

# Fiber From The Farm (FFTF)

## *(C4EU 5.4.2: Report on Pilots on Fiber Deployment -b)*

Roger Baig Viñas, Jaume Barceló Vicens, Albert Boix Molas,  
Lluís Dalmau Junyent, Pau Escrich Garcia, Miquel Martos Membrives,  
Marc Mundó Comerma, Ramon Roca Tió

### **Abstract**

Optical Fiber is certainly the best technology available for data transmission in terms bandwidth, latency, reliability and stability. As installation costs decrease, it is expanding beyond its original realm and major application in the carrier backbone and is moving into the local loop. Following this trend community networks are gradually adopting it. The present technical report accounts for progress made during the first year of optical fiber pilots in the Commons4Europe project.

### **Index Terms**

Bottom-up-Broadband (BuB), Community Networks (CNs), Fiber From The Farm (FFTF/FFTx), Optical Fiber (OF), Points-of-Presence (POPs)

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## I. INTRODUCTION

Despite the scepticism of some people about the capacity of community networks (CNs) to incorporate the optical fiber (OF) technology in guifi.net there are many on-going initiatives<sup>1</sup> to do so. The fact that some of these projects are already in the stage of being fully operational, bringing of Gbs/s broadband Internet access to places (such as rural areas) where the traditional telcos are currently offering connections of few Mbs/s at most, proves that it is totally feasible to deploy and operate OF infrastructure according to the CNs principals following a bottom-up approach. Hence, the aforementioned scepticism is totally unfounded.

The present document reports the presence of OF in guifi.net, paying special attention to the three projects that have been selected as OF pilots [1] in the Commons4Europe project and how they have progressed over the first year. The Gurb project has been selected as a pilot because it was the first OF project started and it is the most advanced one. The Vic pilot has been selected because it is a case of OF in an urban area. Finally Rubí has been selected as a case where the project at the moment is blocked.

Several new terms have appeared for this new way of deploying OF, such as *Fiber From The Farm (FFTF/FFTx)*<sup>2</sup> or *Bottom-up Broadband (BuB)*<sup>3</sup>, etc. all of them referring to the high degree of the implication of the end user in all the phases of the network deployment and operation. It is worth to mention that the BuB term was introduced in the Digital Agenda for Europe as the result of the guifi.net participation in the Stakeholder Day 2010<sup>4</sup>.

FO connections are all end-to-end (Point-To-Point) connections<sup>5</sup>. Hence, the active parts concentrate in the edges. While the intercity connections usually form a mesh

<sup>1</sup>In the guifi.net jargon these initiatives are referred as *projects*

<sup>2</sup>A play on words (i) referring to the active-*from* vs. passive-*to* role of the end users of the CNs models vs. the traditional telcos models, and (ii) reaffirming the popular origin of the initiative *farm* vs. *home*.

<sup>3</sup>Despite this term does not strictly refer to FO the reference is implicit since many people think that FO is the only way to grant the broadband.

<sup>4</sup><http://ec.europa.eu/digital-agenda/events/cf/dae1009/item-display.cfm>

<sup>5</sup>Precisely speaking Passive Optical Network (PON) technologies allow Point-To-Multipoint connections. Despite they are widely used, also in guifi.net, for the sake of clarity in this document they are usually treated as a group of PTP links.

network, the so called *backbone*, the intracity connections usually form starts, the so called *user loop* or *last mile links*, centred in the nodes of the intercity mesh. OF wires are passive, so all the electronics and logical configurations concentrate in the edges. While the next Section focuses on the physical part of the deployments, called *deployments* itself, the following focuses on the nodes, named *Points-Of-Presence (POPs)*. Section VI summarises the results achieved before Commons4EU was started, the results of the first year of the project, and the expected results for the next two years . Finally Section VII sets the conclusions of the present document.

## II. ABOUT THIS DOCUMENT

This report has been produced using open source tools such as  $\text{\LaTeX}$  [2] and *git* [3].  $\text{\LaTeX}$  is widely used in academia to prepare print-class documents. It automatically takes care of numbering, cross-referencing, tables of contents, bibliography, etc. *Git* is a high performance distributed revision control which is used in many open source projects, such as the linux kernel. Git makes it easy and safe to collaborate as each contributor works on his or her own personal copy. Good contributions can be easily shared with others, and it is always possible to revert to a previous version.

Our git repository is publicly available in *github*:

<https://github.com/jbarcelo/C4EU-deliverables>

Anyone who is familiar with  $\text{\LaTeX}$  and *github* can contribute to this document. The first step is to make a copy (a *fork* in *github* jargon). The contributor can work on this copy and make changes to improve the document. After that, it is necessary to request that these changes are merged into the original copy of the document (a *pull request* in github jargon).

If you see anything that can be improved, feel free to contribute. This document is alive in the sense that it will keep evolving as long as contributors make changes and improve it.

The system automatically keeps track of all the contributors and their contributions. It is possible to see who is contributing more actively and which are the exact changes made by each contributor. And everything is public on the web.

### III. RELATED WORK

TODO

### IV. DEPLOYMENTS

This section presents the optical fibre (OF) deployments from the Points-Of-Presence (POPs) to the end users, POPs excluded. Therefore it mainly refers to the physical wire deployment. The POPs deserve their own section and are covered in Section V.

