

# A Distributed End-to-End Reservation Protocol for IEEE 802.11-Based Wireless Mesh Networks

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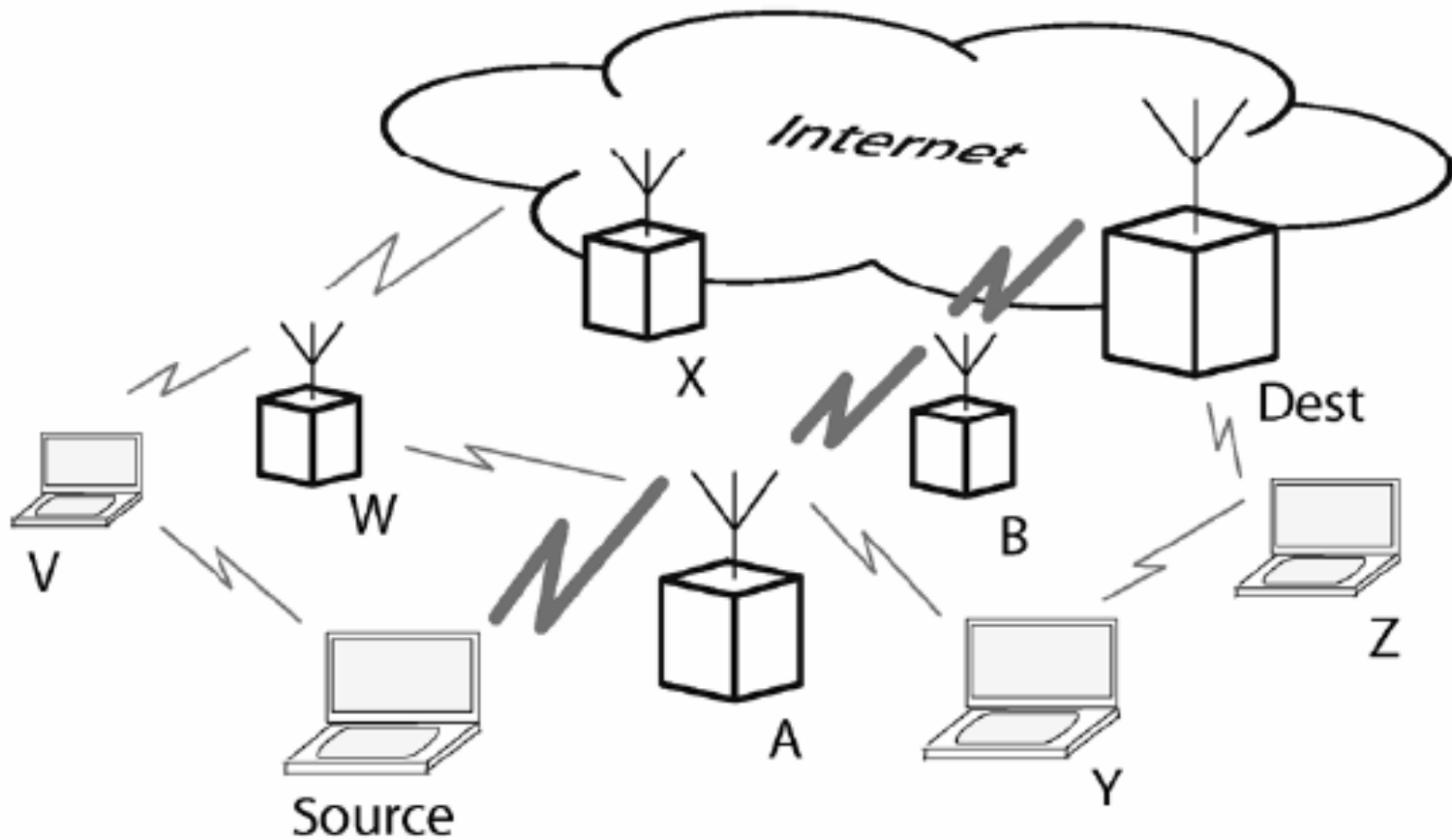
# Outline

- Introduction
- DARE Protocol
- Performance Analysis
- Conclusions

# Introduction

- Mesh networks are expected to handle various real-time applications in addition to the classical best effort applications.
- The alternative QoS approach, motivated in principle by circuit switching, is to perform an end-to-end *reservation* for each real-time flow.
- An end-to-end reservation protocol for quality-of-service called *distributed end-to-end allocation of time slots for real-time traffic* (DARE) is proposed.

