



JazzyMac

An Adaptive, High Performance MAC for
Long-Distance Multihop Wireless
Networks

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Overview

- Introduction
- Background
- Goals
- JazzyMac Design
- Evaluation
- Critical Appraisal
- Related Works
- Summary



Introduction

- Multi-hop WiFi long-distance networks (WiLD)
 - provides connectivity to rural areas
 - low cost

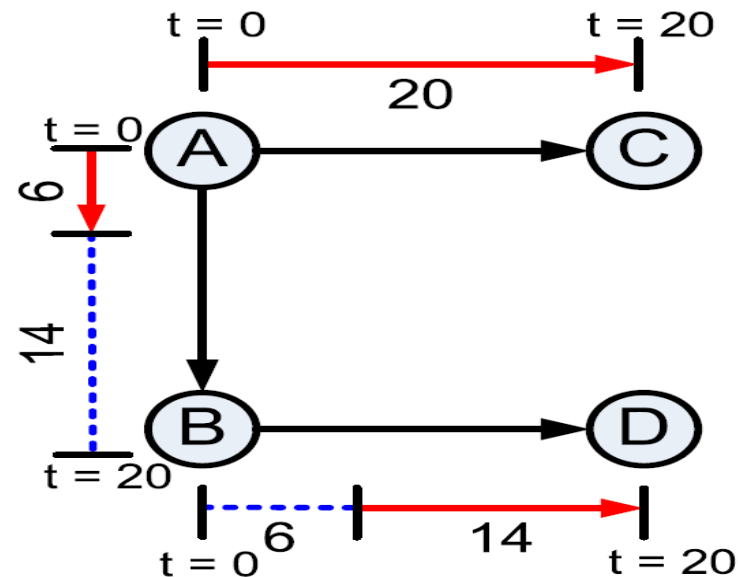


Background

- 802.11
 - uses CSMA-based MAC
 - station listens before transmitting
- Problems in long distance link network
 - high packet loss
 - low throughput
 - long propagation delay
 - inter-link interference

Background cont...

- TDMA with fixed time slots used by 2P and WiLDNet



- Drawbacks:
 - Low throughput
 - Links under utilization

What can we do about it?





JazzyMAC

- TDMA with dynamic slot lengths
- Fully distributed
 - Each node adapts its transmission slot size using purely local state and locally-observed traffic information
- Deadlock free



Goals

- Performance

- Adapts to traffic demand, does not rely on fixed timeslot
- Allows neighbouring transmissions that overlap

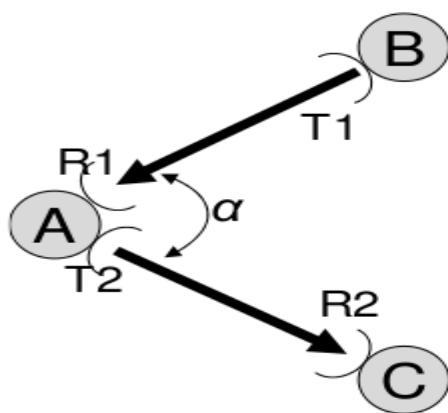
- Tradeoff between throughput and delay

- e.g Internet telephony

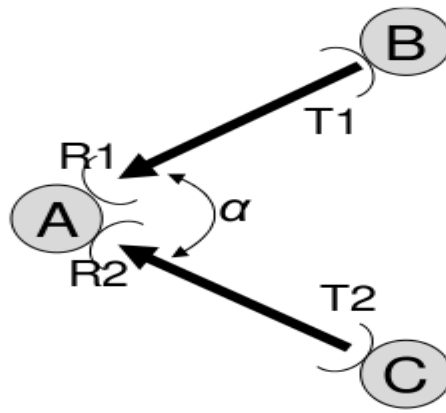
- Works on any network topologies

SynOp

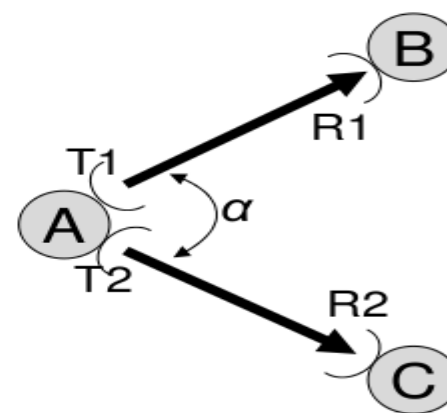
- Simultaneous Synchronized Operation
- Two adjacent directional links either transmit simultaneously or receive simultaneously - interference-free



