OPNET Modeling and Simulation of CDPD MAC Layer Behaviour

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I. Motivation

- Traditional mathematical models cannot accurately capture traffic behaviour in packet networks.
- Conventional queuing techniques cannot be applied and closed-form solutions are difficult to obtain.
- We use simulations to gain insights into the complex network behaviour.

II. Cellular Digital Packet Data (CDPD)

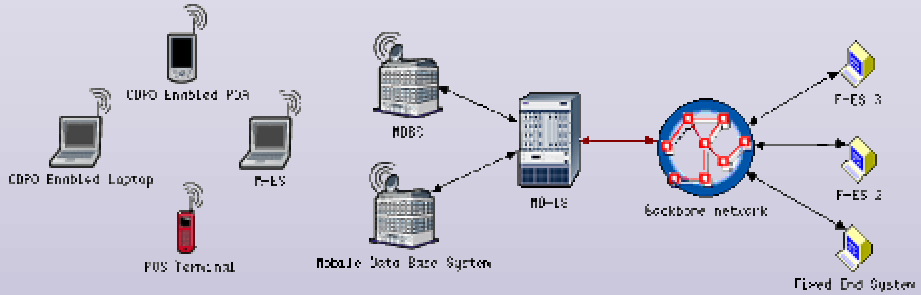
- First non-proprietary wireless data transmission standard that supports Internet Protocol (IP)
- Mobile End Station (M-ES):
  - CDPD enabled laptops, PDAs, and Point-of-Sale (POS) terminals
  - M-ES competes for channel resources using Digital Sense Multiple Access with Collision Detection
- Mobile Database Station (MDBS):
  - Cellular base stations connecting the M-ESs to wired networks
  - MDBS sends information regarding status of the channel and receives M-ES data
- Mobile Data Intermediate System (MD-IS):
  - Customer/user database
  - Gateway to the backbone network

III. OPNET Models

OPNET is an event driven simulator that employs hierarchical design using layered abstractions.

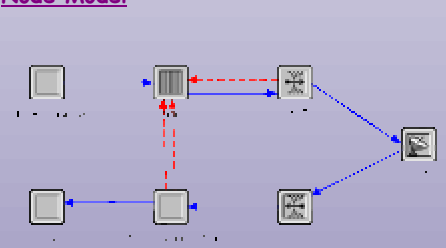
- Subnets:
  - Provide layout and interconnection of network devices
- Node Models:
  - Capture behavioural description of devices
  - Describe device data flow
- Process Models:
  - Describe node functionality using Finite State Machine

Subnet

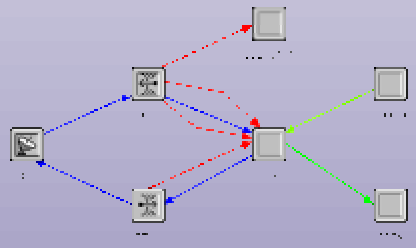


CDPD Network Topology

Node Model

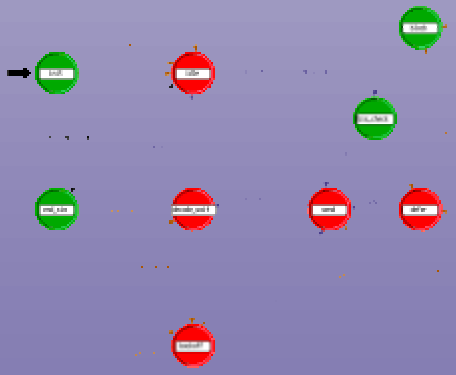


M-ES Node Model

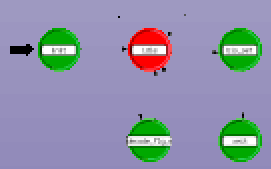


MDBS Node Model

Process Model



M-ES Process Model

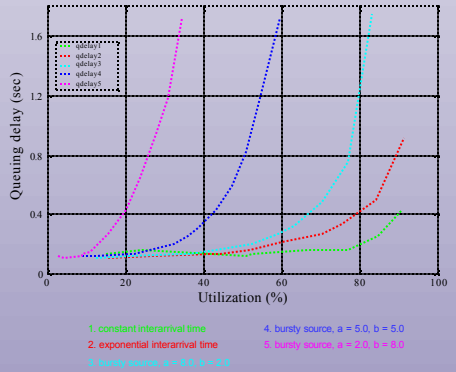


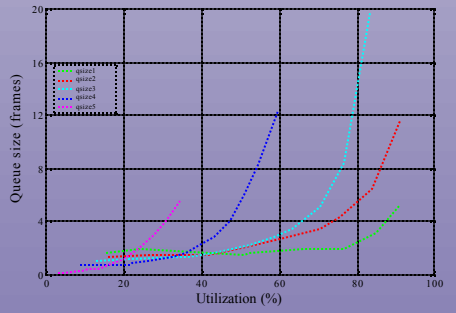
MDBS Process Model

IV. Results and Analysis

Bursty sources:

- Increase queuing delay and queue size compared to traditional Poisson models.
- Require additional network resources (bandwidth and buffers).
- Generate long queuing delay (> 250 ms) for real-time interactive applications.
- Have greater effect on queuing delay than on queue size.





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- *Cellular Digital Packet Data (CDPD) System Specification Release 1.1: Part 402 Medium Access Control*, CDPD Forum, January 1995.
- M. Jiang, M. Nikolic, S. Hardy, and Lj. Trajkovic, "Impact of self-similarity on wireless network performance," in *Proc. IEEE ICC*, Helsinki, Finland, June 2001, pp. 477-481.
- OPNET documentation V.9.0.A. OPNET Technologies Inc., Washington DC.