#### A. Pilot's deployments

One of the three selected pilots had FO already operative before the Commons4EU project was started. In another one the initial deployment was done after the project was started. The last one got blocked in the *commitment phase* [1].

1) *Gurb*: Gurb<sup>6</sup> is a typical Catalan rural village formed by a few streets and many disseminated farms, some of them rather isolated. guifi.net project was born in this village as a response of the people to the lack of Internet access. The local government has always been strongly committed to the project. Most of the buildings are connected to guifi.net WiFi network. In this village and in many others of the area guifi.net has become the standard mean to access the Internet. Local government ducts and dark fibers are available to be used according to guifi.net's principals.

This was the first OF initiative in guifi.net. It was started in 2009. The deployment and the activation of the first iteration<sup>7</sup> took place in 2010. It was connected to the Internet in April 2011<sup>8</sup>. Despite of the several obstacles found, most of them related to the novelty of the model, and the extra steps that had to be taken to circumvent them, thanks to the determination and the conviction of many volunteers the project was successfully carried out. Figure 1 shows four pictures of the festive atmosphere of the deployment execution. Figure 2 shows the map of the first deployment iteration, where up to 24 farms were connected.

<sup>6</sup>Gurb, population 2.538 hab, density 49,19 hab/km<sup>2</sup>, located in the "comarca" of Osona, Catalonia.

<sup>7</sup><http://guifi.net/node/23273>

<sup>8</sup><http://guifi.net/node/36864>



Fig. 1. OF deployment in Gurb's first iteration. Pictures of the deployment execution, August 2009.

In 2012 the second iteration was started<sup>9</sup>. It is expected to be finished at the very beginning of 2013.

The third iteration is scheduled for 2013 and 2014. In this iteration urban areas will be wired using some of the local government ducts and dark fibers available.

Gurb deployments can be seen as the experimental environment where the Bottom-up Broadband (BuB) model has been tested. Due to its success it has become a reference for the guifi.net community.

<sup>9</sup><http://guifi.net/node/50325>





Fig. 2. OF deployment in Gurb's first iteration. Map. Executed in 2009.



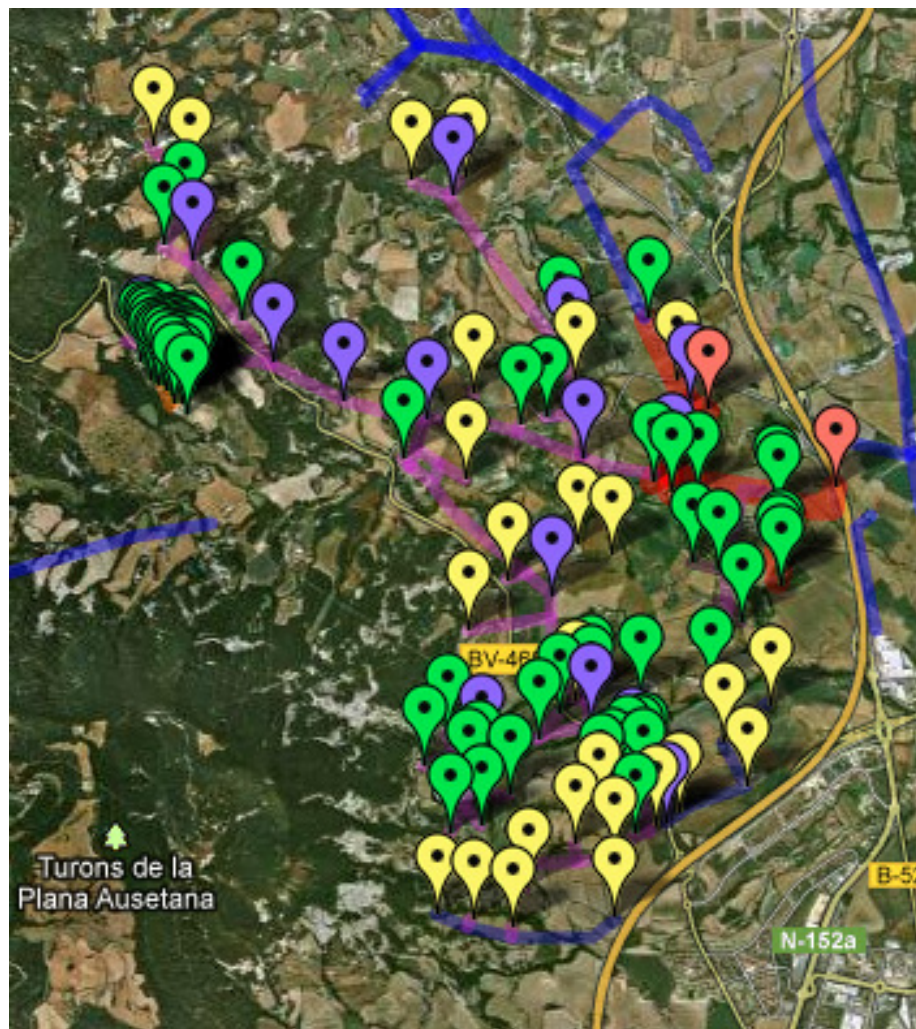


Fig. 3. OF deployment in Gurb's fist iteration. Map. Blue spots are the *Passive Optical Splitters*, green spots are homes connected as of the beginning of December 2012, yellow spots are homes to be connected by the end of this iteration.

