ETArch Pilot: Scaling up the Deployment of a Clean Slate Network Architecture at a Telecom Operator

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Abstract. *Future Internet architectures is a response from the research community to the challenges that Internet architecture faces today, such as mobility. One major issue in this area is the deployment and test of them over large scale production networks. This work scales up the deployment of the clean-slate Entity Title Architecture (ETArch) on a production network of a telecom operator. Using Virtual Tunnel (VTun) as an overlay is was possible to connect different users in different cities at Minas Gerais state in Brazil. ETArch Pilot shows the feasibility to move toward future Internet deployment in order to bring new services and applications to users.*

1. Introduction

As the Internet has become fundamental to a huge volume of worldwide activities, there is a need to refine the architecture proposed since the beginning of its operation. Trying to find solutions, researchers around the world have been struggling to propose new architectural models, new protocols using a clean-slate approach or evolution the current ones considering the same network architecture [Bronzino et al. 2013].

To evaluate new proposals, validation in an environment close to the one in real world is crucial to verify performance, restrictions and benefits when compared to the current network architecture. However, this evaluation is really complicated to be conducted on real production networks considering security aspects and also possible out of service situations.

This work extends a previous one [Claudio et al. 2015] and its goals is to scale up the deployment of a Software-Defined Networking (SDN) based clean-slate network architecture, named ETArch, in a real network managed by a telecom operator, namely Algar Telecom.

To support a growing number of users and bypass the different access technologies, a tunneling approach, named Virtual Tunnels (VTun), was used. By using VTun, it was possible to connect several Algar Telecom customers located in different cities.

This work is organized as follows: Section 2 describes the scale up of ETArch

deployment at the current network of the telecom operator. Section 3 describes the experiments conducted and finally, Section 4 presents some concluding remarks.

2. ETArch Pilot Scale Up

Proposed by our research group, ETArch has a natural match with SDN, since both share the concept that the control plane is separated from the data plane. ETArch supports several requirements from current applications such as quality of experience (QoE) during mobility [Silva et al. 2014] and multicast [Amaral Gonçalves et al. 2014].

This work proposes the scale up of the deployment of ETArch by using a real telecom network and their customers, which are geographically distributed in the operator's network.

To accomplish this, it was necessary to establish a Layer 2 connection between customers and to have an fully OpenFlow capable infrastructure. Since this last condition was not satisfied in the operator infrastructure, then a tunneling technique was used. The VTun software was chosen [VTUN 2016].

The Virtual Tunnels (VTun) is a software that act in the client/server mode, and is capable to accomplish a point to point connection between the involved hosts.

For the traffic to be tunneled by the VTun, one host needs to act as a server, opening a socket in the system and listening to the port 5000. When a client connects to this service, one virtual interface is created in the operating system. That virtual interface is the *access bridge* to the created tunnel.

Compared to the previously published work [Claudio et al. 2015], the relevant improvement occurred in the simplification of the tunneling process that occurred due to the use of VTun instead of GRE. That evolution brought to us a major simplicity since the VTun offers less complexity to accomplish the scale up of ETArch deployment. When using GRE, it is necessary to configure the client's modem in *bridge mode*.

By using VTun to produce the tunnel, it was possible to do a smooth deployment and use of ETArch based applications. With this approach, there was no need to change the customer's modem operation mode and in this case the only requirement to use ETArch based applications was to be a customer of the telecom operator. It happens because when the VTun is started, one virtual interface is created in the operating system, which is then responsible to carry the traffic through that interface and also for the created tunnel.

3. ETArch Pilot Experimental Evaluation

To conduct the tests, VTun was used to create the virtual tunnels between the hosts, allowing ETArch based applications to send data to all the hosts connected to the same workspace.

In the evaluation scenario, a concentration tunnel host was created. The function of this machine was to host the VTun in server mode and to receive all the client's connections from the ETArch architecture. In this scenario, only the VTun concentrator machine was acting like an OpenFlow switch. This made the configuration and troubleshooting process easier since there is only one OpenFlow switch in the topology. The topology for the tests conducted under this scenario is described in detail by the Figure 1.