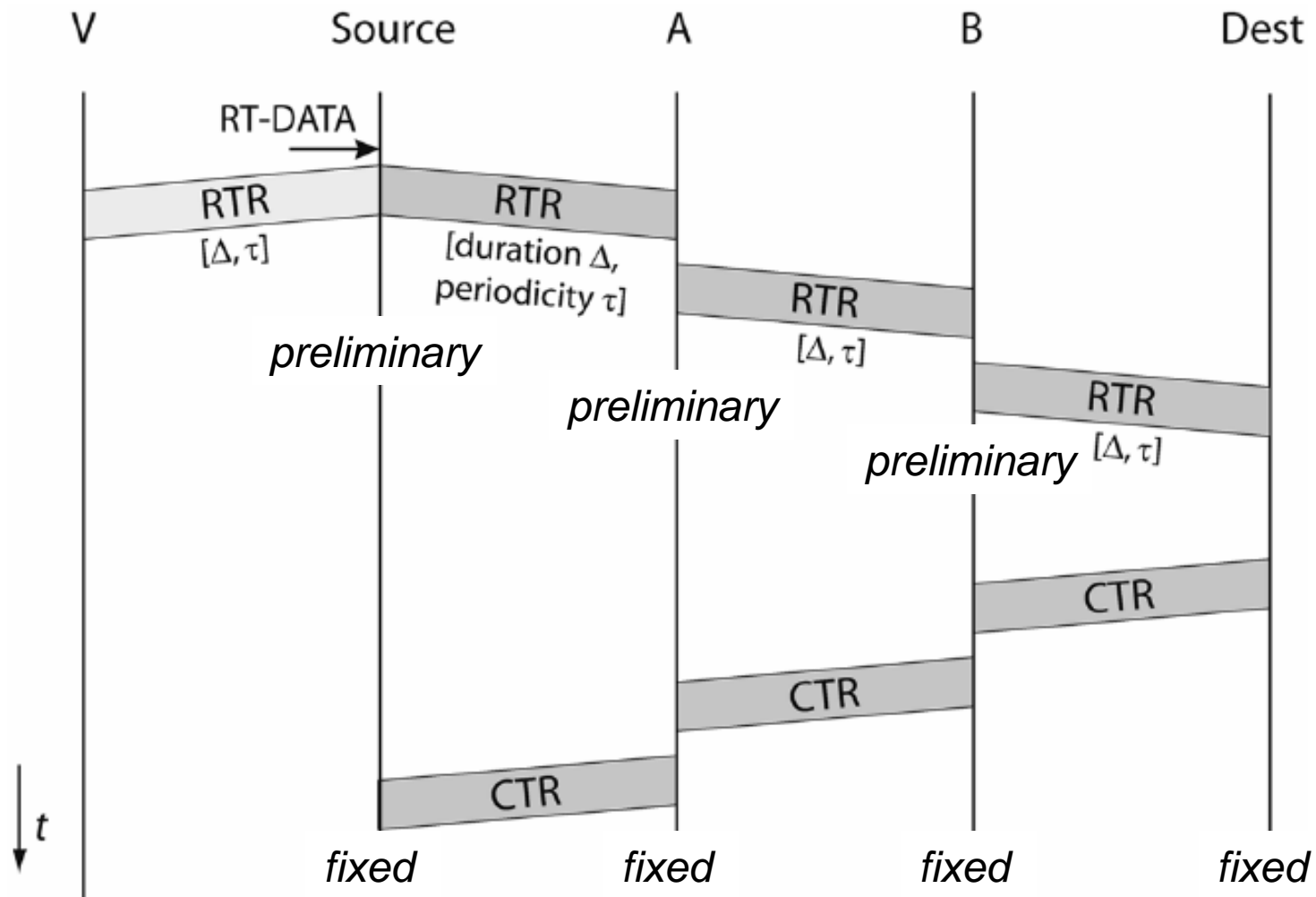
# Introduction



# DARE Protocol

- The DARE protocol can be described by five functional building blocks.
  - Reservation Setup
  - Real-time Data Transmission
  - Reservation Protection
  - Reservation Repair
  - Reservation Release