2) *Vic*: Vic<sup>10</sup> is a typical middle size Catalan city of the Catalan rural areas where most of the population lives in the urban area with several industrial parks. It is neighbouring Gurb. Initial guifi.net nodes were set up in 2003. The local government has gradually increased the commitment to the project up to the point to make available its ducts to deploy OF according to guifi.net's principals. At the moment the access to the local government dark fibers is being negotiated.

Initial attempts to deploy OF dates back to 2009. In 2011 the Catalan government proposed to the guifi.net Foundation to organise a summer camp<sup>11</sup> meant for teenagers. As a result of it the first iteration was executed in August 2012 and activated next the month. Summer camp attendees actively participated in the whole process of the OF deployment. Figure 4 shows some pictures of the summer camp. Figure 5 presents the map of this iteration. In this case non-residential buildings where connected. More precisely, a primary school<sup>12</sup>, a students residence<sup>13</sup>, a sport resort<sup>14</sup> and a weather station. At the moment of the deployment the fastest Internet connection offered by the traditional telcos to these buildings was: primary school 0.5Mb/s, students residence 2Mb/s, sport resort 2Mb/s, weather station 1Mb/s.

Currently the second iteration is already being started and it is expected to be finished by 2013. Figure 6 presents the map of this iteration.

<sup>10</sup>Vic, population 40.900 hab, density 1.336,60 hab/km<sup>2</sup>, the capital of the "comarca" of Osona, Catalonia.

<sup>11</sup><http://blogs.guifi.net/camp2012/>

<sup>12</sup>Escola Andersen, students from 3 to 11 years old, 600 students, <http://www.xtec.cat/ceipandersen/>.

<sup>13</sup>Alberg de Joventut Canonge Collell, 100 rooms, Generalitat de Catalunya, [http://www10.gencat.cat/sac/AppJava/organisme\\_fitxa.jsp?codi=2549](http://www10.gencat.cat/sac/AppJava/organisme_fitxa.jsp?codi=2549).

<sup>14</sup>Club Patí2212 Vic, 2000 members, first hockey Spanish league, <http://www.clubpativic.net/clubpativic/index.php/ca/>.



Fig. 4. OF deployment in Vic's first iteration. Pictures of the deployment execution during the summer camp, August 2012.



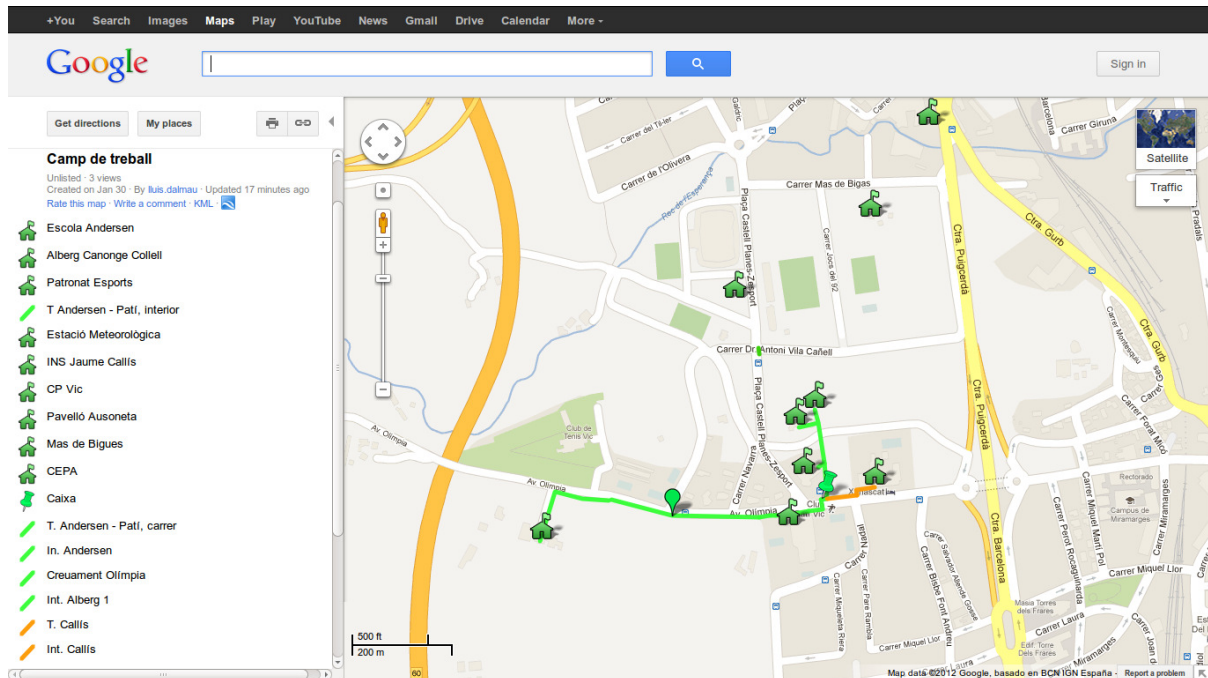


Fig. 5. OF deployment in Vic's first iteration. Executed in 2012. Result of a teenager's summer camp.

