



UNIVERSITÀ  
DEGLI STUDI  
FIRENZE

UNIVERSITÀ DEGLI STUDI DI FIRENZE  
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE  
TESI DI LAUREA TRIENNALE IN INGEGNERIA INFORMATICA  
Anno Accademico 2016-2017

# **Progettazione di un protocollo di diffusione dell'informazione per reti veicolari basato sul principio del Network Coding**

*Candidato*  
Daniele Mugnai

*Relatore*  
Prof. Francesco Chiti

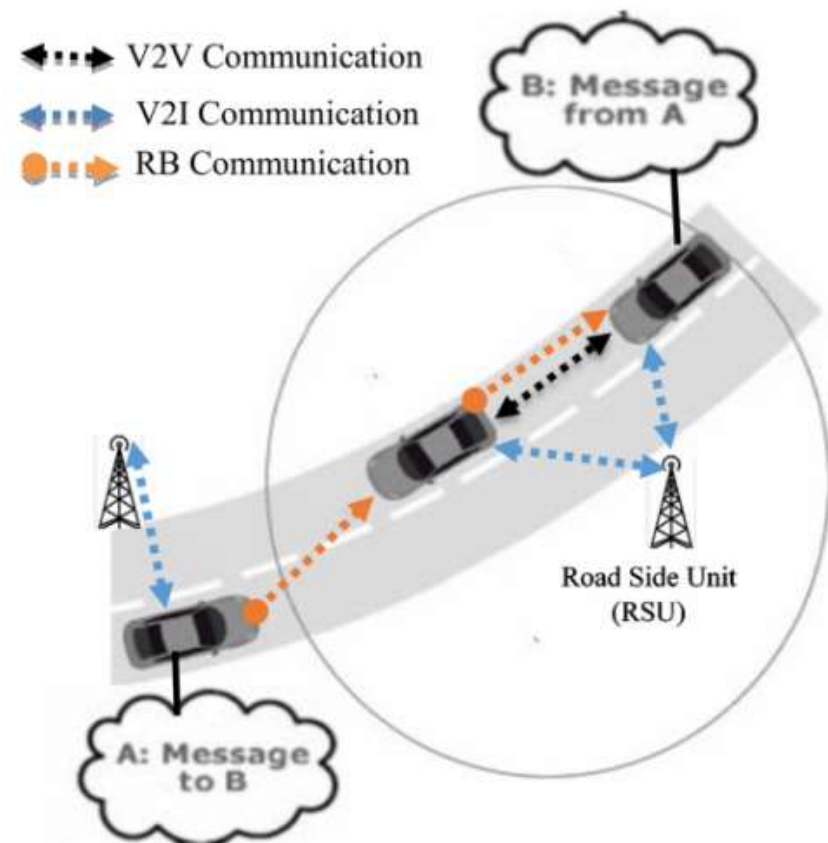
*Correlatore*  
Dott. Alessio Bonadio

**Firenze, 12.04.2018**

# Introduzione

## VANET

- Caratteristiche
  - Vehicle
  - RSU
- Comunicazioni
  - V2V
  - V2I
  - V2X



# WAVE(Wireless Access in Vehicular Environments)

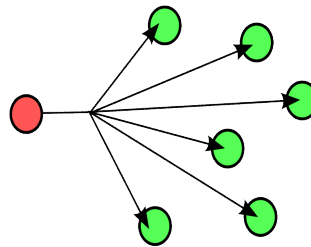
➤ **IEEE 1609**

➤ **IEEE 802.11p**

APPLICATION	1609.1
TRANSPORT	UDP/TCP
NETWORK	IPv6
Logical Link Sub-layer	IEEE 802.2
MAC Layer Sub-layer	IEEE 802.11p
Physical Layer	IEEE 802.11p

