OPTIMIZED CACHE POLICIES AND RESOURCE ALLOCATION FOR FOG COMPUTING ENVIRONMENTS

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1. Motivation

- ✓ Future 5G networks results in growing data traffic to multiple mobile terminals, this means a large consumption of network resources, power and computing (Figs. 1 and 2)

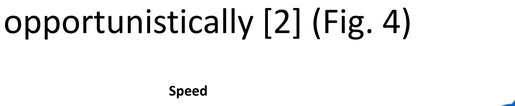


Fig. 1. Global Mobile Data Traffic
Source: Cisco VNI Mobile, 2017

Fig. 2. Global Mobile Devices and Connection Growth
Source: Cisco VNI Mobile, 2017

- ✓ In Fog computing (Fig. 3), typical tasks of communication networks (e.g., computing, content storage) are pushed toward the edges and end devices [1], maximizing the system performance by leveraging both Cloud and Fog (edge) resources

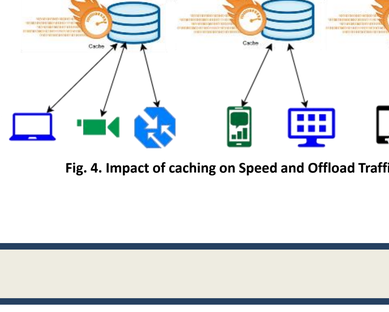


Fig. 3. F-RAN – Fog Radio Access Network Architecture

- ✓ The smart use of caches or coded caching can help significantly to put the information closer to final consumers, thereby reducing latency largely and helping to offload data from the base stations opportunistically [2] (Fig. 4)

Fig. 4. Impact of caching on Speed and Offload Traffic

2. Thesis Objectives

- ✓ Establish the critical characteristics of coded caching in hierarchical network architectures on fog computing environments
- ✓ Determine the impact of caching and opportunistic transmission over latency and power consumption in D2D transmission systems
- ✓ Develop a mathematical model for analyzing different caching and coded caching protocols and strategies for fog computing environments
- ✓ Develop a scheme for hierarchical network architectures to optimize the performance of latency and storage of contents on fog computing
- ✓ Implement a conceptual proof for the proposed scheme
- ✓ Present an analytical development about the effects of caching and transmission mechanisms on the interaction of mobile terminals

3. Research Plan

	Activities	2016					2017					2018				
		Jan	Apr	Jun	Aug	Dec	Jan	apr	Jun	Aug	Dec	Jan	Apr	Jun	Aug	Dec
1	State of the Art on coded caching															
2	Propose the Evaluation Framework															
3	Implementation of schemes for Coded Caching in NS3 Simulator															
4	Development and validation of proposed mathematical model															
5	Simulation and evaluation of proposed optimized scheme															
6	Publication of results in Conferences and International Journals															
7	Preparation of the Ph.D. Disertation															

4. Results & Discussions

- ✓ Analysis of F-RAN:
  - ✓ Delivery latency = Fronthaul Latency + Edge Latency

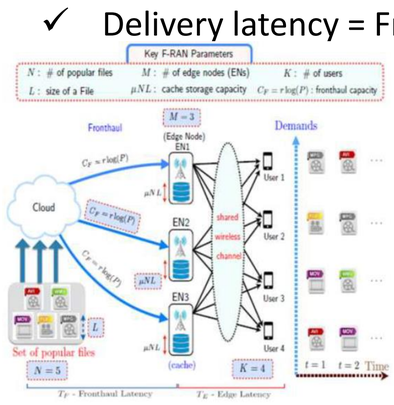


Fig. 5. Information-Theoretic Model for a F-RAN [8]

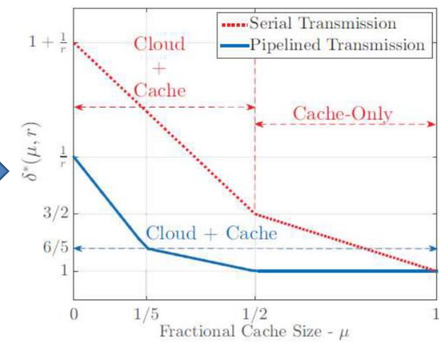


Fig. 6. Trade-off between the Normalized Delivery Time and Fractional Cache Size [3]

- ✓ Analysis of coded caching schemes

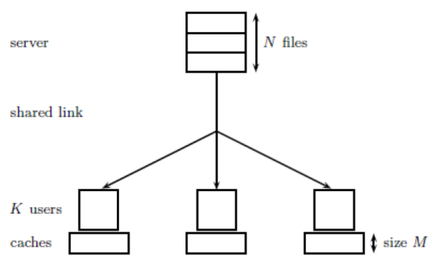


Fig. 7. Typical coded caching scheme [6]
(N=3; K=1)

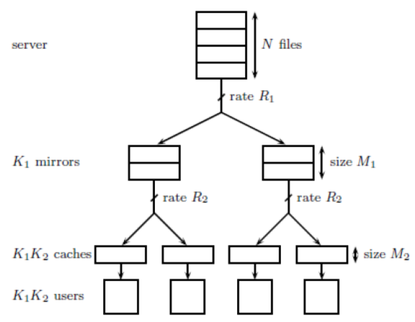


Fig. 8. Hierarchical coded caching scheme [6]
(N=4; K1=K2=2; M1=2; M2=1)

- ✓ Working on:
  - ✓ Development of simulation tools
  - ✓ Evaluation of caching schemes

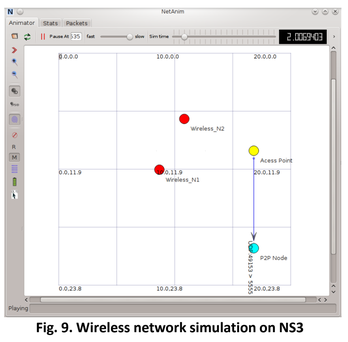


Fig. 9. Wireless network simulation on NS3

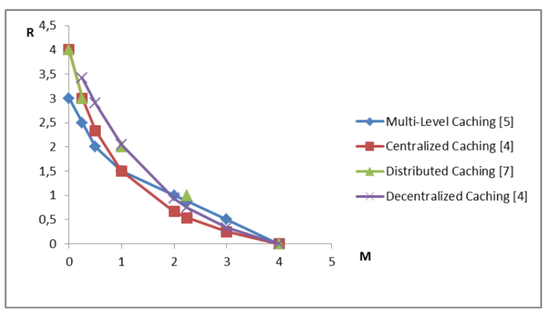
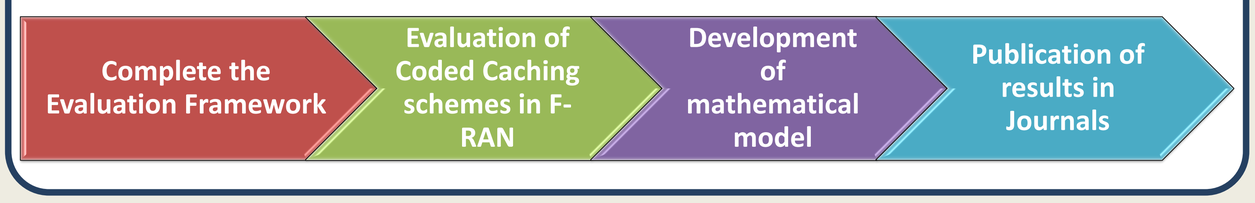


Fig. 10. Comparison of coded caching schemes
(N=4; K=4)

5. Next Year Planning



6. References

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