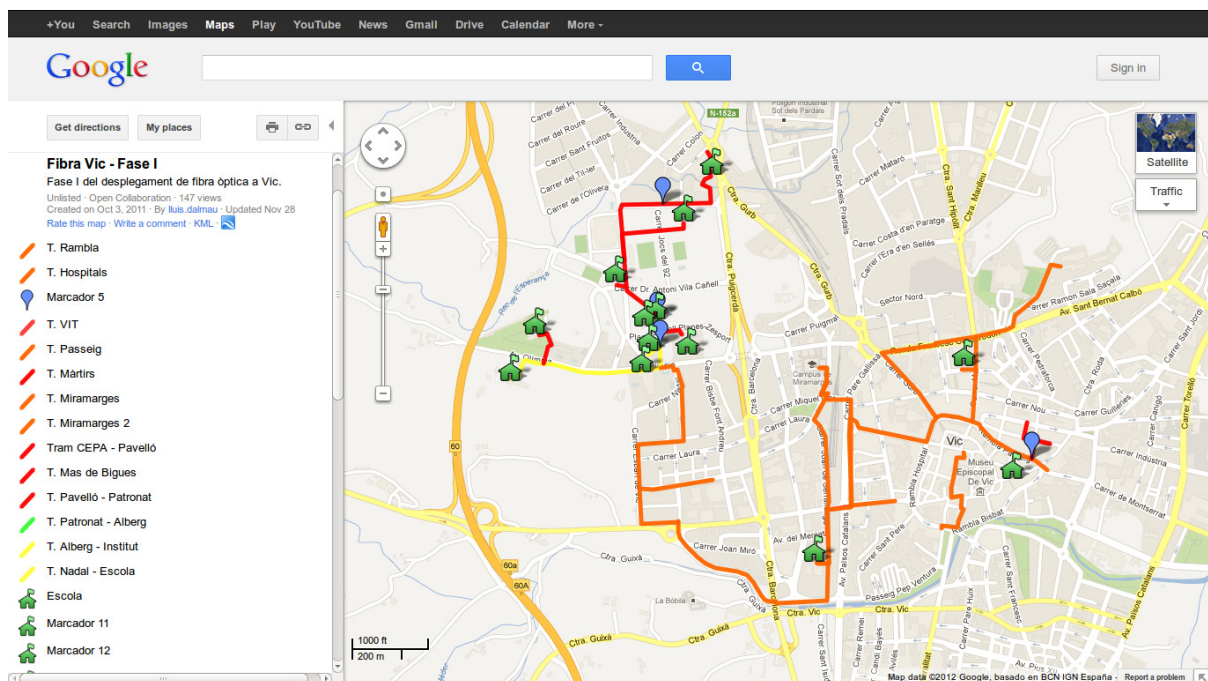


Fig. 6. OF deployment in Vic second iteration. Planned for 2013.

3) *Rubí*: Rubí<sup>15</sup> is a typical middle size Catalan city of the Barcelona surroundings where most of the population lives in the urban with several industrial parks.

Rubí local government in early 2012 showed interest in deploying OF following a Bottom-up Broadband model. The first goal was to offer high-speed Internet connections to the largest companies operating in one of Rubí's industrial areas called "Can Jordi". These companies have access only to slow ADSL connections and the absence of OF is seriously affecting their competitiveness. The lack of commercial high speed connections prompted the city's local government to look for alternatives.

An initial round of conversations took place in Spring 2012 to plan for a deployment during the Summer. The planning involved a strong participation of a local partner, a company with experience in wireless deployment. This initial planning for a bottom-up-broadband deployment did not pass unnoticed, and commercial ISPs approached the Rubí local government with fiber deployment offerings. Traditional telcos offered to prioritise their deployment plans over other cities. Guifi, UPF and the local partner were asked by the city's local government to prepare a concrete offering that could match the offering of the ISPs.

The arrival of traditional ISPs proposals, combined with unforeseen uncertainties of the competence of the local partner to carry out the deployments and internal discrepancies in the Rubí's local government slowed down the pilot. Currently this pilot is on hold, and it is not clear how it will resolve. Personal interests and personal connections within the City local government will play an important role in the final resolution.

It is remarkable that the fact that the City local government entered in conversations to plan a BuB deployment triggered a number of events that placed the city in a much favourable situation to negotiate with the ISPs about future fiber deployments.

### *B. Other deployments*

Aside from the deployments already presented there are other OF initiatives the guifi.net Foundation is aware of the following deployment initiatives:

<sup>15</sup>Rubí, population 73.979 hab, density 2.290,37 hab/km<sup>2</sup>, located in the "comarca" of Vallès Occidental, Catalonia.

- Taradell<sup>16</sup>, first iteration executed in 2012, interconnection of a secondary school with guifi.net local POP. Small extensions planned in 2013/2014.
- Igualada<sup>17</sup>/Masquefa<sup>18</sup>, first iteration planned for 2013, connection of many homes expected

## V. POINTS-OF-PRESENCE (POPs)

A Point-Of-Presence (POP) is an artificial demarcation point or interface point between communicating entities. All POPs mentioned in this document refers to optical fiber (OF) interconnection points.

Since 2010 the guifi.net community has raised five POPs over the Catalan territory, all of them according to the Bottom-up Broadband (BuB) model specified in the guifi.net network license<sup>19</sup>. Thus anyone is able to connect to them as long as he/she accepts this license.

