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Monitoring and Validation of Services

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Agustin González-Quel	22/02/17	Draft 0.1	Table of contents and tips to include information from the monitoring activities carried out in the last months.
Agustin González-Quel, Julian Arroyo Dimitris Simitopoulos, Christos Lampros, Miguel Tavares, Balázs Bodnár.	14/03/2017	0.2	First draft including all document sections.
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Agustín González-Quel.	31/03/2017	1.0	First version

Executive Summary

This document is the final deliverable of WP 1 intended to present the work done to monitor and validation of services. This activity is considered from a multiple perspective:

- Validation of the services deployed, evaluating how the different applications cloudified are validated from the technical and deployment point of view. Each city has applied slightly different procedures. The reason for that is that deployment of applications and services must be coincident with the strategic and political agenda of the Municipality. This is a fact to be considered for similar processes in the future.
- Validation of the Open Innovation process followed in STORM CLOUDS shows that the key stakeholders in a process like this are the personnel of the Municipality at the different levels: Political management, technical and financial. The cloudification process is mostly transparent to the user that is not concerned about the technical mechanism that hosts the services.
- Last, the migration process has been considered particularly interesting in all Municipalities. We have extracted some technical conclusions and, specially, organisational conclusions: Having a realistic planning that considers all possible barriers in the process is the key tool for the process.

The experience brings some conclusions summarised in section 5 under the title "barriers found and lessons learnt". We may extract, some of them

- Cloud migration is transparent to the citizen so their involvement in the process is not particularly relevant, while it is essential to involve the technical, administrative and political/management stakeholders of the Municipality.
- The leadership of the top management of the organisation is essential.
- Change management policies must be foressen and put in practice from the very begining..
- It is particularly important to have a detailed technical plan to be absolutely sure that all the required elements will be available prior to face the migration.
- The availability of trained personnel for the new environment is to be ensured. Either by training the existing technical people or by hiring new personnel.
- The ownership of applications to be migrated must be ensured before the process is to start. Existing applications may be locked in by legal agreements with vendors.
- From the financial staff it is important to plan the actions to be taken:
- Training sessions to Municipality personnel are required.
- Political changes may stop, even drop, the whole process as, normally, they bring changes in the priorities of the City agenda.

The following major achievements can be summarised as results from the work in STORM CLOUDS

- **Valladolid** has started the process to migrate their whole infrastructure to their own IT infrastructure. This infrastructure will operate as a private cloud that will interact with public clouds for punctual services.
- **Thessaloniki** has launched several applications particularly relevant for the City. Thessaloniki is a large city and these applications that are already in production represent an important step towards the city modernisation. They are very well accepted by the population.
- **Agueda**, based on the STORM CLOUDS experience, has decided to migrate their own IT infrastructure to the cloud. The process has started by contracting a cloud to a Portuguese company. The migration of the first applications is already in place.
- **Miskolc** is implementing their first applications successfully. In particular, the Open Data application is expected to push ahead a number of start-ups in the city.

According to these results, it is clear that STORM CLOUDS has produced a relevant impact in the participant cities and they can be an example of cloud adoption in Europe.

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Abbreviations

Acronym	Description
DBMS	Data Base Management System
GIS	Geographic Information System
HTTP	Hypertext Transfer Protocol
IaaS	Infrastructure as a Service
IT	Information Technology
PaaS	Platform as a Service
SaaS	Software as a Service
SFTP	Secured File Transfer Protocol
SME	Small and Medium Enterprise
SMTP	Simple Mail Transfer Protocol
SSL	Secure Socket Layer
SSH	Secure Socket Shell
WP	Work Package

1 Introduction

This document is the final deliverable of WP 1 related to monitor and validation of services. In this sense, this document can be considered as a summary and conclusions of all the work done in the project within WP1.

This document builds on a previous deliverable of this WP [SC-D1.4.1-2015] and, therefore, many references to those contents are included here. We will not be repeating the text in that document but some conclusions from that document will be also included here. This way this document is absolutely self-contained and for further reference and details, the reader should consider D1.4.1.

Monitoring and validation in the context of STORM CLOUDS project is considered from a multiple perspective:

- Validation of the services deployed. This includes the service itself and also the reliability of the cloud support that is new in the project. We present in this document the feedback from the services and also from the cloud support. In this latter case, the feedback comes from the technical staff of the municipalities as the citizen is not aware about where a service is hosted.
- Validation of the Open Innovation process followed in STORM CLOUDS. Already in D1.4.1 we included feedback of this topic. At the end of the project we have created a formal survey to get the feedback from the users in a structured way. The objective is to understand if this methodology is applicable to face a cloudification process.
- Validation of the migration process. This is the key element for STORM CLOUDS. The objective of the project is not to define services nor to put them in production. The objective is to analyse the migration process. Therefore, most valuable conclusions can be obtained from the monitoring of the migration process. For this purpose we have designed a survey for the municipalities involved in the project so we can validate the work in this area.

Finally all the experience is summarised in section 5 under the title “barriers found and lessons learnt”. In this section we include a summary with the main conclusions from WP1 during the project. We firmly believe that these conclusions are very valuable and they will help for future Municipalities and Public Administrations in Europe that are willing to face cloud migration processes.

2 Monitoring and Validation of Services Cloudified

The monitoring and validation of services includes two main aspects:

- On the one hand, the specific activities carried out on the services cloudified during the second innovation cycle. It is important to understand if these services can be useful to the citizenship but also, if this way of deploying services can be sustainable in the City after the project end.
- Connecting with this latter fact, the replicability of the cloudification activities will also be based on the reliability of the cloud infrastructure. Services cloudified will be valuable for the cities and the assessment may be appropriate if they are available at 99,99% of the time.

About Cloud monitoring, Annex I of this document includes the graphical representation provided by Zabbix monitoring tool [ZabbixWEb] used in the SCP [SC-D2.3.3-2015]. As a summary, we must state that the SCP@Enter cloud used in the process is providing up times over 99,99%. This is a normal figure for most cloud providers. The fact that no information from up times at the cities Data Centres is available, makes impossible to compare. The overall impression of the technical staff is that reliability of a professional cloud service is higher than private IT installations.

This is even more evident if the Municipality is a small or medium city: A large city will normally have a large team to deploy and support their IT infrastructure. As well as support tools, alert systems, etc. If we focus on mid or small cities, their IT budget is normally bounded and the teams consist of few professionals. It is very difficult to set up services as 24x7 support or bounded response times upon failure.

About the services itself, at this moment all the services cloudified are up and running. Some of them are already publicly available as they have been naturally integrated into the main strategic IT plans of the cities. In the case of the services selected for the second phase, some of them are waiting to be incorporated into the deployment plans of the city. In some cases, the reason is that the Municipality political responsible are waiting to carry out the launching near an election process while, in some other cases, the public launching of the services must be coincident to a specific promotion campaign of the Municipality that involves several topics.

In the following subsections, we include the experience of each city in the project.

2.1 Validation of Services in Valladolid

The portfolio of services deployed in Valladolid consist of the following services:

- Phase 1
  - Urbanismo en Red UeR (*Urbanism through the network*)
  - Vive Valladolid
- Phase 2
  - Virtual City Market
  - CloudFunding

Validation of services deployed in the second phase in Valladolid has been carried out based on two diferent profiled users:

- Personnel of the Municipality, both technical and managerial.
- Selected citizens from the original groups that participated in the selection processes.

Validation has shown that the applications selected are suitable for the city needs and they can fulfil the initial requirements identified at the working sessions with stakeholders, namely:

- Easy to maintain: The Municipality can not charge with additional operating costs.
- Answer to specific needs/demands of the citizens
- Improve the economy of the city.

At this moment, the services are publicly available and can be accessed by the citizens. It is now a decision of the Municipality to start the promotion of the services so they are known by all the citizens and can be massively accessed. There are two issues that are under consideration before this decision is to be taken

- Valladolid Municipality promoted a shopping center application in the last months and there are some functionalities that overlap with Virtual City Mall. At this moment, it is under study which is the application that finally is proposed to the local shops in the city.
- In the case of CloudFunding, there are some legal issues with the management of the funds that the citizenship may send to the application. There are strict regulations for the Spanish Municipalities for funds management and it is being discussed what are the mechanisms to be implemented.

Once these issues are solved, the applications will be fully operated by the citizens.

2.2 Services Monitoring in Thessaloniki

The portfolio of services deployed in Thessaloniki consist of the following services:

- Phase 1
  - Virtual City Market
  - CityBranding
- Phase 2
  - CloudFunding
  - Vive Thessaloniki

In order to monitor the services, Thessaloniki Municipality along with URENIO-AUTH established a four dimensions group of indicators for each service separately analysing supply, demand, dissemination and the level of validation. For this purpose a number of indicators for each application were produced.

In these pages, we include the data compiled from 01/08/2015 to 28/02/2017 for those indicators.

Virtual City Market

Supply	Nbr of shops participating in the app	620
	% of shops participating in the platform/shops in the area (total)	
	Nbr of shops that have extended their online presence in the platform	43
	Nbr of shops making online transactions through the platform	0
	Nbr of offers per shop	0.05 (total=30 offers)
	Nbr of synergies between two or more shops	0
Demand	Nbr of users – visitors (since 28.02.2017)	10.142
	Nbr of registered users	100
	Area, Age	See figures below
	Sex	Female 36.15% Male 63.85%
	Nbr of stakeholders providing feedback for the application	7
Validation	Nbr of users providing feedback for the application	≈50
	Nbr of stakeholders providing feedback for the application	7
	Nbr of modifications (new characteristics that have been modified based on the feedback received)	3
	Engagement	See figures below

Nbr of sessions per Country			
1	GREECE	10.721	88,54 %
2	USA	619	5,11 %
3	SPAIN	85	0,7 %
4	FRANCE	79	0,65 %
5	OTHER		5 %

% per Ages		
1	18-24	23.82%
2	25-34	35.24%
3	35-44	20.85%
4	45-54	11.42%
5	55-64	5.84%
6	65+	2.82%

Engagement		
1	0-1 MIN	79.61%
2	1-10 MIN	16.31%
3	10+ MIN	4.08%

Citybranding

Supply	Nbr of shops participating in the app	40
Demand	Nbr of users – visitors (since 28.02.2017)	27
	Nbr of registered users	-
	Area, Age	See figures below
	Sex	Female 0% Male100%
Validation	Engagement	See figures below

Nbr of sessions per Country			
1	GREECE	123	80,39 %
2	POLAND	7	4,58 %
3	UNITED KINGDOM	5	3,27 %
4	SPAIN	4	2,61%
5	OTHER		9,15 %

Engagement		
1	0-1 MIN	66.01%
2	1-10 MIN	19.6%
3	10+ MIN	14.37%

Cloudfunding

This application was not functional until now. So all the projects that are hosted until now are not applicable. The group of indicators for this service separately analysing supply, demand, dissemination and the level of validation.

Supply	Nbr of projects in the app	-
	% of projects completed (total)	-
Demand	Nbr of users – visitors (since 28.02.2017)	54
	Nbr of registered users	-
	Area, Age	See figures below
	Sex	Female 12.64% Male 87.36%
Validation	Nbr of successful projects for the application	-
	Average amount of funds for the application	-
	Engagement	See figures below

Nbr of sessions per Country			
1	GREECE	165	72,69 %
2	SPAIN	6	2,64 %
3	GERMANY	5	2,2 %
4	NETHERLANDS	5	2,2 %
5	OTHER		16,27 %

% per Ages		
1	18-24	0%
2	25-34	28.32%
3	35-44	71.68%
4	45-54	0%
5	55-64	0%
6	65+	0%

Engagement		
1	0-1 MIN	24.81%
2	1-10 MIN	22.54%
3	10+ MIN	52.65%

Vive Thessaloniki

Supply	Nbr of EVENTS in the app	9
	Type of EVENTS in the app	7
	Price Categories	3
Demand	Nbr of users – visitors (since 28.02.2017)	203
	Nbr of registered users	8
	Area, Age	See figures below
	Sex	Female 47.98% Male 52.02%
Validation	Average Amount of money per Event	Free 2 Less than or equal 15€

		4 More 15€ 3
	Nbr of reported Events	0
	Engagement	See figures below

Nbr of sessions per Country			
1	GREECE	289	89,20 %
2	GERMANY	5	1,54 %
3	SPAIN	11	3,4 %
4	UNITED STATES	5	1,54 %
5	OTHER		4,32 %

% per Ages		
1	18-24	8.93%
2	25-34	32.74%
3	35-44	27.98%
4	45-54	20.24%
5	55-64	10.12%
6	65+	0%

Engagement		
1	0-1 MIN	35.24%
2	1-10 MIN	28.04%
3	10+ MIN	36.36%

2.3 Validation of Services in Agueda

The portfolio of services deployed in Agueda consist of the following services:

- Phase 1
  - Have you Say (Eu Participo)
  - Location Plans
- Phase 2
  - Vive Agueda

The applications selected for the second phase was only Vive. CloudFunding and Virtual City Market were also considered very interesting for the city. However, at this moment, the definitive selection for a fourth application is under study due to its implications to the executive's agenda and legal limitations. Therefore, only Vive is fully operative

During the project life, the following information was gathered from application usage. It is important to bear in mind that Agueda Municipality has about 40.000 inhabitants, from which, only 15.000 are living in an urban environment. The information gathered from the applications' usage is basically number of registered users and number of people accessing the tool.

