Patient Monitoring in a Hospital Environment

Course Project - Wireless Networking and Applications

Chelsea Chen, Samuel Kim

Motivation

- Goal: Allow **continuous monitoring** and **secure transmission** of patient vitals while allowing patients to **move freely** in the absence of reliable wireless infrastructure.

Problems and Implications

- Continuous monitoring → minimal packet loss
- Dense environments → high traffic rate
- Patient privacy → encrypted transmission
- Patients should be able to...
  - move freely → ad-hoc network
  - roam far → packet resiliency, ECC
  - roam for long durations → energy efficiency

Approach

- Each patient has multiple sensor nodes (e.g. HR, BP, CO2) and one coordinator node (aggregates data and broadcasts to the network).
  - For this project, no sensor nodes; only coordinator nodes with mock patient vitals.
- Use an ad-hoc mesh network
  - Improve overall range for patient mobility
  - Each patient also acts as a relay node
  - Assumption: Patient coordinator nodes are high medical grade and won't fail
- TDMA to fix high collision rates
  - Idea is to increase overall throughput
  - Vary QoS for different nodes (prioritization)
- Path routing
  - Implement efficient and smart path routing
- Security
  - Encryption
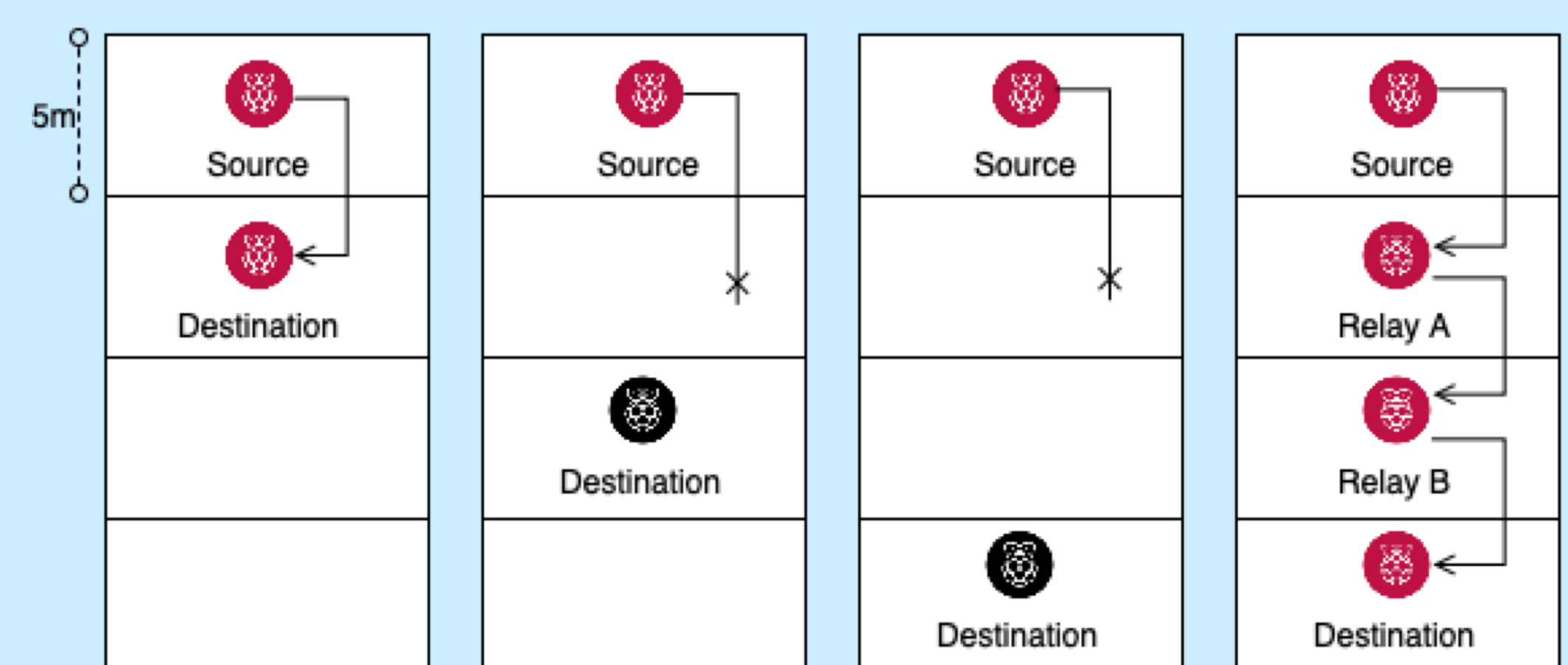 - Proxy Certificate