From a general perspective guifi.net community is building a set of neutral exchange points, leaving the infrastructure available to the individuals, associations or either companies. These kind of POPs are named POP-IX referring to the Internet eXchange points (IX).

Figure 7 shows the OF network map of guifi.net POPs as of December 2012. The backbone, i.e. the POPs interconnections are made using third party infrastructures. Currently all the POP interconnection links are over the Xarxa Oberta de Catalunya (XOC)<sup>20</sup>.

<sup>16</sup>Taradell, population 6.181 hab, density 233,25 hab/km<sup>2</sup>, located in the "comarca" of Anoia, Catalonia.

<sup>17</sup>Igualada, population 39.191 hab, density 4.826,48 hab/km<sup>2</sup>, the capital of the "comarca" of Anoia, Catalonia.

<sup>18</sup>Masquefa, population 8.310 hab, density 487,1 hab/km<sup>2</sup>, located in the "comarca" of Anoia, Catalonia.

<sup>19</sup>This is the agreement all users must accept to join the network. Its mission is to keep the network free, open and neutral. The Catalan version can be found at <http://guifi.net/ca/CXOLN>. It has not yet been translated into English

<sup>20</sup><http://www.xarxaoberta.cat/en/about-xoc>



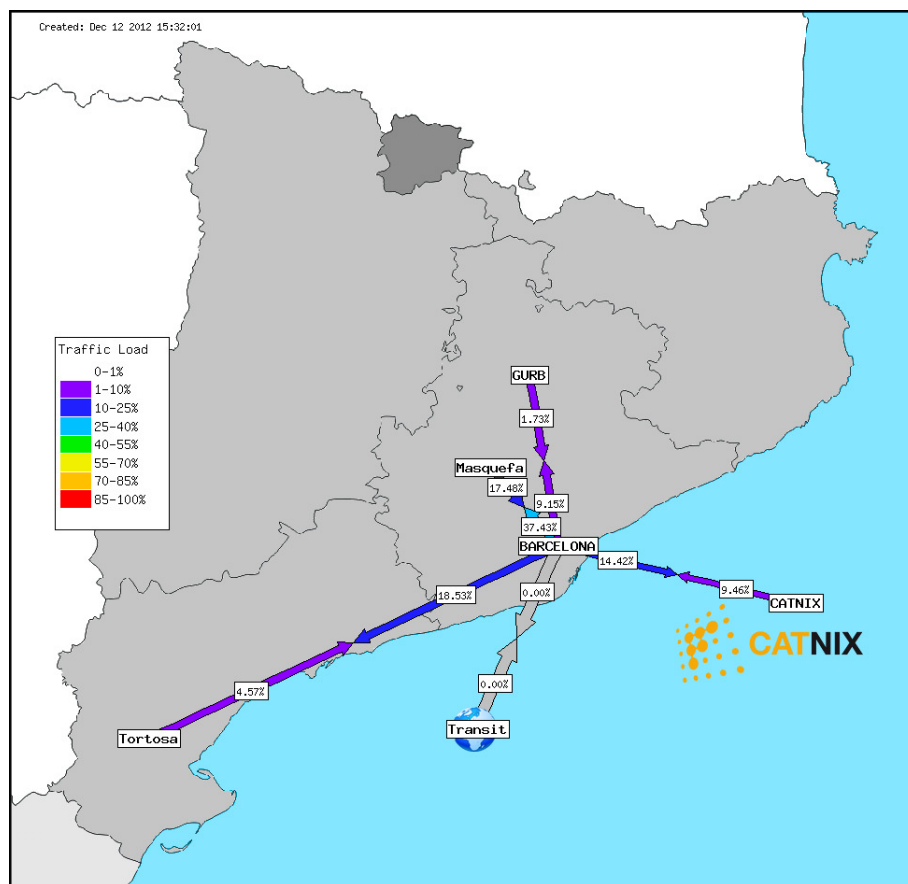


Fig. 7. Guifi.net fiber POPs network map

### A. Pilot's POPs

1) *Gurb*: Gurb pilot has its own POP fully operational. The POP is placed in the garage of a home's guifi.net member. The garage also hosts a data center where the guifi.net partners<sup>21</sup> can collocate their hardware. Pictures on Figure 9 shows some details of the current installation.

This POP, activated in 2010, was the first one. Figure 9 shows its traffic load in 2012.

<sup>21</sup>A guifi.net partner is a guifi.net member that has professional interest in the network.

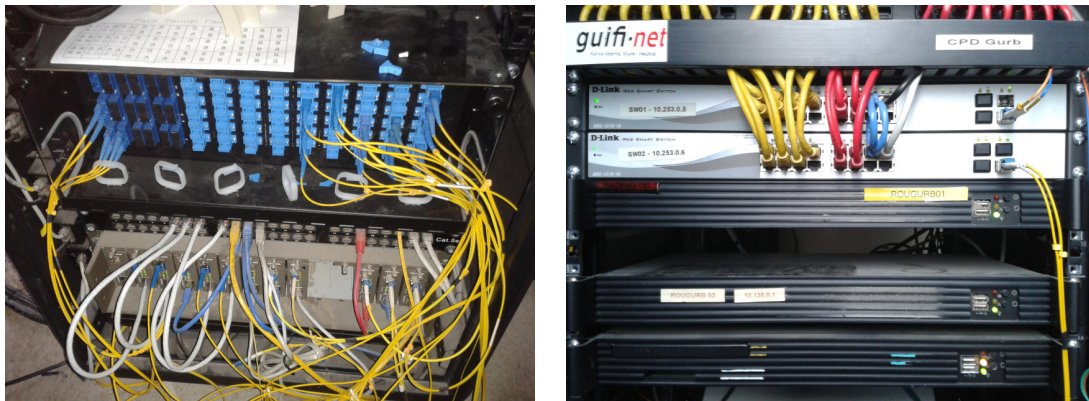


Fig. 8. Gurb's POP detailed pictures. On the right the OF terminations. On the left the routers.