- Have Your Say, Registered users: 144
  - Logs: Access of registered users
    - 2015 = 1563
    - 2016 = 1465
    - 2017 (only until mid march) = 192
- Location Plans: Registered users: 178
  - Logs: Plant printed (to pdf) by citizens

- 2015 = 2736
- 2016 = 3652
- 2017 (only until mid march) = 1494

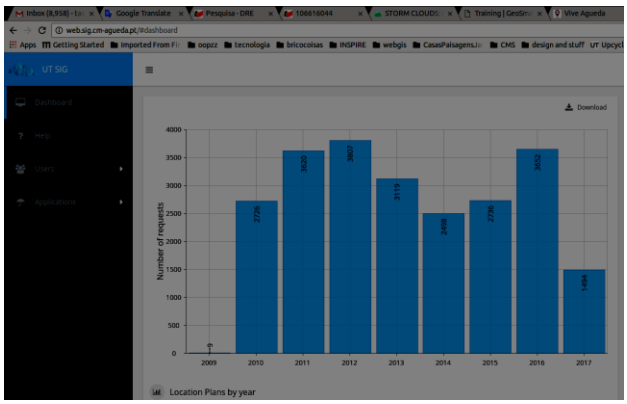


Figure 1: Location Plans statistics

- VIVE Águeda (open to the public on 1 march 2017). Registered users: 12

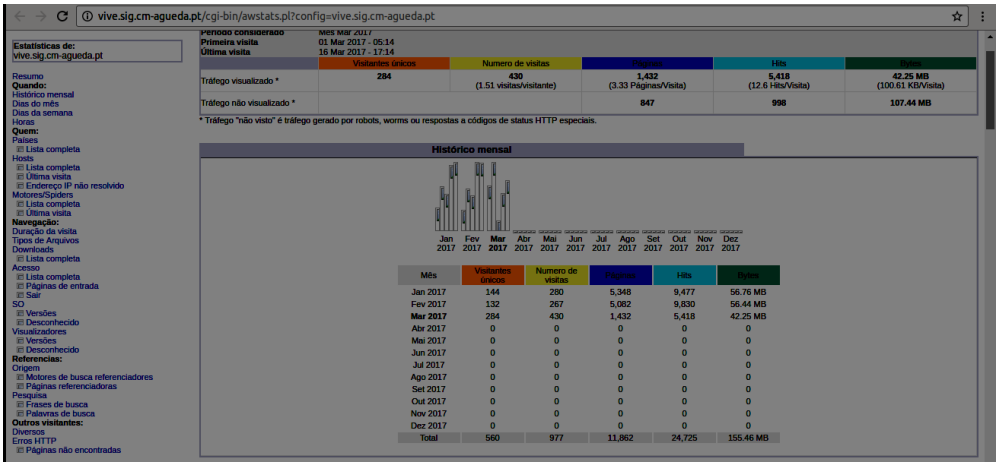


Figure 2: Vive Águeda statistics (1 month)

About application usage we may mention

- Location Plans have a growing usage after the full development of inputs covered by stakeholders more than 100%
- The use of the service - Have Your Say - depends on whether or not there are open themes, by the municipality, to public discussion.
- VIVE Águeda is quiet new to the public for having significant usage data. However the numbers pointing for 284 unique visitores and 430 visits in 16 days after presenting the service in STORM Clouds event on 1 march.

2.4 Validation of Services in Miskolc

The validation of services at Miskolc is based on two aspects: technical and usage by the citizens. In the following sections we explain how these have been carried out:

2.4.1 Technical Monitoring

2.4.1.1 Timi – Infrastructure load test 2016.12.25. – 2017.02.28.

We accomplished the infrastructure test with a PHP program made straight for this purpose. PHP script sent multeity of fictive TiMi reports to the server, while we were monitoring the exploitage of server resources.

Registered users: 8

All attendees: 208

Error reports: 64157

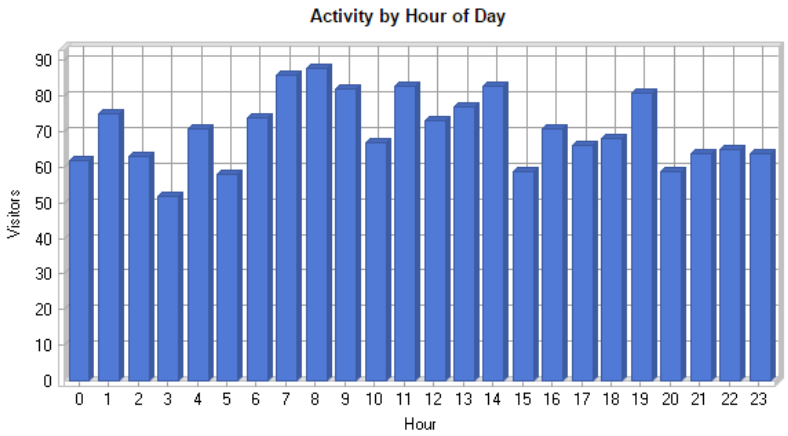
Hits	
Total Hits	212,531
Visitor Hits	208,395
Spider Hits	4,136
Average Hits per Day	3,220
Average Hits per Visitor	123.24
Cached Requests	4,751
Failed Requests	1,978
Page Views	
Total Page Views	197,160
Average Page Views per Day	2,987
Average Page Views per Visitor	116.59
Visitors	
Total Visitors	1,691
Average Visitors per Day	25
Total Unique IPs	456
Bandwidth	
Total Bandwidth	1.82 GB
Visitor Bandwidth	1.72 GB
Spider Bandwidth	104.84 MB
Average Bandwidth per Day	28.31 MB
Average Bandwidth per Hit	9.00 KB
Average Bandwidth per Visitor	1.04 MB

Figure 3: TiMi Data traffic during infrastructure testing

Daily Activity

Date	Hits	Page Views	Visitors	Average Visit Length	Bandwidth (KB)
Tue 2017. 01. 10.	90	17	16	00:00	2,111
Wed 2017. 01. 11.	85	34	31	01:00	2,486
Thu 2017. 01. 12.	84	36	30	01:00	2,558
Fri 2017. 01. 13.	178	58	27	01:06	3,731
Sat 2017. 01. 14.	137	31	26	01:36	2,732
Sun 2017. 01. 15.	93	31	23	02:04	2,250
Mon 2017. 01. 16.	67	16	16	00:00	1,924
Tue 2017. 01. 17.	129	20	13	00:16	2,464
Wed 2017. 01. 18.	101	47	35	00:00	2,980
Thu 2017. 01. 19.	112	58	34	00:37	3,501
Fri 2017. 01. 20.	176	126	24	02:43	5,487
Sat 2017. 01. 21.	106	34	33	00:53	2,653
Sun 2017. 01. 22.	83	30	24	01:41	2,309
Mon 2017. 01. 23.	98	34	36	00:00	2,794
Tue 2017. 01. 24.	111	22	22	00:00	2,380
Wed 2017. 01. 25.	86	31	28	00:43	2,674
Thu 2017. 01. 26.	580	200	29	04:09	16,622
Fri 2017. 01. 27.	3,292	1,120	31	05:41	74,693
Sat 2017. 01. 28.	174	27	25	00:00	2,749
Sun 2017. 01. 29.	82	21	24	00:00	2,340
Mon 2017. 01. 30.	917	372	29	01:02	13,705
Tue 2017. 01. 31.	87	27	24	02:48	1,246
Wed 2017. 02. 01.	90	30	31	00:00	346
Thu 2017. 02. 02.	75	25	25	00:00	288
Fri 2017. 02. 03.	917	304	36	03:29	7,498
Sat 2017. 02. 04.	96	25	21	01:10	2,369
Sun 2017. 02. 05.	172	47	27	00:28	3,142
Mon 2017. 02. 06.	59,484	56,162	42	24:22	558,708
Tue 2017. 02. 07.	28,342	24,653	34	09:42	848,972
Wed 2017. 02. 08.	39,454	39,272	32	15:42	27,230
Thu 2017. 02. 09.	21,968	21,890	35	09:47	18,868
Fri 2017. 02. 10.	147	95	25	02:53	2,910
Sat 2017. 02. 11.	104	26	24	01:47	2,468
Sun 2017. 02. 12.	154	24	23	03:25	2,668
Mon 2017. 02. 13.	41,008	40,823	33	20:54	89,040
Tue 2017. 02. 14.	1,366	1,225	24	04:10	107,025
Wed 2017. 02. 15.	9,092	8,947	31	04:10	10,545
Thu 2017. 02. 16.	84	30	31	00:00	2,523
Fri 2017. 02. 17.	164	113	27	02:43	4,894
Sat 2017. 02. 18.	238	107	31	02:52	4,493
Sun 2017. 02. 19.	94	29	32	00:00	2,464
Mon 2017. 02. 20.	96	45	24	01:12	2,892
Tue 2017. 02. 21.	268	219	26	00:03	2,423
Wed 2017. 02. 22.	241	128	31	01:30	3,534
Thu 2017. 02. 23.	169	51	32	00:01	3,240
Fri 2017. 02. 24.	81	30	25	01:06	2,524
Sat 2017. 02. 25.	78	23	23	00:42	2,361
Sun 2017. 02. 26.	99	45	28	01:46	2,944
Mon 2017. 02. 27.	149	25	27	01:02	2,682
Tue 2017. 02. 28.	53	18	18	00:00	1,657
Subtotal	**211,151**	**196,803**	**1,378**	**03:20**	**1,877,121**
Total	**212,531**	**197,160**	**1,691**	**02:50**	**1,913,248**

Figure 4: TiMi daily activity



Activity by Hour of Day

Hour	Hits	Page Views	Visitors	Bandwidth (KB)
00:00 - 00:59	217	73	62	6,296
01:00 - 01:59	412	105	75	7,749
02:00 - 02:59	219	73	63	6,228
03:00 - 03:59	267	55	52	6,188
04:00 - 04:59	211	74	71	6,236
05:00 - 05:59	386	249	58	9,360
06:00 - 06:59	240	80	74	6,287
07:00 - 07:59	1,502	1,105	86	8,799
08:00 - 08:59	18,493	16,021	88	553,354
09:00 - 09:59	11,466	10,011	82	166,893
10:00 - 10:59	27,307	26,818	67	25,260
11:00 - 11:59	27,486	25,513	83	72,772
12:00 - 12:59	24,798	23,655	73	52,606
13:00 - 13:59	30,738	28,141	77	522,945
14:00 - 14:59	40,937	39,370	83	374,015
15:00 - 15:59	21,035	20,834	59	17,941
16:00 - 16:59	4,745	4,177	71	24,690
17:00 - 17:59	458	285	66	6,277
18:00 - 18:59	209	74	68	5,998
19:00 - 19:59	276	107	81	6,888
20:00 - 20:59	281	81	59	6,774
21:00 - 21:59	234	69	64	6,105
22:00 - 22:59	339	125	65	7,330
23:00 - 23:59	275	65	64	6,247
Total	**212,531**	**197,160**	**1,691**	**1,913,248**

Figure 5: TiMi data traffic evolution during workday

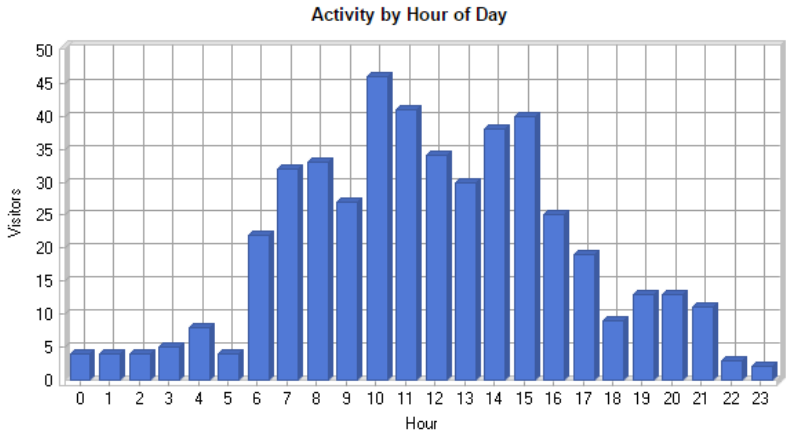
2.4.1.2TiMi – Closed user test 2017.02.25. – 2017.03.23.

During the closed user tests we did human tests with the inclusion of MIVÍZ Ltd., MIHŐ Ltd., Ciy Maintenance Non-profit Ltd. and Miskolc Holding Plc.