# Content Distribution Application

➤ MULTI-CAST



## Routing Problem

APPLICATION

TRANSPORT

INTERNET

NETWORK

APPLICATION

UDP

FORWARDING

802.11p

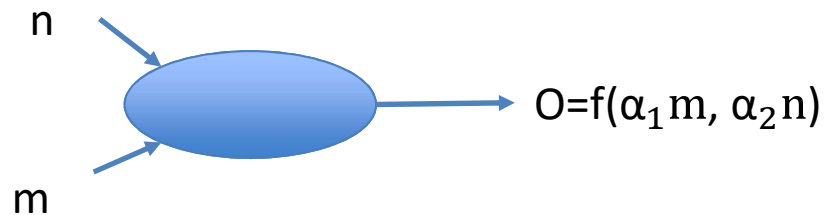
# Flooding

- Store and Forward
- Broadcast Storm

# Network Coding

- Store, Combine( or Decode) and Forward

- Combine



- Decode

$$A = \begin{bmatrix} \alpha_1 & \cdots & \alpha_2 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \alpha_3 \end{bmatrix}$$

# Applicazioni Content Distribution

## ➤ File swarming

- BitTorrent-CarTorrent
- CodeTorrent(*Mario Gerla, 2006*)
- Avalanche(*Windows, 2007*)

