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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. Thus, this technology is one of the three selected in the Commons for Europe project for Bottom-Up Broadband pilots. The present technical report accounts for the progress made during the third reporting period (Nov 2013 - Oct 2014) of optical fiber pilots in the Commons for Europe project.

Background / Suggested Reading

The socio-economics fundamentals of the optical fiber pilots as long as the technological aspects are explained in the report of the first reporting period (Nov 2011 - Oct 2012). The progress during the second period (Nov 2012 - Oct 2013) of fiber pilots were appropriately reported in the reports of that period. The present document accounts only on the progress made during the third year of these pilots following the same structure of the first and second reports. Thus, it is strongly recommended to be familiar with these two reports before reading this one.

The "Fiber From The Farm (FFTF) *D5.4.1: Report on Pilots on Fiber Deployment -a*" report, the first reporting period report of fiber pilots, can be found at https://github.com/jbarcelo/C4EU-deliverables/blob/master/D_5_4_1_report_on_pilots_on_fiber_deployment_a/DELIVERED_VERSION/D5.4.1%20Report%20on%20pilots%20on%20fiber%20deployment%20-%20a%20guifi.net_DELIVERED_VERSION.pdf

The "Fiber From The Farm (FFTF) *D5.4.2: Report on Pilots on Fiber Deployment -b*" report, the second reporting period report of fiber pilots, can be found at https://github.com/jbarcelo/C4EU-deliverables/blob/master/D_5_4_2_report_on_pilots_on_fiber_deployment_b/DELIVERED_VERSION/D5.4.2%20Report%20on%20pilots%20on%20fiber%20deployment%20-%20a%20guifi.net_DELIVERED_VERSION.pdf

Index Terms

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

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I. DEPLOYMENTS

This section presents the evolution of optical fibre (OF) deployments, from the Points-Of-Presence (POPs) to the end users. POPs are covered in Section II.

A. Pilot's deployments

During the third reporting period¹, *Gurb*'s pilot, the most developed of the three pilots, has kept growing steadily in terms of new users connected, in *Vic*'s the PoP has been consolidated through the addition of new connections to the initial ones deployed in Y2, and in *Rubí*, a pilot categorised as "blocked" by the end of the first year, the opportunity for retaking it appeared in Y2 has produced some tangible results during the current reporting period.

1) *Gurb*: *Gurb*, the first OF initiative to be put into practice, was started two years before Commons for Europe (C4EU) project begun. The subsequent deployments in other areas have greatly benefited from the problems solved, the procedures developed and the knowledge gathered during the execution of this pilot. The first iteration, which finalised before C4EU was started, proved that the commons model being used for WiFi deployments was also adequate for OF deployments. The second iteration, carried out during Y1 and Y2, focused on rural deployments, showing that model was not only valid for core infrastructure (i.e. rising the PoP and make the initial connections), but also to reach end-users. The third iteration, Y3, carried out at the urban area of the town evidenced that the model is also suitable for this sort of areas. During this iteration an option to reduce the entry costs and to boost new deployment areas has been developed and put in practice. Now the users interested in getting OF connection can decide between the model already used for the former iterations, that is to say, wait until a project for covering their area consolidates and then pay the whole connectivity costs (around 1.500€ for rural deployments and around 750€ for urban deployments) at once, or to declare their interest and support for a future deployment by paying a

¹NOTE: Commons for Europe project has three reporting periods: Nov 2012 - Oct 2013, Nov 2013 - Oct 2014 and Nov 2014 - Oct 2015. In this document they can also be referred as first year (Y1), second year (Y2) and third year (Y3), or simply 2012, 2013 and 2014.

small monthly amount of money (at the moment 20€/month) as payment on account. This way the professionals have budget in advance which makes possible to undertake smaller projects, thus, fulfilling users' demands earlier on average. Once the connection is delivered to the users the remaining costs can be cleared or refinanced. This way the entry costs can be reduced up to a total amount of 40€ a month (20€/month for the connectivity -Internet access included- and 20€/month for financing the deployment costs).

Table I summarises the state of the *Gurb's* pilot at the end of the third reporting period.

OF deployment of <i>Gurb's</i> Pilot (Oct. 2014)	
Users already connected	61
Users in the waiting list	25
Unsubscribed users	0
Km of OF deployed	30
Topology	PoP, rural, urban

TABLE I

GURB PILOT - STATE AT THE END OF C4EU PROJECT (OCT. 2014).

Fig. 1 shows a general view of *Gurb's* and *Vic's* deployments. Green are lines are existing fibres by October 2014. Yellow ones are planned deployments to be executed before May 2015. Purple lines are circuits owned by the municipality of *Vic*. Fig. 2 is a detailed view of the urban area covered during this last year.

