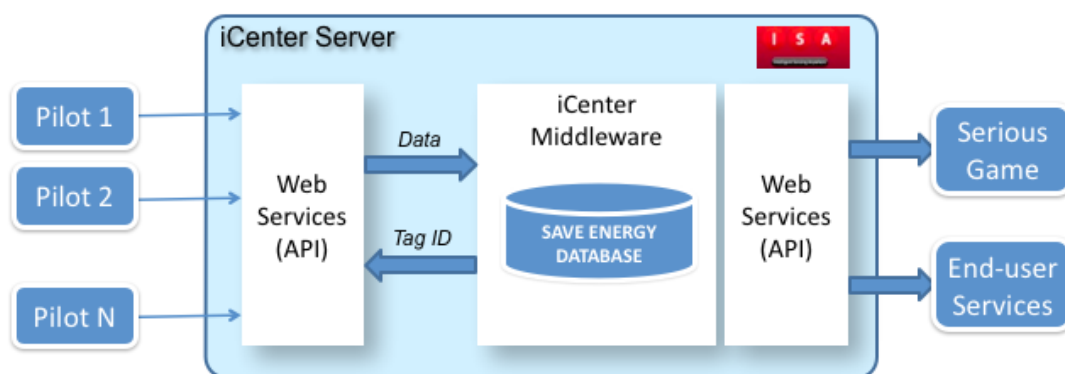


Figure 1 - Central Platform: iCenter OS

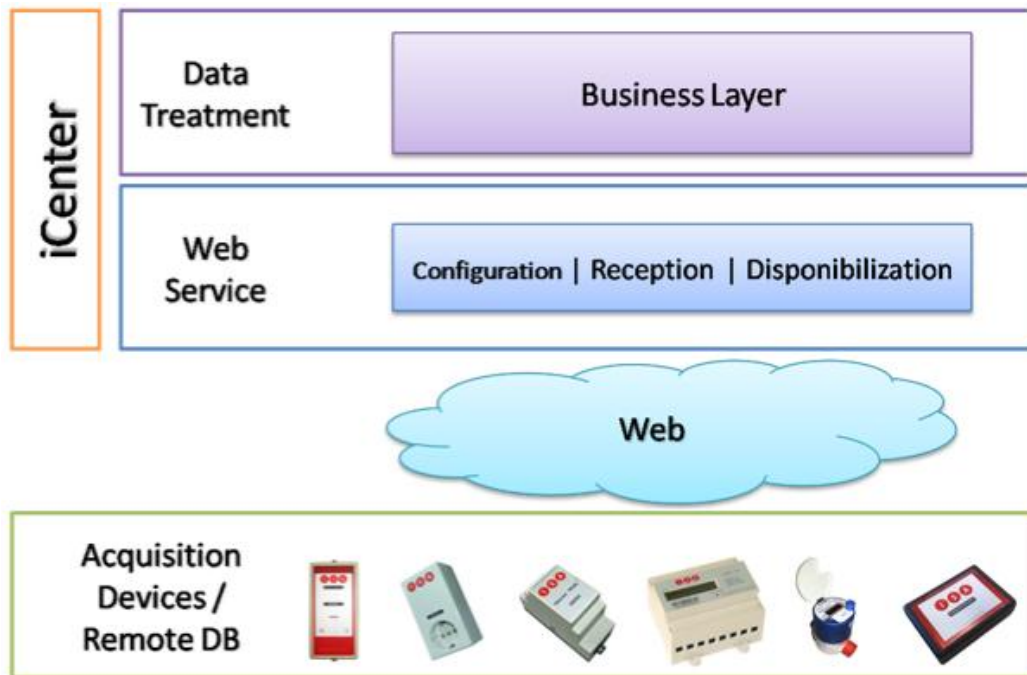


Figure 2 - iCenter OS Architecture

Core entities

There are four main entities that are central to the iCenter OS platform and that should be clearly understood. The four entities are:

- **Local**: A physical location that has the remote metering hardware installed. Locations usually correspond to a house or a building where the metering hardware installed.
- **Unit**: The hardware that is located at the client’s location and that receives the data readings from devices. These reading are then forwarded to a central server. The server interprets the incoming data (using a specific protocol) and then notifies the iEnergy service. A unit usually communicates with the server using a TCP/IP connection.
- **Device**: Another piece of hardware that is located at the site being monitored. Devices can read several parameters (current, power, etc.) and send the data that has been read to its governing unit. There can be more than one device associated to unit. A device can be a socket plug that is used to monitor the consumption of a specific appliance, or it can be a clamp that is used to monitor the current on a specific wire. A device usually communicates with its unit using some form of wireless connection.
- **Tag**: A measurement end point that stores the data readings of a specific device. If a device measures current and power then it has two tags associated; one for current and another for power. A device may have one or more tags, in other words, it may measure one or more parameters.

Data Flow

We now exemplify some flowcharts that explain how some of the more important and frequent processes work.

Create Unit

The creation of a unit complies with the following flowchart.

