Mobile Adventure

Reconfiguration in ad-hoc networks.

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Overview

- DoCoMo Euro Labs
- Example Problem:
  - The synchronized reconfiguration problem
  - A time-out based algorithm
    - joint work with B. Souville
- Some thoughts & questions

NTT DoCoMo's R&D Centers

NTT DoCoMo Euro-Labs

DoCoMo USA Labs
Nov. 1999

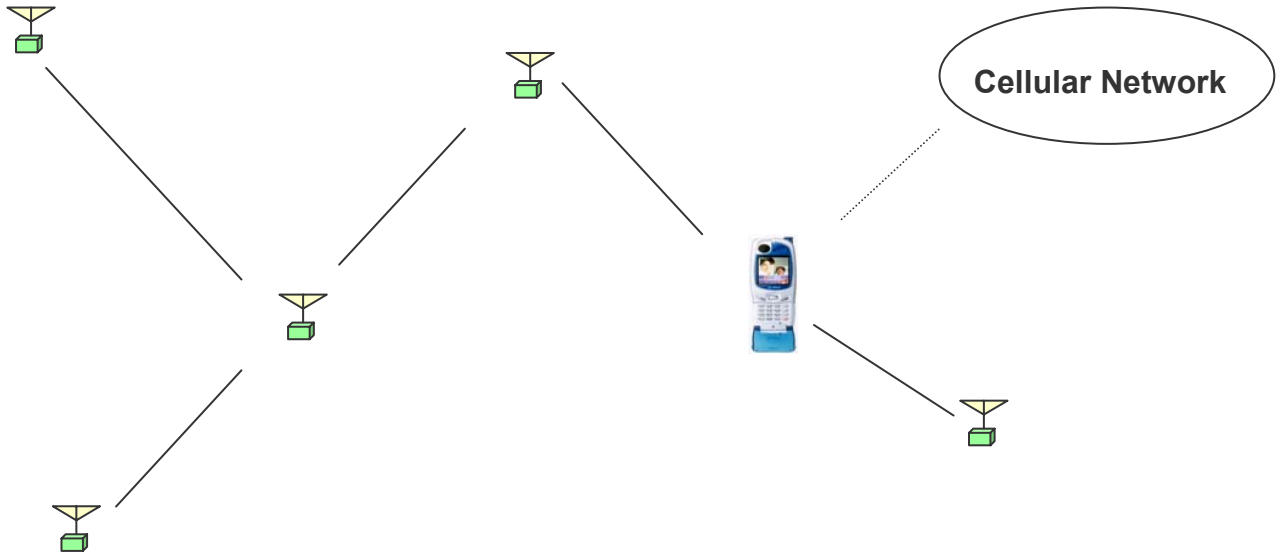
DoCoMo Europe
Aug. 1998 (Standardization

YRP R&D Center
Mar. 1998

DoCoMo Euro-Labs
Nov. 2000

YRP: Yokosuka Research Park

Synchronized Reconfiguration Problem



Simultaneous reconfiguration of mobile nodes

- Software upgrade, reconfiguration
  - may include all communication layers
  - may fail and fallback is needed
- No central control
- All connected nodes shall have same configuration
- Dynamic nature of ad-hoc networks

Application scenarios

- Change ad hoc Routing protocols
  - AODV and DSR
    - Change of routing protocols according to network load and mobility characteristics
    - Fallback signal
      - IEEE 802.11 broadcast message on the MAC layer
- Software radio reconfiguration
  - IEEE 802.11 and Hiperlan/2
    - Main differences on the MAC layer
    - Small differences on the Physical layer
    - No fallback signal
- Change frequency, e.g. in IEEE 802.11
  - No fallback signal

Assumptions and Requirements

- Assumptions
  - Mobility of the nodes
    - Ad hoc network may split into several groups
  - No communication possible during reconfiguration
  - Reconfiguration failures possible
- Requirements
  - Consistency properties
  - Fallback signals in the case of reconfiguration failures (optional)

Goal of the Algorithm

- Goal: Connected groups have same configuration
  - Connected refers to a specific decision time point (agreed time out)
- Problem
  - Cannot distinguish two cases
    - node moves away
      - don't care
    - node fails with reconfiguration
      - May be detected with fallback signal
      - Do fallback
- Variations
  - Do fallback if node disappeard, but no fallback signal

