Data forwarding and routing path setup for IEEE 802.16j multihop wireless networks

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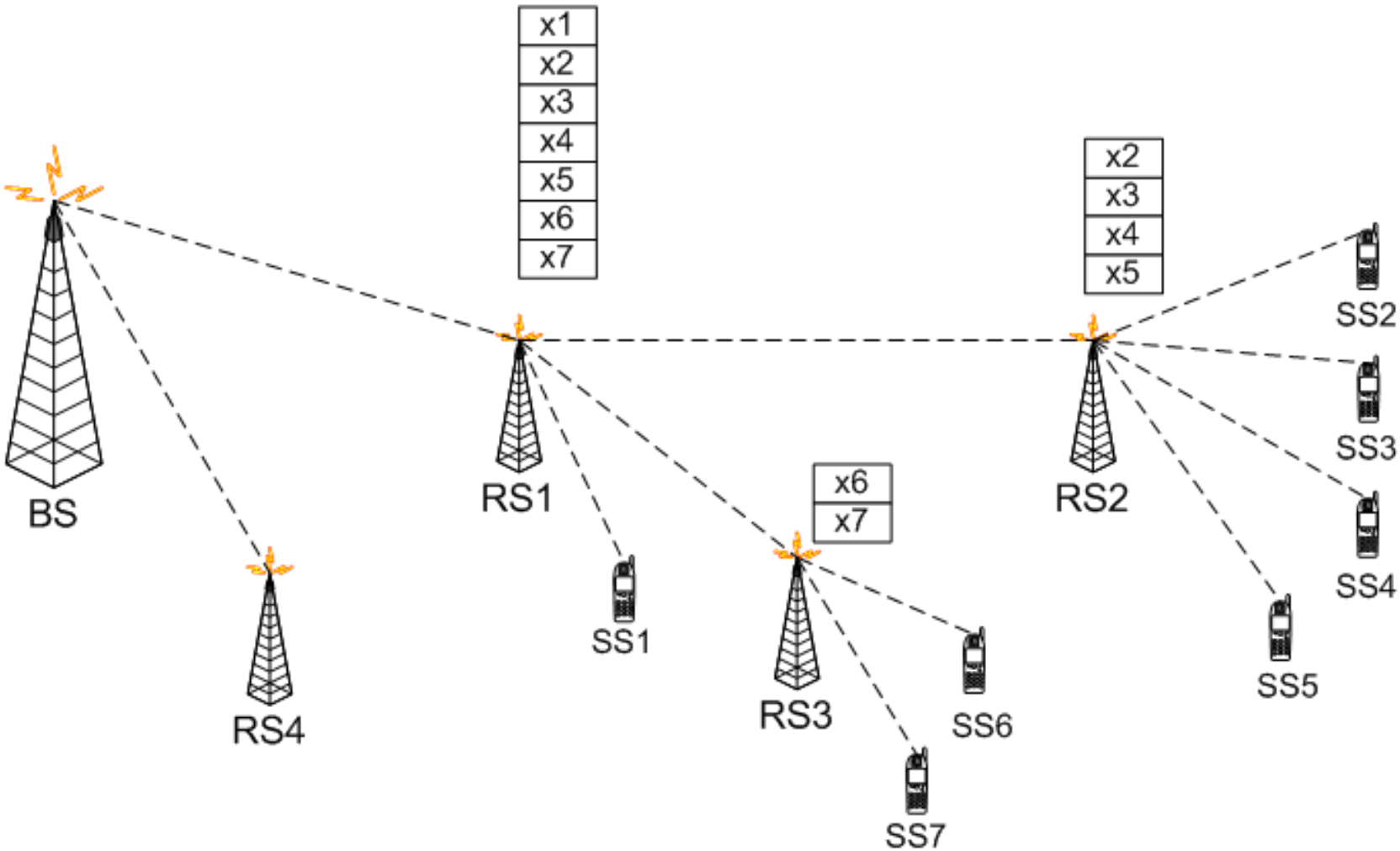
Purpose:

Propose a data forwarding solution for the IEEE 802.16j at MAC layer. We propose to use path CID to identify each routing path between BS and a RS. It not only reduces the routing table size significantly comparing to the method of forwarding data with SS CID, but also simplify the routing management work caused by the mobility of SS/RS nodes. We also propose to use forwarding CID to identify the next hop so that ambiguity may be eliminated. To setup the routing path for data forwarding, we also propose to use path creation and ACK message to create the routing path when centralized routing scheme is used.