a) Mix-Tx-Rx



b) SynRx



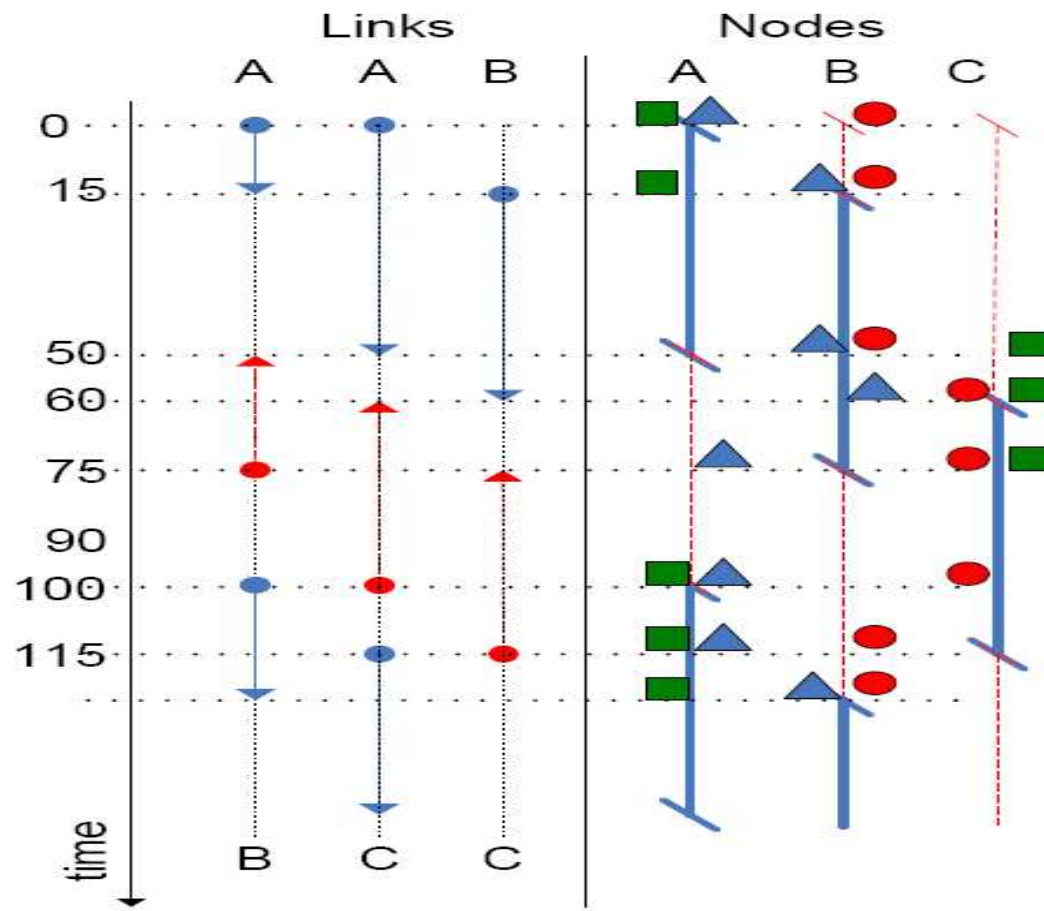
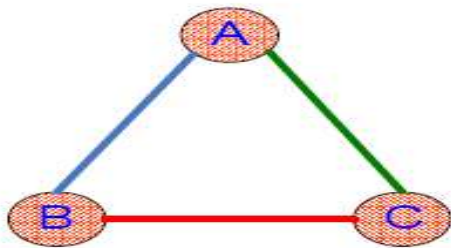
c) SynTx