Registered users: 35

All attendees: 467

Number of error reports: 275



Activity by Hour of Day

Hour	Hits	Page Views	Visitors	Bandwidth (KB)
00:00 - 00:59	80	5	4	423
01:00 - 01:59	71	6	4	278
02:00 - 02:59	88	23	4	889
03:00 - 03:59	23	7	5	204
04:00 - 04:59	132	26	8	18,205
05:00 - 05:59	47	17	4	238
06:00 - 06:59	85	50	22	13,557
07:00 - 07:59	1,372	349	32	322,845
08:00 - 08:59	3,592	670	33	317,888
09:00 - 09:59	3,197	655	27	310,018
10:00 - 10:59	6,600	1,057	46	449,494
11:00 - 11:59	17,345	879	41	1,531,992
12:00 - 12:59	3,592	490	34	248,904
13:00 - 13:59	6,389	607	30	1,213,606
14:00 - 14:59	6,311	563	38	1,328,063
15:00 - 15:59	8,599	738	40	1,490,421
16:00 - 16:59	1,499	468	25	186,219
17:00 - 17:59	254	140	19	53,828
18:00 - 18:59	32	15	9	3,851
19:00 - 19:59	340	53	13	28,617
20:00 - 20:59	88	50	13	5,517
21:00 - 21:59	127	25	11	13,543
22:00 - 22:59	23	3	3	160
23:00 - 23:59	11	3	2	85
Total	**59,897**	**6,899**	**467**	**7,538,855**

Figure 6: TiMi data traffic evolution during workday (closed test)

Most Popular Pages

	Page	Hits	Incomplete Requests	Visitors	Bandwidth (KB)
1	http://timi.hu/mob/datajson.php	1,296	0	243	1,375
2	http://timi.hu/mob/selectlast3a.php	680	0	115	887,526
3	http://timi.hu/mob/uploadimage.php	1,952	0	100	767
4	http://timi.hu/mob/signinlogin2.php	378	0	75	171
5	http://timi.hu/mob/selectgpsdata.php	237	0	66	1,237
6	http://timi.hu/	104	0	60	1,193
7	http://timi.hu/mob/mapbounds.php	74	0	59	67
8	http://timi.hu/mob/webremoricka.php	644	0	51	3,017
9	http://timi.hu/mob/ticketinformation.php	325	0	47	175,957
10	http://timi.hu/phadm/js/ messages.php	60	0	24	337
11	http://timi.hu/phadm/navigation.php	81	0	24	707
12	http://timi.hu/phadm/	131	0	24	205
13	http://timi.hu/phadm/phpmyadmin.css.php	91	0	24	603
14	http://timi.hu/phadm/sql.php	307	0	23	2,334
15	http://timi.hu/phadm/main.php	32	0	23	242
16	http://timi.hu/phadm/db_structure.php	32	0	21	773
17	http://timi.hu/mob/mapbounds_vp.php	24	0	16	35
18	http://timi.hu/mob/status.php	28	0	14	7
19	http://timi.hu/user/	24	0	12	209
20	http://timi.hu/phadm/import.php	42	0	5	166
21	http://timi.hu/phadm/tbl_change.php	16	0	4	108
22	http://timi.hu/mob/modifyimage.php	102	0	4	3,369
23	http://timi.hu/phadm/tbl_replace.php	18	0	4	138
24	http://timi.hu/phadm/tbl_sql.php	25	0	4	90
25	http://timi.hu/phadm/tbl_operations.php	10	0	3	73
26	http://timi.hu/phadm/tbl_structure.php	10	0	3	60
27	http://timi.hu/phadm/view_create.php	10	0	3	121
28	http://timi.hu/error-map/	5	0	3	96
29	http://timi.hu/user/login/	3	0	2	23
30	http://timi.hu/hu/	2	0	2	18
31	http://timi.hu/how-it-works/	4	0	2	104
32	http://timi.hu/mob/proba.php	16	0	2	2,124
33	http://timi.hu/phadm/db_sql.php	5	0	2	17
34	http://timi.hu/overview/	4	0	2	105
35	http://timi.hu/phadm/view_operations.php	5	0	2	14
36	http://timi.hu/phadm/tbl_row_action.php	3	0	2	27
37	http://timi.hu/user/password/	1	0	1	31
38	http://timi.hu/phadm/tbl_select.php	2	0	1	8
39	http://timi.hu/system/ ajax/	2	0	1	5
40	http://timi.hu/user/register/	1	0	1	33
41	http://timi.hu/phadm/tbl_create.php	4	0	1	36
42	http://timi.hu/mob/selectlast3.php	1	0	1	1
43	http://timi.hu/node/6/	1	0	1	0
44	http://timi.hu/node/690/	1	0	1	0
45	http://timi.hu/admin/config/ development/performance/	3	0	1	7
46	http://timi.hu/mob/egyebek/ email.html	2	0	1	1
47	http://timi.hu/mob/selectgpsdata2.php	1	0	1	2
48	http://timi.hu/node/691/	1	0	1	0
49	http://timi.hu/notification/	1	0	1	30
50	http://timi.hu/phadm/tbl_addfield.php	9	0	1	70
	Subtotal	6,810	0	N/A	1,083,664
	Total	6,825	0	N/A	1,083,756

Figure 7: Frequency of searching JSON files

There were no way for the examination of the charging of servers during the human test, as we should have worked with a much more bigger user base. However the human test was appropriate for analysing the operation of frontend and backend processes. Several feedback came from the users during the tests, which is worth to build in the application.

2.4.1.3 Opendata – Infrastructure load test: 2017.02.24. - 2017.03.01.

We analysed the download of public access data sets during the tests. As there is no necessity to registrate when download, by the download of the data set we have no access to the data concerning the organisation or the person of the downloader.

BASH script has done the download of OpenData datesets during the infrastructure test. The BASH script run on the server of Aruba Cloud VPS in order to be independent from the network of Miskolc Holding Plc. and the HP cloud as well.

The script has done the downloading of OpenData files in closed cycle to ensure the constant charging for the application. 13,85 GB amount of data has been downloaded during the test.

Registered users: 2

Registered organisations: 2

All attendees: 445

Dowload of shared OpenData data packages: 267

Hits	
Total Hits	1,469
Visitor Hits	1,449
Spider Hits	20
Average Hits per Day	91
Average Hits per Visitor	3.18
Cached Requests	0
Failed Requests	424
Page Views	
Total Page Views	657
Average Page Views per Day	41
Average Page Views per Visitor	1.44
Visitors	
Total Visitors	455
Average Visitors per Day	28
Total Unique IPs	133
Bandwidth	
Total Bandwidth	13.85 GB
Visitor Bandwidth	13.85 GB
Spider Bandwidth	270.35 KB
Average Bandwidth per Day	886.64 MB
Average Bandwidth per Hit	9.66 MB
Average Bandwidth per Visitor	31.18 MB

Figure 8: Downloaded data

Hits	
Total Hits	59,897
Visitor Hits	59,075
Spider Hits	822
Average Hits per Day	2,139
Average Hits per Visitor	126.50
Cached Requests	46,964
Failed Requests	142
Page Views	
Total Page Views	6,899
Average Page Views per Day	246
Average Page Views per Visitor	14.77
Visitors	
Total Visitors	467
Average Visitors per Day	16
Total Unique IPs	270
Bandwidth	
Total Bandwidth	7.19 GB
Visitor Bandwidth	7.19 GB
Spider Bandwidth	4.59 MB
Average Bandwidth per Day	262.93 MB
Average Bandwidth per Hit	125.86 KB
Average Bandwidth per Visitor	15.75 MB

Figure 9: Activity during human test

2.4.2 Validation by the users

We did not discover negative changes in the operation of applications while using HP cloud infrastructure during tests. The applications put to cloud operated without any error. During loading tests we did not discover such signs which refers to the lack of resources.

As a result of running the install scripts, software environment of the applications are consequently installable and the web applications as well. The GitHub version control ensures that the last release will be installed in any case.

All the database servers (MySQL and PostgreSQL), and all the web servers (Apache) performed as expected.

Data for TiMi Application

Supply	Nbr of issues	275
Demand	Nbr of users – visitors (since 01.01.2017)	467
	Nbr of registered users	35
	Sex	Female 37% Male 63%
Validation	Engagement	See figures below

Nbr of sessions per Country			
1	HUNGARY	23	69,7 %
3	UNITED KINGDOM	7	21,21 %
4	GREECE	3	9,09%

The data above is gained from the server diary file. The data set of Google Analytics is similar, although some differences exists.

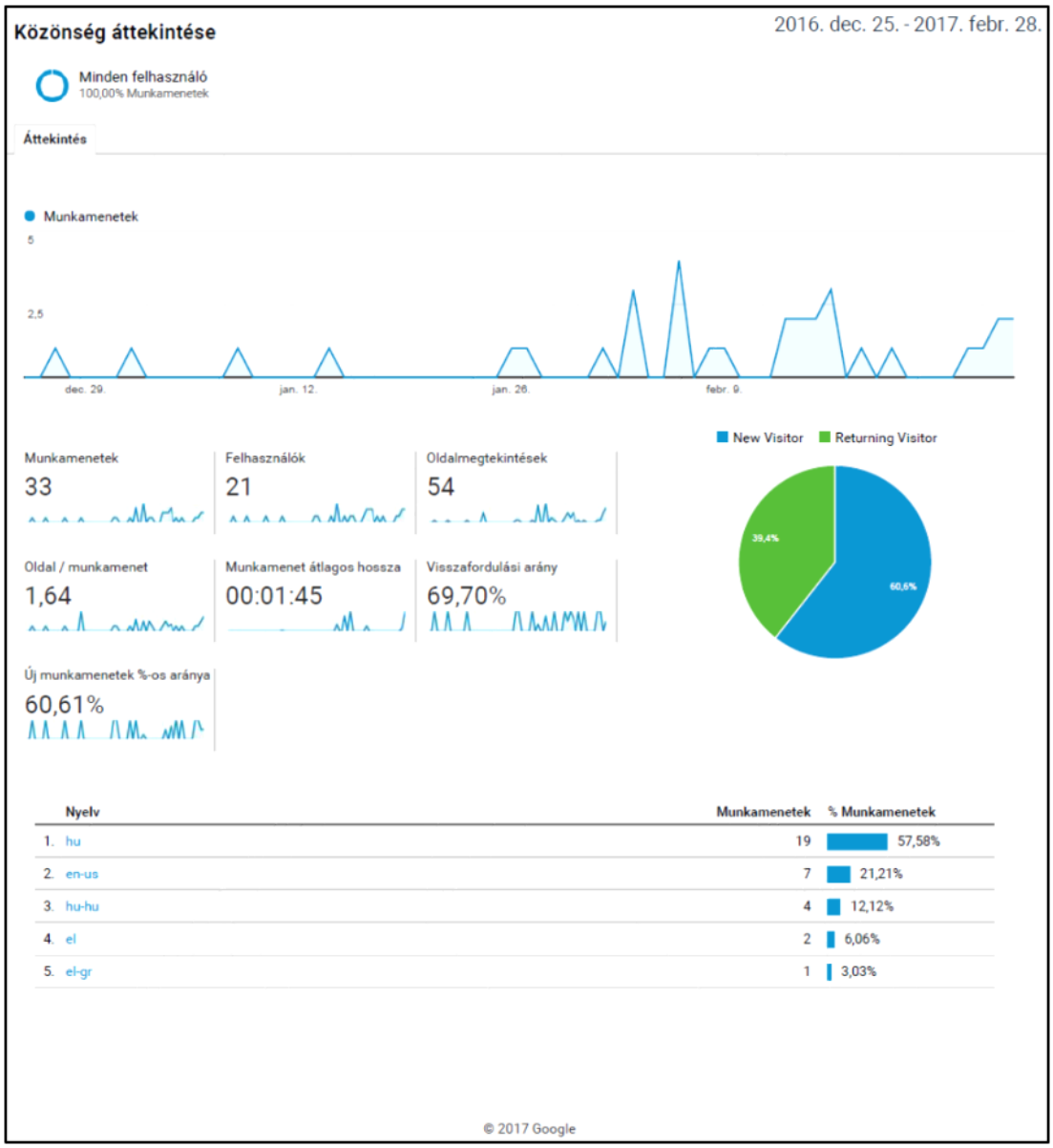


Figure 10: Google Analytics for TiMi

Data for OpenData Miskolc

Supply	Nbr of downloads	267
Demand	Nbr of users – visitors (since 01.01.2017)	2
	Nbr of registered users	2
	Sex	Female 0% Male 100%
Validation	Engagement	See figures below

Nbr of sessions per Country			
1	HUNGARY	23	69,7 %
3	UNITED KINGDOM	7	21,21 %
4	GREECE	3	9,09%

3 Validating the Open Innovation methodology

In addition to the activities reported by each partner at their cities, a general survey was created to get all the feedback from the partners of the project. The results of this survey are presented here below. There are three main concerns with respect to the application of Open Innovation to the cloudification process:

- Who is the stakeholder selected
- What is the value of the contribution of each stakeholder
- Would you repeat the services

For the first question, results show that most of the cities have selected personal internal to the Municipality:

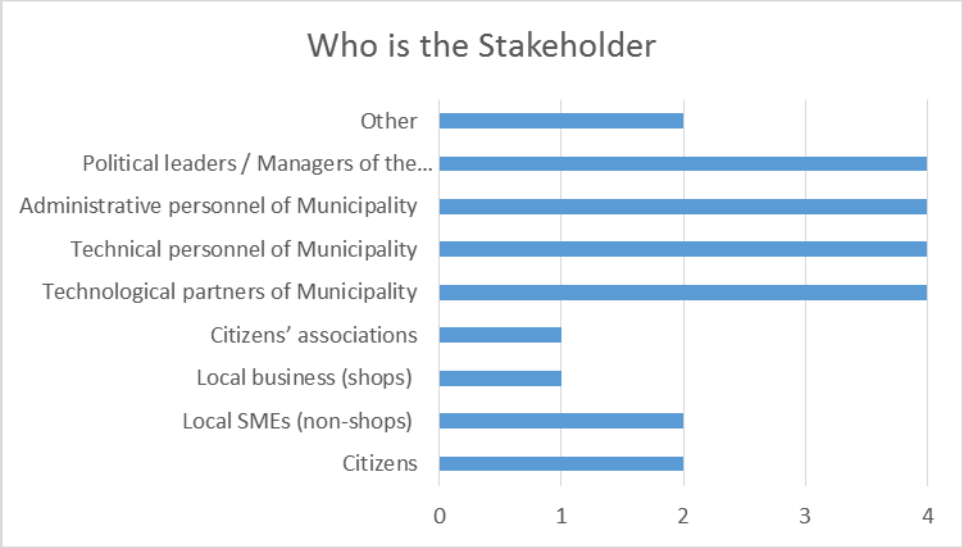


Figure 11: Stakeholder profile

The option "Other" was marked by Thessaloniki and Agueda and the stakeholders selected were Commercial and Touristic association in the case of Thessaloniki. For Águeda, they selected personal from Academia, as well as technical representatives from other cities (Guimaraes).

For the second exercise, we proposed to the cities to express from 0 to 10 the Interest shown by each stakeholder, the need to involve them, the value of their contributions and, finally the influence they have in the process. We processed this information in two ways:

On the one hand, we present the information included by cities.