## Design e Implementazione

APPLICATION

NETWORK CODING

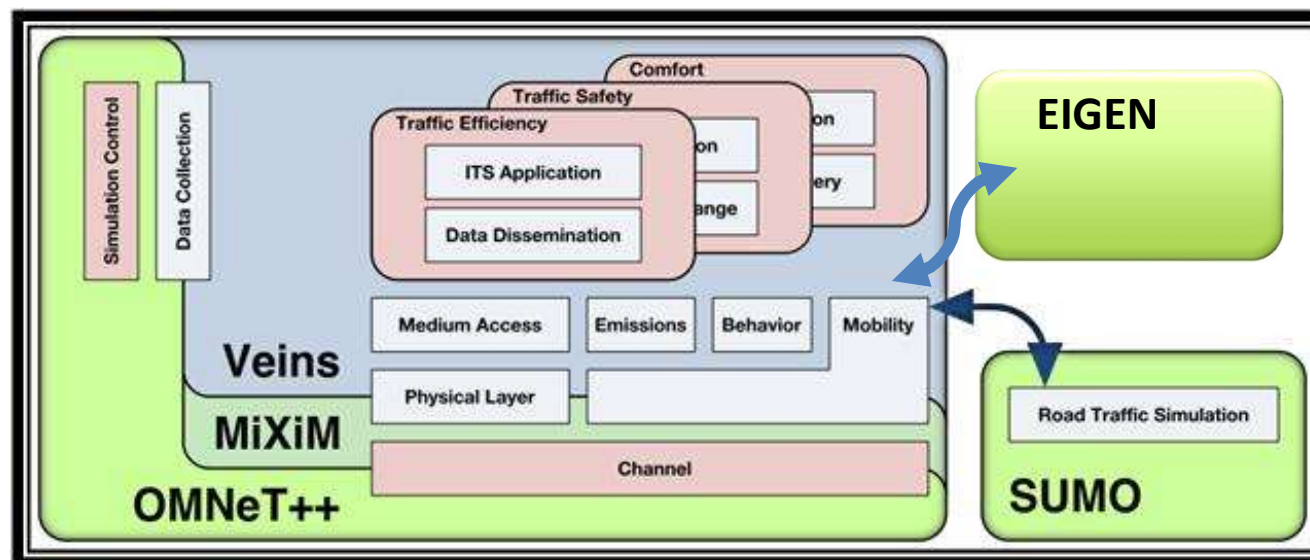
UPD

802.11p

# Simulazione

