

Information-Centric Networking for Airborne Networks

Location: Taufkirchen/Munich

Start: Spring 2021

Duration: 6 months

Topic Description

The term *Information-Centric Networking* (ICN) appeared around 2010, likely inspired by Van Jacobson's 2006 Google Tech Talk "A New Way to look at Networking". This talk pointed out a new direction of moving the Internet toward a content distribution architecture.

The major motivation towards ICN is the architectural mismatch of today's Internet architecture and its usage. If we look at the current Internet, content based networking is already the dominant paradigm (e.g. YouTube, Netflix, Amazon, iTunes). The same conclusion is achieved if we look at new Internet services such as *Internet-of-Things* and specific middleware used in industrial and mission critical environments such as *Data Distribution Services*.

ICN brings several advantages to dynamic networks such as Airborne Networks, namely: i) provides connectionless and topological independent communications by identifying data with unique global names, instead of naming network interfaces (locator) or end-hosts (end-host identifiers); ii) data is retrieved by having nodes issuing requests, and having data packets processed in intermediary nodes (routers and/or switches) if at least one matching request packet is stored in the local cache.

The Airlab testbed, developed at Airbus, has as one of its goals to show the potential of using ICN as a core element of future Airborne Networks, in terms of supporting *Internet Protocol* (IP) applications, while achieving better performance on mobile environments.

There are several ICN frameworks that could be used as a baseline for the development of Airborne Networks. However most of them, such as the *Content Centric Networking* (CCN) and the *Named Data Networking* (NDN), rely on the development of ICN networks on top or below IP, which could bring difficulties for the deployment of traditional IP services on Airborne Networks, due to the less transparent integration with existing IP networks and applications.

Hence, this work plan is focused on the usage of *Hybrid ICN* (hICN)¹, which is a framework focused on the integration of ICN inside IP, rather than over or under IP, while following the CCN/NDN design.

The aim of this work plan is to show how an Airborne Network based on hICN could look like, describing and evaluating the benefits and constraints of hICN. The focus will be to demonstrate how IP services such as HTTP and WebRTC can be provided based on hICN in a network encompassing two segments: ground segment with adhoc segment.

The network topology should be created based on an emulation framework such as Mininet and a set of hICN functionalities (e.g. HTTP proxy, vRouter, Server, Host) available in docker containers².

¹ <https://wiki.fd.io/view/HICN>

² <https://hub.docker.com/u/icnteam>

Your responsibilities will include:

- Create an initial topology focusing on air-to-ground communications with a couple of mobile devices (e.g. Viper, audio client) requesting data from a server in the ground (e.g. HTTPProxy).
- Extend the initial topology by adding an adhoc segment encompassing several hICN capable routers (e.g. vRouter).
- Setup a video or audio service, with a server in the ground and several mobile clients.
- Extend the initial service setup by deploying the server in a mobile node.
- Evaluate the hICN networking setup in an emulation environment based on Containernet³ (a Mininet extension that is able to use docker containers as network hosts).
- Document and present the results in the form of a Master's Thesis.

We are looking for candidates with the following qualifications:

- Education: degree studies in the field of computer sciences with focus on network system or compatible.
- Experience: hands-on experience on emulation tools such as Mininet, containers frameworks such as Docker.
- Knowledge: proficient in computer networks, Linux and programming languages (C, C++, Python). Acquainted with ICN, namely CCN/NDN is a plus.
- Languages: fluent in English (reading as well as writing).

Contact

If you're interested in working on this topic, please send your CV , transcript, and description of projects/assignments related to programming in C/C++, emulation tools (namely Mininet), and networking protocols (namely ICN and CCN/NDN) to: **paulo.mendes@airbus.com**

Remuneration for the duration of Thesis is an option that can be evaluated, in which case the work will be done in a project to be developed at **Airbus** in Ottobrunn.

³ <https://containernet.github.io/>