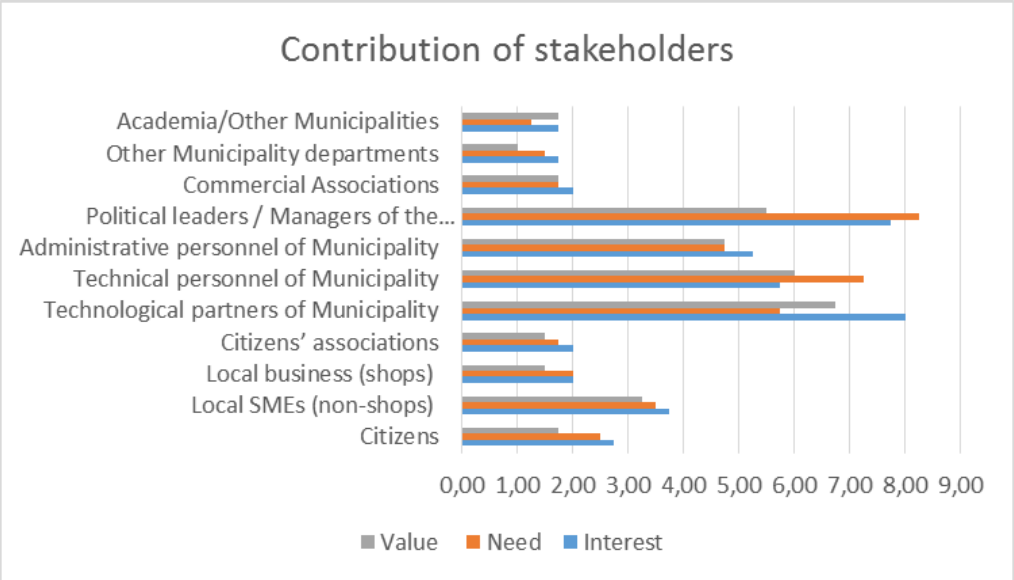


Figure 12: Contribution of stakeholders

We can see some interesting results:

- The contribution that is most required comes from Political leaders and technical personnel. This shows where decision centers with respect to cloudification reside.
- In some cases (Citizens, technical partners, etc) the value of their contribution is lower than the need. This shows some disappointing with respect to the expected input.

To complete this part, we calculate the product: value, need and interest to obtain a magnitude that can represent the overall influence of each stakeholder. Then, we compare this information to the influence directly reported by the STORM CLOUDS teams members.

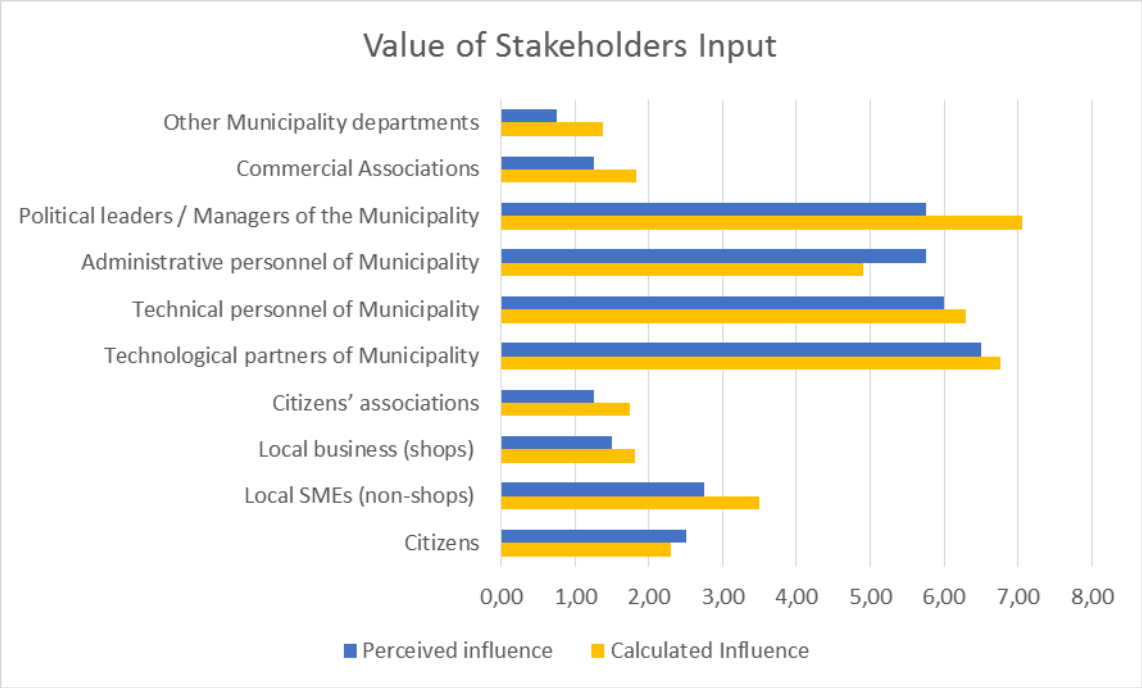


Figure 13: Influence of stakeholders

It is interesting that the perceived influence of the technical personnel of the Municipality is the largest while the calculated influence of the Political leaders is the largest. Nevertheless, it is clear that the most important stakeholder in this process is internal to the Municipality.

Finally, about the replicability of the Open Innovation approach for a similar project, Thessaloniki and Miskolc would repeat the process for sure, Valladolid answered that "very likely", and Agueda said that "probably not, depending on the specific topic.

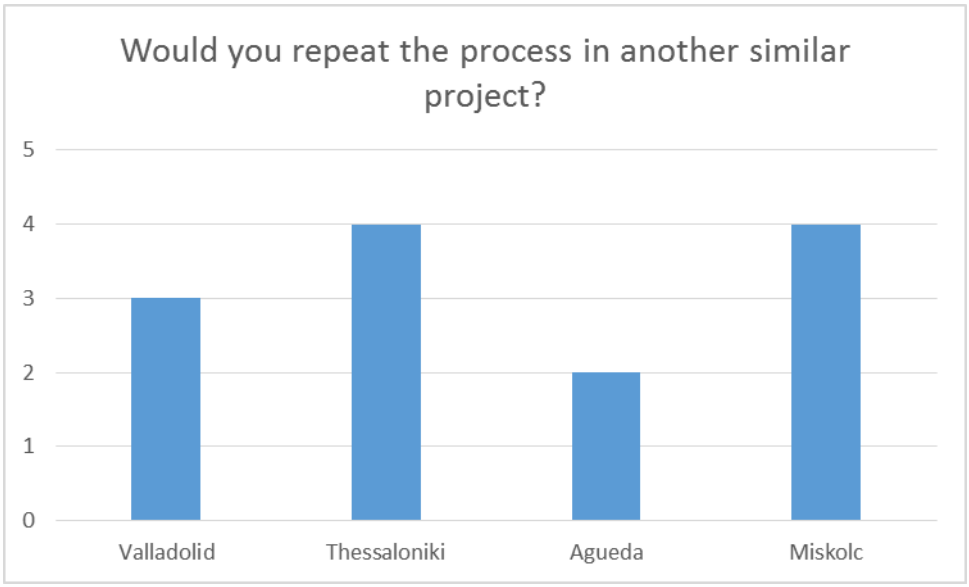


Figure 14: Replicability of Open Innovation approach

In the following lines each city presents their own experience in the process.

3.1 Open Innovation at Valladolid

The Valladolid pilot focused the cloudification process on the open innovation methodology, as it was stablished in the project's Document of Work.

Our stakeholders group was composed of different profiles that could provide an interesting insight to the project. Part of them was selected among the municipality internal departments affected by this change in their way of working.

Relationships with the stakeholders was very fluent during the life of the project and their collaboration has been very significant, in general. Initially, internal users with an administrative role had no clear knowledge about the object of the project and to what extent the scope of cloud computing was going to change the way of service providing. This could be more related to a lack of connection between their work positions and new trends in technology, than to a possible reluctance to change.

Meanwhile, external users stood out as the most involved stakeholders at the beginning of the project, probably because all of them were more familiar to cloud computing technological environments. Later on, the participation of the whole group can consider it definitively more homogeneous and the work done had a balanced result.

Another point to underline about participation of stakeholders is that, initially, a big group of internal technical users was selected in order to give support to and somehow sponsor every candidate application. Once selected that first candidate application for cloudification, the stakeholders sponsoring the rest of applications left the group, as their contribution to the project would be significantly more reduced from that time.

Once stablished the definitive stakeholders group for the rest of the project, some regular meetings were held, approximately every three months (excluding summer), although an informal email list including all the group members had been used to provide relevant information when a project milestones were reached.

Not only in the project steering committee, but also in our city project team, there was an extensive debate about whether to include citizens in the stakeholders group as their role of final users of public services could be considered relevant. Finally, it was agreed that in any case, public services providing must be transparent to the final user, so the technology focus underlying the service should not be considered something relevant to ta that group of possible stakeholders.

Having into account this, all the people involved in the group that was external to the municipality was found among a group of candidates with a solid technical background that could provide a better feedback to the project and with a personal commitment to innovation.

Another group of people that was included in the stakeholder group was the managerial level of the municipality. It was considered a key group as they were supposed to provide organizational support to the transition to the cloud environment. In this case, this part of the group showed a lower level of involvement that can be understood to their broad scope of work and their scarce availability. Nevertheless, at the end of the period, it's clear that those representatives encouraged work development and showed a message of backing the project from the municipality of Valladolid.

Although it has been difficult to keep a suitable involvement level during those three years of project development, contributions made by the stakeholders group have been highly appreciated, providing supplementary points of view that enriched the work done and promoting a positive atmosphere in the group during the project.

3.2 Open Innovation at Thessaloniki

The implementation of cloudification was deployed according to the following user centric methodology.

- Thessaloniki Municipality decided from the very beginning to cloudify applications that are related to entrepreneurship and quality of life in the city of Thessaloniki. During the first stage (first 2 cycles) the city cloudified two applications, Virtual City Mall and Crowdfunding, while a third one, Citybranding, developed and released later on. The two applications that selected to be deployed from the other partners were Vive Thessaloniki and Have your Say.

- Thessaloniki Municipality, along with URENIO-AUTH followed the user centric methodology adopted in STORM CLOUDS, including meetings with stakeholders and municipal services, training sessions and validation sessions with end users, dissemination activities and so on. The Table below (Table 1) presents an integrated view of all the meetings, events and other types of activities that took place from August 2015 until now in order to secure stakeholder participation.

The unstable political environment and the on going crisis affected with various ways the local entrepreneurship and the local economy. The major disadvantage of this task was the lack of interest and the general absence of trust. So much work has been done to get the desired transparency. Only with team work and general activation of the citizens we managed to get some remarkable results.

Applications have been deployed as a tool from the local politicians to enhance the local entrepreneurship. A few decisions had been taken from the citizens. Different ideas and proposals for the implementations of the applications with various and useful different characteristics.

Date	Type of Meeting/ Participants/ Location	Service reviewed	Results
20.10.15	Meeting with the Commercial Association of Thessaloniki, Professional Chamber of Thessaloniki/ Municipality of Thessaloniki	VCM,CB	Collaborate with the two stakeholders, Improve the awareness of their menbers through the newsletter of the Chamber, implementation of the applications.
10.12.15	Working group meeting/ Municipality of Thessaloniki/ Directorate of Operational Planning/ Department of Operational Planning & Monitoring of Structural Funds	All services	Promotion of all applications through the municipality. Organize the presentation at the Home Page of Thessaloniki.
09.02.16	Working group meeting/ Municipality of Thessaloniki/ Urenio / Department of Tourism/ Vice-Mayor of Tourism	CB	Selection – Modification of Points of Interest, Selection of type businesses related to the POI'S, Promotion through their Department
16.06.16	Meeting with the Vice-Mayor responsible for the Department of Entrepreneurship	All services	Re-Scheduling actions and strategy for the implementation of the applications, Roadmap planning
18.10.16	Working group meeting/ Municipality of Thessaloniki/ Urenio /President of the Metropolitan Development Company	Crowd-funding	Discussion on payment procedures and the role of Thessaloniki Municipality in the selection of projects.
18.11.16	URENIO members/Municipality of Thessaloniki	All services	Establishment of a working group adopting an implementation strategy for all the applications.
06.12.16	LOCAL STAKEHOLDERS GROUP-LSG for Eu-Program "PUblic authorities Role Enhancing COmpetitiveness of SmeS"-PURE COSMOS-INTERREG EUROPE	All services	Presentation from Christos Lampros, member of the project team of the Municipality."Applications of Municipality of Thessaloniki, Department of Entrepreneurship"
31.01.17	Peer Review Region of Central Macedonia for Eu-Program "PUblic authorities Role Enhancing COmpetitiveness of SmeS"-PURE COSMOS-	VCM	Virtual City Market chosen as a Best Practice for Municipality. Presentation from Christos Lampros, member of the project team of the Municipality."Applications of Municipality of Thessaloniki,Department of Entrepreneurship" presentation of the basic tasks, activities

INTERREG EUROPE	targeted on SME´s provision, scope of activities, budgets, capacities.

The table describes a full list of meetings and events that were held in Thessaloniki pilot during the stage of the cloudification process.

Figure 15. Local Stakeholders Group -LSG for Pure Cosmos (06.12.2016)

The figure above shows two pictures of the meeting for local stakeholders meeting for Pure Cosmos.(06.12.2016). Christos Lampros member of the project team presented the project and all the applications of the Municipality as a best practise.

Figure 16. Peer Review Region of Central Macedonia for PURE COSMOS(31.01.2017)

The figure above shows two pictures of the Peer review of Central Macedonia for local stakeholders Pure Cosmos (31.01.2017). Virtual City market has been chosen as a best practice for the Municipality between the other stakeholders proposals.