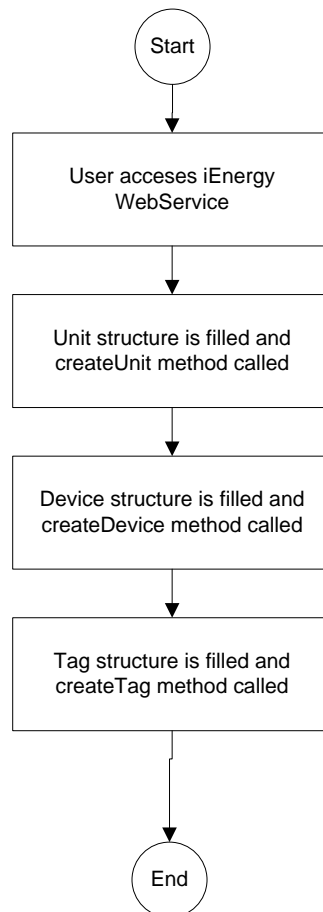


Figure 3 - Unit creation flowchart.

Arrival of Data

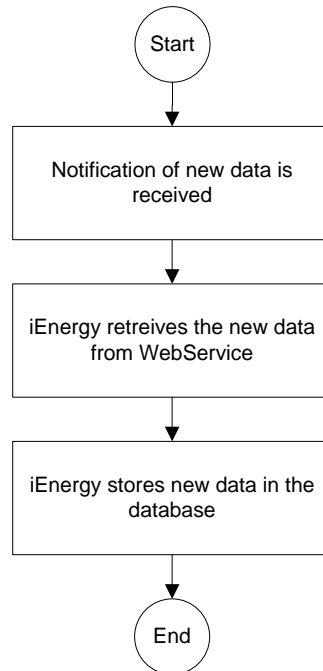


Figure 1 – Data arrival flowchart.

Hardware Quality Indicators

In order to evaluate the system, quality indicators were defined.. The indicators are:

- **Tag Communication State** – indicates if the tag has been sampling new data and if that data has been sent to the server. The timestamp of the data received has to be below the defined threshold.
- **Device Communication State** – indicates if the device is communicating with the unit. This indicator can be obtained by taking into account the data of tags of a specific device and comparing the date of the last data item received with the current date and verifying if it is below the defined threshold.
- **Unit Communication State** – indicates if the unit has been communicating with the server. This indicator can be obtained by taking into account the timestamp that is associated with each message received from iCenter, comparing it with the current time and making sure it is below a define threshold.

Platform Interaction

In order to comprise and interact with the platform, client applications should use the data provision document aimed for API description and iCenterOS data input or collection, provided in **Annex A - iCenter - Data Provision**.

Example on iCenter OS Web Services

The following section describes how to access the SAVE ENERGY SOAP webservice that contains energy consumption information of the Leiden City Hall.

Please note that the web service address has changed over what was presented earlier.

Important URLs:

List of TAGS: <http://saveenergy.leiden.nl/~erwin/saveenergysoap/listoftags.php>

Save Energy Webservice:

<http://saveenergy.leiden.nl/~erwin/saveenergysoap/server1.php>

WSDL description of the webservice:

<http://saveenergy.leiden.nl/~erwin/saveenergysoap/saveenergy.wsdl>

Client source of the webservice (working example after you fill in user name + password):

<http://saveenergy.leiden.nl/~erwin/saveenergysoap/client1.phps>

The username is: liacs, the password is saveenergy.

Implementation steps:

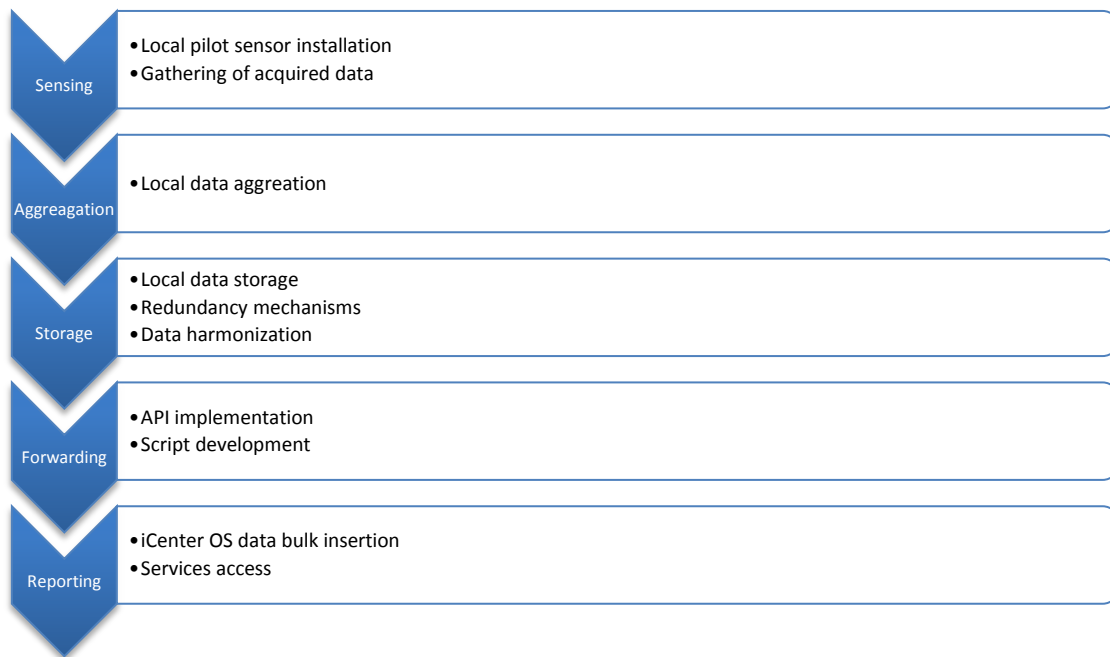
- 1) Setup client file
 - a. Copy the contents of the client source file (see above) into a new php file.
 - b. Set the username and password in the getToken Method.
 - c. Set the tagid, begindate, enddate and aggregation type
 - d. Save the file
- 2) Test for data retrieval
 - a. Run the php file and check for data. Retrieved data in demo should look like:
 - b. Array ([0] => Array ([tagid] => 501 [datetime] => 2010-09-10 00:00:00 [value] => 63.53570000000045) [1] => Array ([tagid] => 501 [datetime] => 2010-10-01 00:00:00 [value] => 24.76850000000001))
- 3) Use the retrieved data
 - a. Instead of the print_r method in the demo file, use a loop to step through the data and modify it to your wishes.