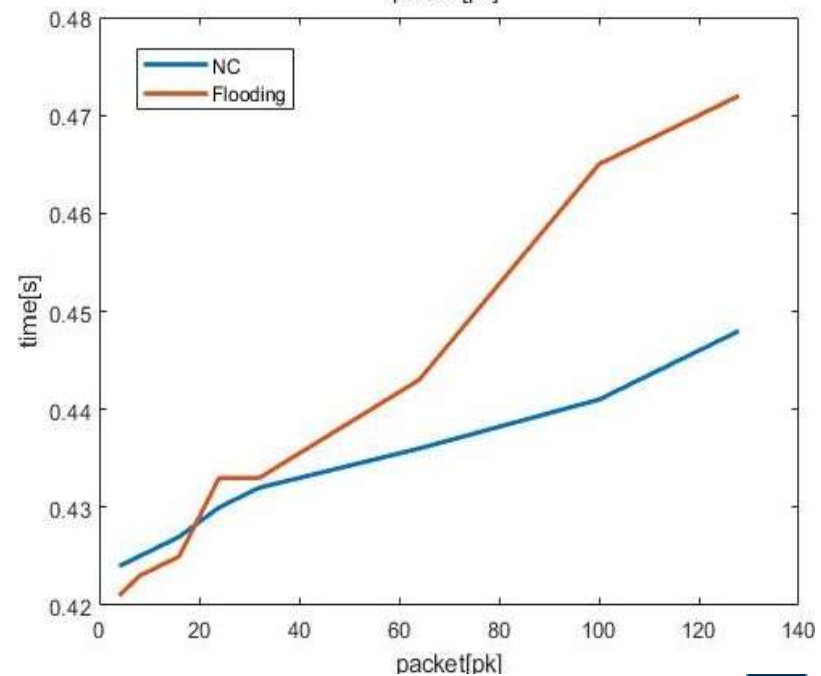
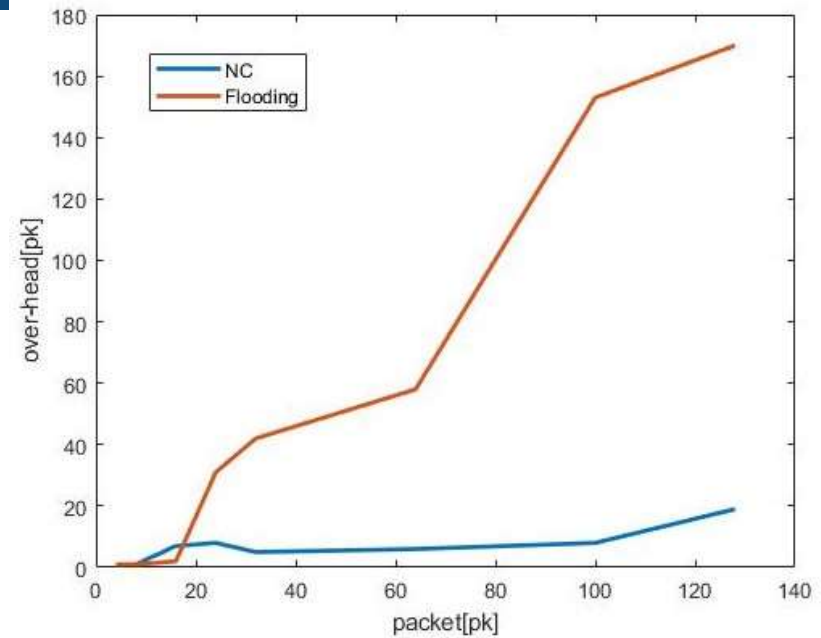
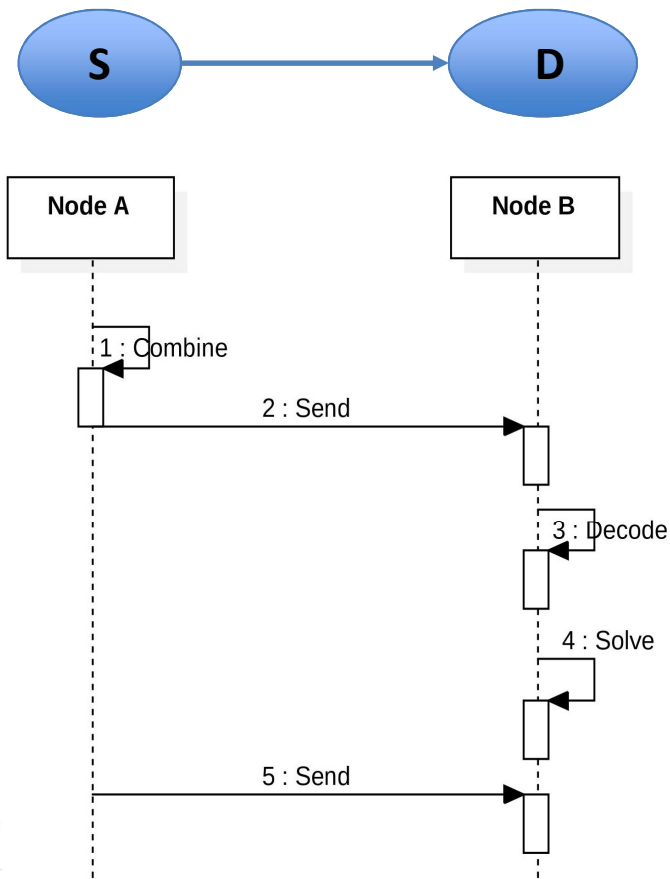
## Tecnologie per la simulazione