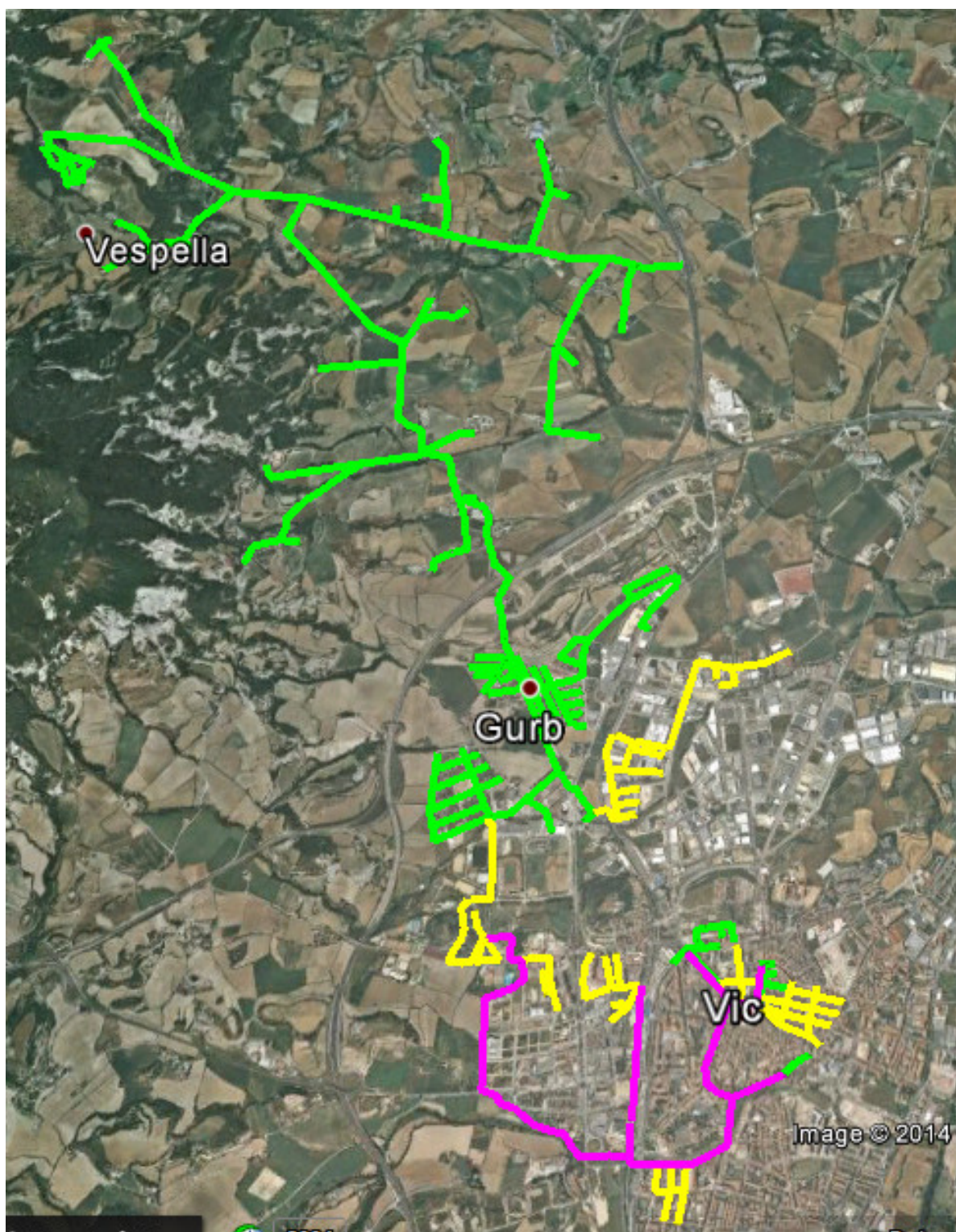


Fig. 1. General OF deployment of Gurb's and Vic's pilots at the end of C4EU project (Oct. 2014). Green are lines are existing fibres by October 2014. Yellow ones are planned deployments to be executed before May 2015. Purple lines are circuits owned by the municipality of Vic.



Fig. 2. OF deployment of 2014 in an urban area.

Pictures of Fig. 3 were taken during the third deployment iteration. The top left is of one of the project's presentation sessions to the neighbours. In this case the presentation was given by the president of the guifi.net Foundation in the Grub's Town Hall. The top right shows a general view of the PoP of the pilot. Despite its external appearance, all the hardware installed is redounded as well as all the connections and the power supply are granted by a uninterrupted power supply combined with a diesel generator. Bottom left picture shows the backside of one of the racks of the PoP. Last picture shows a fibre splicer, the tool used to make the OF connections.



Fig. 3. Gurb pilot - Fiber From The Farm (FFTH) process pictures . Top left: Project's presentation to the neighbours. Top right: Grub's PoP general view. Bottom left: Backside of one of the racks of the PoP. Bottom right: The fibre splicer and the additional tools needed.

Fig. 4 shows the traffic the Gurb's PoP. A clear increase can be observed since the first week of August, when the deployments done during the spring and the beginning of summer were finally put in service².

²The jump of the inbound traffic is mostly due to a reconfiguration of the ports monitored which was made in conjunction with the illumination of the new tracks, thus, most of it does not correspond to a real traffic increase.

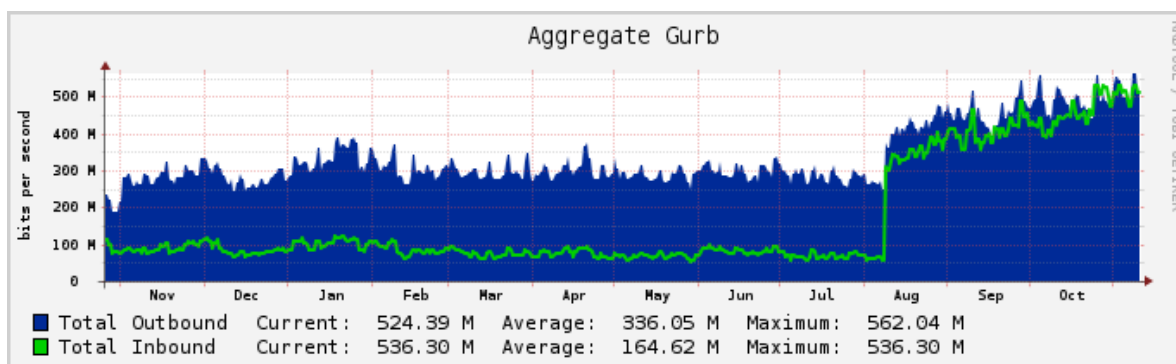


Fig. 4. Gurb's pilot network traffic 2014.

2) *Vic*: This urban deployment was started as the result of the collaboration of individuals, industries and social services. During 2013 a primary and a secondary school, a hospital and a chemical factory together with a dozen of dwelling houses have been connected. The number of connections in 2014 was expected to significantly increase. Nonetheless, due to the conflicts caused by a professional which quitted guifi.net the expansion slowed down. Solving these conflicts consumed great efforts because he involved the municipality and other actors such as the collocation centre managers. The positive outcome is that the access to the municipal fibres³ have been standardised and thanks to it the expansion has been restarted. As Fig. 1 shows that three circuits of the municipality are already used and another three are foreseen to be used in the coming months.