The iCenter OS - Pilot Integration

The implementation methodology stands as it follows:

1. Pilot definition and installation;
2. Map the pilot structure accordingly to the iCenter OS architectural framework;
3. Local data storage;
4. Script development for data forwarding based on the provided API;
5. Integration with the iCenter OS central platform;
6. Regular upload/download of data;

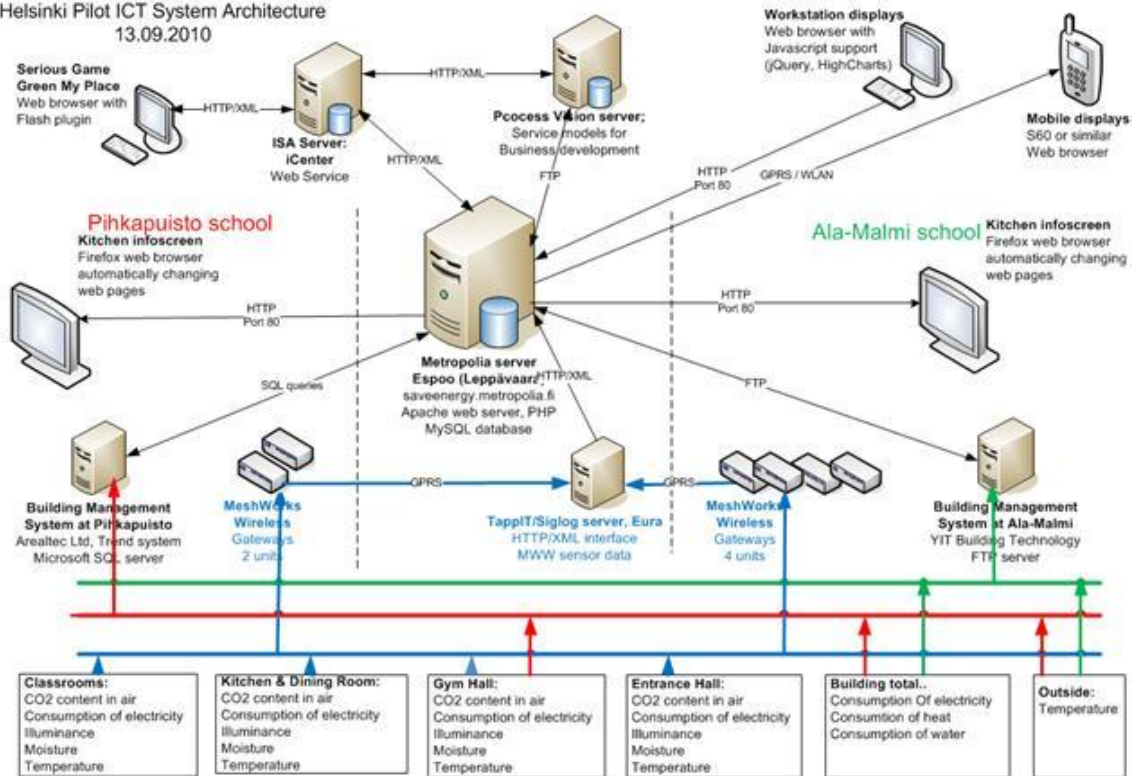
Within the consortium all the pilots follow this macro approach, typically based on a hierarchical framework:



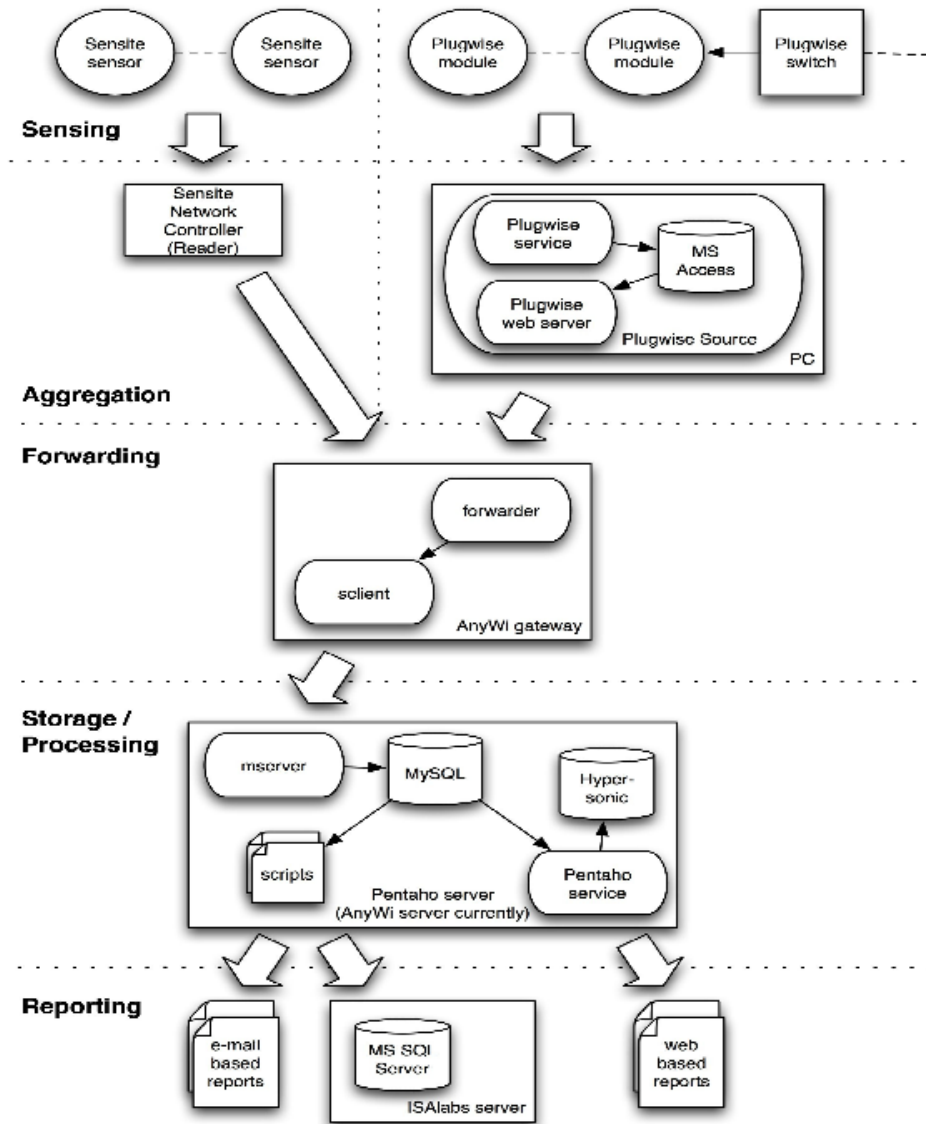
We can therefore go deeper within all the pilots and look on a more detailed perspective on how the real information flow and architectural implementation has been undertaken:

Helsinki:

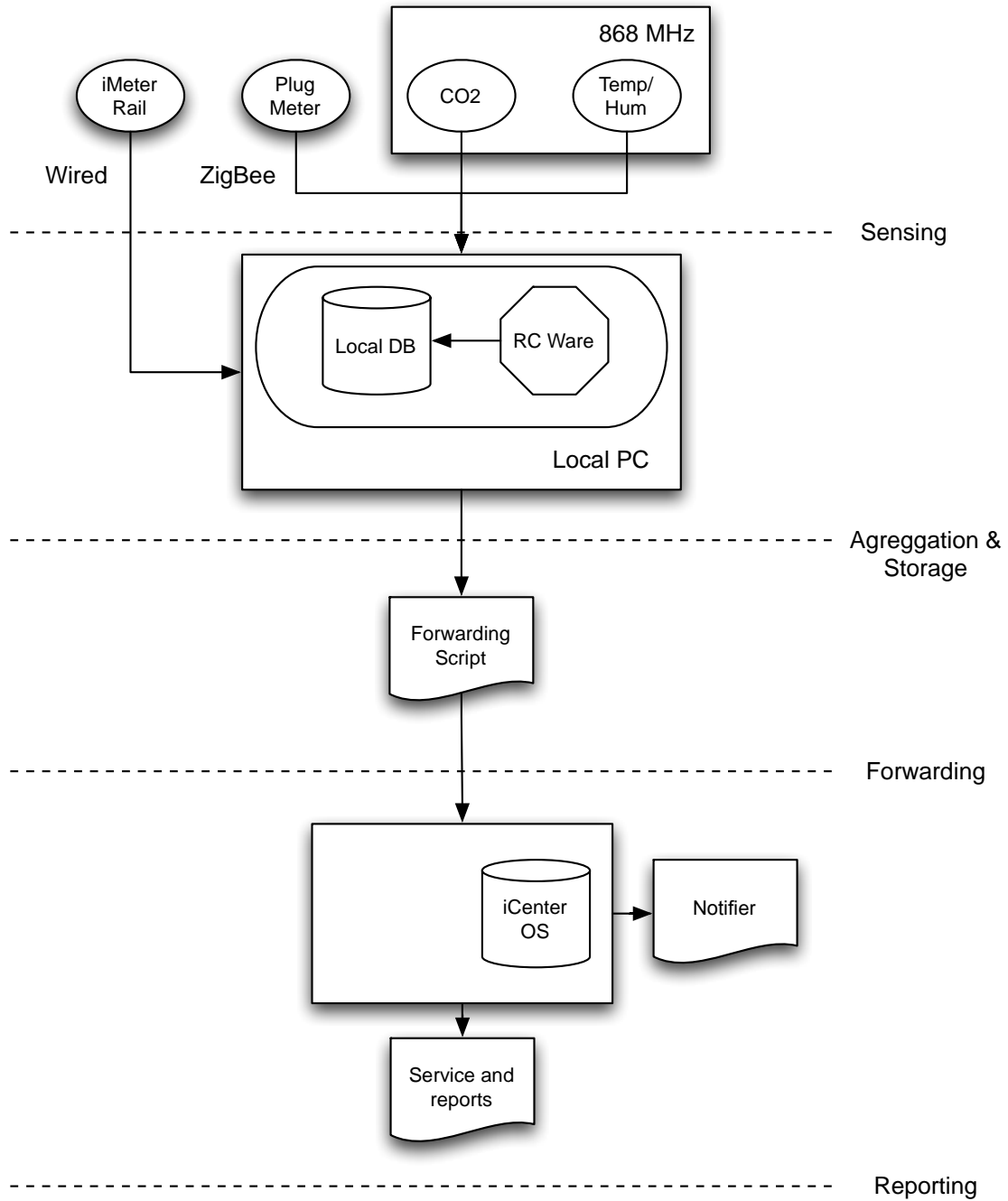
Helsinki Pilot ICT System Architecture
13.09.2010