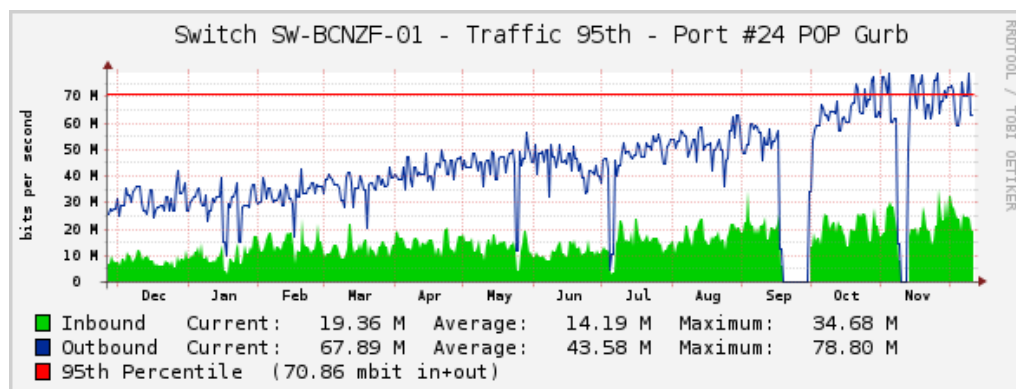


Fig. 9. Gurb's POP network load (year 2012).

2) *Vic*: The Vic's POP is expected to be fully activated in the coming days.

## B. Other POPs

1) *Telvent-Barcelona*: Telvent-Barcelona is a commercial data center<sup>22</sup> placed in an industrial park of Barcelona. It hosts the CATNIX<sup>23</sup>, the Internet exchange point (IX) of Catalonia, a physical infrastructure provided by the Catalan government. IXs are critical for the Internet since they are meant to let the network operators exchange their information and connect their networks (autonomous systems).

<sup>22</sup><http://www.telvent.es/en/>

<sup>23</sup><http://www.catnix.net>

On the one hand, as be shown in Figure 7, all guifi.net POPs are linked to TELVENT-Barcelona. On the other hand, guifi.net connects to the Internet through this POP.

guifi.net Foundation operates it's own backbone infrastructure using the ASN 49835 (Autonomous System Number). An open peering policy is followed to establish peering sessions with all potential partners. Figure 10 shows the total peering traffic of guifi.net CATNIX port<sup>24</sup>. Additionally guifi.net Foundation has an Internet Gigabit uplink contracted with Cogent<sup>25</sup>. Figure 11 . All guifi.net Foundation routers and servers are allocated in a 22U rack in Telvent-Barcelona, shown in Figure 12.

Figure 13 shows a connection scheme (layer 2) of the hardware used for the CATNIX POP. The first port of the switch SW-03 is the optical fiber which brings the data from the other POPs. As can be seen each of them use a separate VLAN. The seventh port of the second switch is the connection with the carrier to reach the Internet. And the eight is connected to the CATNIX infrastructure where the exchange of data with other ISPs and networks is possible.

The Telvent-Barcelona Foundation resources are shared with other partners, such as puntCat<sup>26</sup>, the Catalan Top-Level Domain (TDL), which is currently using half of the space available.

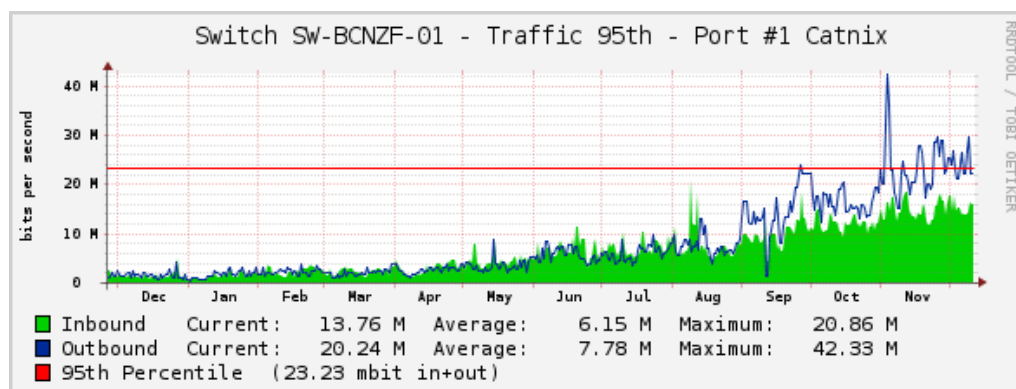


Fig. 10. Telvent-Barcelona's POP network load (year 2012).