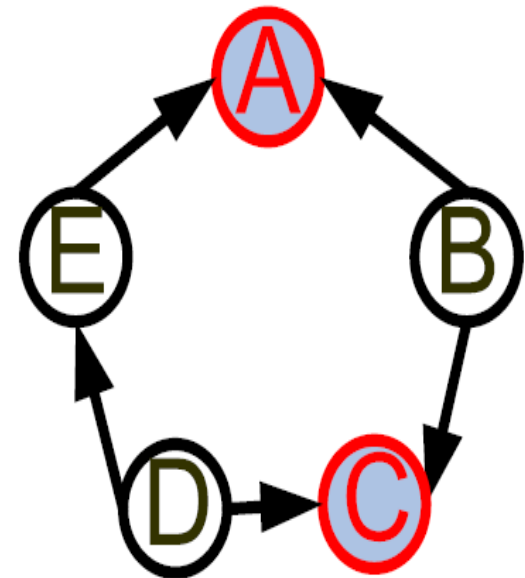
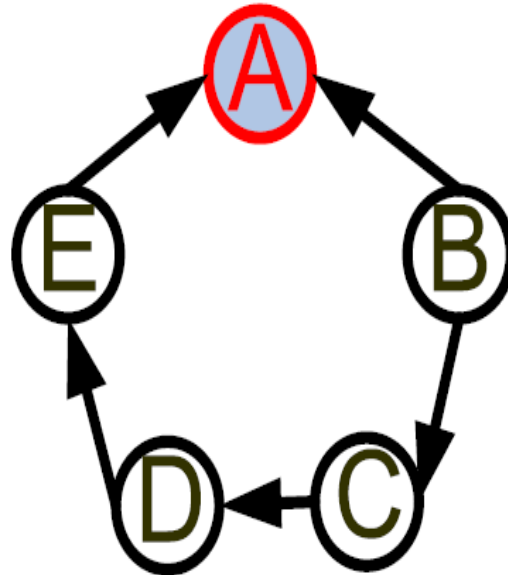
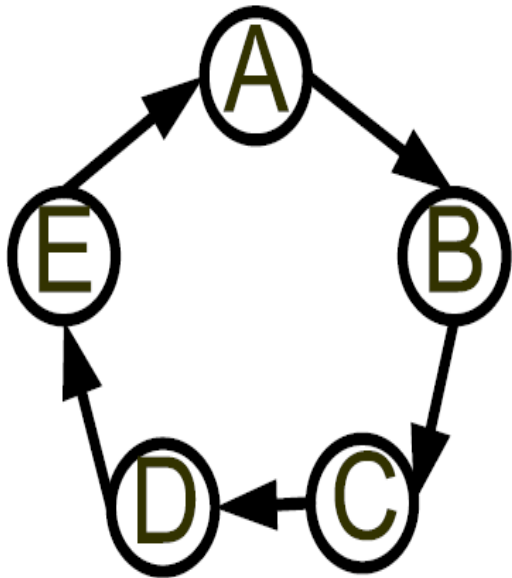
Design

- Variable time slots
- Allow parallel transmission
 - Solving problem \implies *neighboring-but-independent*
- Improve throughput

Design cont...