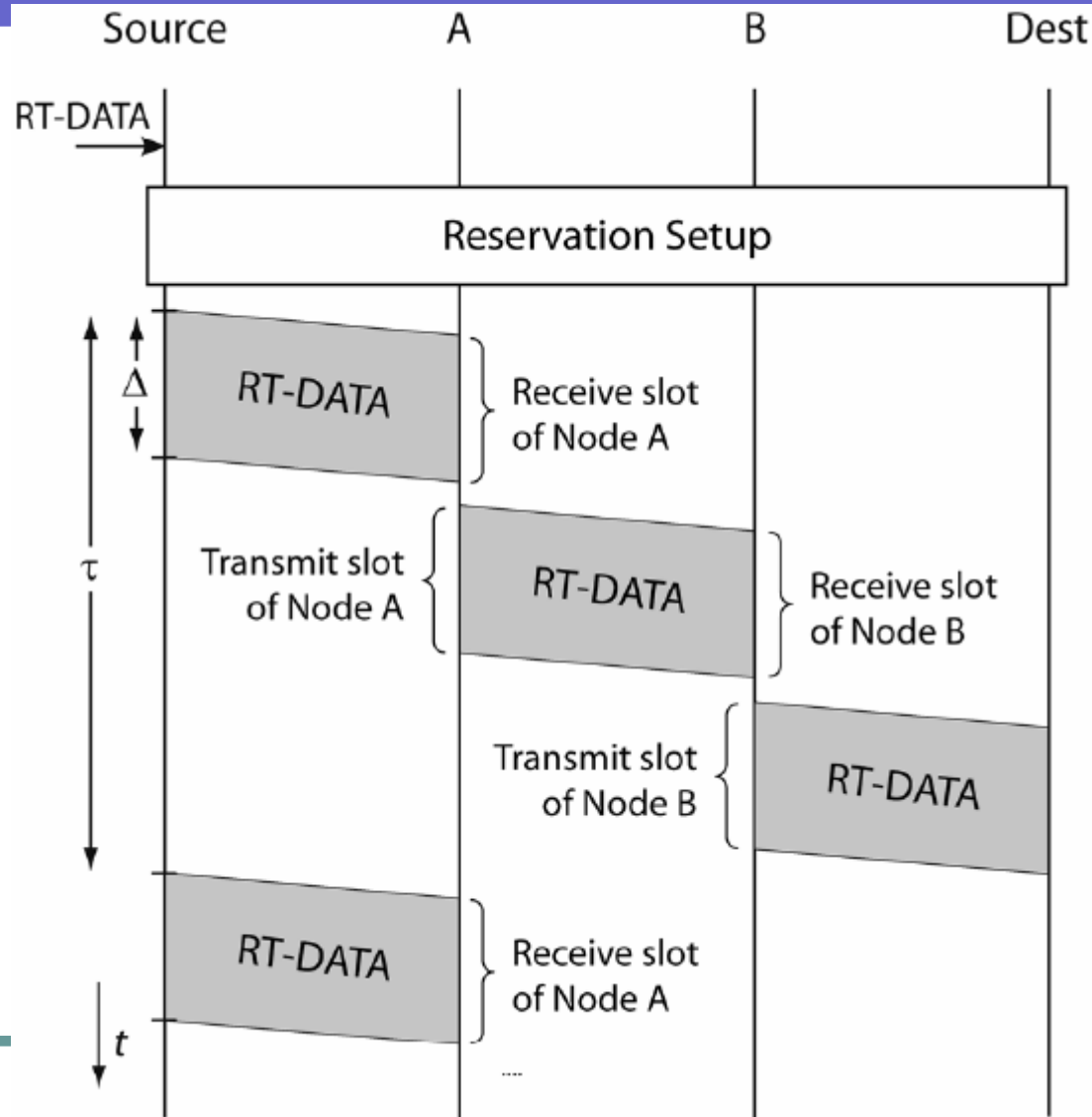
# Reservation Setup



# Reservation Setup

- If a node cannot fulfill a reservation request, it does not forward the reservation message.
- The preliminary reservation will be released after some time period if the end-to-end reservation is unsuccessful.
  - When a node sends the RTR to the next node in the path, it starts an RTR timer.