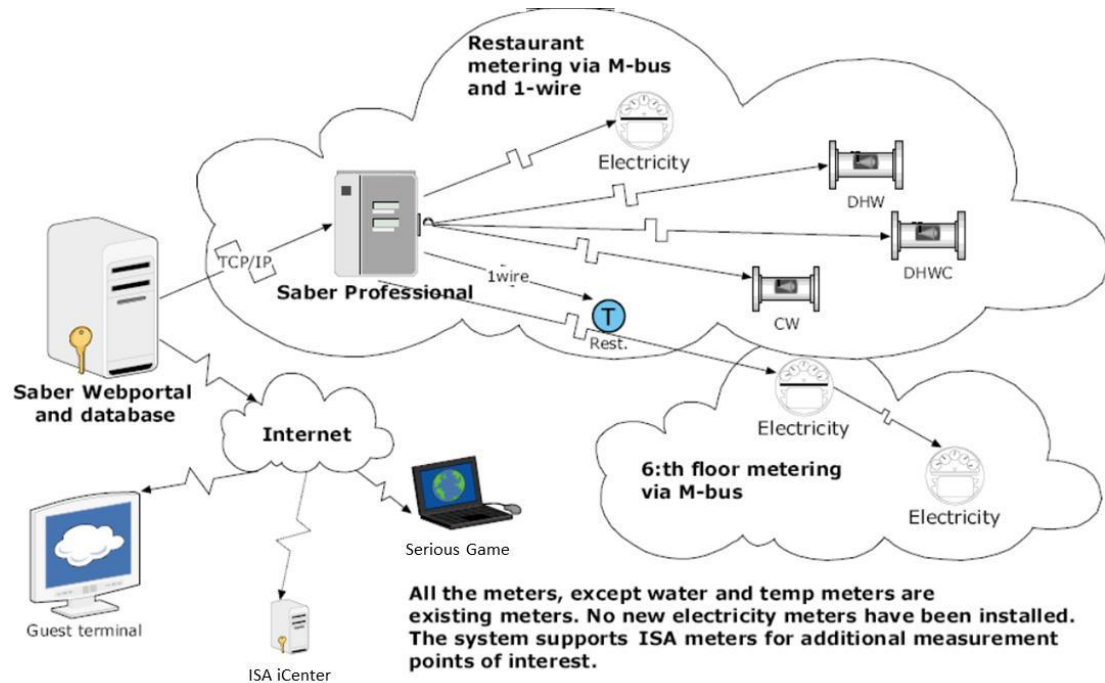
Leiden:



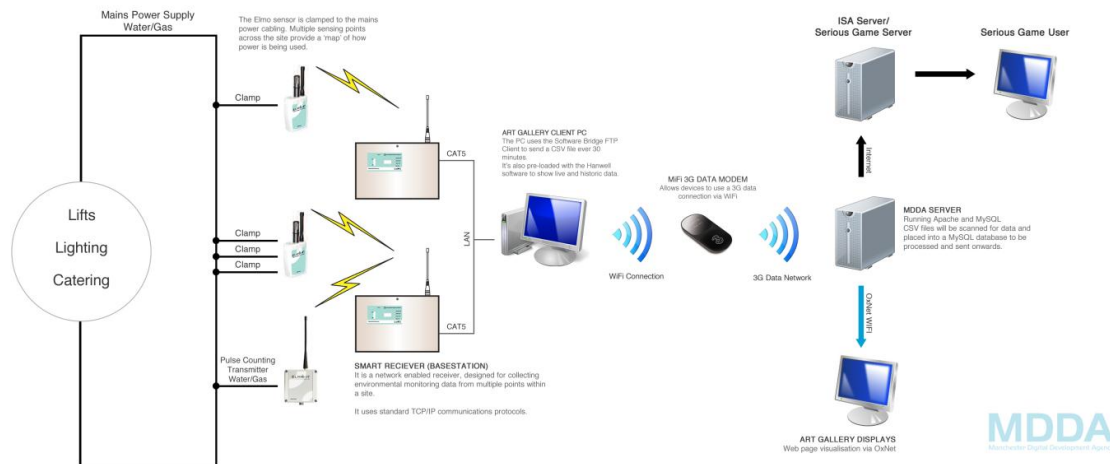
Lisbon:



Lulea:



Manchester:



During the process of implementation System Tests to the server have been undertaken, and can be found in the technical Annex II – Test Report iCenterOS and the generated code, iEnergyOS-soapui-test-project.