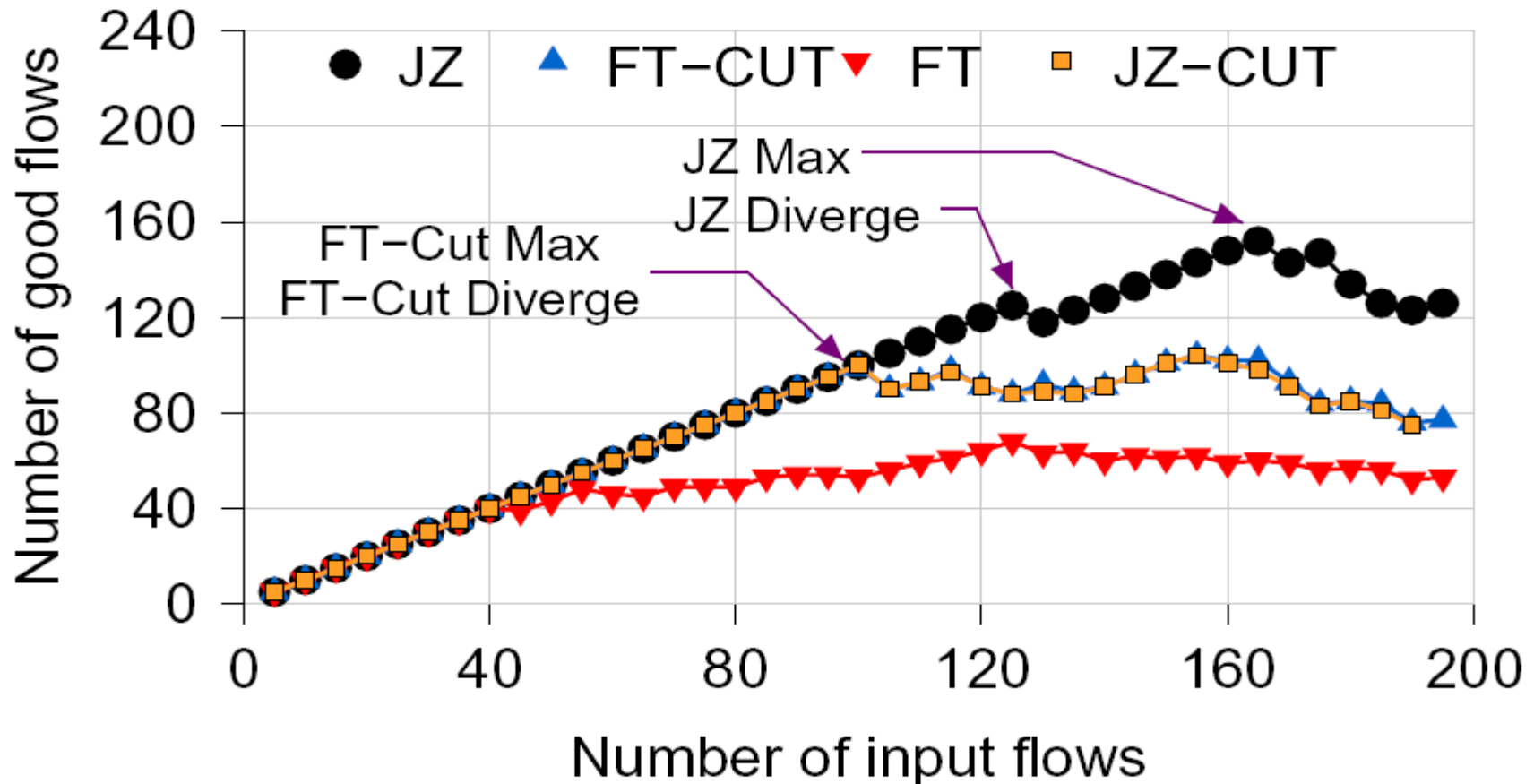


Token assignment



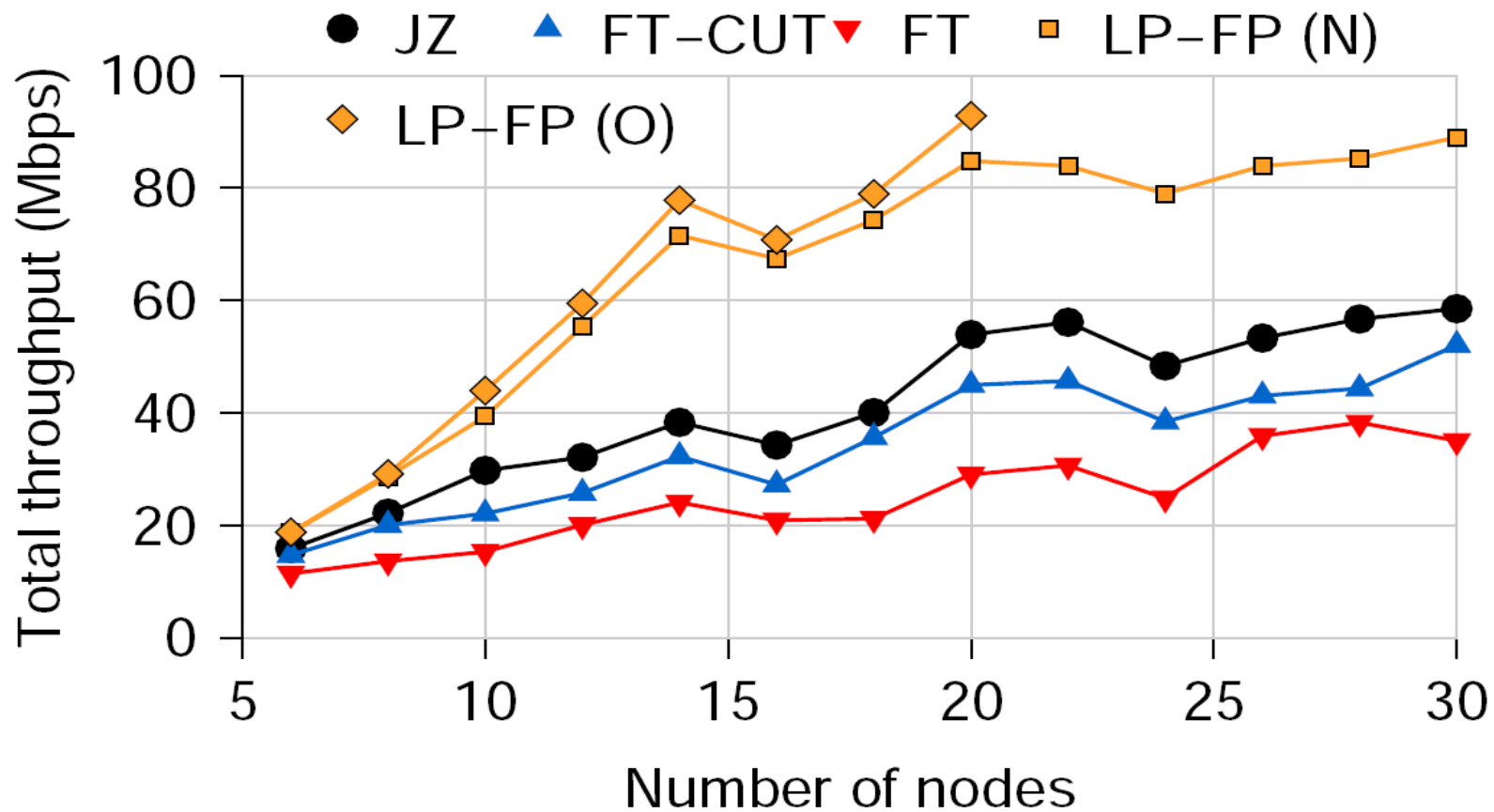