<sup>24</sup>To be a CATNIX members must have at least one public ASN and one public IP block. Guifi.net is a Local Internet Registry (LIR) since it is a RIPE-NCC member, and has its own ASN numbers and IPv4 and IPv6 blocks.

<sup>25</sup><http://www.cogentco.com/en/>

<sup>26</sup><http://www.domini.cat/>

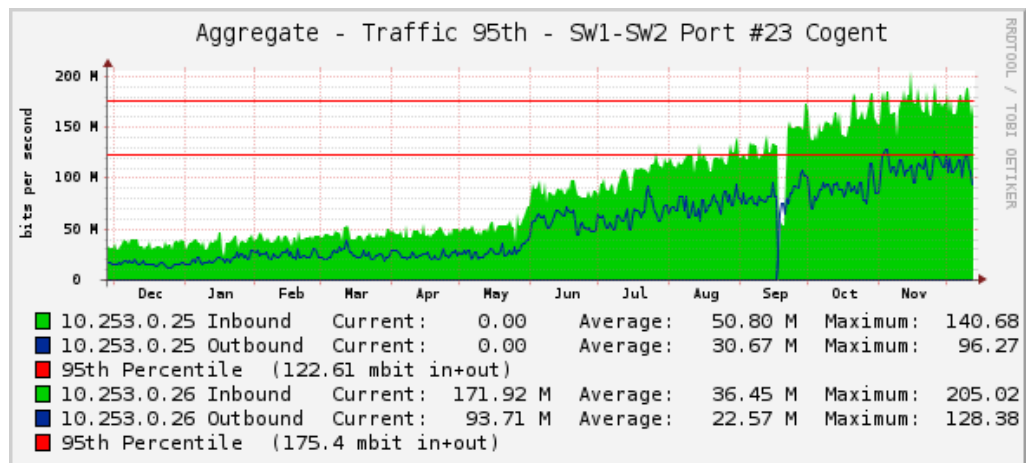


Fig. 11. Internet uplink load (year 2012).

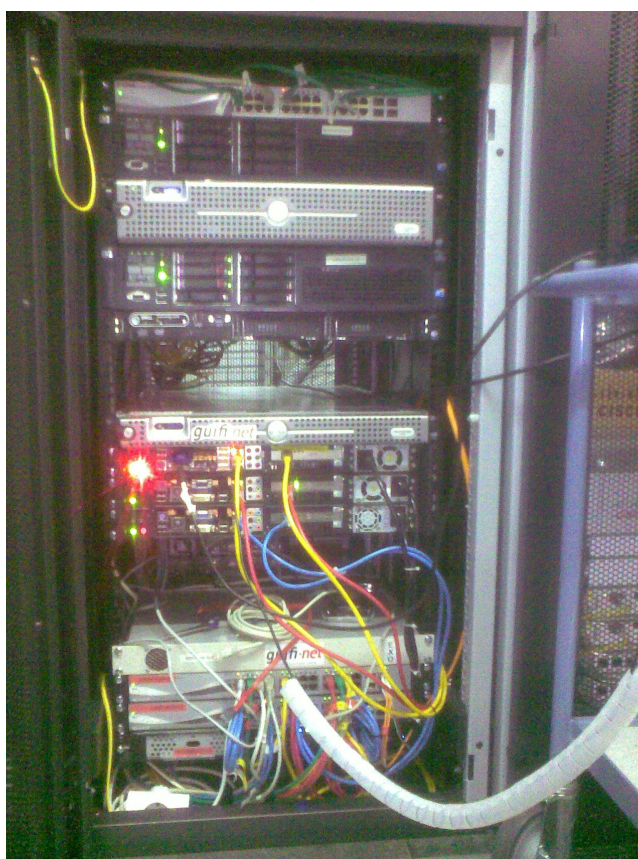


Fig. 12. guifi.net Foundation rack in TELVENT-Barcelona.