3.3 Open Innovation at Agueda

In order to engage stakeholders, we made questionnaires, in the very beginning, as well as presencial contacts, phone and e-mail contacts. Focus groups were set up and used during the process to gather the opinion of stakeholders.

We presented the project, inside national events, mainly geospatial based, however we didn't catch enough attention of GIS technicians or political leaders.

The focus of stakeholders was the services, their usability, design, functionalities and tools. In this aspect we had good contributs and we made work in several aspects to answer to stakeholders. Citizens and Municipality staff were very important.

At the end, we think that the open innovation process was inadequate for this project, considering the insufficient expertise of the stakeholders and their interest dropped on the applications.

3.4 Open Innovation at Miskolc

The city of Miskolc joined the STORM CLOUDS project with a significant delay, which was partly a disadvantage, as the city of Miskolc had to reach the result of the project within a shorter period of time, on the other hand it was an advantage as well because other members of the project had already established certain conventions for example in the field of documentation.

We could gain support for the project in Miskolc within a relatively short period of time. Following this, forming the circle of stakeholders proved to be more difficult or rather time-consuming.

In the beginning the people involved (stakeholders) were less aware of the meaning of the term „Information cloud". It seemed that everybody had some kind of concept associated with this term but it had different meanings for each participant. There were people to whom it meant a server in a distant, unknown land whereas to other people the term Cloud outlined a server farm in the United States. In most cases it meant something that might be a risk to our applications and data.

When convincing those in doubt a significant reason was that the applications will be placed in a European data center. (within the EU)

Throughout the development of STORMCLOUDS project the people involved (stakeholders) could get a clear vision of the cloud technology as well as of the advantages and disadvantages of moving information services into clouds.

Although it was originally planned, the citizens of Miskolc were eventually not involved in the project. Its main reason was that the citizens were generally not aware of the outlined technology, therefore they had no wish to take part in the project. We assume that associations formed by citizens did not answer our invitation due to similar reasons.

Following the formation of the group of stakeholders, Miskolc Holding Plc. – as a technical partner of the Municipality – took part in the fulfilment of the project. We managed to gain the support of political leaders in the first round for the STORM CLOUDS project as well as for the chosen applications.

While the Miskolc Holding Plc. was approaching the solution for "Cloudification", the participants were more and more aware of the advantages of it. Although the process was a bit delayed, between December 2016 and February 2017 all the stakeholders reported about positive experience and positive expectancies.

From time to time the Miskolc Holding Plc. was slightly left alone during the project, but when reaching each milestone the stakeholders got their enthusiasm back. This helped to prepare the following steps. All in all, we find the cooperation of the members involved constructive.

However we consider it a deficiency that we could not significantly involve the SMEs in the STORM CLOUDS project, because they could have taken the greatest benefits of the cloud technology.

- First of all, it helps to put the business to the foreground so that companies can focus on what they know the best, and maintaining the digital infrastructure should not be a task to solve. Maintenance of data centres and servers is a task of an outside partner, the cloud service provider, the customer only pays for the service and – in an ideal situation – enjoys its advantages.

- Not only the infrastructure can be hired, besides IaaS (Infrastructure as a Service) one has the possibility for faster application development as well. By the exploitation of PaaS (Platform as a

Service) a program that facilitates business aims may occur sooner, which could generate profit and save expenditures sooner, this way the company may become more efficient faster.

- The most important advantages of SaaS (Software as a Service) is that it makes the installation of the free trial version easier. Most producers provide such opportunity for those who are planning to use their services. Try it in small and as long as you are satisfied you can extend the service with confidential data and other critical systems from business point of view.

4 Monitoring the Cloudification Process

This is the most relevant aspect for the project as the main objective of STORM CLOUDS is to analyse the cloudification process in order to extract conclusions. At the end, STORM CLOUDS, as well as the other projects included in the area of "Cloud of Public Services" aim at promoting the usage of cloud based systems in Public Administrations in Europe.

In general cloudification activities have progressed according the expected plans. The technical progress have been quite smooth and cities have had the support of the technical partners in the project. This experience has been quite positive and the cities have become particularly familiar to work with the cloud.

However, the entering of services into full production has not been as smooth. In most cases, launching a new service for the city must be balanced with the strategic plans and City's agenda. During the project important changes in the political leadership of some partners have taken place. These changes have modified the cities' priorities and some plans have evolved in a different time frame than expected.

In the following lines we present the experience of the four cities in the project.

4.1 Cloudification at Valladolid

In the case of Valladolid pilot, there was selected only an application that was migrated from a physical deployment to the cloud and other three ones that were selected from the project's applications catalog, so they were entirely new to the organization.

When the migration of Urbanismo en Red took place, it was noticed that the installation procedures were not as clearly defined as it was thought at the beginning of that phase. Anyway, it could be solved with additional support from one the companies involved in the development of the application and finally, the transition could be completed with a small delay.

After completing the transition to the cloud, we can conclude that there are several risks associated to this step.

- The first one is the need of a secured environment for services, using electronic certificates and secure protocols in any interaction with the users, especially if there are personal data involved. In our case, that leaded to change the way the service was provided, but it could be managed with a reasonable amount of effort.
- The second risk involved in the transition to the cloud is the period when both physical and cloud applications are up and running at the same time, while there could be data updates not reflected in the other instance. To reduce this risk to a minimum, it's important to use a fixed date to swap environments, transferring information in a short time and, finally avoid facing this kind of troublesome issues which can easily lead to loss of application information.
- Another risk that arose from this experience is the need to have updated installation procedures that can be adapted to cloud computing paradigm in advance. Provided this information, tasks can be carried out in a smoother way, in the expected time.

For the rest of applications we followed a much simpler procedure, because some installation automation scripts had been created by the consortium. In those cases, it only was needed to conduct a previous translation work for all the messages shown at the application using a specific tool that made easier that task.

As these applications were completely new services, there was no need to neither perform any kind of migration, nor to plan a transition time for providing the new services. On the other hand, the use of new applications implies a training period for administrators and a modification in corporate monitoring procedures.

If we refer to the technology used to deploy these applications, it's necessary to say that the work done by the technical partners of the consortium was outstanding in order to simplify not only any task involved in the application deployment, but also in monitoring these services.

4.2 Cloudification at Thessaloniki

Barriers Involved in Data Cloudification Process for Thessaloniki

In the case of Thessaloniki there were no existing applications that were migrated during the project. All applications were completely new to the city. Data cloudification needs an effective methodology that enables the best way to plan, design, migrate and validate the cloudification.

- Data loss risk

  There is a great possibility for data loss all the way through the cloudification process. When the data is available in legacy system but after migration process is lost, is concerned as a data lost. This certainly affects to the total cost of the process. Only with continuously comparing of the data, such as number of files will prevent any possible data lost. The applications stop working properly and this affects to the reputation of the organization and adds extra cost to the process.

- Data Corruption and Data integrity.

  It is not rare that content of data in legacy system and target system is different in comparison due to cloudification process. As a result we have corrupted. Data corruption affects to operation efficiency and it totally destroys the purpose of Cloudification. Only by validating each and every data between legacy and target system will avoid any possible data corruption.

- Interference risk

  This type of risk appears when all of the stakeholders are using the source application simultaneously during the transition period. This must be faced at the organizational level. Only with better project planning and schedule all the modifications, we will prevent any dis-functionality.

Problems founds.

During the second phase of the process, a number of problems were detected and are explained in detail below. Definitely, there were some organisational issues regarding all the applications and some technical issues regarding "Have your say".

Cloud hosting related changes in administration and maintenance

- SSH key-based authentication is more secure than password authentication and suitable for servers hosted in the cloud.
- Database access port is only available within the server farm. No windows based tools for database administration are available. Only web based access and command prompt (SSH).
- Applications need to send email using third party providers or send through the Municipality's SMTP. In the latter case they need to configure their networks and/or mail servers to trust external, to the municipalities, specific IP addresses (the ones that belong to the applications).
- The SSL certificate may have to be installed in a proxy instead of the web server in order to facilitate the scaling of the application to more than one web servers.
- SFTP with key based authentication is required for file transfer.
- File transfer to the web server(s) becomes complicated in case a proxy is used since it requires moving files from one machine to the other in order to reach the destination web server.
- Additional automated backup in other physical locations like the Municipality's IT infrastructure is complicated.

4.3 Cloudification at Agueda

Two applications were migrated to the cloud in the first and second innovation cycles.

Both applications were designed to attend requirements of just one entity, the Águeda municipality. When these two applications were chosen to be migrated, there were two distinct strategies that could be followed: just to rehost/replatform the applications or to refactor/redesign the applications.

The later strategy was chosen. The redesign of the application was an opportunity to evaluate some cloud native features.

For the redesign process, several topics were considered:

- Source availability
- Improved documentation
- Multi-language support
- New requirements

Source availability

It will be more easier for other municipalities or institutions to adopt an application that can be study and enhanced in a open way. That was the reason to move both application's source to github.

Improved documentation

While the source code can be read and study, it is far more easier if the applications were well documented. We need to read it to say that it is really open. In particular, the deploy process was rewritten and improved to guarantee that it could be repeated with success.

Multi-language support

The multi-language support has a major impact in the application development. Since both applications have a client and a server side, both parts were rewritten to support several languages. The native language was changed to English, and any other language is now a translation from English.

New requirements

Two sorts of requirements were added: functional requirements and technological requirements.

Since we decided to redesign the applications, the stakeholders were invited to discuss additional requirements. The requirements suggested from the stakeholders were implemented. Some technological requirements were also added to address specific cloud issues: to enable more customization (identity, locales, http/https) and a better integration with other platforms (smtp, dbms, logging and proxy support).

During the 3rd and 4th cycle of innovation, the portfolio of services, built following the successful cloudification of services by pilot cities, was presented to the mayor.

Considering the executive's strategy, legal limitations and services already available to the citizen only the VIVE application was chosen. This decision was final, so the remaining stakeholders were not consulted.

Internal stakeholders were consulted in the scope of the proposal for the dissemination of the three migrated applications. There were contributions to the content and design as well as for the elements of dissemination.

4.4 Cloudification at Miskolc

The migration process completed successfully and no problems arose:

- The time spent was a little bit less than predicted
- Considerable technical difficulties have not emerged, we could cope with all technical issues
- The attitude of the management has been supportive.

Some details about the cloudification technical details are:

- Further monitoring information are available based on the automatized test:
- procession of making the installation script, results of running: the installation script run down in a completely automatised manner, the application did not need further manual intervention
- Apache server books for analysing the infrastructure test, analysed by Weblog Expert Lite program: Apache server completed pressure test without hitch
- Mysql server books for analysing the infrastructure test: MySQL server completed pressure test without hitch
- Syslog server books for analysing the infrastructure test: we did not realise any extraordinary in Syslog
- Drupal logs for analysing the infrastructure test: Drupal system requirements completed
- Processed results of running of the Ubuntu Linux top: optimal rates were identified
- Processed results of running of the Ubuntu Linux htop: optimal rates were identified
- Processed results of running of the Ubuntu Linux apachetop: optimal rates were identified

- Processed results of running of the Ubuntu Linux **mytop**: optimal rates were identified

The installation scripts run down in a completely automatised manner, the application did not need further manual intervention.

Once the installation is completed, it was necessary to accommodate the launching on the application to the Municipality political agenda.

5 Lessons learnt and achievements

As the project is approaching its termination, it is time to wrap up conclusions and lessons learnt. In fact, all the work during these years had as main objective to extract those lessons that can be useful for Municipalities and Public Bodies that are willing to approach a process to migrate their IT to a cloud based system.

From the methodological point of view

- Cloud migration is transparent to the citizen so their involvement in the process is not particularly relevant. If the non-technical stakeholder is to be included in the process, it is required a communication campaign in the City that allows them to understand that they are participants to an important modernisation process taking place in the city.
- On the other hand, it is essential to involve the technical, administrative and political/management stakeholders of the Municipality.
- The leadership of the top management of the organisation is essential. Technical people in charge of migration will have to consider political cycles and be prepared for changes in the management structure.
- There may be internal personal in the Municipalities that is reluctant to change. Therefore change management policies must be foreseen and put in practice from the very begining. These actions may require training activities on personal to adapt their competencies to a new IT environment.

From the technical point of view:

- The integration and modifications to legacy systems present a medium difficulty. This has been the case, as most of the applications were rather new but, older applications have presented additional problems.
- Before going into a migration process, it must be checked that all the documentation for the applications is available. If this is not the case, the impact must be evaluated.
- It is particularly important to have a detailed technical plan to be absolutely sure that all the required elements will be available prior to face the migration. We refer to aspects as:
    - Source code, documentation,
    - Availability of technical support either internal or external.
    - Similarities/diferences between the existing IT environment and the cloud environment and how to cope with these differences (O.S. versions, ...)
    - Coordinate this activities with specific technical partners that give the necessary help and support to obtain a successful cloudification of the services.
- The availability of trained personnel for the new environment is to be ensured. Either by training the existing technical people or by hiring new personnel.
- The ownership of applications to be migrated must be ensured before the process is to start. Existing applications may be locked in by legal agreements with vendors.
- Security and Data privacy are a serious concern. The technical staff must ensure them and communicate effectively to the management.

From the administrative point of view

- From the financial staff it is important to plan the actions to be taken:
    a. On the hardware that will become unused in the Municipality: depreciation, selling, etc.
    b. Hiring personal with specific technical qualification.
    c. Providing with specific formation to technical stuff in the Municipality.
    d. Considering costs from an incentive plan for stakeholders. These incentives may be from current activitities of benefits from the municipality but also, others specific for stakeholders can be organized.

- It is particularly difficult to measure the economical impact of cloud because, in most of cases no information about the cost of each application in the Municipality datacentres exists. If costs is a relevant criteria, mechanism to measure it must be foreseen in advance.
- Training sessions to Municipality personnel are required.