The tests reside moreover the server side, where we need to make sure that the envisaged system is ready to receive all data requests from the data pilots, the integration with the iCenter OS is defined through the API.

Adding New Mini-games to Green My Place

The mini-games in Green My Place are all designed to fit a particular presentation format. They are accessed via a button in the Green Box, and are displayed in a specifically designed page. The Green Box also shows a text description and the award which is earned by playing medal-winning games. The entire game should be possible to display in 5 different languages, including its description. All of these facts imply certain development constraints and requirements for the developer of new mini-games, which the 3 guides below explain. First, the guide to code specifies what needs to be added to or defined in the code of the game. Second, the guide to the platform illustrates how to use the admin panel of the Ruby on Rails framework to add a game and associated material. Finally, the guide to xml shows how games use xml for their data purposes.

Of note, all the technology used in the game is already described in D5.1 – we only describe here *how* to use it.

Guide to Code

Games should be developed in a way that localisation is easy to do at any stage of development. For example, games need 5 different versions of intro/splash screens depending of the language selection. Sparse use of text in the game elements makes the progress of making games faster.

Localisation of games is made possible with FlashVars. To load variables, you have to load them before anything else by placing this function to first frame:

```
function loaderComplete(myEvent:Event)
{
    var FlashVars=this.loaderInfo.parameters;
}
this.loaderInfo.addEventListener(Event.COMPLETE,
loaderComplete);
```

And after that you can call those variables

```
if(FlashVars.lang=="en"){code here}
```

Sending score and other data to main game from minigames example script getting score from textfield "scoreboard":

```
GlobalVarContainer.vars.loader = new URLLoader();

var loaderFun:Function = function
loaderCompleteHandler(event:Event):void
{
    var externalXML:XML;

    try {

        externalXML = new
XML(GlobalVarContainer.vars.loader.data);

        } catch (e:TypeError) {

            trace("Could not parse the XML file.");

        }
    var token:String = externalXML.token;

    try {

        var url:String = "/say/score";

        var request:URLRequest = new URLRequest(url);

        var variables:URLVariables = new URLVariables();

        variables.score = String(scoreboard);

        variables.codename = "switchingoff";

        variables.token = token;

        variables.perfect = String("false");

        variables.security =
SHA1.encrypt(String(variables.score) +
variables.codename + variables.perfect +
variables.token + "aww, come on...");

        request.data = variables;

        sendToURL(request);
```

```
    } catch (error:Error) {trace(error)}  
}  
  
GlobalVarContainer.vars.loader.addEventListener(Event.COMPLETE,  
loaderFun);
```

Scoring should be balanced between games so that every game has same level of difficulty to get points

Guide to Admin Rights

When a user logs in as *root*, they are automatically given admin rights over the game. This means they can see the admin panel, which is a list of links to various functions.

[users](#)
[visits](#)
[wall_posts](#)

[pilots](#)
[pilot_roles](#)

[pages](#)

[minigames](#)
[game descriptions](#)
[categories](#)
[categories_minigames](#)
[knowledge_items](#)

[award_categories](#)
[awards](#)
[medals](#)

This page: [Edit](#) | [Destroy](#) | [View All](#)

Using the admin panel on greenmyplace.net

If you log in as *root*, you can find the 'Admin panel' link at the bottom left corner. The Admin panel gives the user the capability to create the objects needed for implementing a new mini-game (among others). In addition to an object for the game, a new mini-game will need:

- A game description object (a short text in each of the five languages);
- An award object (with associated swf files);

A game also requires (these only need to be uploaded to the server, no object is created):

- An icon (which is a 64x64 pixel png image used in lists on the Account page, for instance);

- A button for the Green Box (which is an animated swf button).

It's important that when you create a mini game (or an award_category) it will be given an id number that you will need to remember to make links to it. You can always check a minigame's id by viewing the

<http://greenmyplace.net/minigames.xml>

page (or

http://greenmyplace.net/award_categories.xml

for award id-s) or by opening the game and checking the number in its address.

XMLs Accessible Through the Admin Page

These xml files should only be altered through the admin pages, not directly. In other words, there is a form available for each item detailed in these xmls, which can be used to read, create, update or destroy any object from the database.

Mini games xml:

<http://greenmyplace.net/minigames.xml>

<http://greenmyplace.net/minigames>

```
<minigames type="array">
  <minigame>
    <codename>>windowwatcher</codename>
    <created-at type="datetime">2010-03-02T14:31:25Z</created-at>
    <file-name>WindowWatcher.swf</file-name>
    <id type="integer">7</id>
    <screenshot-name>>windowwatcher.jpg</screenshot-name>
    <size-x type="integer">800</size-x>
    <size-y type="integer">500</size-y>
    <title>Window Watcher</title>
    <updated-at type="datetime">2010-08-26T11:42:23Z</updated-at>
  </minigame>
  ...
</minigames>
```

Adding a new mini game through the admin panel adds a new <minigame> tag to this xml.