Introduction

- Connection IDs (CID) are used to identify connections at MAC layer in 802.16 standard, including 802.16j.
- Using SS CID in routing makes the protocol complex as 802.16j relay networks are multihop wireless networks.
- We propose to use forwarding and path CIDs to simplify the protocol design.

Forwarding with SS CID



Disadvantages

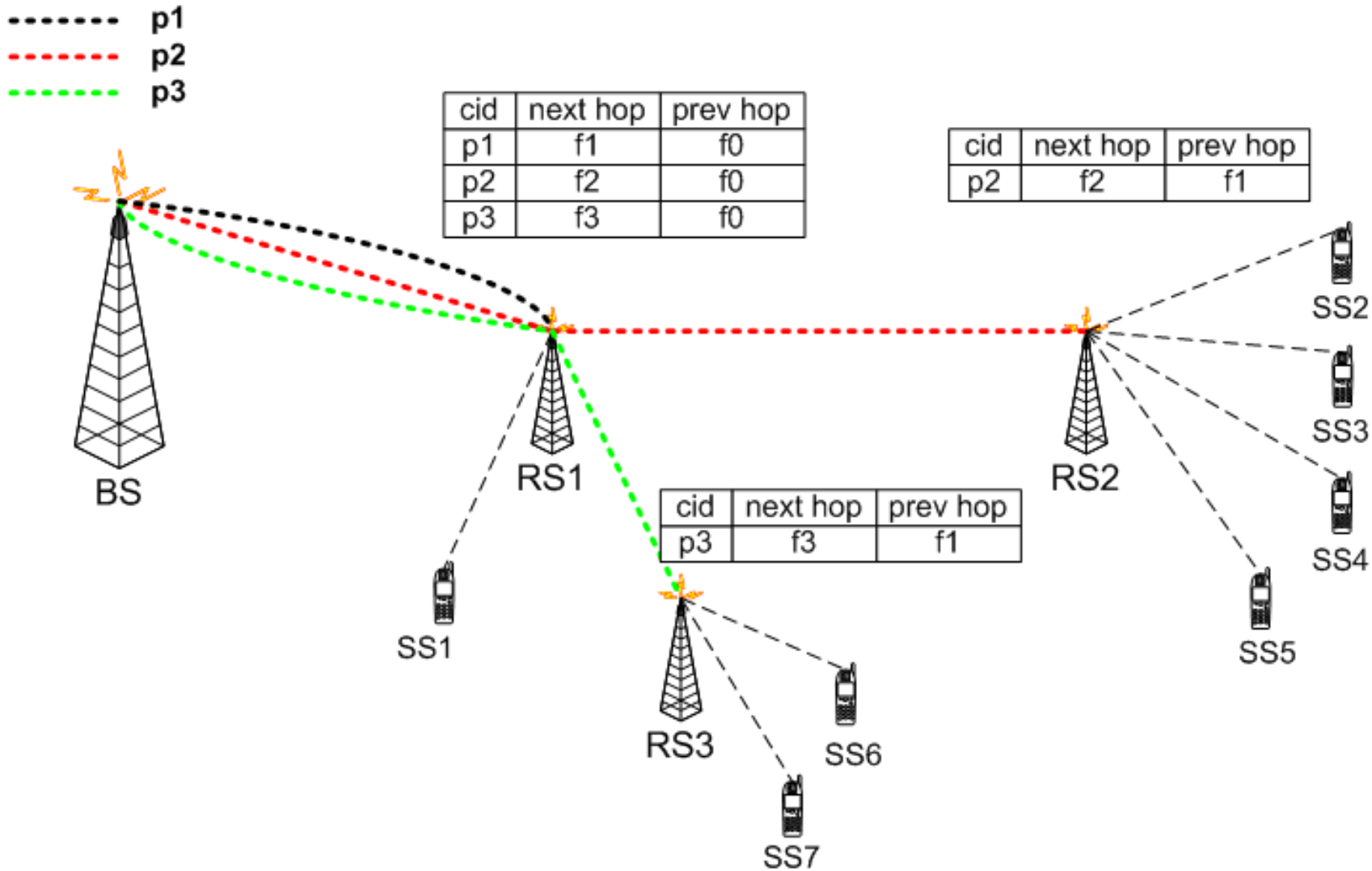
- Routing table size is large.
- Overhead of control messages are high as routing control messages have to be sent when:
  - New connections at SS/BS are open.
  - Connections at SS/BS are closed.
  - SS switches to a different RS.
  - RS switches to a different RS.