From the Political/Management point of view

- It is essential the commitment of the top level decision centres.
- Political changes may stop, even drop, the whole process as, normally, they bring changes in the priorities of the City agenda.

5.1 Project Achievements

The following major achievements can be summarised as results from the work in STORM CLOUDS

- **Valladolid** has started the process to migrate their whole infrastructure to their own IT infrastructure. This infrastructure will operate as a private cloud that will interact with public clouds for punctual services.
- **Thessaloniki** Cloud technologies have already been adopted by the Municipality of Thessaloniki by creating a private cloud within the Municipality's premises. However, the Municipality has never used public cloud services. For serving internal, critical and/or confidential data and services of the Municipality, the administration and the IT staff prefer a private cloud in order to minimize complexity, latency, availability and security issues that the networks between the Municipality and the cloud provider impose. After experimenting with the Storm Clouds Platform, a public cloud platform, we saw many benefits in using public cloud services for fast deployment of new web applications, short-lived web applications and applications that expect to have significant variations of their load over time, since procurement of new server infrastructure is very time consuming in the Greek public sector.
- **Agueda**, based on the STORM CLOUDS experience, **has decided to migrate their own IT infrastructure to the cloud**. The process has started by contracting a cloud to a Portuguese company. The migration of the first applications (GIS and SMART Cities) is already in place.
- **Miskolc** is implementing their first applications successfully. In particular, the Open Data application is expected to push ahead a number of start-ups in the city.

According to these results, it is clear that STORM CLOUDS has produced a relevant impact in the participant cities and they can be an example of cloud adoption in Europe.

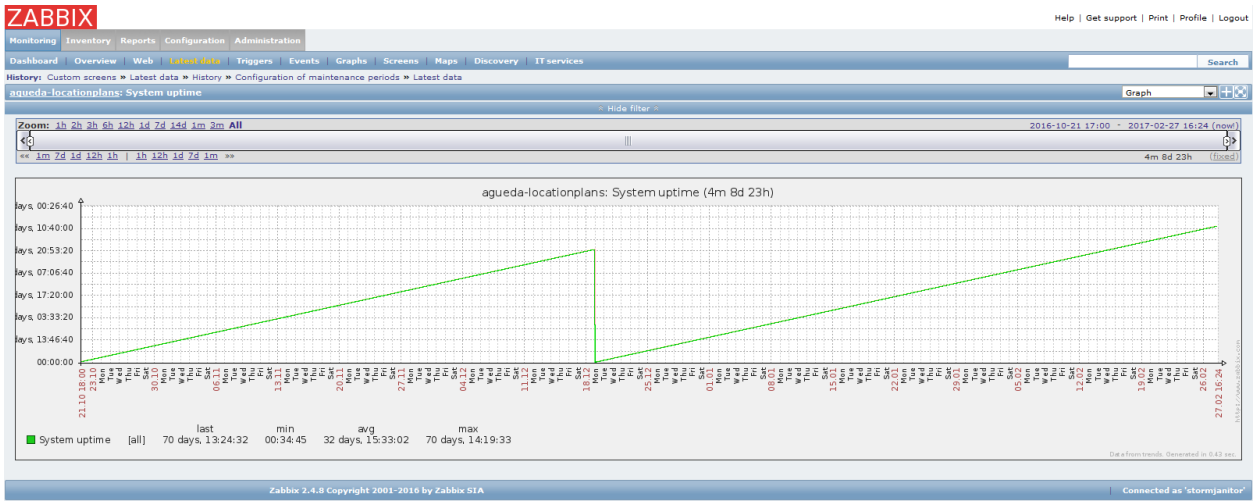
Annex I: Uptime of applications in the cloud

The following data report the uptime value for the applications hosted by SCP@Enter in the period from end of october to February 27th, 2017.

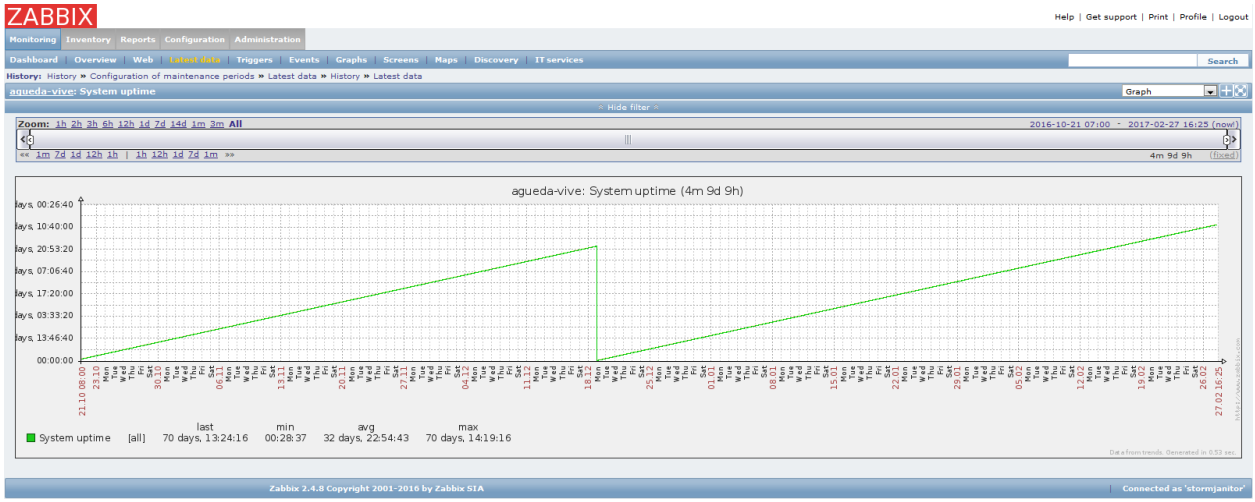
In all case, uptime is reported, except in Agueda's service "Have you Say" that ping result is reported due to a lack of data from Zabbix monitoring.