Evaluation

■ Divergence point / Max point



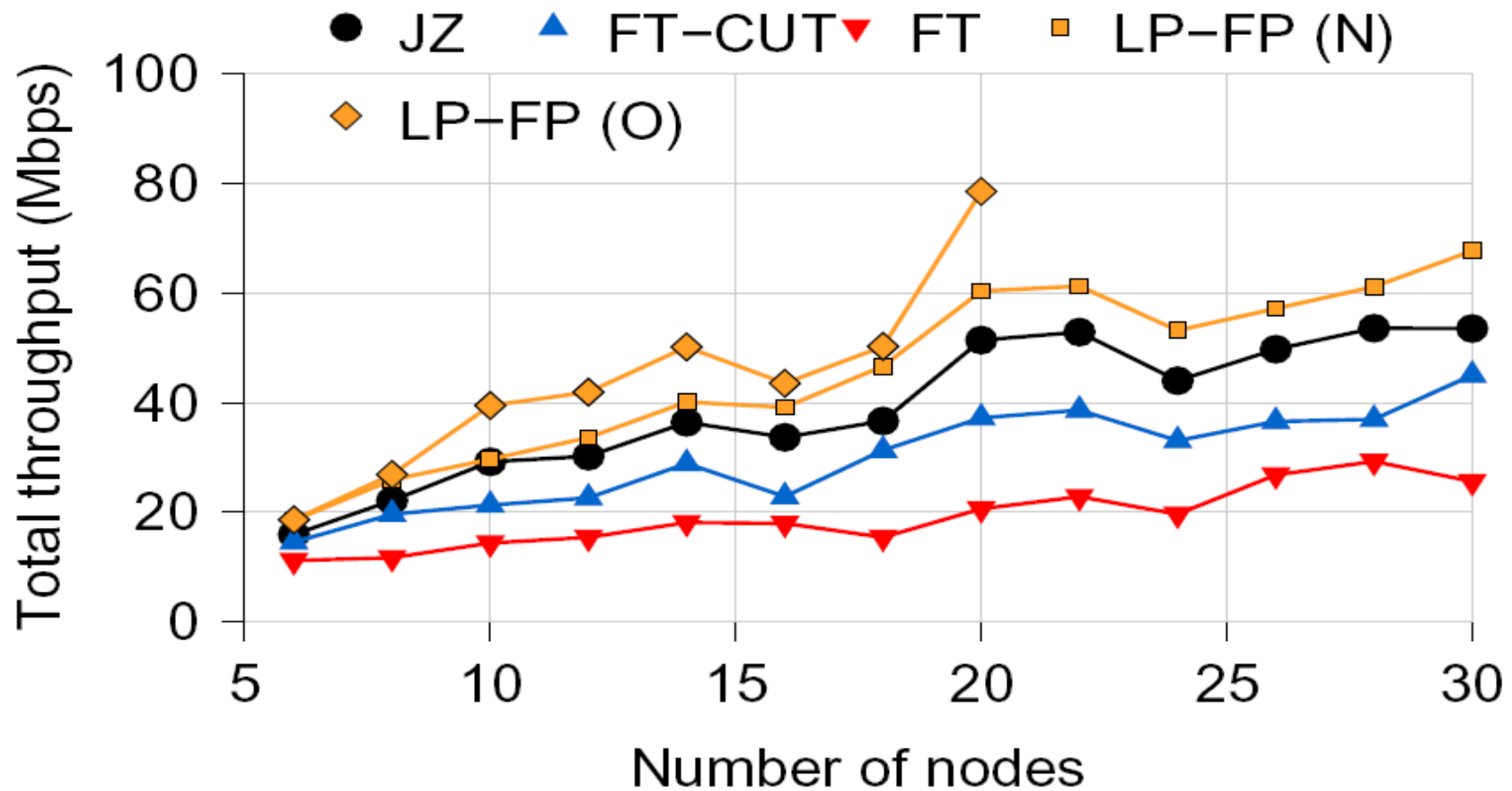
Evaluation cont..