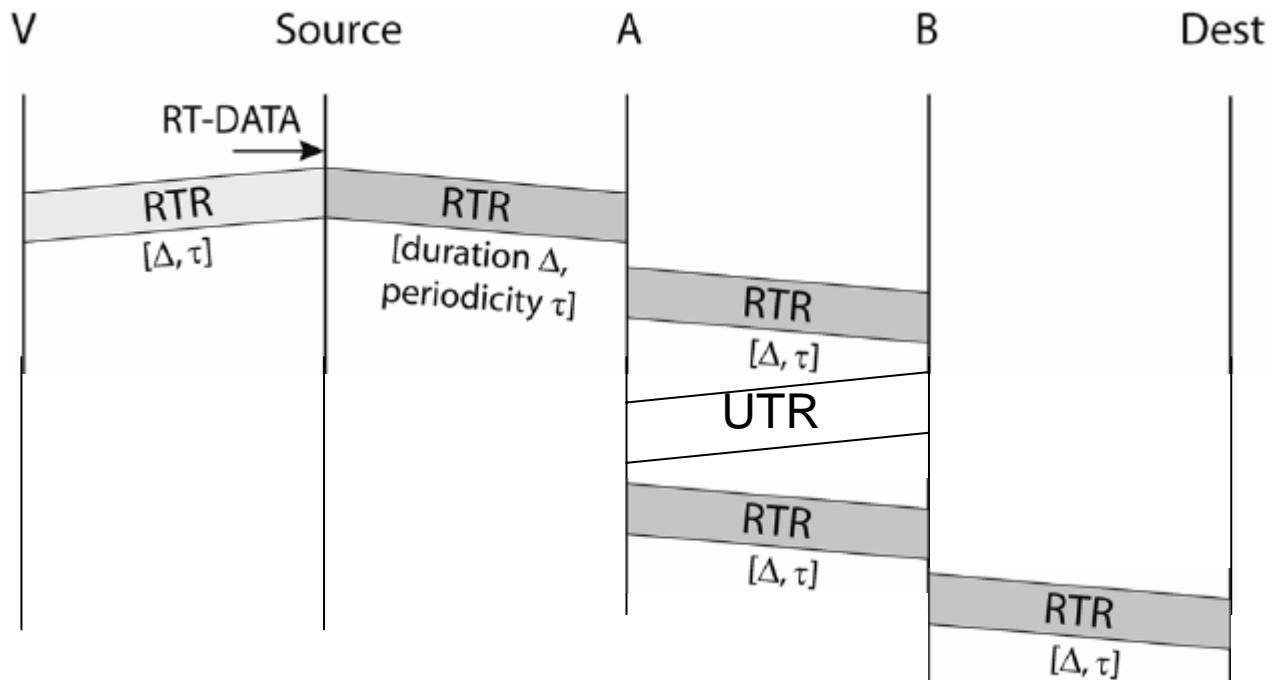
# Real-time Data Transmission





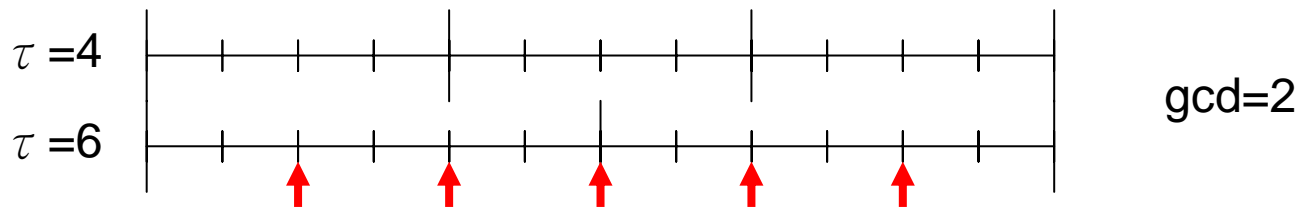
# Reservation Setup (Multiple Reservation)

- checks whether the requested receive slot is conflicting
  - *update-transmit-reservation* (UTR)

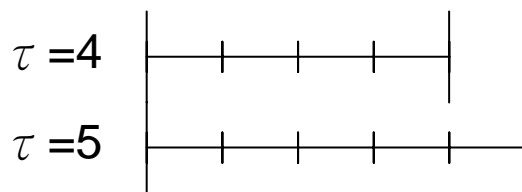


# Reservation Setup (Multiple Reservation)

- checks whether the transmit time slot is appropriate
  - greatest common divisor



- Periodicities that do not have any common divisor (e.g., prime numbers) are not allowed.