Agueda

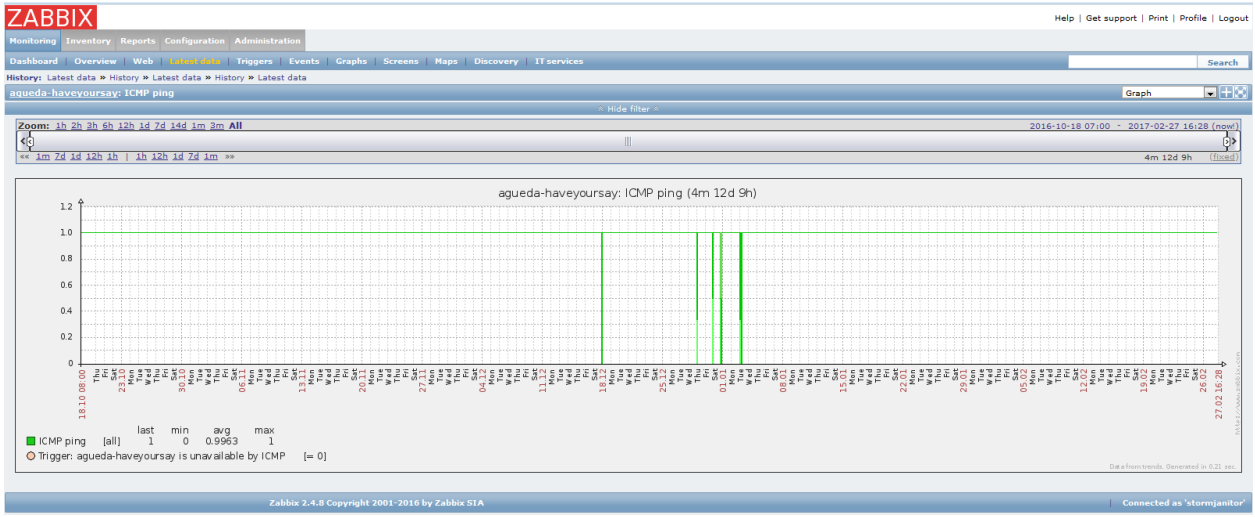
Location Plans



Vive

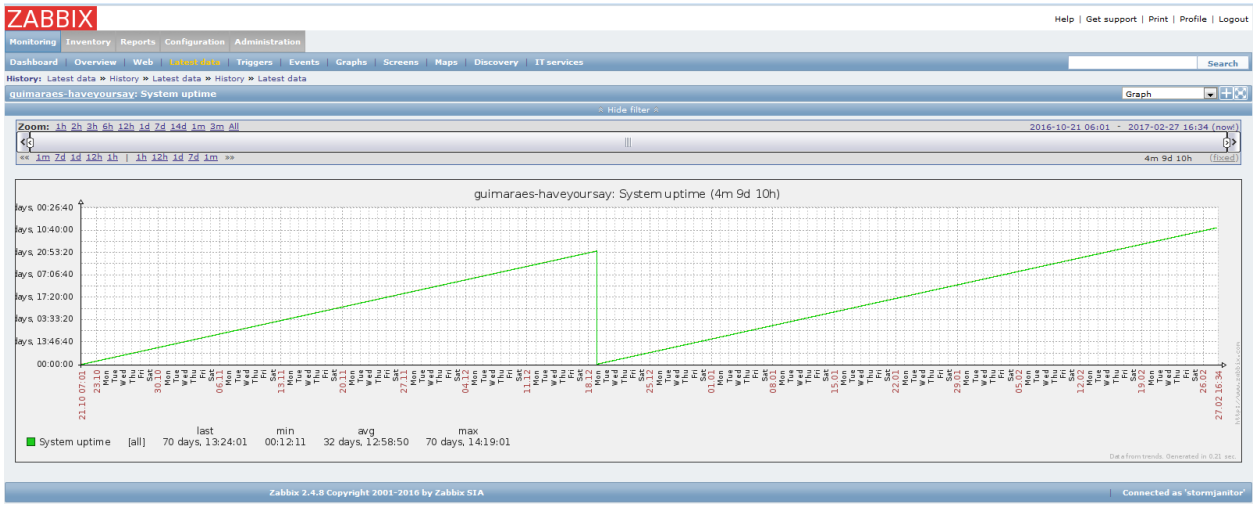


Have Your Say



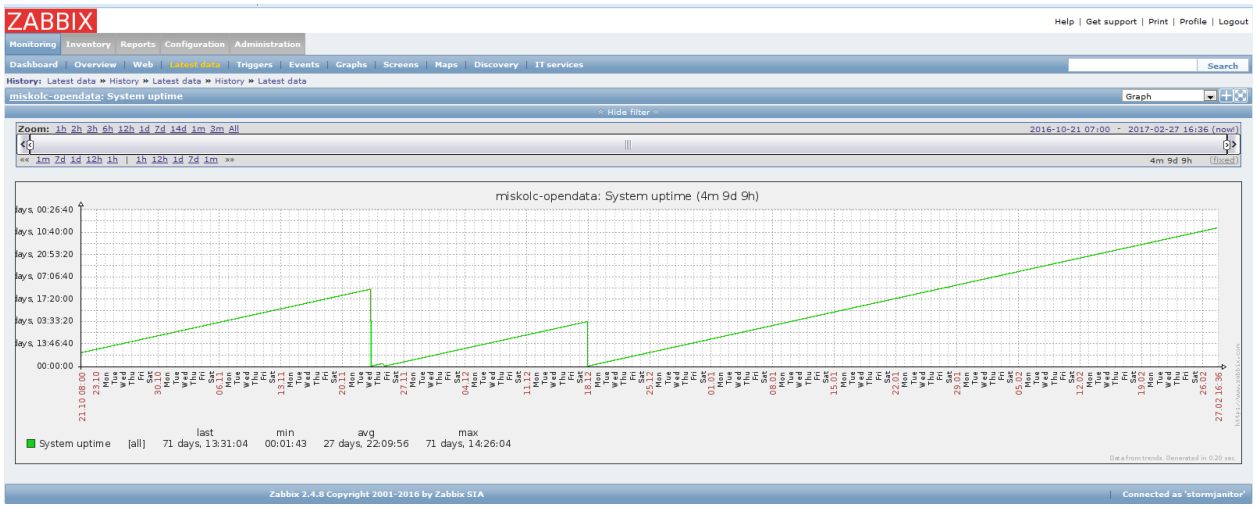
Guimaraes

Have Your Say

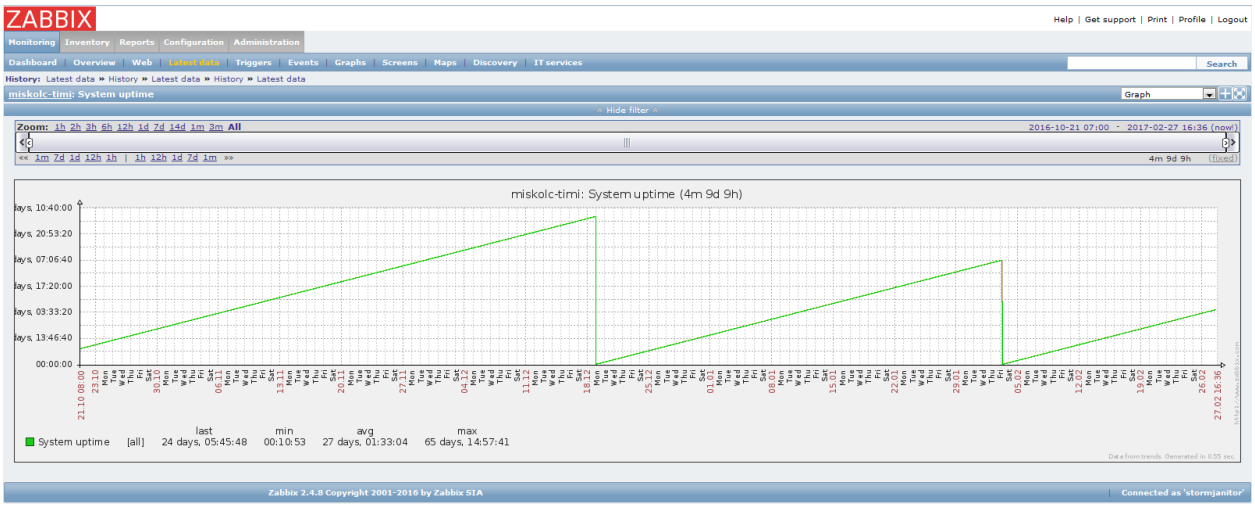


Miskolc

OpenData

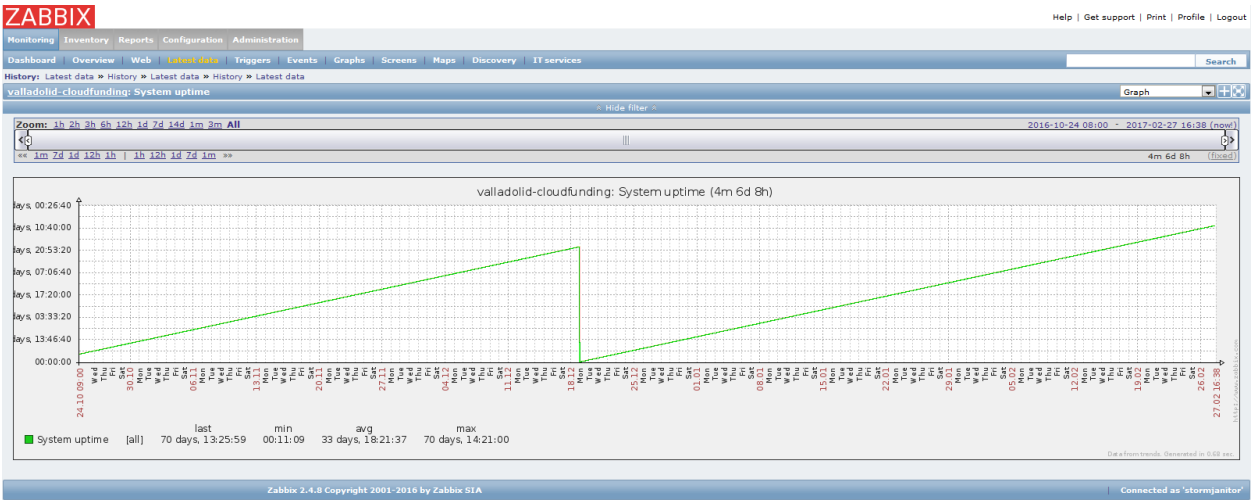


Timi



Valladolid

Cloud Founding



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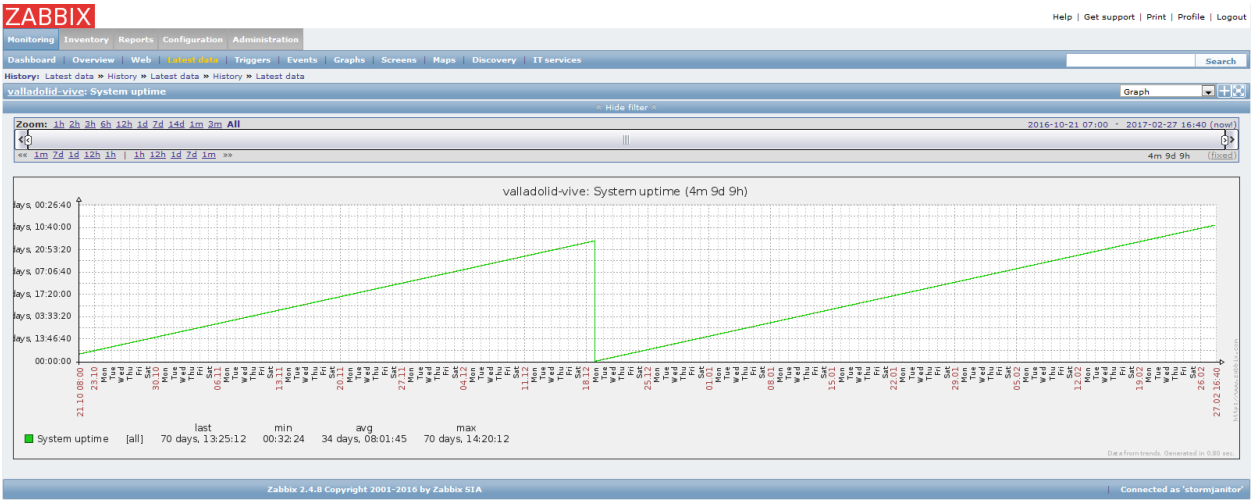
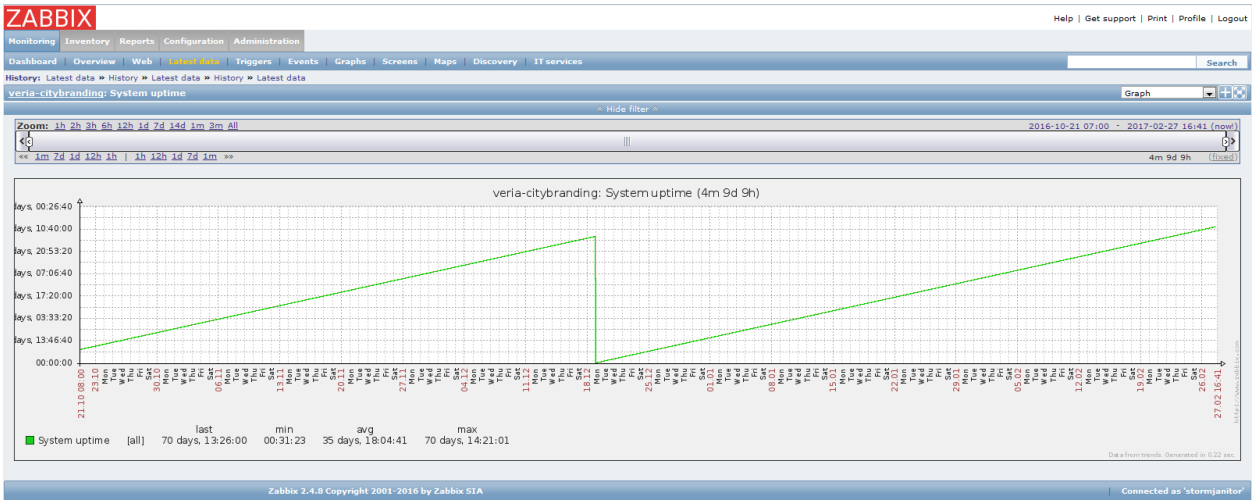
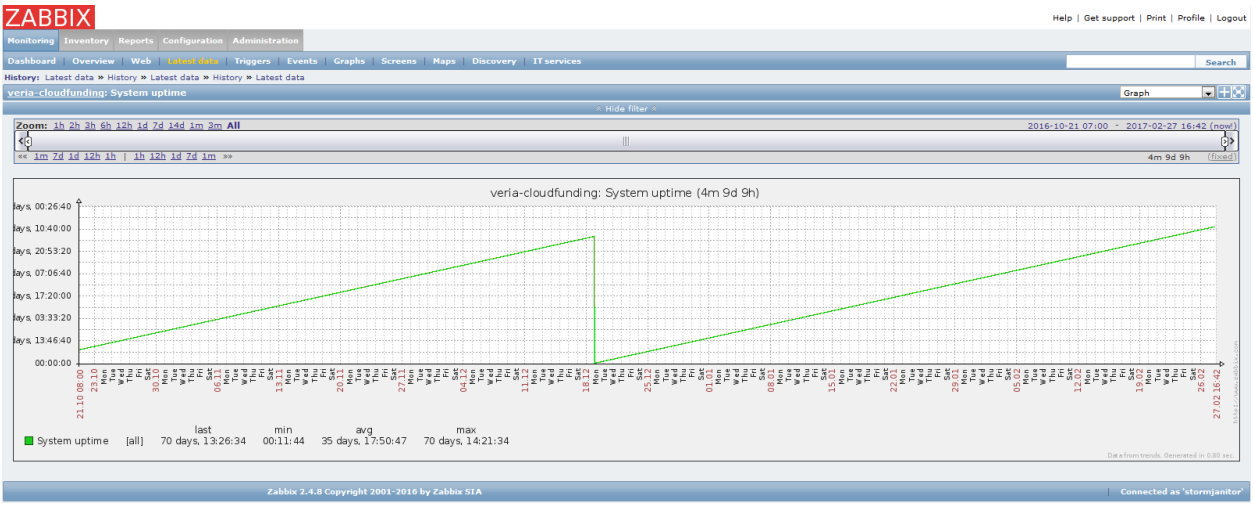