Note that you can also view just one of the nodes of this xml like this:

<http://greenmyplace.net/minigames/7.xml>

and open the game associated with this xml here

<http://greenmyplace.net/minigames/7>

Mini game description xml: http://greenmyplace.net/game_descriptions/find/<minigame id>.xml

http://greenmyplace.net/game_descriptions

```
<?xml version="1.0" encoding="UTF-8"?>
<game-description>
  <created-at type="datetime">2010-09-30T07:19:50Z</created-at>
  <id type="integer">31</id>
  <language>fi</language>
  <minigame-id type="integer">3</minigame-id>
  <text>Elecktrickery on peli wateista. Sinun tulee verrata laitteita niiden virrankulutukseen n&#228;hden, ja valita se, joka mielest&#228;si k&#228;ytt&#228;v&#228; hiten virtaa - peli muuttuu koko ajan haastavammaksi. Varo ettei aika lopu kesken!</text>
  <updated-at type="datetime">2010-09-30T07:19:50Z</updated-at>
</game-description>
```

Adding a new mini game description through the admin panel creates a new xml like this one. To find the description in another language use one of the *?lang=fi / pt-PT / sv-SE / nl* parameters. E.g. the address for the previous example was:

http://greenmyplace.net/game_descriptions/find/3.xml?lang=fi

Pilots xml:

<http://greenmyplace.net/pilots.xml>

<http://greenmyplace.net/pilots>

```
<pilots type="array">
  <pilot>
    <banner>lisbon.png</banner>
    <created-at type="datetime">2010-03-01T14:33:46Z</created-at>
    <id type="integer">2</id>
    <language>nl</language>
    <name>Lisbon</name>
    <rank type="integer">1</rank>
    <score type="float">7611.3418</score>
    <swf>LisbonView.swf</swf>
    <updated-at type="datetime">2010-04-30T17:42:06Z</updated-at>
  </pilot>
  ...
</pilots>
```

Adding a new pilot through the admin panel would create a new <pilot> node in this xml... You can check the generated id of the pilots and use that info to know their address. E.g. Lisbon opens here:

<http://greenmyplace.net/pilots/2>

Award categories xml:

http://greenmyplace.net/award_categories.xml

http://greenmyplace.net/award_categories

```
<award-categories type="array">
  <award-category>
    <created-at type="datetime">2010-11-07T02:25:01Z</created-at>
    <id type="integer">5</id>
    <image>/swf/plantyellowim.swf</image>
    <minigame-id type="integer" nil="true"></minigame-id>
    <name>Yellow Plant</name>
    <swf>/swf/plantyellow.swf</swf>
    <tutorial-permalink>tutorials_week2</tutorial-permalink>
    <updated-at type="datetime">2010-11-10T16:23:48Z</updated-at>
```

```
</award-category>
```

```
...
```

```
</award-categories>
```

Adding a new award category through the admin panel adds a new `<award-category>` tag to this xml.

Note that you can also view just one of the nodes of this xml like this:

http://greenmyplace.net/award_categories/5.xml

and find the award's page here

http://greenmyplace.net/award_categories/5

Guide to xml

How to find the xml-s and swf files that build up greenmyplace.net?

Log in to ftp.greenmyplace.net and then navigate to `/home/ckir/rails/public/swf`. The files in this folder open up when you go to greenmyplace.net in a browser. For the development version, go to `/home/ckir/railsdev/public/swf` instead.

Changing the Green Box

Use the `gamesList.xml` to change the name, image, link and award of the activities in the Green Box. From WinSCP go to: `/home/ckir/rails/public/swf` to find it, from browser:

<http://greenmyplace.net/swf/gamesList.xml>

gamesList.xml's structure:

The xml builds up from months and months build up from weeks. Additionally there is one extra node at the beginning for setting the current month, called `currentMonth`. Changing this will move the NOW point on the line and also change the NEW RELEASES, FUTURE RELEASES, etc. texts accordingly.

One month:

```
<months>
  <months>
    <currentMonth>1</currentMonth>
    <!--1 November-->
    <month>
      <week>
```

```
<id>3</id>
<name>ELECTRICKERY</name>
<image>/swf/ebutton.swf</image>
<icon>/swf/electmini.swf</icon>
<link>/minigames/3</link>
<desc>/game_descriptions/find/3.xml</desc>
<awardId>3</awardId>
<locked>no</locked>
<innewtab>no</innewtab>
</week>
<week>
  <id>5</id>
  <name>FIRST TUTORIALS</name>
  <image>/swf/tutorial1button.swf</image>
  <icon></icon>
  <link>/tutorials_week2</link>
  <desc>Tutorial about the connection between Save Energy
  and Green My Place and how you can support your
  team.</desc>
  <awardId>5</awardId>
  <locked>no</locked>
  <innewtab>yes</innewtab>
</week>
<week>
  <id>7</id>
  <name>WINDOW WATCHER</name>
  <image>/swf/wwbutton.swf</image>
  <icon>/swf/wwmini.swf</icon>
  <link>/minigames/7</link>
  <desc>/game_descriptions/find/7.xml</desc>
  <awardId>4</awardId>
  <locked>no</locked>
  <innewtab>no</innewtab>
</week>
```

```
<week>

  <id>8</id>

  <name>OTHER TUTORIALS</name>

  <image>/swf/tutorial2button.swf</image>

  <icon></icon>

  <link>/tutorials_week4</link>

  <desc>Tutorial about Green My Place as a guest and team
  ranking.</desc>

  <awardId>6</awardId>

  <locked>yes</locked>

  <innewtab>yes</innewtab>

</week>

<week>

  <id></id>

  <name>ENERGY QUIZ</name>

  <image></image>

  <icon></icon>

  <link></link>

  <desc>Energy quiz is designed to test how much you know
  about energy efficiency.</desc>

  <awardId>7</awardId>

  <locked>yes</locked>

  <innewtab>no</innewtab>

</week>

</month>
```