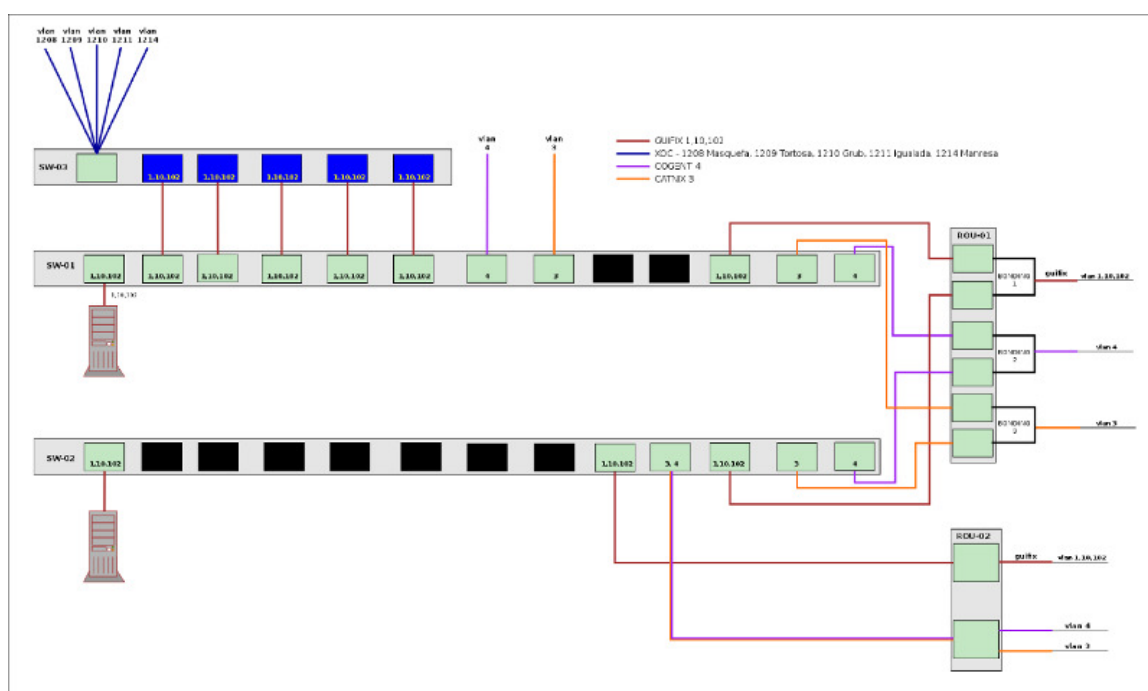


Fig. 13. CATNIX connections scheme



2) *Masquefa*: Masquefa is a town of a rural area with a pretty high population density. Due to the poor quality of the Internet access of the traditional telcos the local government undertook a project to bring the broadband to the homes. The project was carried out and is maintained by a local SME. It combines WiFi and OF technologies and integrates a POP which was activated in 2012.

3) *Igualda*: Igualda is a city similar to Vic. It was one of the pioneers adopting guifi.net outside Osona. The same SME which is operating the Masquefa infrastructure managed to rise a POP in this city also in 2012.

4) *Tortosa*: Tortosa<sup>27</sup> is a city placed on the south of Catalonia. It has a urban center similar to Vic and Igualda but additionally has a pretty big rural area. The guifi.net users started a project named OpenFPnet<sup>28</sup> with the objective of create an open and neutral fiber backbone around the surrounding villages and set up a POP, which was rised in 2012. From October 2011 to September 2012 the project was partially-funded by the Spanish government through a secondary school<sup>29</sup>. Currently it is economically sustained by community users grouped in associations and some local SMEs.

5) *Expected POPs in 2013*: In 2013 other POPs are expected to be risen. The POPs that have a very high probability to happen are:

- Balanyà
- Centelles

The POPs that can be consolidated during the 2013 are:

- Aldea
- Mataró
- Cerdanyola

## VI. RESULTS

The achievements prior to 2012 were:

- Deployments

<sup>27</sup>Tortosa, population 34.432 hab, density 157,62 hab/km<sup>2</sup>, the capital of the "comarca" of Anoia, Catalonia.

<sup>28</sup><http://openfpnet.guifi.net>

<sup>29</sup>Institut Montsi, <http://www.iesmontsia.org/>

- Gurb, first iteration (2010), about 8kms long, 24 farms connected
- POPS
  - Gurb, activated (2011)
  - Telvent-Barcelona, activated (2011), Internet uplink 1Gb/s (2011), CATNIX interconnection

The achievements of 2012 are:

- Deployments
  - Gurb, second iteration (2012), about 20kms long, over 60 farms connected
- Deployments
  - Vic, first iteration (2012), about 6kms long, 5 non-residential buildings connected
- POPS
  - Gurb, significantly extended (2012)
  - Igualada, activated (2012)
  - Masquefa, activated (2012)
  - Tortosa, activated (2012)

The actions very likely to happen are in less than two years time:

- Deployments
  - Gurb, third iteration (2013/2014), over 40kms long, over 300 connections
  - Vic, second iteration (2013/2014), over 20kms long, over 50 connections
- POPS
  - Vic, activation (early 2013)
  - Balanyà, activation (2013)
  - Centelles, activation (2013)
  - Telvent-Barcelona, second 1Gb/s Internet link with an other carrier (backup line)

## VII. CONCLUSION

The results of the first year of fiber deployment are outstanding. Firstly, over 65 fiber connections have been made in 2012 (60 farms in the Gurb pilot), and 5 non-residential buildings in the Vic pilot). Secondly, 3 Points-Of-Presence (POPs) have been activated

in 2012 and at least 4 expected for 2013, one of a selected pilots (Vic pilot). Thirdly, the activity is not restricted to the selected pilots since many other initiatives are going-on in parallel, some of them very autonomous and barely known by the guifi.net Foundation. Finally, the future is very promising since the model proves not only to be self-sustainable but to have an exponential growth.

The information of the present document will be yearly updated (in Deliverable D 5 4-b and D 5 4-c respectively).

This document is publicly available as a common resource to be shared by the community.

#### ACKNOWLEDGMENT

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#### REFERENCES

- [1] J. Barcelo, B. Bellalta, R. Baig, R. Roca, A. Domingo, L. Sanabria, C. Cano, and M. Oliver, "Bottom-up Broadband Initiatives in the Commons for Europe Project," *arXiv preprint arXiv:1207.1031*, 2012.
- [2] L. Lamport, *LaTeX: A Document Preparation System*. pub-AW, 1994, vol. 14.
- [3] S. Chacon, J. Hamano, and S. Pearce, *Pro Git*. Apress, 2009, vol. 288.