Fig. 5 shows the current deployments in green, the circuits of the municipality used or to be used in purple and the deployments planned for the coming months in yellow.

³Vic council constituted as operator and is deploying dark fibre. The monthly cost of a circuit within a radius of 1km is 25/month. Ducts can also be rented at a yearly cost 1.35/m with 80% of reduction if they are used to deploy infrastructure held in commons.

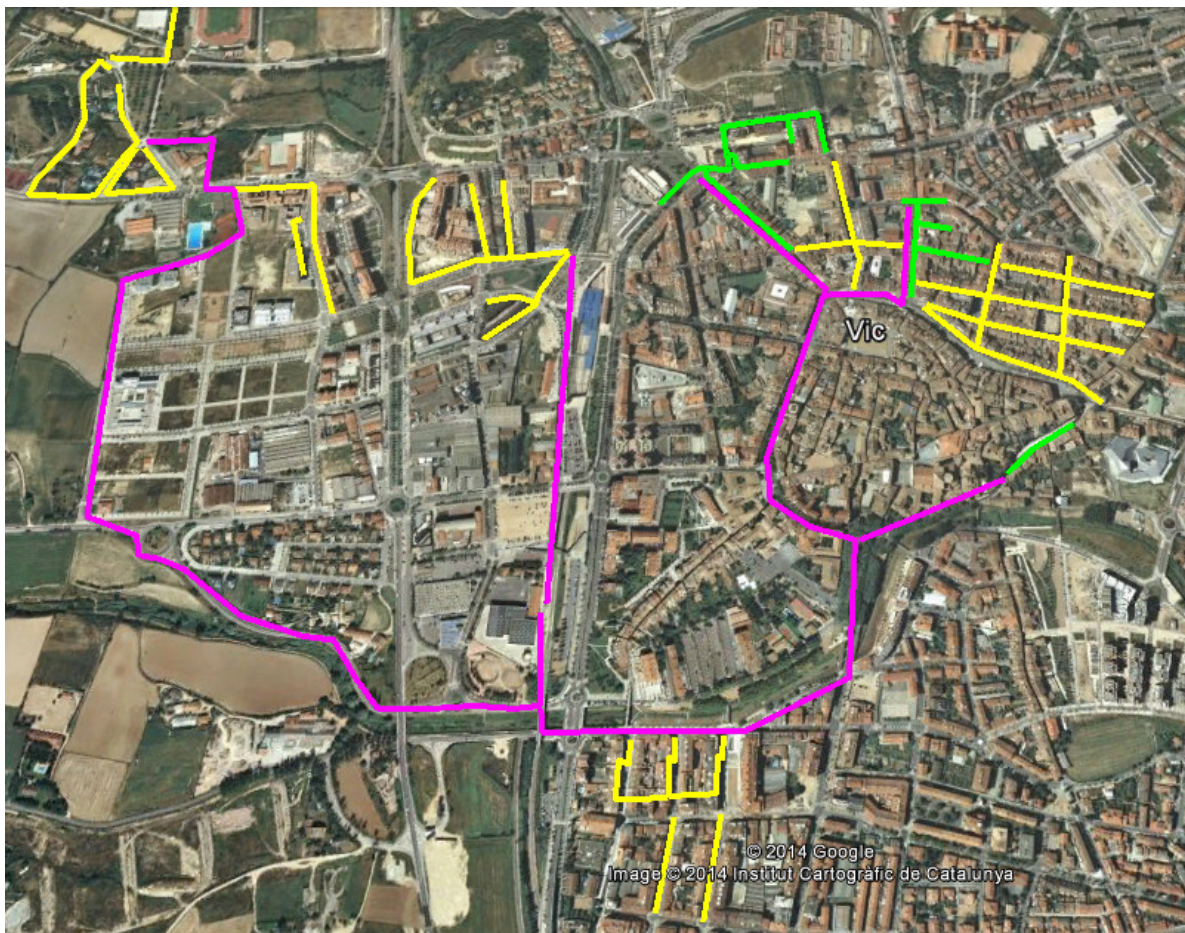


Fig. 5. Green are lines are existing fibres by October 2014. Yellow ones are planned deployments to be executed before May 2015. Purple lines are circuits owned by the municipality of Vic.

Fig. 6 shows the traffic at Vic's PoP. The valleys correspond to the weekends, showing that these deployments are mostly professional (industries, schools, etc.).

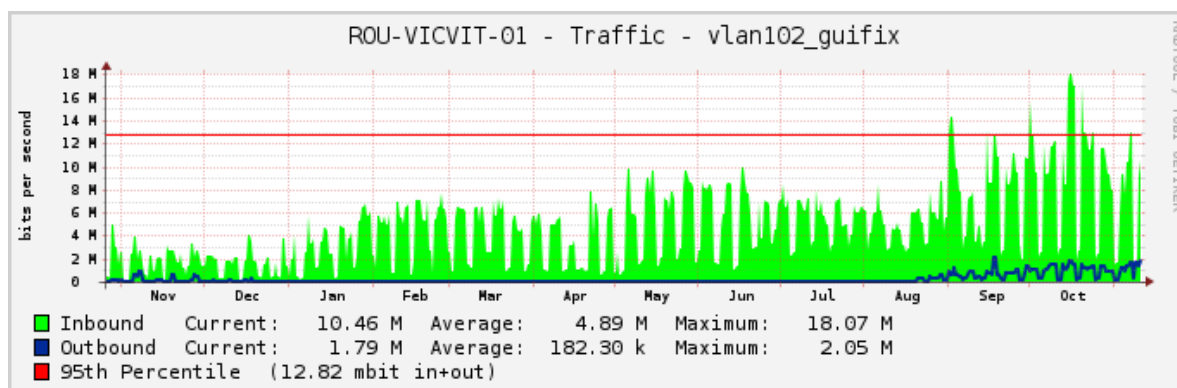


Fig. 6. Vic's pilot network traffic 2013.