- OMNET++
- VEINS
- EIGEN



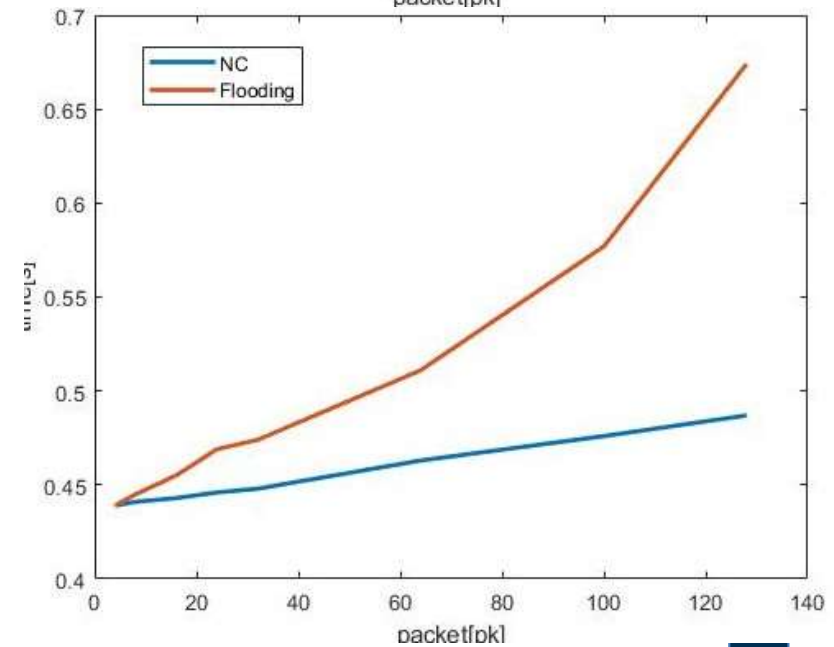
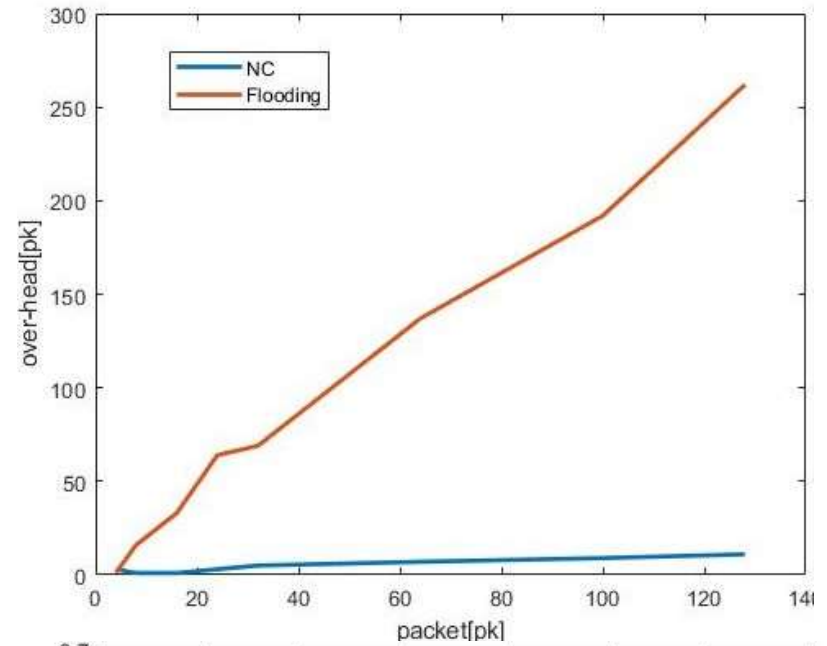
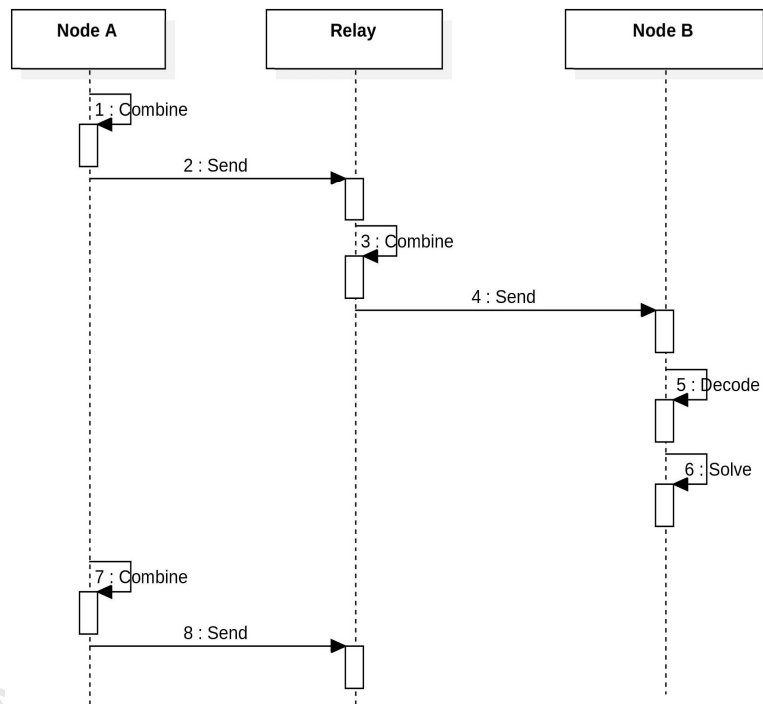
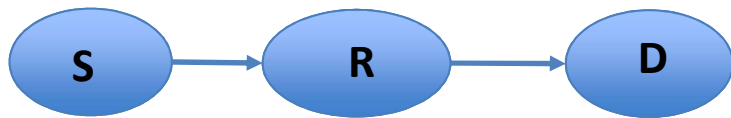