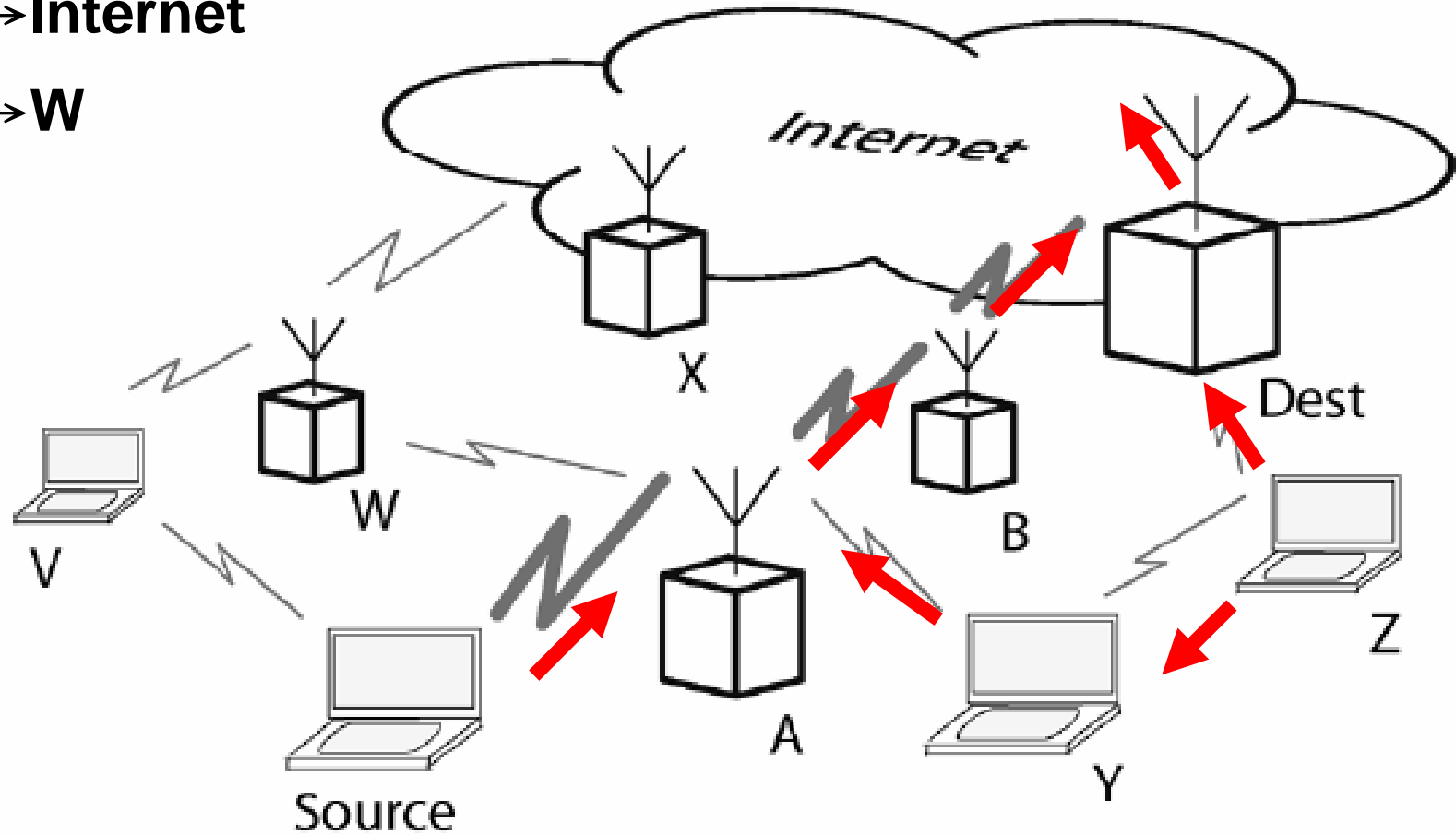
# Reservation Protection

- The nodes located close to the real-time path abstain from transmitting during the reserved slots.
- A basic level of protection is already achieved in the reservation setup phase.
- To achieve a higher level of spatial reservation, the reservations of nodes up to two hops backward in the reservation path are piggybacked.

# Reservation Protection

**Z→Internet**

**Z→W**

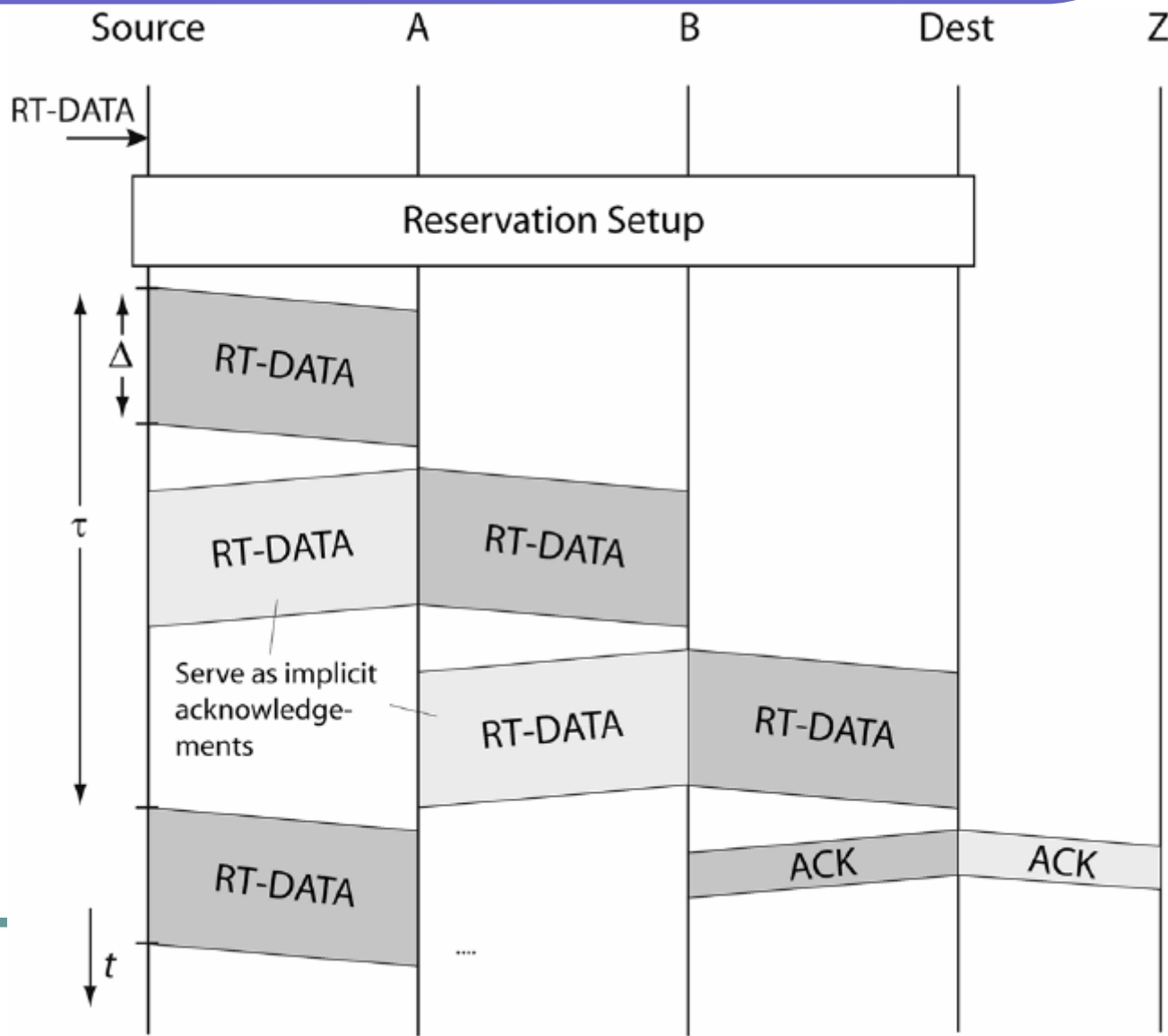


# Reservation Repair

- An established reservation path might break during the real-time transmission if the network topology changes.
- The node preceding the “hole” in the path must notice the broken link To initiate a path repair.