■ Improve throughput



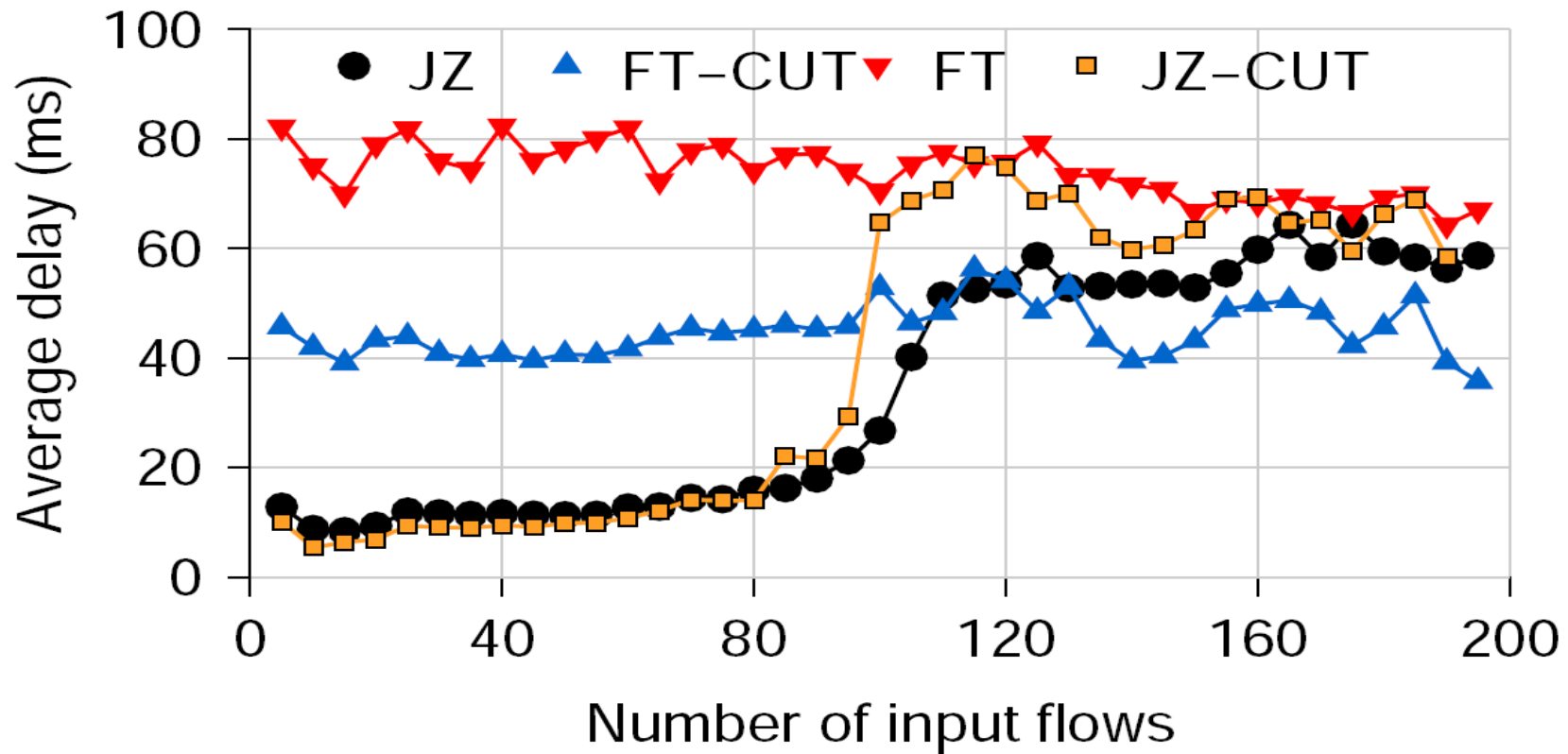
Evaluation cont...