Concept of Forwarding and Path CID

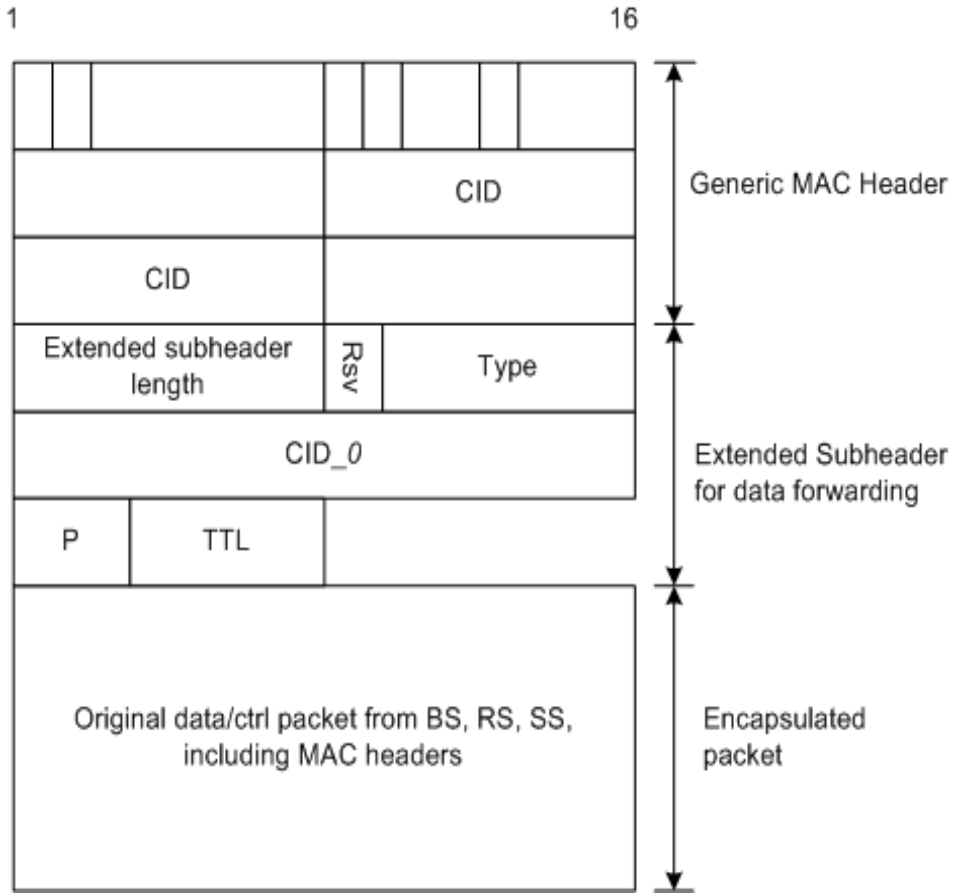
- Forwarding CID
  - Identify a RS.
  - Used in data forwarding and served as next hop in the MAC header. It may accelerate the data processing and eliminate the possible ambiguity.
  - Used in routing management such as routing setup and maintenance.