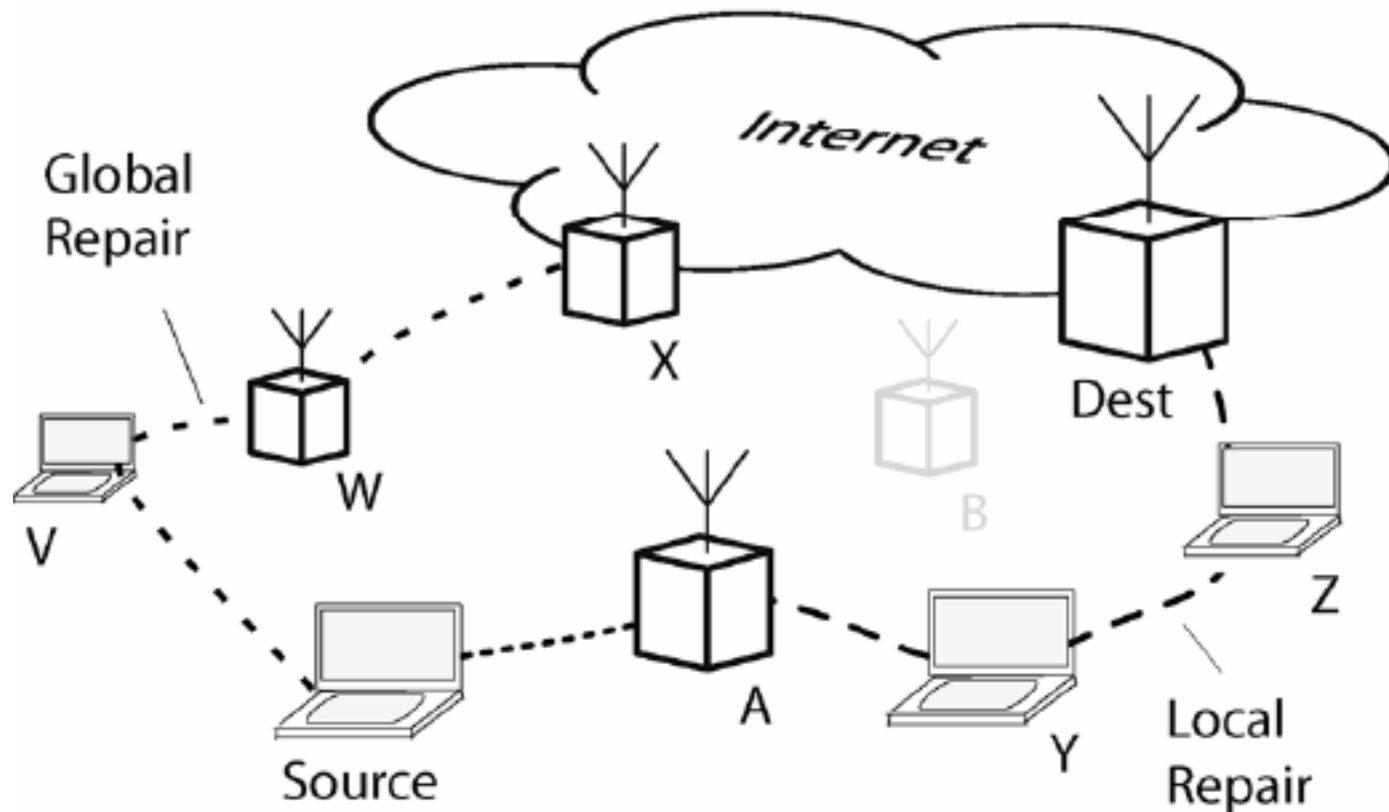
# Reservation Repair

- Detection



# Reservation Repair

- Repair



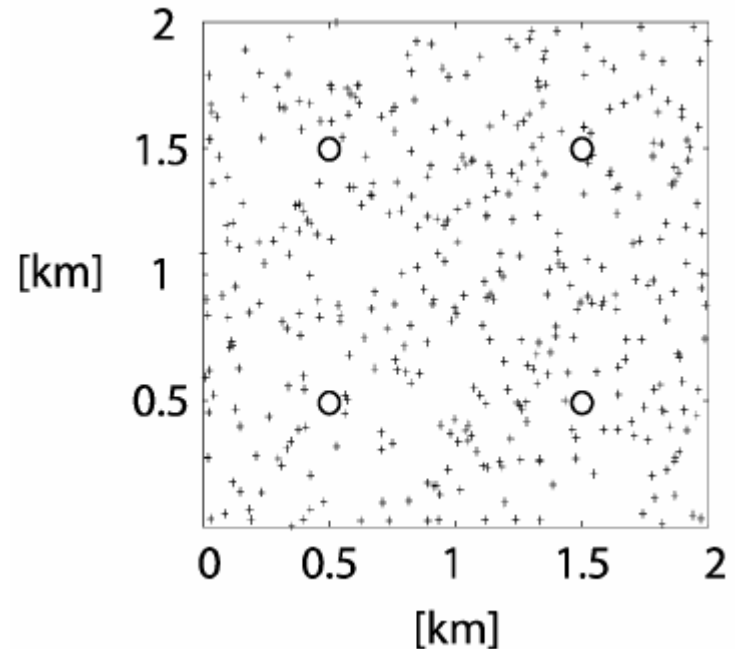
# Reservation Release

- To release unused reservations, DARE employs a time-out.
- If a node does not receive or overhear any real-time data packet for a number of successive slots, it will release all reserved slots for this flow.
- To avoid falsely release, the source node is allowed to transmit dummy packets or the release time-out value could be increased during path setup.