- Improve throughput cont..



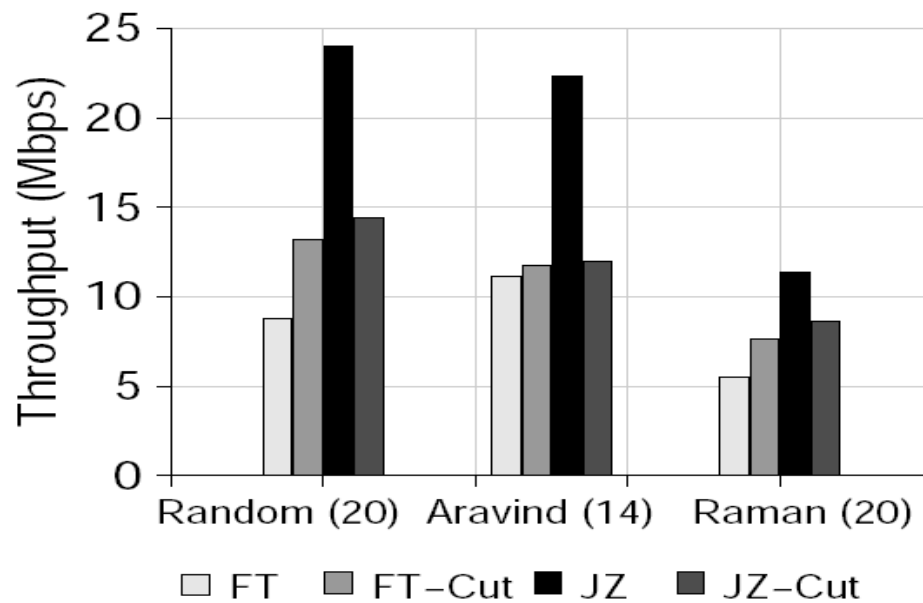
Evaluation cont..

■ Per-flow average delay

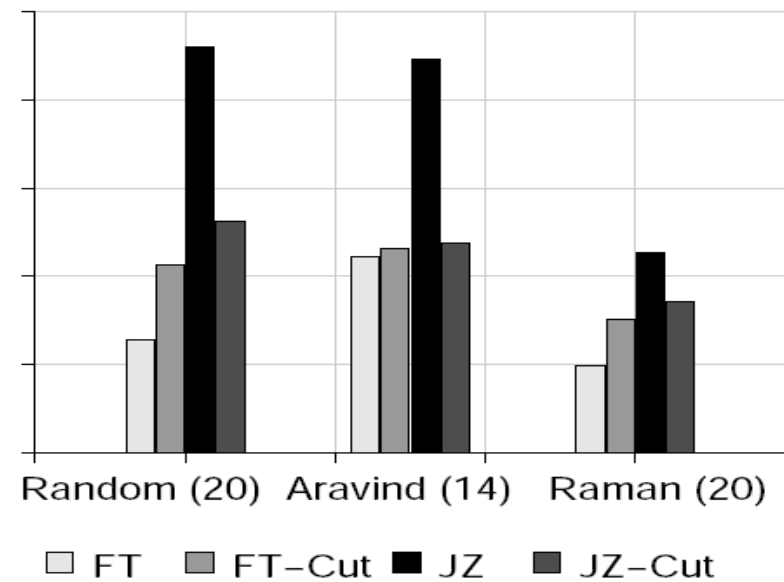


Evaluation cont...

