# Performance Evaluation of Content Centric Networks

Pedro M. Caldas, Otto Carlos M. B. Duarte

Universidade Federal do Rio de Janeiro - GTA/COPPE - Rio de Janeiro, Brazil

*Abstract*—The current Internet architecture presents limitations to provide mobility, quality of service, security, scalability, among other services. New architectures are proposed to address these challenges and, therefore, virtualization is required to test new Internet protocols. The Content Centric Network (CCN) is considered as one of the most promising future internet architectures. This paper evaluates the performance of Content Centric Network and its benets when compared with the current Internet architecture.

## I. Introduction

The great access of content and the rapid Internet growth has permanently changed the Internet. The classic model of client-server is being transformed into a big content networking distribution, so, a new architecture is required. The current TCP/IP has shown itself to be uncapable of providing massive data distribution, hence, congestion may occur. In that niche, the Content Centric Network [1] gains strength, because now the communication is oriented to content, instead of host locations. Consequently this type of architecture can outperfom TCP in many situations as it will be showed in this paper.

Network virtualization paradigm offers that TCP/IP Internet production traffic can be shared with other experimental networks. So using theses techniques, Content Centric Network will be implemented, showing its differential in mobility services and in which scenarios it outperfoms TCP.

## II. CONTENT-CENTRIC-NETWORK

The main innovation of the CCN is not being connected in point to point communication, the priority is no longer at the destination, but at the content. Thus, there is no more distinction between servers and routers, each one is a data provider. The network architecture creates a cache memory in the network elements, ie, from the moment that a given request is made, through routing protocols, the network finds where is the searched data. Hence, the connection is no longer end to end, it is based on data. This innovation can ensure increased performance in terms of throughput compared to TCP communication, as the number of users requesting the same data increases.

## III. Implementation

A CCN network is implemented as a virtual network in Future Internet Testbed with Security (FITS) [2]. The project FITS held by the GTA (Grupo de Teleinformática e Automação) / UFRJ, provides an test environment for networks based on virtualization techniques. This allows a pluralistic solution to the Internet, in which multiple logical networks coexist in the same physical substrate. Each logic network performs different protocols stacks and, thus, offers different services. In that virtual network, every node runs CCN protocol stack, based on CCNx [3] and OSPFN [4] software packages. In this scenario, two tests were applied. The first one will consist of 5 rounds, where the number of users increases during the test (one to five). Thus, at the end of the test the download time with this increase will be compared in both CCN and TCP. The second test is a mobility test that simulates a wireless scenario. The same topology is used, however, another client is added to the network edge, so that, it can be connected with the other five clients as the test runs. During its execution, the interfaces of this edge client will be shut down one by one, except for the last one. That experiment is similar to a car that is being connected to five differents wireless antenas as it moves along the road.

## IV. Conclusion and Future Work

The testbed environment allows the creation of isolated virtual networks with secure access, quality of service differentiation and virtual network migration features. The results show that CCN outperforms TCP as the number of consumers increases, scenario that is faced on Internet everyday, and CCN can provide mobility that is a key service when talking about computer networking. Thats why Content-Centric Network (CCN) is pointed out as one of the most viable Future Internet proposals.

As a Future Work, we propose to experiment CCN with all FITS nodes, allowing to have a content network spreaded all over the world.

### References

[1] V. Jacobson, D. K. Smetters, J. D. Thornton, M. F. Plass, N. H. Briggs, and R. L. Braynard, "Networking named content," in *Proceedings of the 5th international conference on Emerging networking experiments and technologies.* ACM, 2009, pp. 1–12.

[2] P. H. V. Guimaraes, L. H. G. Ferraz, J. V. Torres, I. D. Alvarenga, C. S. Rodrigues, and O. C. M. Duarte, "Experimenting content-centric networks in the future internet testbed environment," in *Workshop on Cloud Convergence, ICC*, 2013.

[3] CCNx. (2011) CCNx Project. http://www.ccnx.org/.

[4] L. Wang, A. Hoque, C. Yi, A. Alyyan, and B. Zhang, "Ospfn: An ospf based routing protocol for named data networking," *University of Memphis and University of Arizona, Tech. Rep*, 2012.