SoftOffload – A Programmable Approach for Mobile Offloading

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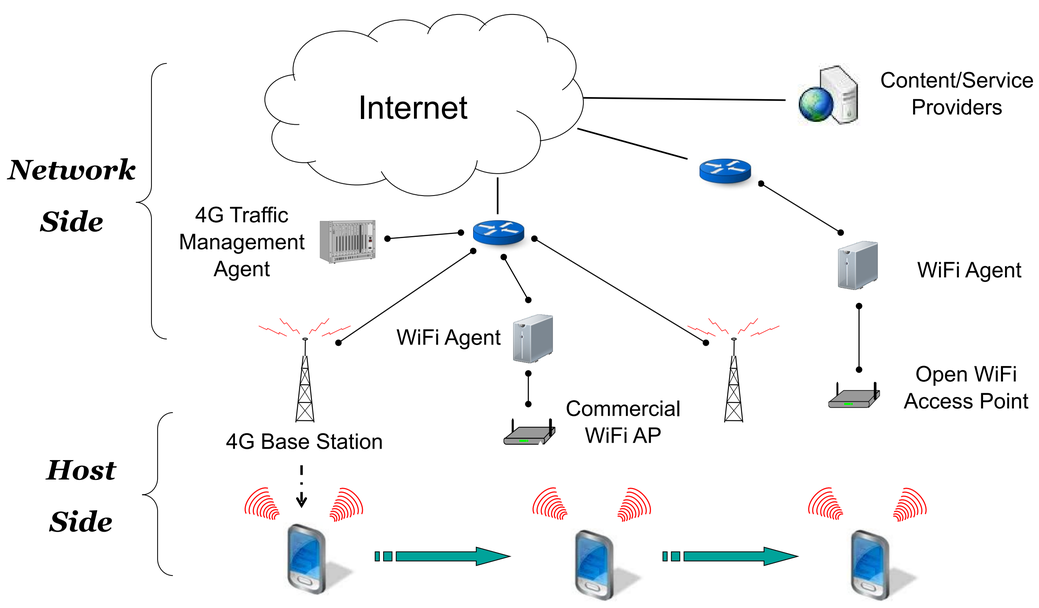
Background and Motivations

- Rapid increase of mobile data traffic overloads the cellular networks
- Massive deployment of 4G and WiFi in metropolitan areas
- Hardware advance on smartphones, e.g., wireless connectivity
- Collaboratively utilize resources on devices and networks
- Improve performance and energy efficiency for networks and users

Earlier Design

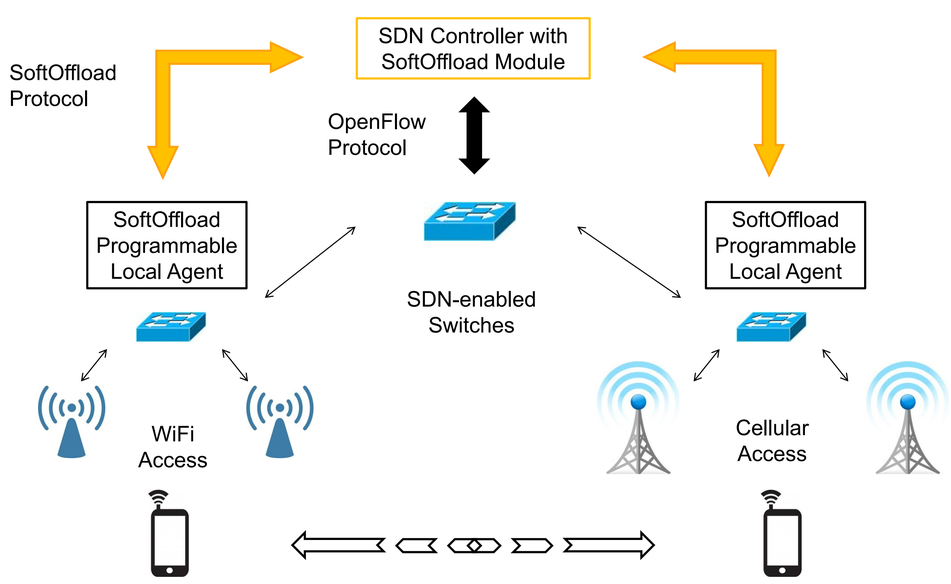


Collaborative Offloading Architecture [1]

Challenging Issues

- Paper driven work – adhoc design for limited scenarios
- Deployability – customized protocols and components
- Extensibility – lack of open API, platform, modular design
- Scalability – user growth, variance of hardware, operators policy
- Performance – limited adaptation for wireless and core dynamics
- Openness – lack of community interests or supports

SoftOffload Architecture



SoftOffload SDN-based Architecture

Proposal Highlight

- SDN based design using standardized protocol
- Programmable and modular approach
- Hierarchical controller design for performance at the wireless edgy
- Open-source platform for further community development
- Dedicated for WiFi cellular offloading with extensible add-on
- Utilize resources of mobile end and benefit from network supports
- Enable collaboration of users and mobile network providers

Research Questions

- What is the role of SDN for a programmable offloading platform
- How to use SDN to improve deployability and extensibility
- How to switch from static & closed design into dynamic & open one
- What are the benefit and overhead of our design

Test-bed and Setup

Test-bed Setup and Equipment in the lab

Key Components

- SoftOffload controller – Floodlight based, with SoftOffload extension
- Local agent – Click based, with offloading module
- SDN switches – OpenvSwitch, supporting OpenFlow
- Smartphone extensions – support collaborative offloading
- Communications – OpenFlow, SoftOffload protocol

Use Cases and Research Initiatives

- Cellular WiFi inter offloading – load balancing, energy efficiency
- WiFi intra offloading – meeting, exhibition alike scenarios
- Monitor wireless and backhaul access – support offloading decision
- SDN supported mobility management
- Enhance security in wireless mobile networks [2]

On-going Work

- Modularize monitoring, mobility management, security enhancement
- Investigate a balanced design: centralized, distributed
- Explore channel management and the impact
- Manage uplink and downlink for real time and TCP-based traffic
- Test and evaluate the system in a live environment
- Release open-source packages to the community

Reference

[1] Aaron Yi Ding, et al, “Enabling Energy-Aware Collaborative Mobile Data Offloading for Smartphones”, In Proceedings of IEEE SECON, New Orleans, USA, 2013
[2] Aaron Yi Ding, Jon Crowcroft, Sasu Tarkoma, Hannu Flinck, “Software Defined Networking for Security Enhancement in Wireless Mobile Networks”, Vol. 66, Computer Networks, 2014

Acknowledgement

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