## Scenario 1



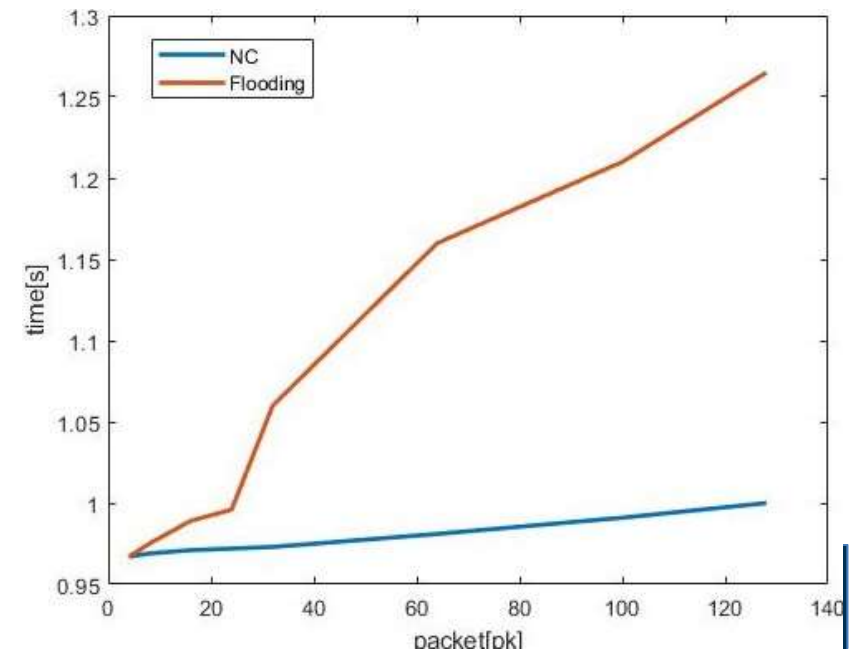
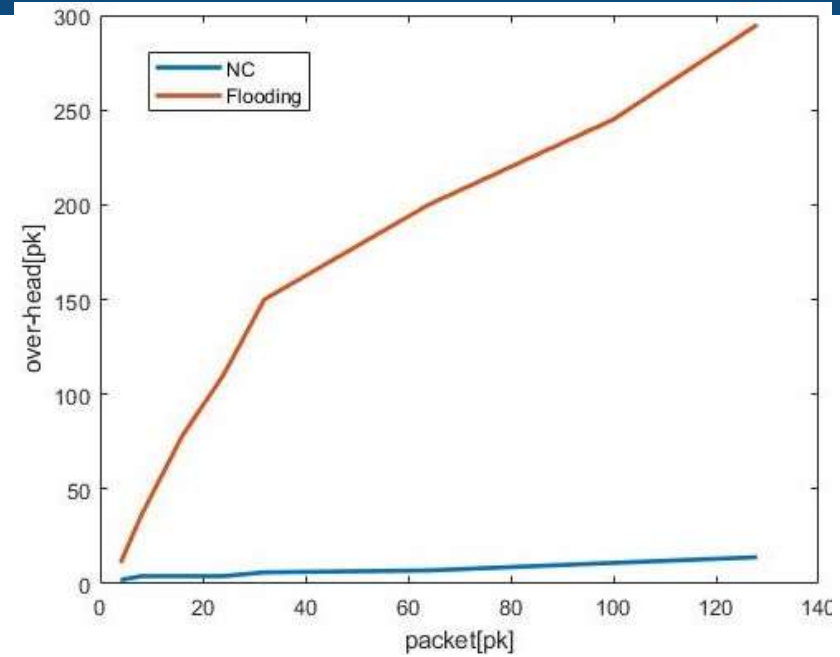
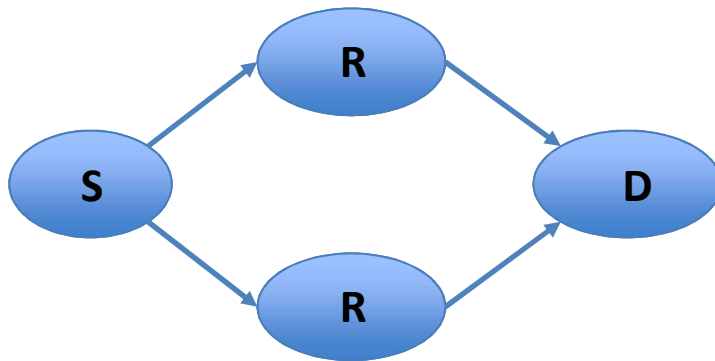


