Investigating RINA as the next generation GÉANT and NREN network architecture

Adventures outside of the TCP/IP comfort zone

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***Abstract*—**IRINA is a project in the Geant Open Call that sets out to study the use of the Recursive InterNetwork Architecture (RINA) as the foundation of the next generation NREN and GÉANT network architectures. IRINA builds on the open source RINA prototype developed by the IRATI project. The success of IRINA could lead to field trials of the Recursive InterNet Architecture, pave the way for increased security, reliability and scalability of research networks and, ultimately, provide a safer and improved networking experience.

***Index Terms*—Future Network Architectures, Géant Open Calls, RINA.**

I. Introduction

A lot has been written about the “ossification” of the Internet: the core technologies residing in the “narrow waist” are so ubiquitously deployed that they are almost impossible to change. Therefore, most research progress is being made where it can be easily deployed: below L3, improving the use of bandwidth through optimized modulation formats and advanced medium access control (MAC) protocols and above L3, where custom protocols are being added on top of the Internet.

The two mainstream “Future Internet” technologies - i.e. SDN and NFV - are oriented towards managing (the cost of) complexity in the current network. On the one hand, SDN is (logically) centralizing the network state and control functionalities; on the other hand NFV aims at shifting network functions from expensive dedicated hardware to virtualized environments running on commodity servers. However, in order to scale the Internet to the hundreds of billions of devices, as predicted to connect to it by 2050, research on fundamental aspects of networking (such as namespaces and addressing) may be needed.

Recently, a potential candidate for such an Internet architecture has emerged in the form of the Recursive InterNetwork Architecture (RINA), championed by John Day [1]. Its core principle is that the endpoints of any communication are processes, and by applying a complete naming and addressing scheme as advocated by Saltzer [2], challenges such as end-user mobility and multi-homing can be more readily addressed.

Currently, the EC is funding a number of innovative projects focusing on RINA. The FP7 IRATI project [3] is developing a first prototype [4] implementing the core functions of the RINA architecture and providing a framework that allows developers to directly bind their applications to RINA functionalities [5]. The FP7 PRISTINE project [6] is tackling important issues such as security and QoS. The GN3+ Open Call project IRINA [7] is looking at how RINA could be beneficial to NRENs by developing a traffic generator over the IRATI prototype, in order to evaluate an NREN use case.

II. IRINA: Designing NREN networks in the RINA framework

IRINA performed an analysis using SWOT and PEST techniques to assess and evaluate the impact of deploying RINA within the NRENs and GEANT context. Identified opportunities in deploying RINA are: speeding up both service development and provisioning, thereby lowering both CAPEX and OPEX. The main threats are that it may face resistance from incumbent technologies with inherent deployment risks The analysis highlighted a common weakness between current approaches in that they primarily focus on fixing specific networking issues rather than providing an all-encompassing solution, which is the strength of a a clean-slate approach such as RINA.

The results of a survey among NRENs, to which 24 have responded, were used to shape the project’s use case focusing on three aspects: the network topology comprising of the NREN networks interconnected via the GEANT backbone, the services currently deployed on these networks and the impact of future requirements over the selected services. The topology is abstracted into three different NREN types - a Large NREN (based on RENATER), a medium NREN (based on RoEduNet2 and SurfNET), and a small NREN (based on AMRES). The survey identified the most important technical goals for NREN IP networks: the maximization of throughput, the reduction of latency, the reduction of provisioning time, improving mobility and improving energy efficiency. Currently NRENs provide mobility via Wi-Fi (e.g Eduroam) but there is growing demand for 3G and 4G services. In terms of bandwidth, several NREN customers have higher and higher bandwidth demands (for specific services). In terms of security,

DDoS attacks are more frequent which is mitigated by specific countermeasures.

The IRINA use case encompasses three different services - HD Video conferencing (based on RENATER SeeVogh/RMS), p2p VPN services and Cloud storage (based on SURFDrive+[8]).

RINA is being researched to develop an appropriate schema for the case of different NRENs interconnected via the GEANT network providing the services above in a secure manner. This schema focuses on specific areas, representing common configurations used in the NREN architecture:

- Internal NREN design
- Peering with other NRENs (via GEANT or directly via CBF)
- Peering with commercial ISPs
- Interconnecting customers
- Interconnecting internal datacenters
- Providing application specific RINA layers

A lab trial using the IRATI prototype and the experimental facilities contributed by the project partners will provide a proof-of-concept demonstration

III. Acknowledgment

This work is partially supported by the European Commission's Seventh Framework Programme (FP7/2007-2013) project GN3plus Open Call "IRINA".

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