3) *Rubí*: As already detailed in the first report, by the end of the first year this pilot was considered to be in a blocked state. In 2013 on the one hand the traditional ISPs have continued deploying their own OF, but on the other hand new opportunities to deploy BuB OF appeared. Indeed, in June a person from the city advised by the local government contacted the guifi.net Foundation to get further information about the BuB model and to discuss on the viability of setting up a consumers cooperative ISP inspired by the experience she gained during her contribution to Som Energia⁴, an energy consumers cooperative that promotes the fair and green energies consumption.

Som Energia/Eticom⁵, the consumers cooperative ISP, was created in March 2014 and is still in a transient state. Nevertheless, it already has over 450 hundred members and has several delegations around Spain. Despite they have not made any deployment yet, the model is very promising as well as the results already achieved. According to this model, the member fees are to be used to undertake OF deployment projects of infrastructure to be held in commons. At the same time, the coop acts as a reseller of other telecommunications companies to be able to offer a full telecommunications service set (i.e. mobile and fix data and voice) to its members. The providers are selected according to the coop ethical principles.

⁴<http://www.somenergia.coop/welcome-to-som-energia>

⁵<http://www.eticom.coop/en/> and <http://www.somconnexio.org/>

B. Other deployments

The FO initiatives in side guifi.net that consolidated during this last reporting period are:

- Sant Bartomeu del Grau
- Cardedeu
- Vilafranca
- Sant Vicenç dels horts
- Sallent

Thus, guifi.net accounts for a total of 12 consolidated OF initiatives⁶

II. POINTS-OF-PRESENCE (POPs)

During this third year another four territorial PoPs have been raised and made operative, amounting to a total of 11 territorial and the concentration one (Telvent -Barcelona) being operational. Fig. 7 shows their distribution on the map. So far all the territorial PoPs are connected to the concentration one via XOC connections⁷.

⁶The already consolidated before starting this reporting period are: Masquefa, Igualda, Manresa, l'Aldea, Tortosa.

⁷The prices can be found at <http://www.xarxaoberta.cat/en/prices>.

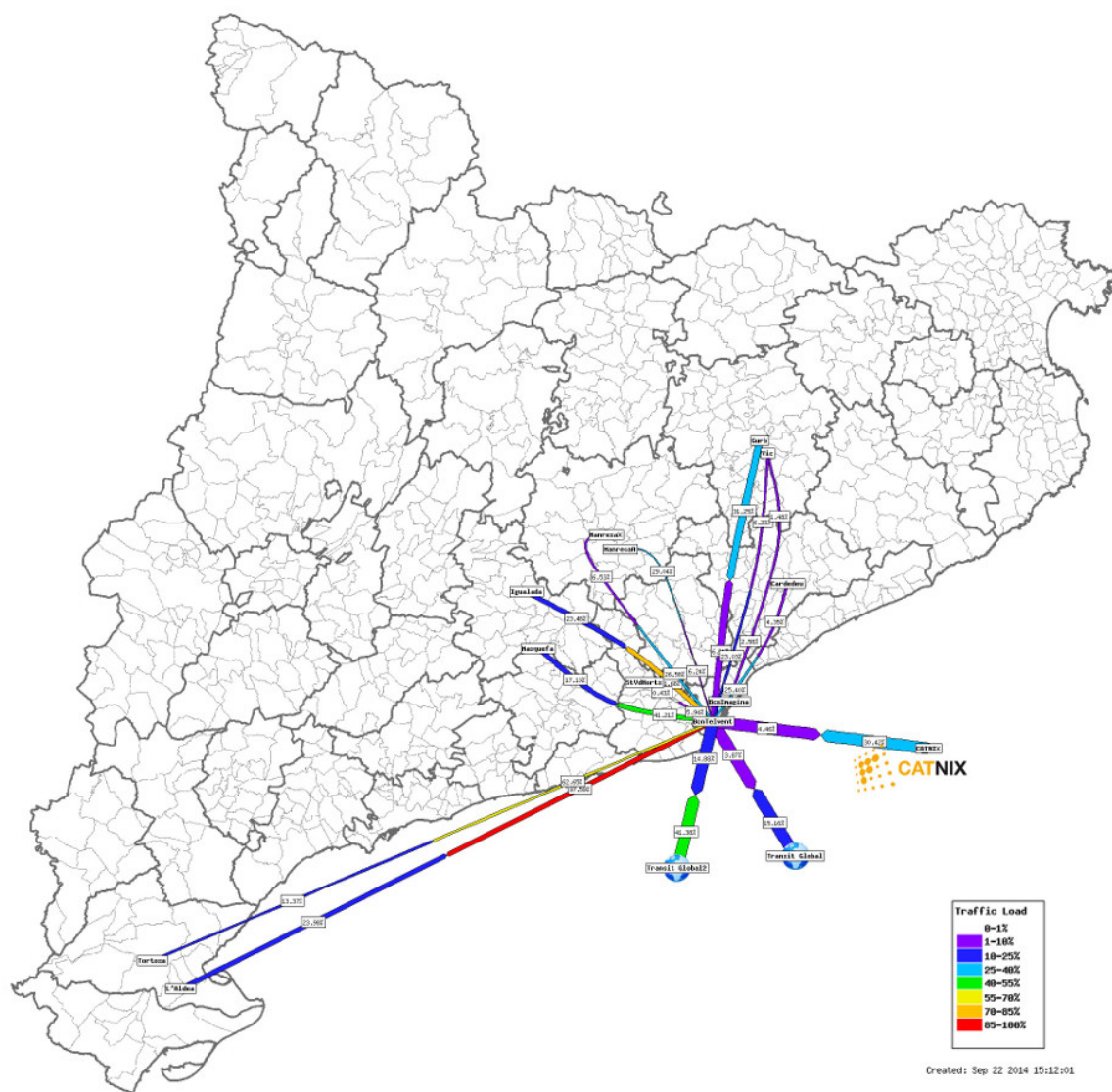


Fig. 7. Guifi.net fiber POPs network map (Oct. 2014).