## Scenario 2



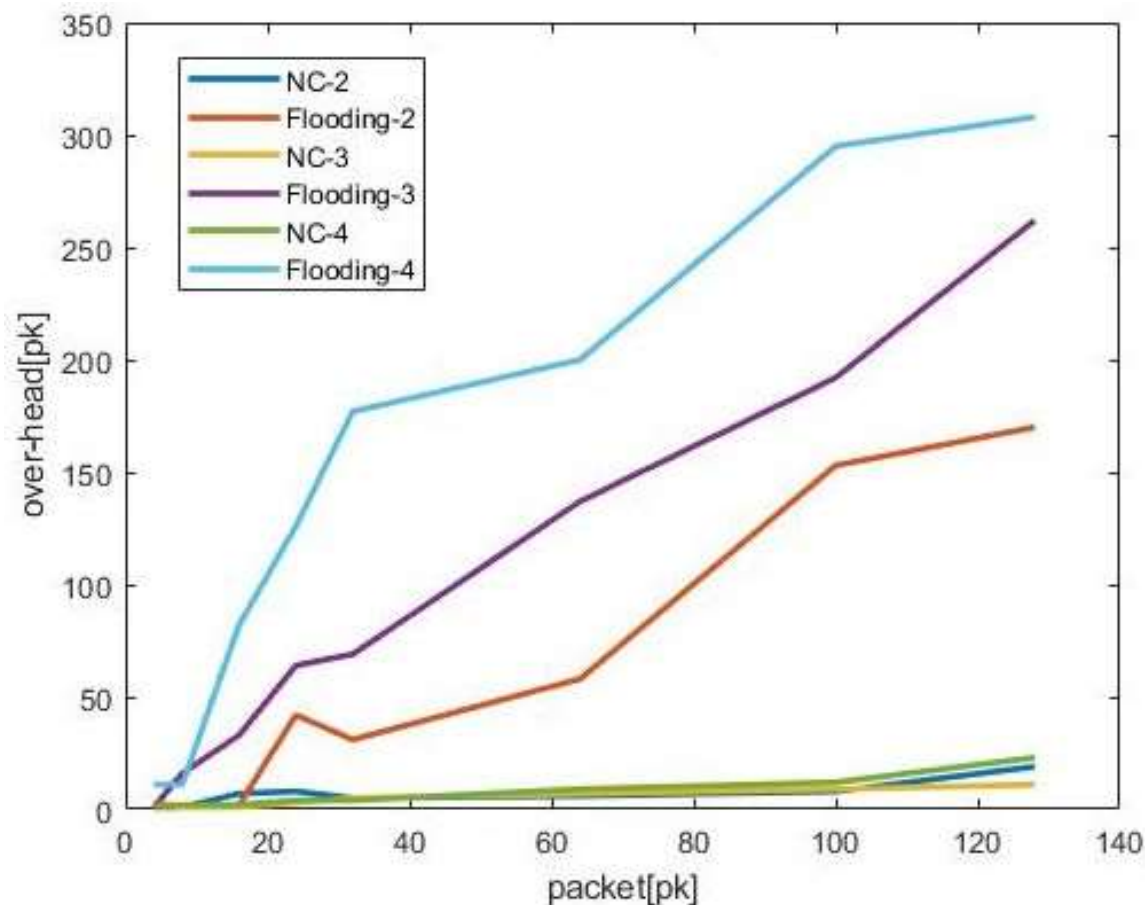


## Scenario 3



# Conclusioni

- Obiettivo
- Risultati Ottenuti
- Possibili Sviluppi





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