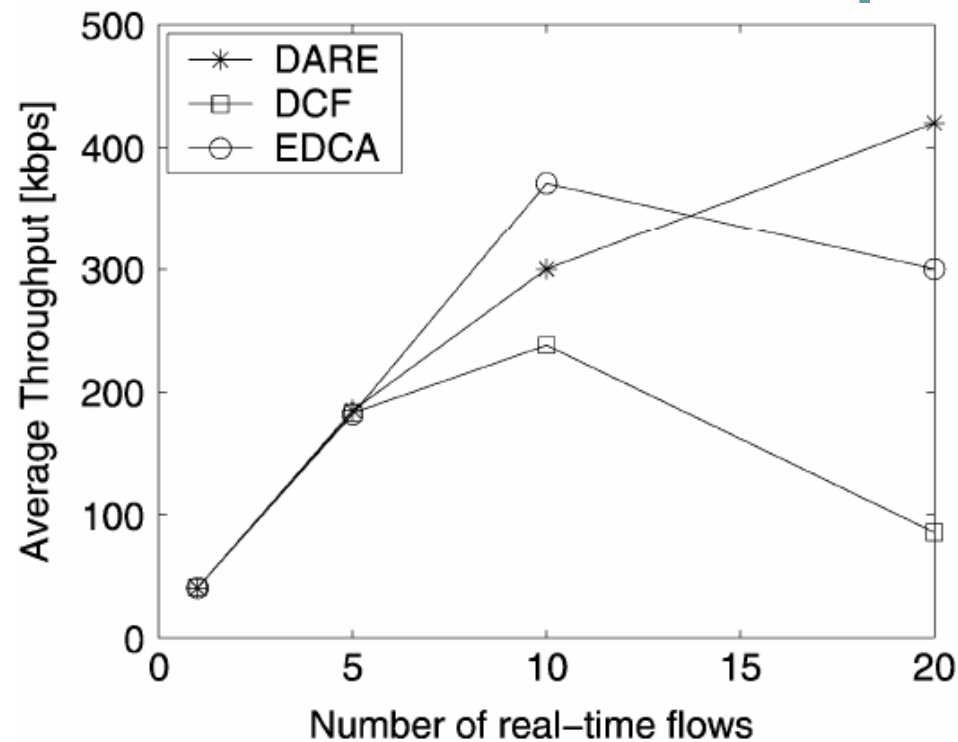
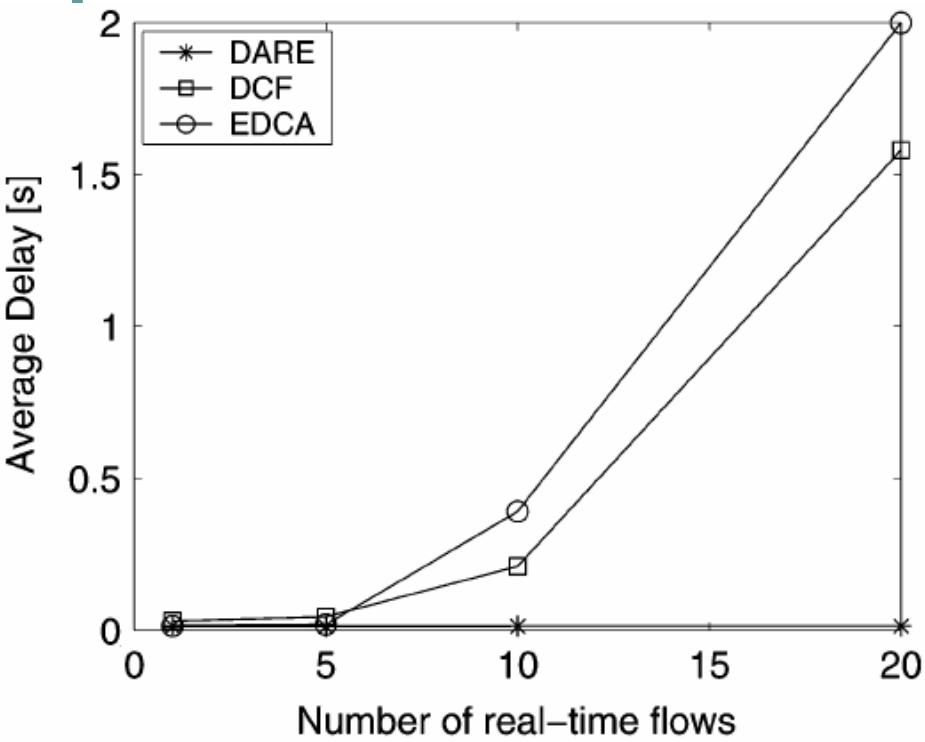