...

</months>

There can be 5 or fewer weeks in a month (otherwise the buttons won't fit in the green box) and any number of months.

One week's structure:

```
<week>

  <id>3</id>
```

In case it's a game this should be its id that was given to it when created, otherwise can be left blank .

```
<name>Electrickery</name>
```

The name of the activity. In case it's a game this should be the same as what was given to it when created. This name appears on the Account Page under 'My Green Acts' tab and on every pilot page under the 'AWARDS & PLAYERS' bubble.

```
<image>/swf/ebutton.swf</image>
```

Relative path to the button's image (png, jpg, swf). This appears in the Green Box (the one that the user can click).

```
<icon>/swf/electmini.swf</icon>
```

Relative path to a small icon (30x30 px, png, jpg, swf). This appears in the Account Page under 'My Green Acts' tab.

```
<link>/minigames/3</link>
```

Relative path to the page that should open when the button is clicked. In case it's a game the path will be '/minigames/<game id>' .

```
<desc>/game_descriptions/find/3.xml</desc>
```

In case it's a game: relative path to the description of the game '/game_descriptions/find/<game id>.xml'. Otherwise: any text. This will appear in the Green Box under the buttons.

```
<awardId>3</awardId>
```

This should be one of the id-s from the award_categories created on the admin page.

http://greenmyplace.net/award_categories

The name and the swf of the award appear in the Green Box and on every pilot page under the 'AWARDS & PLAYERS' bubble twice. The image appears on the pilot page next to the building if the award has been awarded.

```
<locked>no</locked>
```

This should be 'no' or 'yes'. Writing here 'yes' will lock this activity meaning that it will show the button the award and the description assigned to it but there will be a lock image on it and clicking it won't open the page written in the 'link' tag. This tag can be left empty but that defaults to 'no', so the activity won't be locked.



<innewtab>no</innewtab>

This should be 'no' or 'yes'. Writing here 'yes' means that the page specified in the link node should open up on a new browser tab. This tag can be left empty but that defaults to 'no', so the page will open up on the current tab.

</week>

Annex A: Quick access to pages

Webpages

Log In Screen: <http://greenmyplace.net/>

Europe view: <http://greenmyplace.net/home>

Manchester view: <http://greenmyplace.net/pilots/1>

Lisbon view: <http://greenmyplace.net/pilots/2>

Leiden view: <http://greenmyplace.net/pilots/3>

Lulea view: <http://greenmyplace.net/pilots/4>

Helsinki view: <http://greenmyplace.net/pilots/5>

Account view: <http://greenmyplace.net/users/current>

Admin pages, if logged in as *root*:

Admin panel: <http://greenmyplace.net/admin>

Mini games list: <http://greenmyplace.net/minigames>

Mini game descriptions: http://greenmyplace.net/game_descriptions

Wall posts: http://greenmyplace.net/wall_posts

Awards: <http://greenmyplace.net/awards>

Award categories: http://greenmyplace.net/award_categories

...

Games

Aircon-Troll Puzzle: <http://greenmyplace.net/minigames/1>

ReNewer: <http://greenmyplace.net/minigames/2>

Electrickery: <http://greenmyplace.net/minigames/3>

Energy Dash: <http://greenmyplace.net/minigames/4>

Aircon-Troll: <http://greenmyplace.net/minigames/5>

Knocking Off: <http://greenmyplace.net/minigames/6>

Window Watcher: <http://greenmyplace.net/minigames/7>

Direct links to games

Aircon-Troll Puzzle: <http://greenmyplace.net/swf/PipePuzzle.swf>

ReNewer: <http://greenmyplace.net/swf/pulp.swf>

Electrickery: <http://greenmyplace.net/swf/Electrickery.swf>

Energy Dash: <http://greenmyplace.net/swf/dash.swf>

Aircon-Troll: <http://greenmyplace.net/swf/Pipe.swf>

Knocking Off: <http://greenmyplace.net/swf/KnockingOff.swf>

Window Watcher: <http://greenmyplace.net/swf/WindowWatcher.swf>

Switching Off: <http://greenmyplace.net/swf/switchingoff.swf>

Switch Search: <http://greenmyplace.net/swf/switchsearch.swf>

Parameters

Remember that you can change the language of any page by typing *?lang=fi / pt-PT / sv-SE / nl* at the end of its address. And also change the skin of minigames by typing *?skin=fi / pt-PT / sv-SE / nl* at the end of the address.

Annex B - Test Report iCenterOS

Annex C - iEnergyOS-soapui-test-project