Supporting Cloud Deployment in the Guifi.net Community Network

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***Abstract*—Community networking is an emerging model of a shared communication infrastructure in which communities of citizens build and own open networks. Community networks offer successfully IP-based networking to the user. Cloud computing infrastructures however, while common in today's Internet, hardy exist in community networks. We explain our approach to bring clouds into the Guifi.net community network. For this we have started integrating part of our cloud prototype into the Guifi.net community network management tools. A proof-of-concept cloud infrastructure is currently under deployment in the Guifi.net community network. Our long term vision is that the users of community networks will not need to consume cloud applications from the Internet, but find them within the community network.**

***Index Terms*—community networks; cloud computing;**

I. Introduction

The community cloud we present in this paper is the vision of a cloud deployment in community networks: A cloud hosted on community-owned computing and communication resources providing services of local interest. The concept of community clouds has been introduced in its generic form before, e.g., [1], [2], as a cloud deployment model in which a cloud infrastructure is built and provisioned for an exclusive use by a specific community of consumers with shared concerns and interests, owned and managed by the community or by a third party or a combination of both.

Community networks seem to be rather successful and widespread. There are several community-owned networks in the range of 500 to 20,000 nodes in Europe such as FunkFeuer, AWMN, Guifi.net, Freifunk and many more worldwide. Most of them are based on Wi-Fi technology (ad-hoc networks or IEEE 802.11a/b/g/n access points in the first hop, long-distance point-to-point Wi-Fi links for the trunk network), but also a growing number of optic fibre links have started to become deployed [5]. Guifi.net in Spain (Figure 1) is probably the largest community networks worldwide and it is where the cloud deployment we describe in this paper is currently taking place.

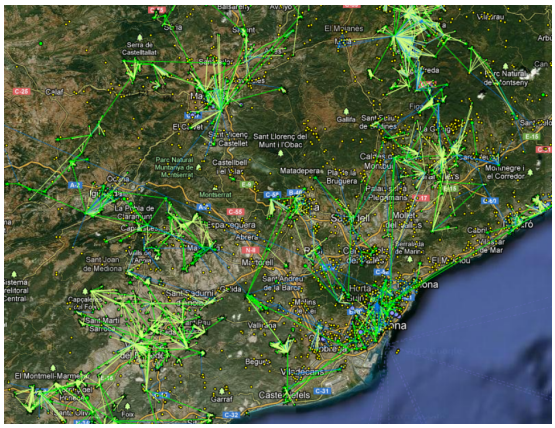

Fig. 1. Guifi.net nodes and links in the area around Barcelona

While community networks are a successful case of resource sharing among a collective, resource sharing in community networks in practice however is done mainly by the sharing of the nodes' bandwidth. This sharing enables that traffic from other nodes is routed over the nodes of different node owners. Since this is done in a reciprocal manner, community networks successfully operate as IP networks. We emphasize that computing and storage resource sharing, which is now common practice in today's Internet through cloud computing, hardly exists in community networks.

We argue that in the same way as the bandwith is successfully shared among community network participants, this sharing should be extended to other computing resources through clouds, to offer in a flexible way more applications inside of the community network, which will finally boost the potential of such open, neutral and collecively managed communication infrastructures.

In this paper we describe the cloud deployment that we have started in the Guifi.net community network. Beyond our specific solution and challenges, however, we believe that the community cloud scenario and our approach should find applicability in other community ICT infrastructures.

II. Deployment of the Community Cloud in Guifi.net

In this section we describe how the community cloud is brought into the Guifi.net community network with the technical support of the community network management software and the social support of Guifi.net community network members. Our cloud deployment is in the starting phase and on-going, and done with the help of the CONFINE project [3] which provides the Community-Lab testbed for the deployment of the initial cloud nodes, and the CLOMMUNITY project [4], which allowed us to engineer the community cloud system.

A. Steps to install a community cloud node

A user can typically add a new device to Guifi.net by registering it through the web interface hosted at the Guifi.net server in three steps, as illustrated in the following figures: (i) Figure 2 shows the general information about a real existing node in Guifi.net, (ii) Figure 3 shows the physical location of the node in a map, and (iii) Figure 4 depicts the web interface that allows the user to add devices to the node, e.g., the *Confine/Clommunity* device, which refers to a cloud resource.

Fig. 2. VicBarriOsona node info page at Guifi.net web: step 1 of 3, node information (source: http://guifi.net/en/node/1655)

B. Community Box as cloud hosts

The hardware that we currently deploy as hosts of the community cloud are bare bones devices of type Jetway JBC362F36 (Figure 5), which we call *community box*. These devices were chosen due to their low power consumption in order to be operational at the user premises at low cost in 24/7 mode and due to being fanless and without moving parts. They are equiped with Intel Atom N2600 CPU, have 4GB RAM and a 120GB SSD.