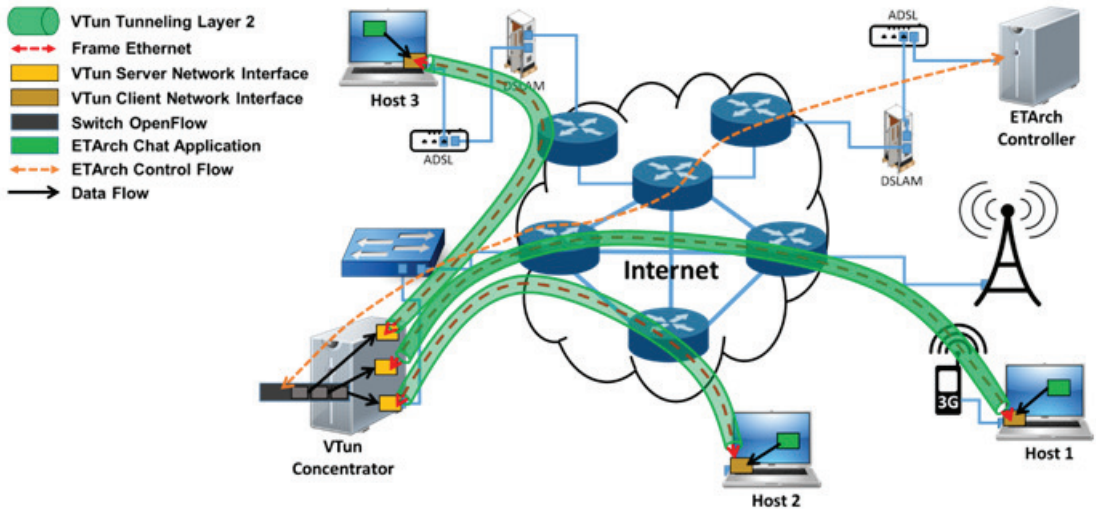

Figure 1. Communication between multiple entities using VTun.

In order to verify the overhead based on packet capture in the test environment, it was possible to identify that the VTUN encapsulation process caused an overhead of about 50.4%, equivalent to 56 bytes in each packet generated by the ETArch application. The overhead of the VTun tunneling versus the packet size ranges between 82.35% to 3.73% considering a total of 1500 Bytes to each packet.

Using the scenario, presented in Figure 1 it was possible to extend the number of entities in an unlimited geographical area. For this reason, we made a test with more than 40 users connected, distributed in a radius of 600 kilometers from the city of Uberlândia, according to Figure 2(a) which shows the localization of the machines performed by the chat clients. Most of the users are located in the city of Uberlândia as can be seen partially in Figure 2(b).

4. Concluding Remarks

This work scaled up the deployment of a clean-slate SDN based network architecture, named ETArch, in the real infrastructure of a network operator, named ALGAR Telecom, with little intervention in the customer environment.

By using VTun to support the tunneling process and to tackle the interconnection issues with the infrastructure, it was possible to use an ETArch based application by several customers located in different cities inside the operator coverage area. The chat application uses natives ETArch's capabilities to support multicast and mobility.

The work demonstrates the feasibility to deploy new network architectures in parallel with current ones and go towards future Internet deployment.

References

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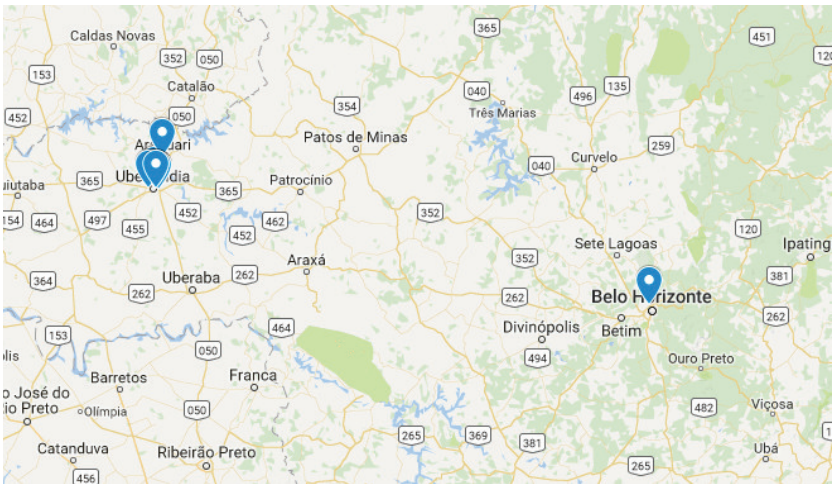
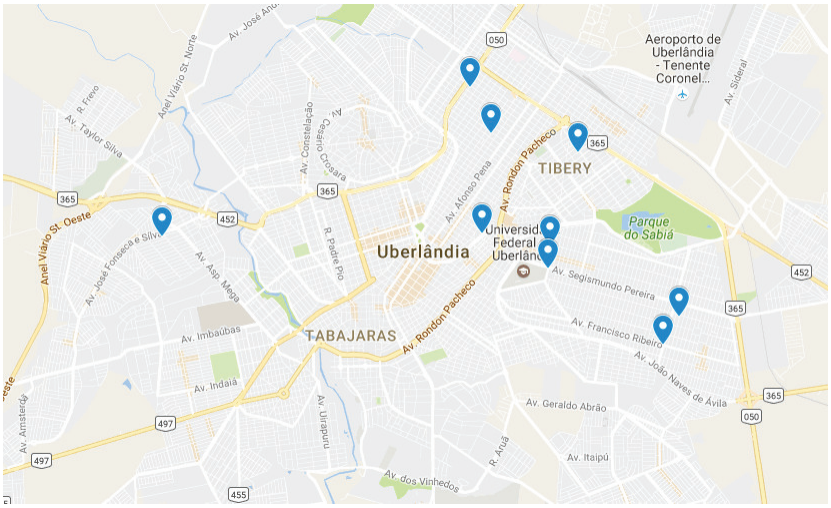


(a) Different cities in a distance of 600 km between peers



(b) Experimentation scenario with different entities in Uberlândia

Figure 2. Geographical distribution of the Entities.

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