Veria

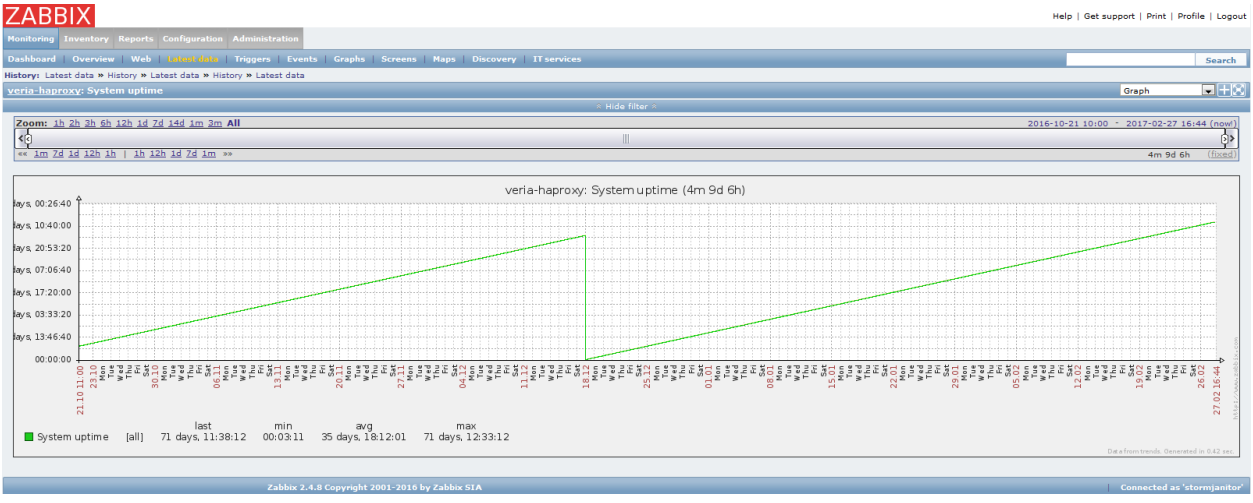
City Branding



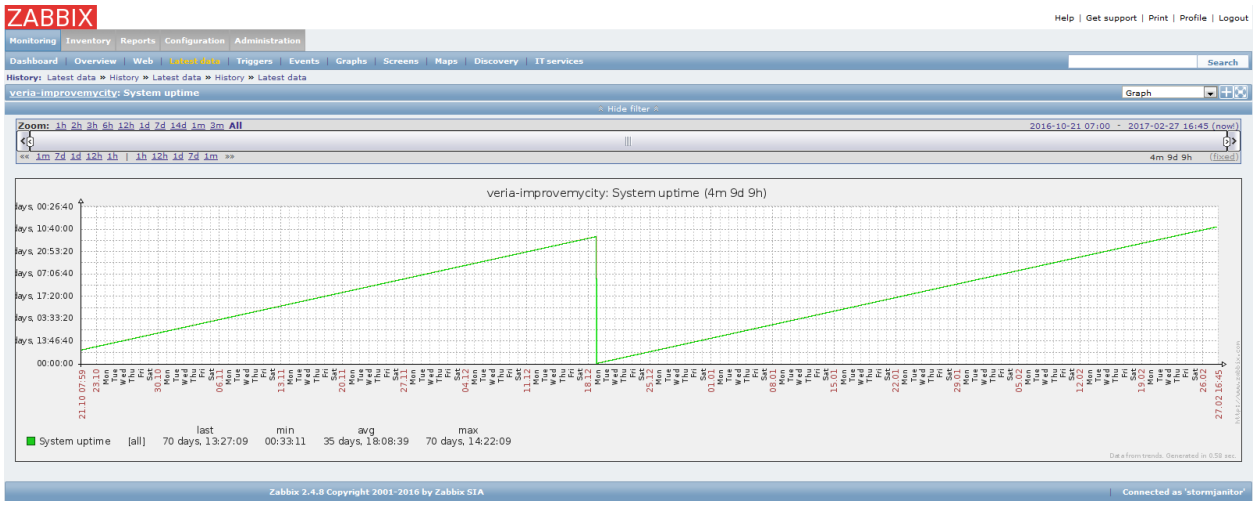
Cloud Funding



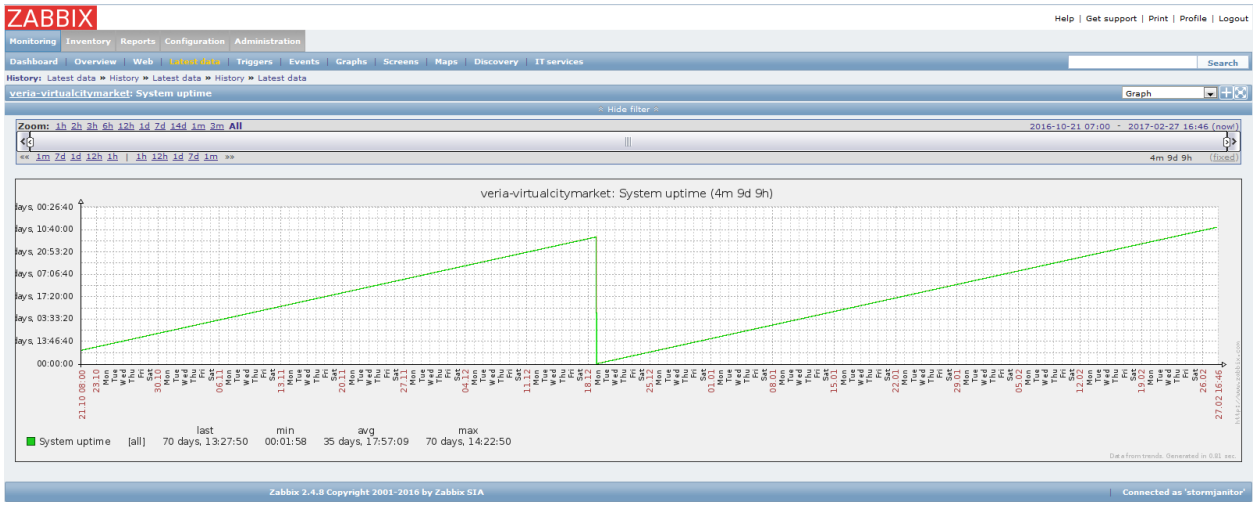
HA Proxy



Improve My City

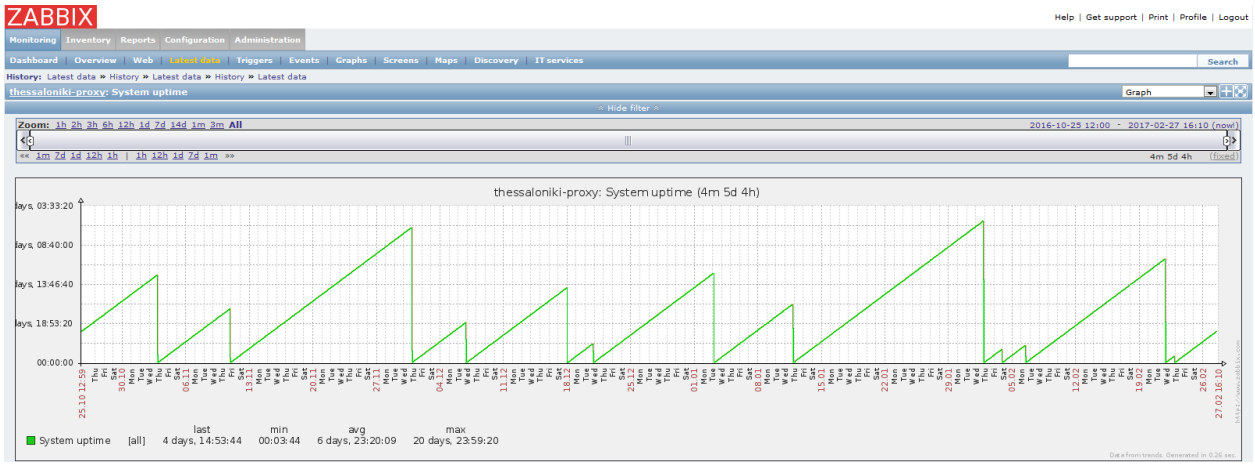


Virtual City Market

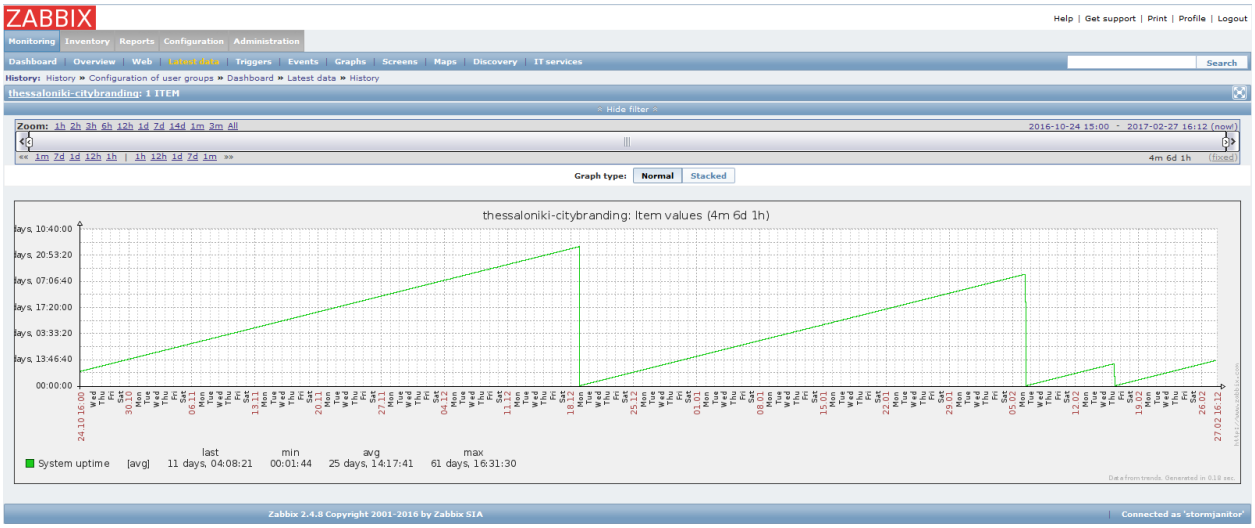


Thessaloniki

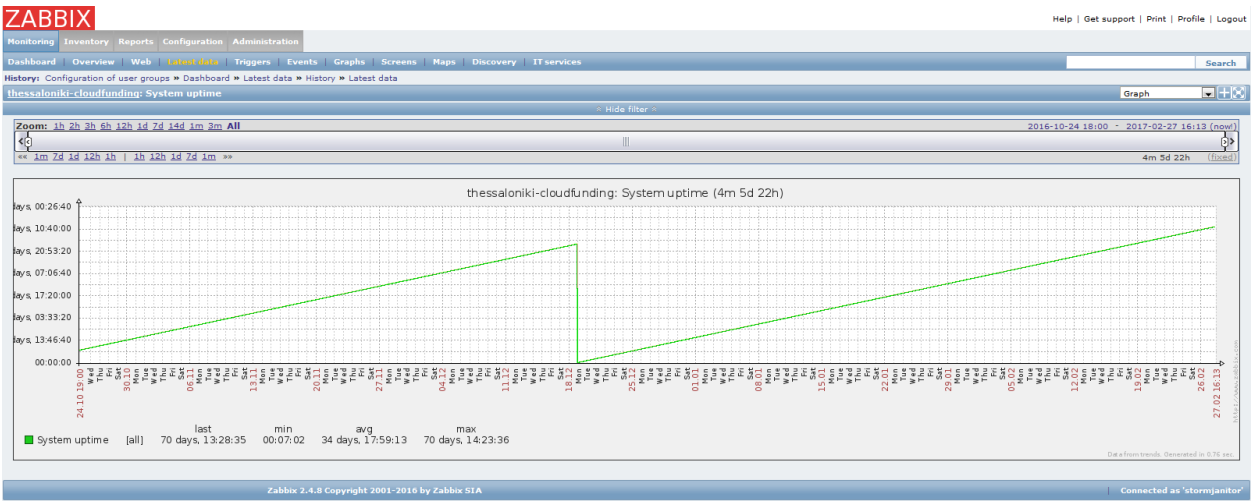
HA Proxy



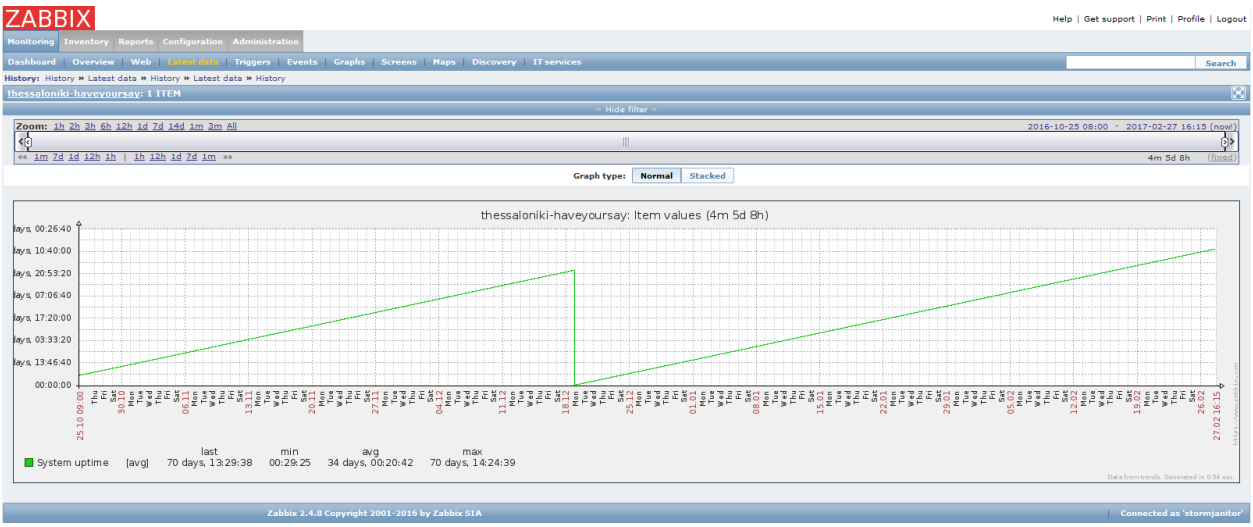
City Branding



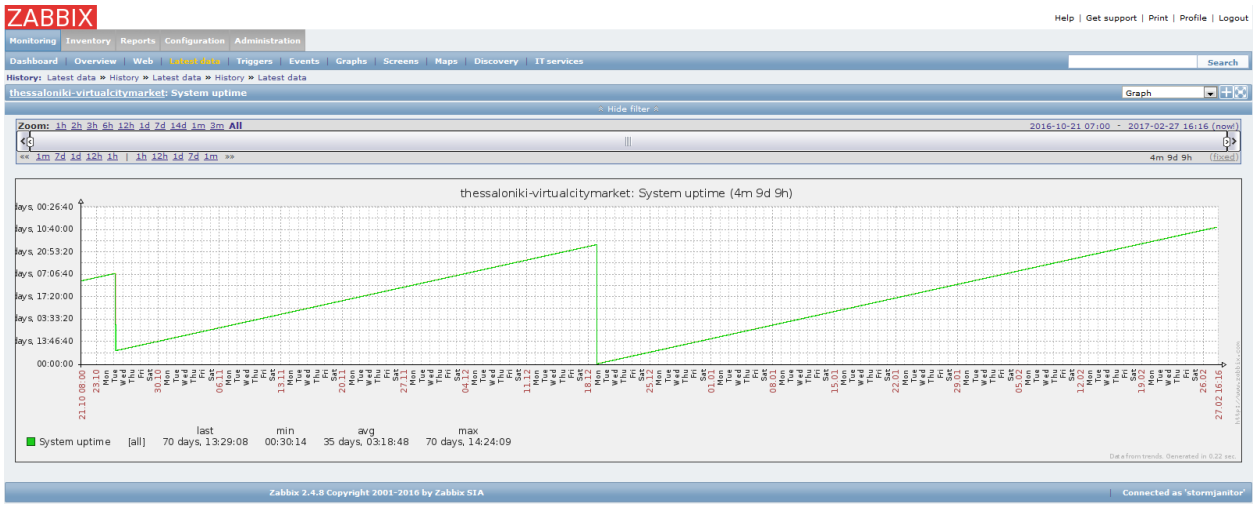
Cloud Funding



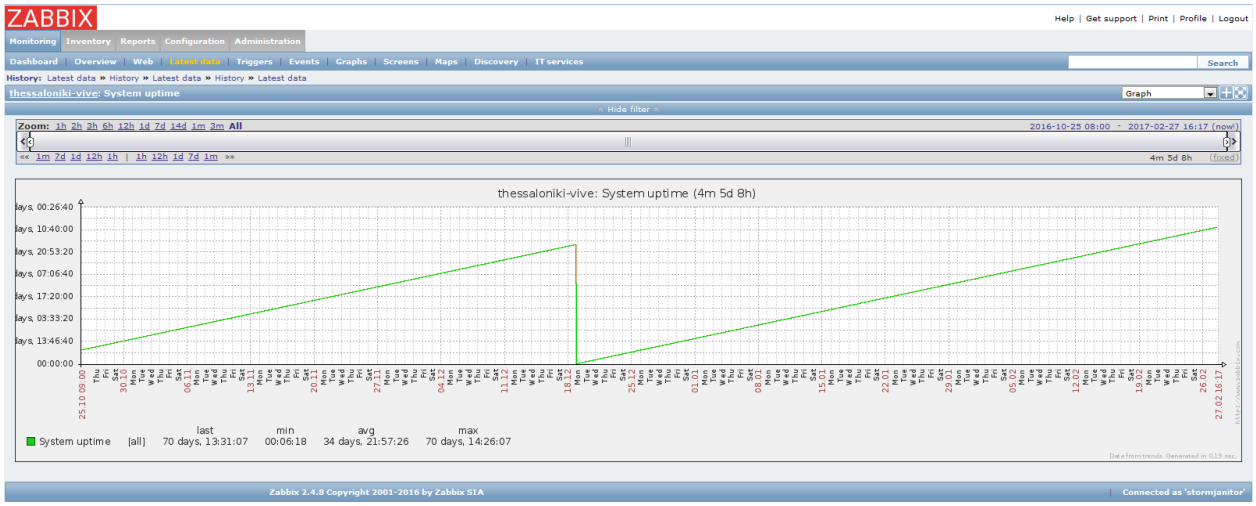
Have Your Say



Virtual City Market



Vive



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