

# Project Proposal :

## Network Coding for Software Defined Wireless Networks

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## 1 Objective

The aim of the project is to integrate network coding functions in wireless SDN. Mininet-WiFi [1] is used as a network emulator for Software Defined Wireless Networks and KODO [2] is a software library implementing a wide range of erasure correcting codes, available in Python.

The platform will serve first to study whether the adaptation of network coding redundancy for intra-flow network coding using wireless SDN is feasible and evaluate the performance considering various use cases. Second, the platform will allow to determine for inter-flow network coding the potential coding opportunities allowing to improve network throughput.

## 2 General context and related work

Since its presentation in [3], Network Coding attracted a significant interest from the research community in several areas of wired and wireless networks thanks to its ability to improve throughput and reduce packet losses. In network coding, the source and intermediate nodes perform linear combinations over the packets received or existing in their buffers rather than delivering simple data packets.

The concept of Software Defined Network (SDN)[4] brings a major change in the network world by decoupling the data plane from the control plane and keeping only data forwarding functions in network devices. SDN Controller provides a global knowledge of the network stack which brings a flexibility of resources allocation including buffer management, dynamic routing, exploitation of multiple paths, etc.

IRTF (Internet Research Task Force) network coding research group (NWCRG) [5] discussed the advantages of the integration of network coding in SDN and different use cases were proposed in [6].

[7], is one of the first tries to develop a framework for network coding in SDN networks. NCoS (Network Coding Over Software-Defined Network) is a preliminary framework performing network coding on network layer and being transparent to users. It includes encoding and decoding functions in OpenFlow switch and management functions in the controller. The proposed solution is designed for multicast transmission, where controller should determine whether an effective multipath multicast tree can be established, to enable network coding in switches. Otherwise, packets are transmitted without network coding. NCoS framework is build based on mininet.

In [8], the work focuses on combining network coding and SDN for wireless mesh networks. The authors propose a new protocol OpenCoding, integrating intra-flow network coding operations in SDN, where the controller makes mainly routing decisions for mesh routers, and switches forwarding function is replaced by network coding function. Authors use ns-3 for the simulation study. They showed that OpenCoding improves network performances, particularly in terms of delay and throughput.

[9] proposed a multi-path network coding based solution for Software Defined Fiber-Wireless Networks (SD-FiWi). The authors presented a solution to integrate intra-flow network coding operation across both the optical and wireless domains to overcome high loss rate in WMNs. Intra-flow coded packets can be generated at the OLT (Optical Line Terminal) and then transmitted to the destination through multiple paths via different ONUs (Optical Network Units). Simulation study showed that this scheme improves network performances in terms of goodput.

### 3 Requirements

Knowledge of wireless networks and emulation platforms.  
Python programming skills in Linux environment.

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