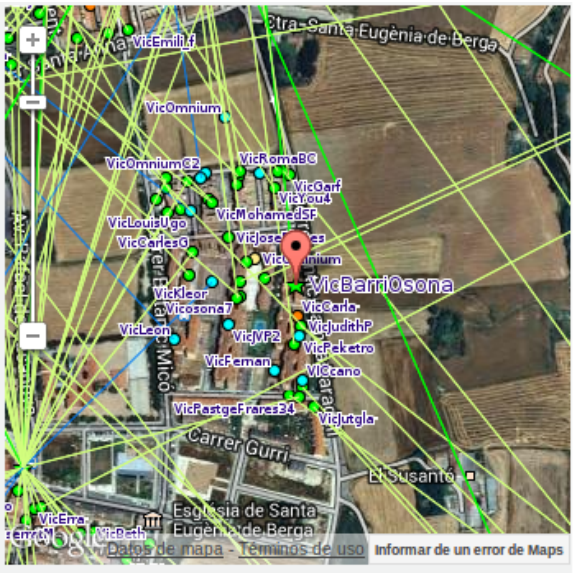

Fig. 3. VicBarriOsona node info page at Guifi.net web: step 2 of 3, node map (source: http://guifi.net/en/node/1655)

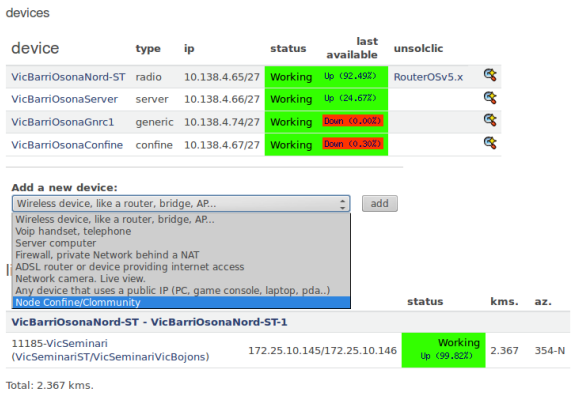

Fig. 4. VicBarriOsona node info page at Guifi.net web: step 3 of 3, add cloud resource (source: http://guifi.net/en/node/1655)

C. Cloud management platform

The community boxes used as cloud hosts need to be managed, in terms of their virtual machines, for monitoring, updating, etc. Currently, we use the management software of the Community-Lab testbed[1], with which the community boxes are integrated into its management services. The Community-Lab management software allows users to create *slices*, i.e., a set of virtual machines on different community boxes. Different to other open source cloud management platforms, the Community-Lab management software allows us to manage cloud resources with OpenWRT as host operating system, which is the case of the community boxes.

A user can select the *Guifi-Community-Distro* (see Section II-D) to be loaded as operating system image into the virtual machines of a slice. The Guifi-Community-Distro contains the main cloud support services, e.g. Avahi[2] and Tahoe-

[1]http://community-lab.net
[2]http://avahi.org/

Fig. 5. Community Box as host in the community cloud

LAFS[3]. This is an important feature of our appoach, since by distributing this image to the cloud hosts, we assure that these services run on all the cloud devices.

D. Guifi-Community-Distro and cloud services

The cloud infrastructure service of the Community-Lab management software (see Section II-C) provides users with a set of virtual machines. The *Guifi-Community-Distro* is the operating system image that we have prepared to be placed on each virtual machines. The Guifi-Community-Distro is a Debian-based distribution that has been equiped with a set of basice platform services and applications. Some of these services are common with other Guifi.net devices, such as the graph server and the proxy service. Other services, such as Avahi[4] and Tahoe-LAFS[5], have been explicitly added to the Guifi-Community-Distro as cloud platform and application service, respectively.

III. Related work

In comparison with other systems, there are a few research prototypes, but none for community networks such as targeted by us. Skadsem et al. [5] provides applications for communities by using local cloud services, leveraging on social mechanisms like trust. The Cloud@Home[6][6] project has similar goals to harvest in resources from the community for meeting peaks in resource demands. The system is well described in terms of design and motivation, but a deployed systems seems not yet to be available. The Clouds@home[7][7] project focuses on providing guaranteed performance and ensuring quality of service even when using volatile volunteered resources connected by Internet. The authors focus on voluntary computing systems, but do not consider the particular context of community networks. The P2PCS[8][8] project has built an initial prototype implementation of a decentralized Peer-to-Peer cloud system. It uses Java JRMI technology and builds an Infrastructure as a Service (IaaS) system that provides very basic support for creating and managing virtual machines as slices. It manages slice information in a decentralized manner using gossip protocols. The system is not completely implemented and integrated.

From the review of the related work it can be seen that these cloud systems are not reported to be deployed. In the cloud system we propose we put emphasis on the feasibility of deployment and aim that it is really used. The cloud system proposed in our work should become part of a production system to be used in real community networks.

[3]https://tahoe-lafs.org/ warner/pycon-tahoe.html
[4]http://avahi.org/
[5]https://tahoe-lafs.org/ warner/pycon-tahoe.html
[6]http://cloudathome.unime.it
[7]http://clouds.gforge.inria.fr
[8]https://code.google.com/p/cloudsystem

IV. Conclusion

Community clouds are motivated by the additional value they would bring to community networks. A vast amount of applications could be deployed upon community clouds, boosting the usage and spread of the community network model as ICT infrastructure for society.

This paper describes the on-going real deployment of clouds in a community network. Our approach uses and extends existing platforms and cloud software systems to be able to achieve a feasible deployment of a cloud system in the Guifi.net community network.

With the cloud infrastructure in place the next steps aim at getting feedback from end user participation to further shape the development of the community cloud components. A measure of success is that community network members will use this community cloud as alternative to the commercial clouds in the Internet.

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