System Design
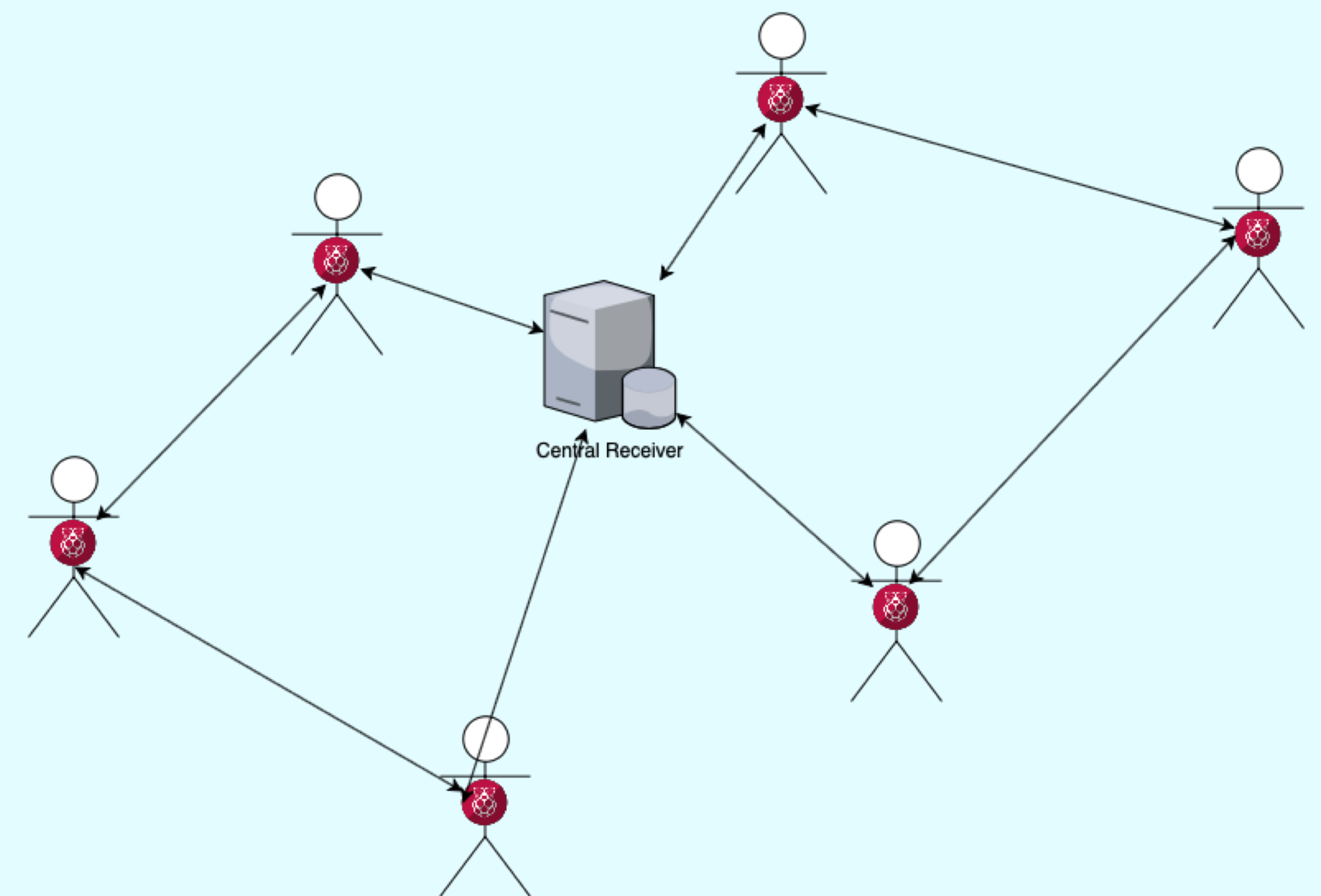
Implementation

- Ad-hoc network
  - 8-10 Raspberry Pi's as nodes
  - B.A.T.M.A.N. routing protocol (open source)
- TDMA implementation
  - Improve throughput in dense environment
- Secure path routing
  - Protect B.A.T.M.A.N. from byzantine failures
  - Node authentication and authorization

Evaluation

Ad-Hoc Network With Relay Nodes, Multiple Floors

Throughput in Highly Dense Environment

Electrical & Computer ENGINEERING

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