# Performance Analysis

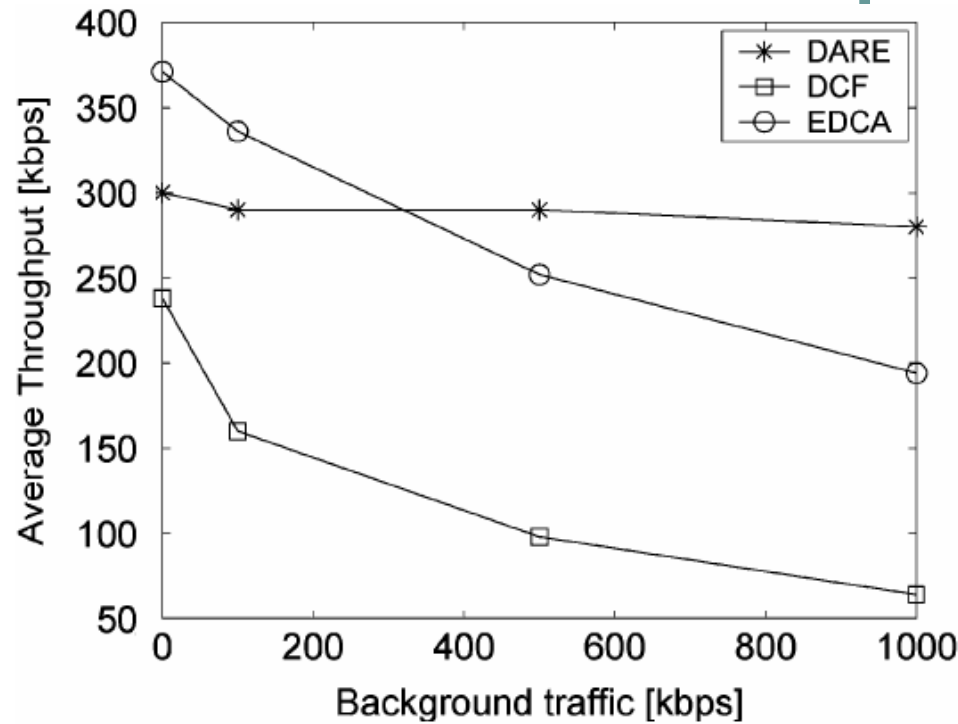
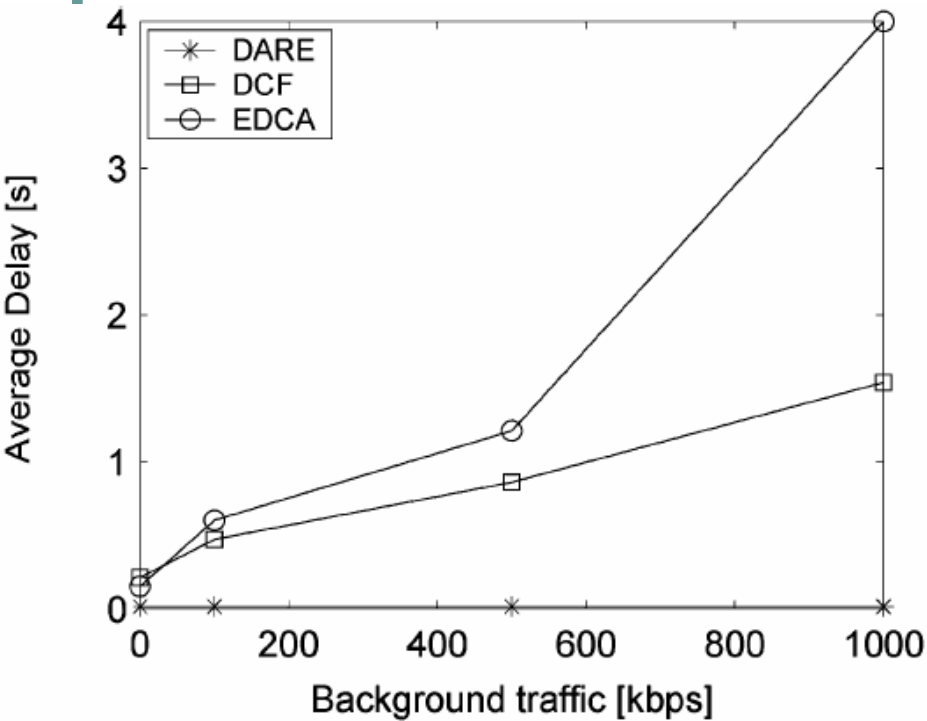
- **Simulation Environment**
  - 400 randomly located nodes
  - 4 internet gateways
- **Metrics**
  - the delay of packets from source to destination
  - the throughput for individual real-time flows



# Performance Analysis



# Performance Analysis



# Conclusions

- This paper presented DARE—a distributed end-to-end reservation protocol for IEEE 802.11-based wireless mesh networks.
- The approach is to allocate and use periodic time slots for QoS-demanding applications.
- The simulation-based study shows that DARE offers a reliable and efficient support for QoS applications.