■ Throughput for various topologies



(a) Max BW



(b) Diverge point

Aravind Network

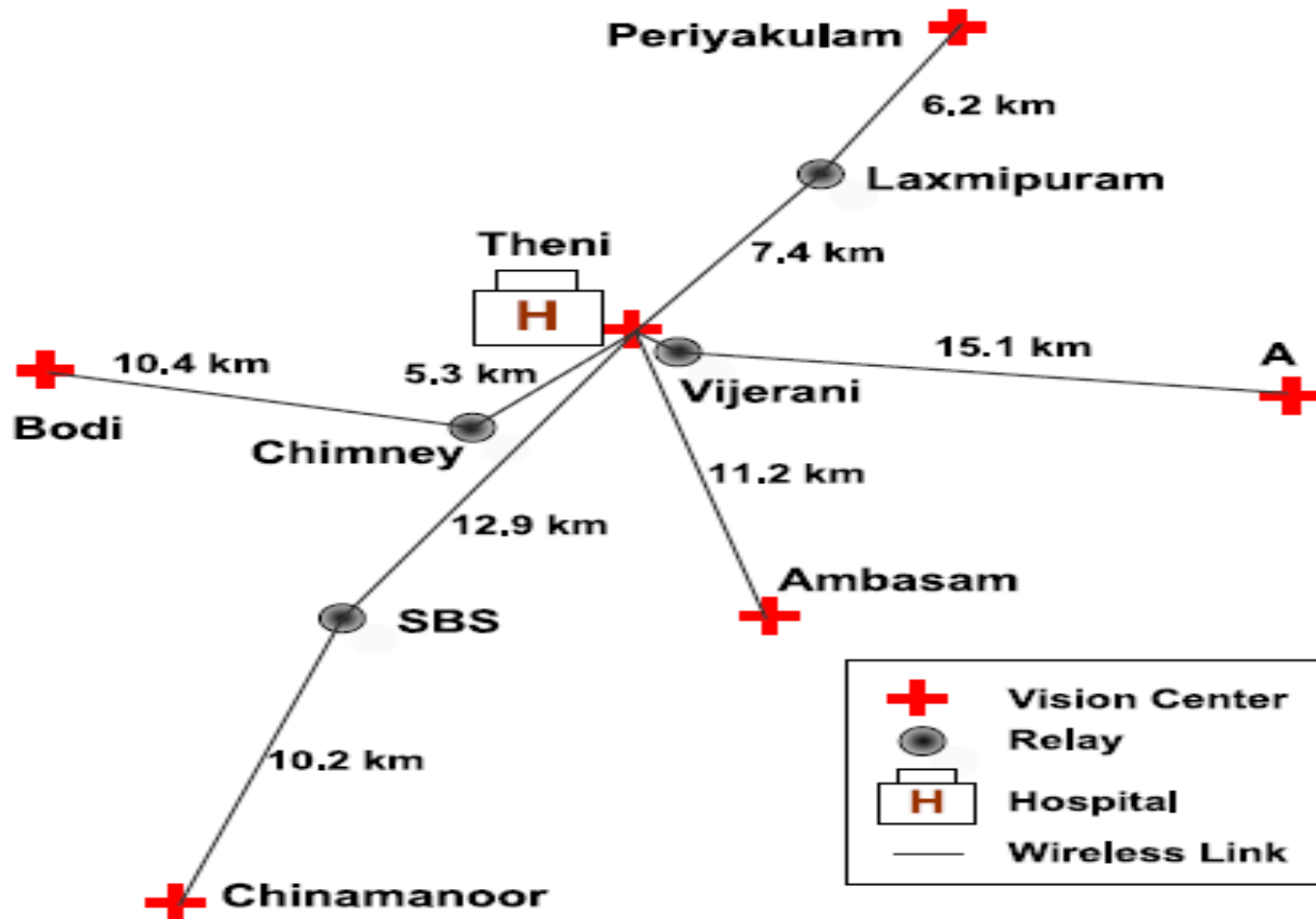


Figure 2: Aravind Telemedicine Network. Theni hospital is connected to 5 Vision Centers. The other nodes are all relays.



Critical Appraisal

- JazzyMAC's per-flow delay is lower than the others at low utilization (<100 input flows)
 - What about at higher utilization >100 input flows?
- The initial token assignment is computed globally during the network planning phase.
 - If new nodes join or current nodes leave the topology, how does JazzyMAC reassigns token?



Related Works

- Maximizing throughput in multihop wireless network [Djukic and Valaee]
 - Min-max heuristic, offline algorithms to minimize delay, link bandwidths are known in advance
- Centralized and distributed algorithms to maximize throughput by taking into account interfering links [Wang et al]
- MAC implementations using 802.11 radios
 - 2P, WiLDNet
- Overlay-MAC, Softmac, MultiMAC,



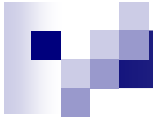
Summary

- WiLD networks provide network access to many users in rural areas.
- These networks uses TDMA based MACs
 - They are limited by fixed size timeslot
 - Neighboring-but-independent problem
 - only operate in bipartite topologies
 - Links underutilized



Summary cont...

- Key innovation in JazzyMAC is to use dynamic timeslot adaptation which gives advantages over fixed size timeslot
 - higher throughput
 - lower average delay
 - unconstrained in any network topology



Questions?