

GOALS

- Improve QoE of end-users at remote tourist sites
- Deliver high-quality content across many different languages at low cost to international tourists
- Examine the advantages of NDN cloudlets at the edge
- Compare NDN, NDN with cloudlets at Iris, and TCP/IP

CHALLENGES

- Familiarization with the Iris testbed and its components
- Installation and configuration of cloudlet components: i. NDN C++ library, ii. NDN Forwarding Daemon, iii. NDN Repo-Ng, iv. srsLTE and srsEPC.
- Integration of NDN with Discover Places Application
- Technical failures and incompatibilities between hardware and software components at Iris

DEMO SETUP

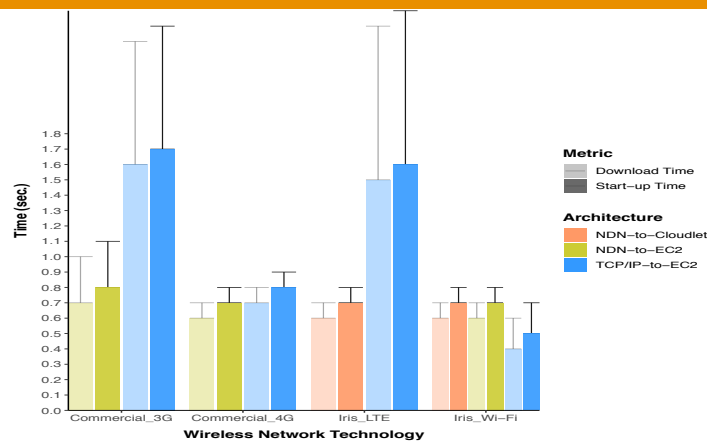
Retrieval of an 659K audio file in 8K chunks, 100 times for each end-user across all architectures, from either Amazon EC2, or the NDN cloudlet at Iris.

- **Architectures:** Traditional TCP/IP, NDN, NDN with cloudlets at Iris, NDN with multipath, NDN with cloudlets at Iris one LTE hop away
- **Technologies:** Commercial 2G/3G/4G, Iris LTE, Iris Wi-Fi
- **Metrics:** Start-up time, Buffer time, Buffer ratio, Download time, Failure ratio, Network traffic, Server load
- **Equipment:** 8 Xiaomi Redmi 5 Android phones, Ubuntu 16.04 KVMs with NFD, NDN Repo-Ng, srsLTE eNodeB, srsLTE EPC, USRP X310 radio hardware, and standard commercial Wi-Fi device

RESULTS

- Failure ratio for all architectures for Commercial 2G is equal to 100%
- Failure ratio is higher for TCP/IP vs NDN & NDN with cloudlets, i.e. between 0.125-2.175%
- Difference in buffer time, and buffer ratio, between the architectures is negligible, i.e. equal to 0.1 sec.
- Start-up and download times for NDN & NDN with cloudlets vs TCP/IP is lower for the majority of the technologies, i.e. between 0.1-0.9 sec.
- Start-up and download times for TCP/IP vs NDN & NDN with cloudlets is lower **only** over the Iris Wi-Fi technology, i.e. equal to 0.2 sec.

MORE RESULTS



CONCLUSIONS

- NDN & NDN with cloudlets have shown to outperform TCP/IP over a number of wireless technologies
- Performance of NDN, & NDN with cloudlets is more consistent compared to TCP/IP, i.e. for the start-up and download time
- **Superiority of NDN with cloudlets vs NDN is unclear, i.e. both conclude to the same results over Iris Wi-Fi technology**
- Different network architectures may favour different wireless network technologies (investigation necessary)

POST MORTEM

- The importance of the chunk size, i.e. 8K instead of 1K used in Stage 1 experiments
- The importance of mature mechanisms in the evolution of the NDN architecture, to fairly compare it vs TCP/IP
- The importance of both hardware and software supported at the Iris testbed to allow the evaluation of all architectures under the same set of technologies
- The importance of the NDN community in integrating new mechanisms/solutions with the existing NDN code
- **Based on the CLONE results, we will consider integrating NDN into our commercial application.**