With respect to the IXs operation, the following improvements have been applied during this year:

- Economic compensation system put in place (see report *D.7.3.2 report on building support for BuB4Europe - b*) and already put in practice in 3 PoPs.
- Netflow feature activated in all core routers (part of the information needed to put the Economic compensation system in practice).
- A second carrier of 1Gb/s has been added to the already existing one in Telvent.

- Load balancing infrastructure to ensure maximum efficiency of the uplinks and redundancy put in place.
- Upgrade of Telvent's infrastructure to 10Gb/s
- A third IPv4 block obtained from RIPE-NCC

Fig. 8 shows Telvent's PoP at wiring level after being reorganised and upgraded to 10Gb/s technology.

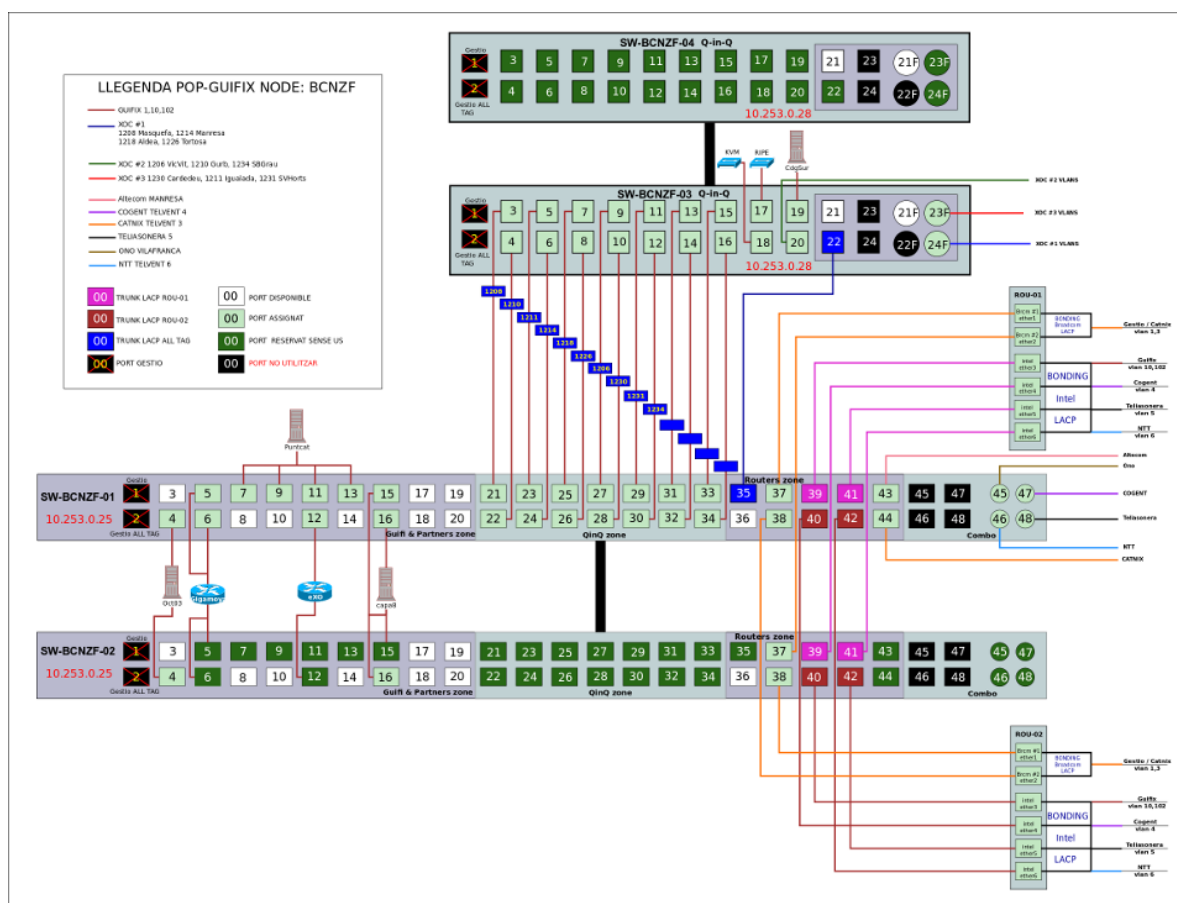


Fig. 8. Telvent network diagram (Oct. 2014).

During this period the number of peers at the CATNIX (the Catalan exchange point) has kept stable, but the traffic has steadily grown as Fig. 9 shows.

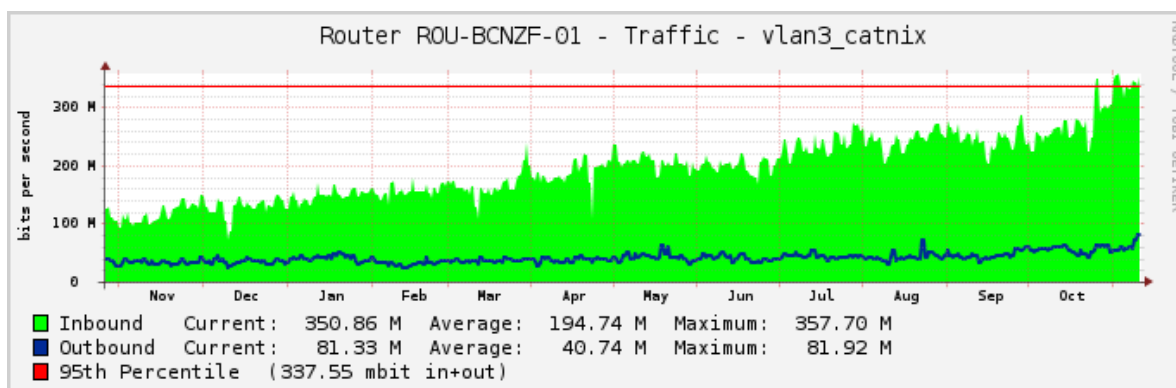


Fig. 9. CATNIX traffic 2014.