Time-out based algorithm: Setup phase

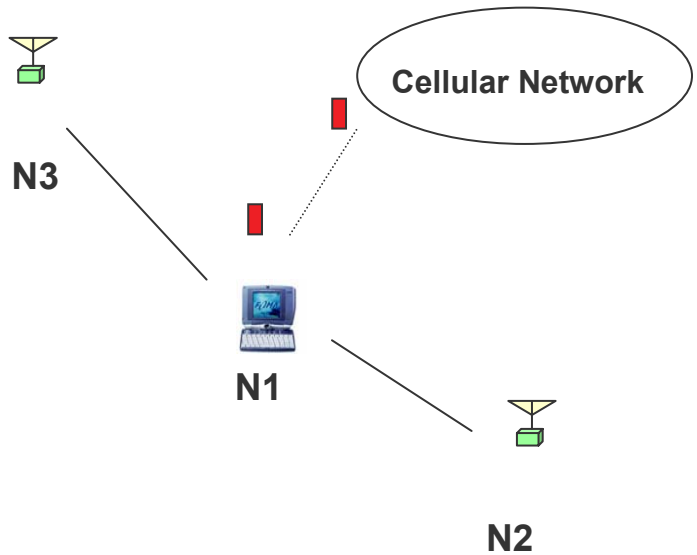
One node retrieves the software

Exchange capabilities

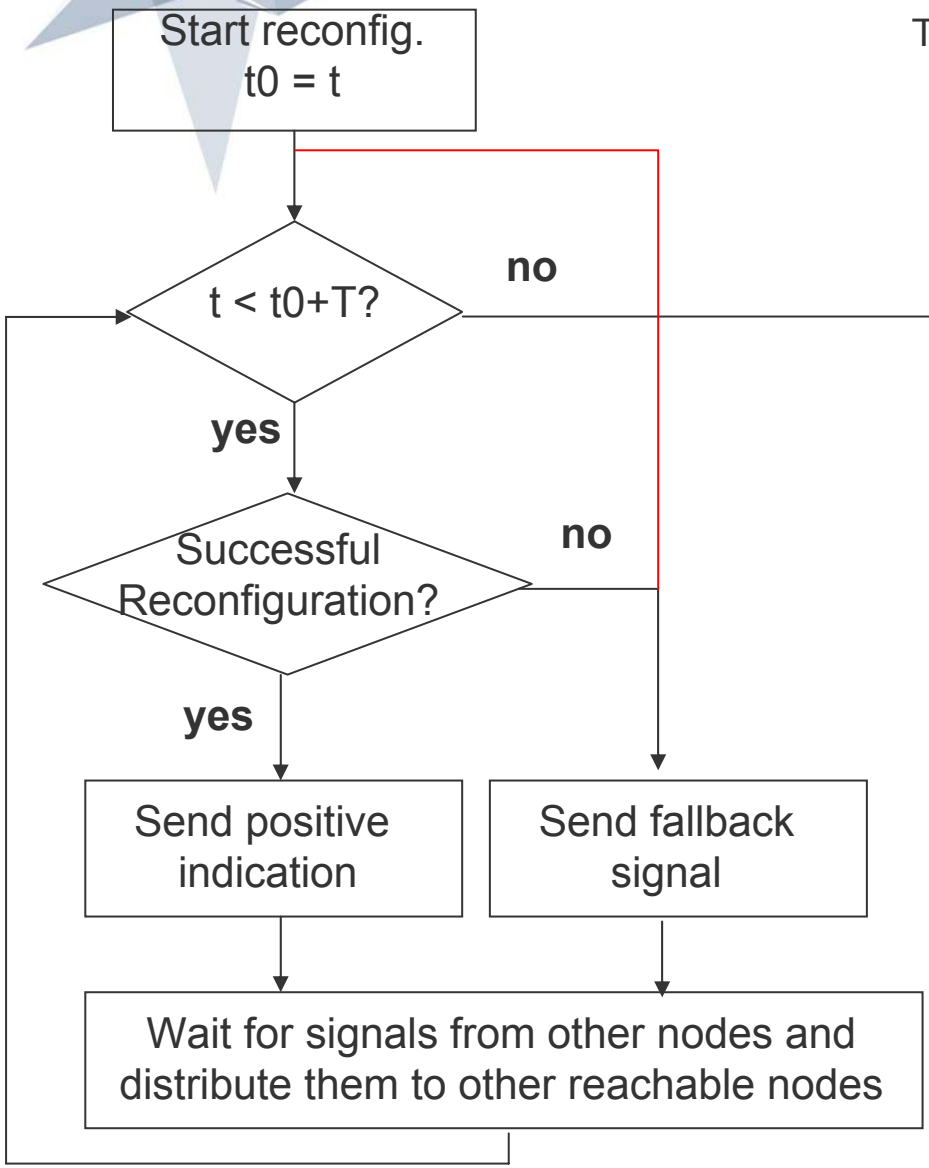
Distribution of SW

Negotiation of maximum time T for reconfiguration

Start reconfiguration t=t0

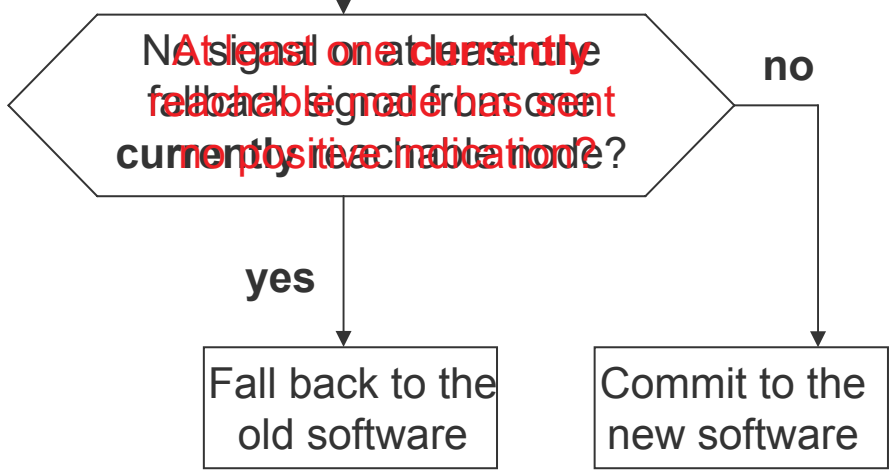


Time-out based algorithm Reconfiguration phase



T maximum time for reconfiguration

Variation: Fallback Signal available



Some thoughts & questions

- „Coordinated operations" are not possible in asynchronous systems with failures (in theory)
  - e.g. distributed consensus, transactions, etc
  - theoretical results assume „infinite wait"
    - no time out
    - need approximate solutions
  - Relevance for intermitted communication?
    - e.g. due to reconfiguration
    - sensor sleep mode

- What kind of ad-hoc coordination is possible/needed?