Routing in the Suburban Area Network (SAN)

- SAN node software contains the following modules:
  - Routing
  - Access Control and Management
  - Security
- Modules are developed independently.
- Communication between modules achieved via a common interface.
- The SAN routing module is responsible for:
  - Neighbour discovery
  - Route discovery
  - Route maintenance
- Similar to Dynamic Source Routing.
- Every SAN node has a routing table.

Route Discovery

- Mechanism for discovering routes to SAN nodes.
- Executed every time a node needs a route to a destination and:
  - Route is not present in the node's routing table, or
  - Route has expired.
- Consists of a Route Request (RREQ) - Route Reply (RREP) cycle.
- Node generates:
  - RREQ packet: when a new route is required.
  - RREP packet: when it receives a RREQ, and it knows of a route to the RREQ destination.

Processing Route Request Packets (RREQ)

- Suppose Node A requires a route to Node Z.
- Node D has one or more routes to Node Z in its routing table.
- Route discovery procedure:
  - Node A broadcasts a RREQ packet.
  - Since intermediate nodes do not know of a route to Node Z, they:
    - Append their address to the RREQ packet RAL.
    - Forward the RREQ packet to neighbouring nodes.

Processing Route Error Packets (RERR)

- Suppose Node A is sending data to Node Z and the link between Node C and D ceases to operate.
- Node C detects the broken link and generates a RERR packet.
- When an intermediate node receives a RERR packet, the node:
  - Deletes broken routes.
  - Determines next hop address from RR and forwards the packet.
- When the RERR reaches global source (Node A) of data transmission:
  - Node A deletes all broken routes from its routing table.
  - If no alternative route exists, initiate route discovery sequence.

Processing Route Reply Packets (RREP)

- When an intermediate node, Node D, that knows of a route to the destination:
  - Add unknown routes from the RAL to its routing table.
  - Generates a RREP packet.
- Intermediate nodes forward the packet en route to Node A.
- Route discovery is successfully found when the RREP packet reaches Node A.
- Node A can now commence data transmission.

Neighbour Discovery

- Executed every time a node is powered up.
- Suppose Node A wants to join the SAN:
  - Node A broadcasts a "Hello" packet.
  - Reports software error if no reply received within set limits.
- Nodes B, C and D receive the "Hello" packet and:
  - Add Node A to their routing tables.
  - Send a "Hello Reply" packet back to Node A.
- Upon reception of "Hello Reply" packets, Node A:
  - Adds Nodes B, C and D to its routing table.
  - Proceeds with node authentication.

Implementation

- CVS code repository comprising ~ 10,000 lines of C
- User space approach:
  - libpcap; library for capturing incoming packets.
  - libnet; library for writing raw Ethernet packets to the NIC.

Project Challenges

- Collaboration with SAN team members
- Coordinating effort not present in other Honours projects.

Future Development

- Further testing and evaluation using wireless equipment.
- Hybrid routing approach by grouping nodes into clusters.
  - Proactive routing inside individual clusters.
  - Reactive routing between clusters.

Faulty link

Unreachable Address D
RR = "C.B.A"