Fig. 10 shows the traffic of each carrier. As it can be observed the second carrier was activated in midMay. The effects of the load blancing can be observed from then on.

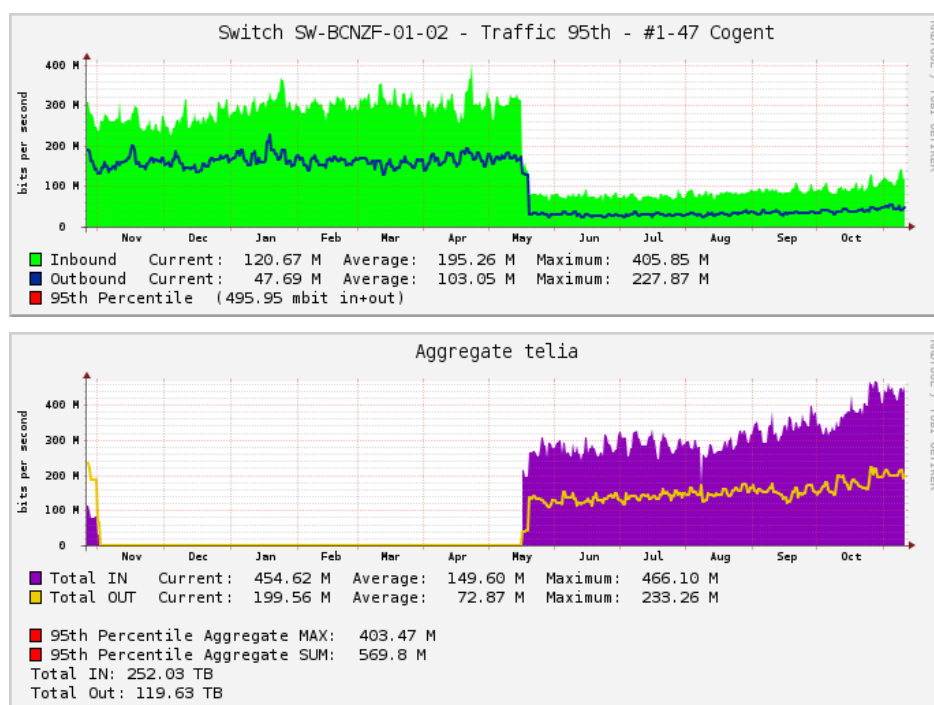


Fig. 10. Carries traffic 2014. Top: Cogent. Bottom: Telia.

Fig. 10 shows the aggregated traffic of all guifi.net interconnections (the two carriers and the NIX) of the second week of November 2014. As it can be observed there are load peaks above 1.5Gb/s.

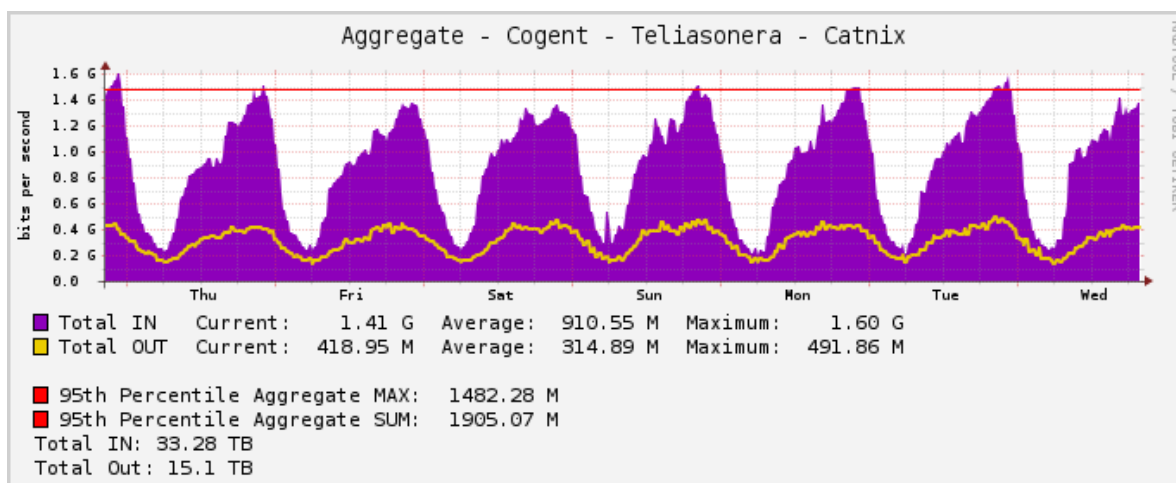


Fig. 11. Total interconnection inbound and outbound traffic Nov. 2014.

A. Pilot's POPs

1) *Gurb*: Operative since 2010, this year this PoP has been rebuilt to accommodate the hardware required for Gurb's OF pilot deployment and to install a new rack for servers. Figure 12 shows the transit of this PoP in 2014.

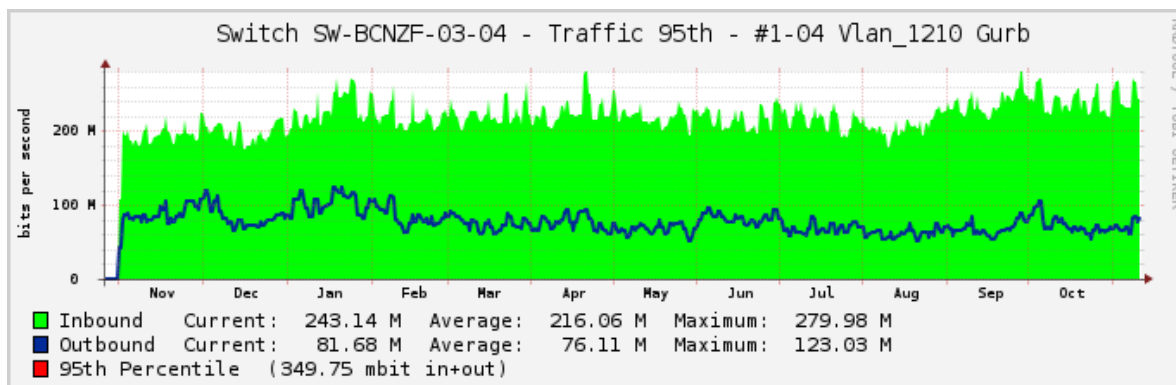


Fig. 12. Gurb PoP traffic 2014.

2) *Vic*: This PoP, activated at the beginning of the second reporting period, is allocated in a data centre of a premise of the local government (<http://www.vitvic.cat/>). Figure 13 shows the transit of this PoP 2014.

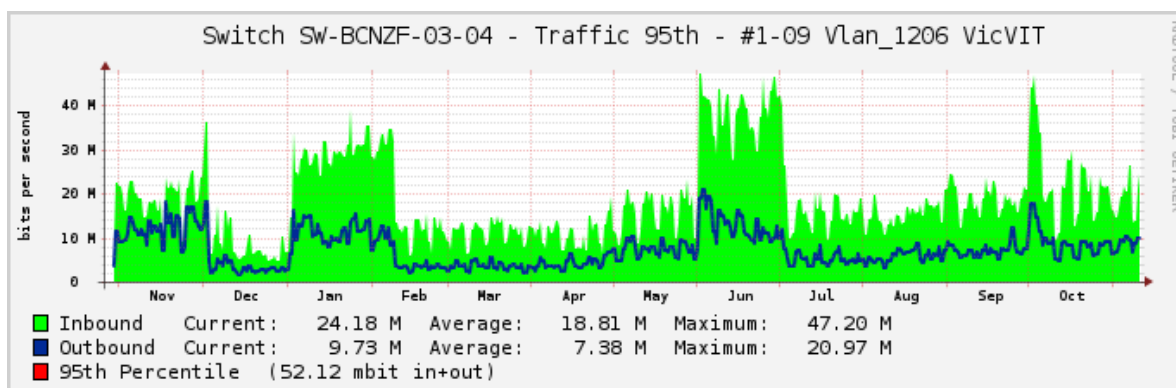


Fig. 13. Vic PoP traffic 2014.

3) *Rubí*: This pilot's PoP has not been risen yet and it is not expected to be done shortly.

B. Other POPs

Fig. 14 shows the transit in 2014 of the rest of the operational territorial PoPs that were already active in 2013. As it can be observed, traffic has significantly incremented in all of them.

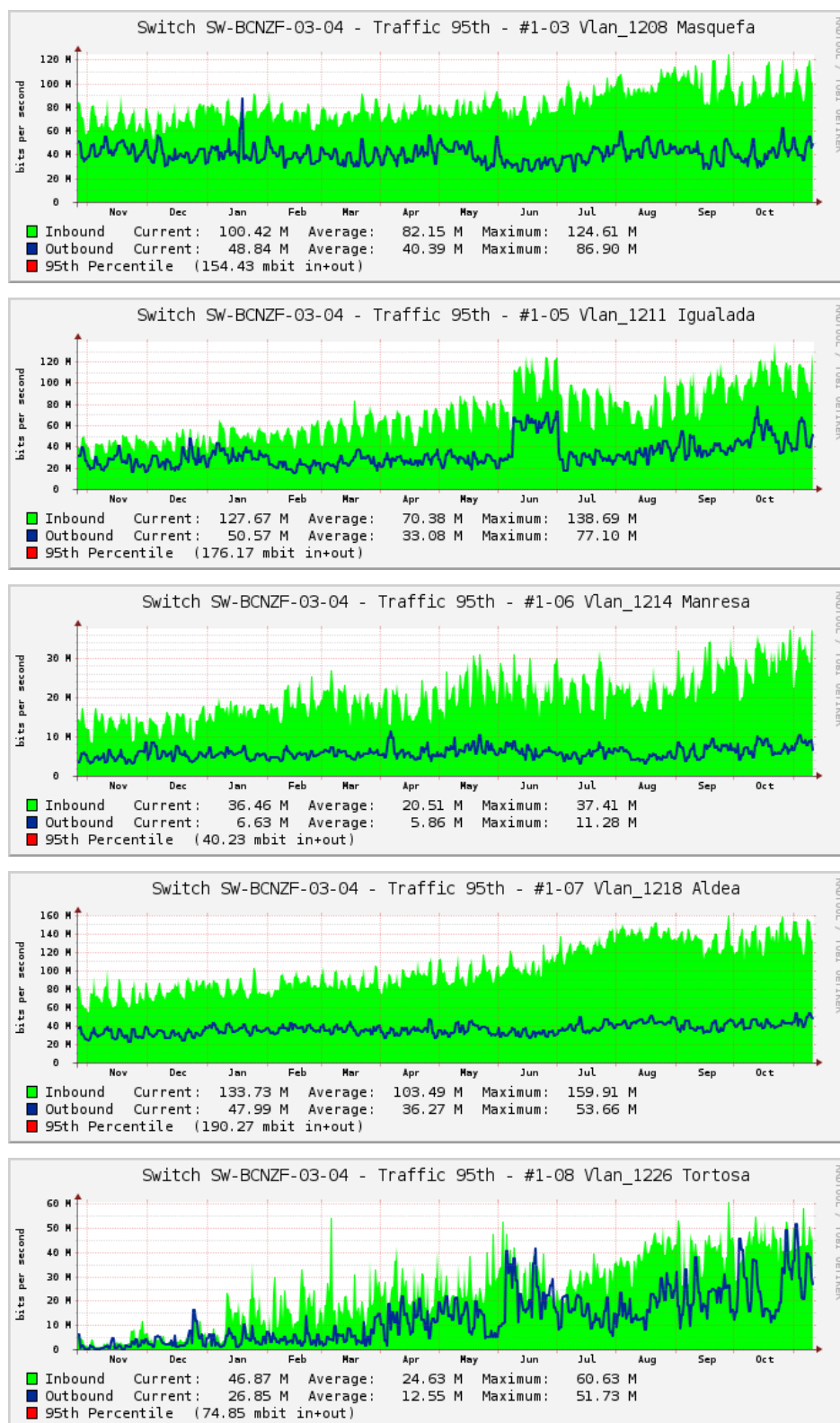


Fig. 14. Other PoPs traffic 2014. Top: Masquefa. Second top: Igualada. Middle: Manresa. Second bottom: Aldea. Bottom: Tortosa.

III. EVALUATION OF PILOT'S RESULTS

In our opinion, despite the fact that in one of the three pilots there are no deployments yet, the progress of the other two, together with the results of the other initiatives the experience, is enough that the experience as a whole is a great success. What in our opinion are the most relevant contributions of the BuB model already observed follow.

A. Model acceptance

Despite all the difficulties inherent to new models, the already seen traffic graphs together with the facts that none of the existing users have withdrawn and the future previsions, prove that the model has been widely been accepted.

B. The pilots as a reference

The pilots are playing a fundamental role with regard to the other projects because they constitute precedents that can be reused in other cases.

Legal uncertainties clarification Although the telecommunications market is liberalised, the facts that it has been a state monopoly for a long time in almost all European countries and that it is unusual that the citizens play an active role in it result in a general lack of knowledge regarding the real rights of the citizens and how to exercise them. Learning about these rights and telling to the third parties (specially to the public administrations) has consumed a lot of resources. Having already running cases together with the support of being a partner of the CommonsforEurope project helps to reduce this overhead in great manner.

Local agreements Agreements to regulate the citizens-private-public collaboration are part of the tools that have had to be developed. The current ones are used as guide for the new ones.

Best practices The day-to-day work is the best way to gain expertise. Best practices regarding technical, financial, etc. aspects are shared among the pilots and the community.

C. Sustainability and Scalability

The results achieved, specially the fact that new initiatives are being developed, show that the model is sustainable from the economic point of view and that it is feasible from the technical and the social points of view.

D. Local economic promotion

In addition to the impact in terms of local economic promotion any deployment of an optical fibre network accessible by the inhabitants (essentially in terms of the cost, because, unfortunately, few people is concerned about other aspects like data retention, surveillance, etc.) has, specially if it is the first one available, the BuB model the following traits:

Knowledge transfer All knowledge and information is accessible to the public. Thus everybody has the same opportunities to start a business. Professional secrecy has a extremely bad reputation.

Job and small business creation Many SMEs have been created so far around guifi.net Two types of job positions are the most common, Internet service access (over the CN) and physical installations. Frequently SMEs combine both of them and, additionally, take the participation in the project as an opportunity to better position themselves in the market.

SMEs cooperation The guifi.net Foundation strongly promotes the cooperation among SMEs in terms of knowledge sharing, resources sharing, etc. The activity in the concentration PoP is a clear example of this collaboration. There ISPs operating in guifi.net (they are all SME) gather together to deal special offers with the providers (carrier, collocation, etc.) and share costs.

E. Digital divide reduction

The presence of a decent internet access has many other benefits for the population aside from the direct impact on the local economy. Nonetheless these benefits are restricted to those who can afford the connection cost. The BuB model is a significant contribution towards the digital divide reduction because BuB is a cost oriented model

(fairness in prices is a compromise taken by the ISPs) and also a Do-It-Yourself model (so everybody has the right to make his own deployments).

F. Social Implication

BuB model fosters social implication of individuals in great manner. Things do not happen if people do not want them to happen. After almost ten years of activity people have (re-)learnt how to cooperate to achieve a common objective, how to interact with the public administrations, how and why to take care of the common good, etc.

We are convinced that this way of doing things can be exported to many other fields like the electrical power or the health care systems.

IV. CONCLUSION

The main conclusion of the results of the Optic Fibre pilots confirm the initial working hypothesis, that is to say, that the fundamentals of the crowdsourcing model successfully put in place during the last decade to boost a telecommunications infrastructure held in commons based on WiFi technologies can be used to deploy Optic Fibre infrastructure in the same commons model.

The execution of these pioneering pilots has significantly contributed in several aspects. Methodologies to make projects involving higher budgets, higher technological complexity and with higher dependencies on local authorities have been developed and put in practice. The software tools as well as the database have had to be engineered to accommodate the new technology requirements. A system to balance the usage and contributions to the infrastructure held in commons by the professionals has been put in place, etc.

During the second reporting period four new operational PoPs have been added to the five already existing ones. Thus, there are already eight on-going deployments in parallel and others are expected to consolidate during the next year.

Sustainability of the model is proved by the number of new OF initiatives emerged during the execution of the pilots as well as for the growth of the pilots itself.

As far as end-users accounting metric is concerned, in order to preserve the inherent autonomy of the BuB model and to better adapt to the current number of PoPs and its

expected future evolution, in this report we introduced the PoPs traffic at the expenses of the precise number of end-users connected. By the end of this reporting period the aggregated OF transit (internet carrier + CATNIX peers) is above 500Mb/s (95% percentile). The yearly traffic graphs presented show a clear sustained rising trend.

In addition to the PoPs and end-user results, the contributions made in local economic promotion, social implication, digital divide reduction, etc. must also be highlighted.

Thus, our overall assessment of T5.4 is extremely positive. We are convinced that through it we have made rather significant contributions to the model development and implementation.

ACKNOWLEDGMENT

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