- Path CID
  - Identify a routing path between BS and a RS.
  - Used in both directions.

Routing with Forwarding and Path CIDs

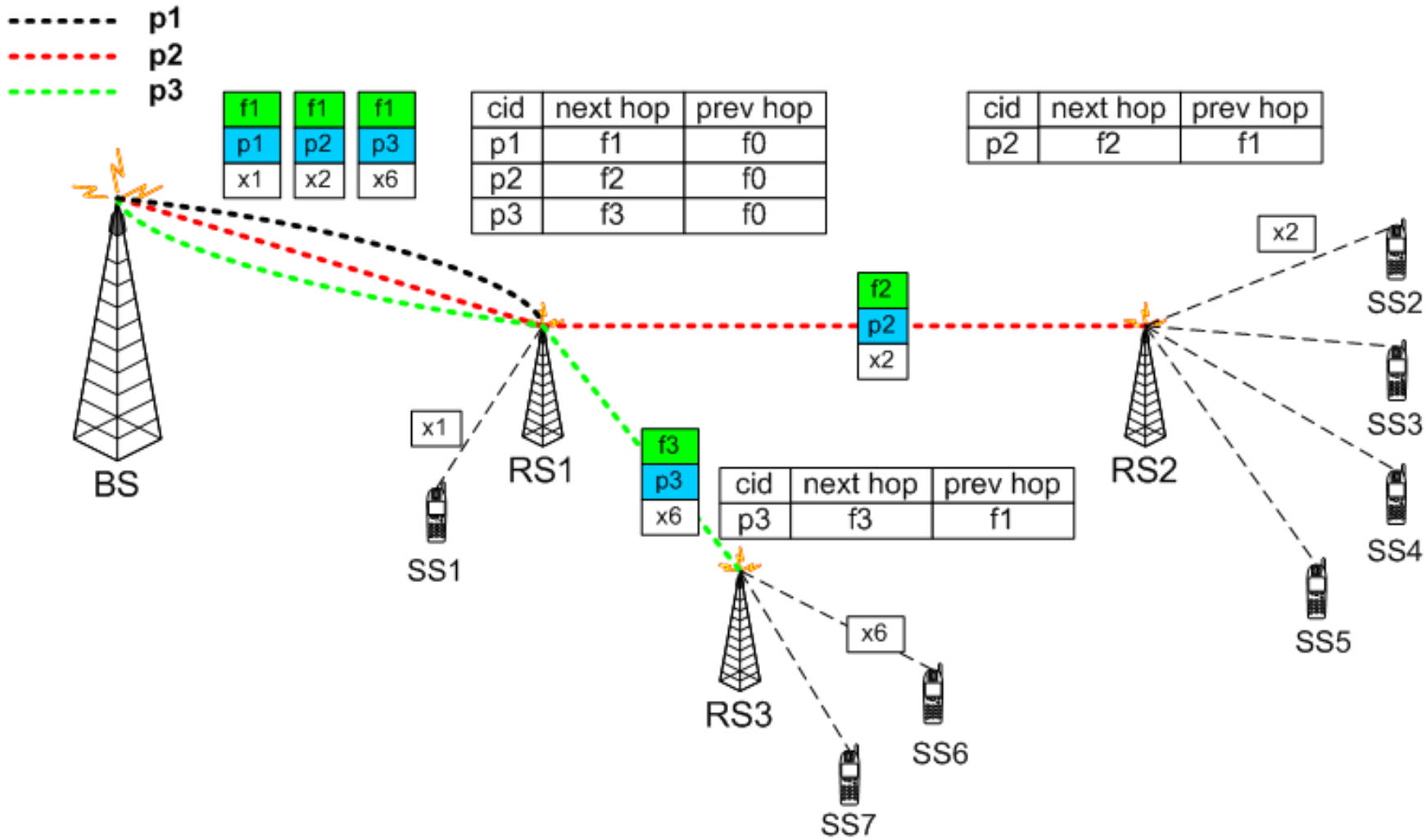


Forwarding Packet Format

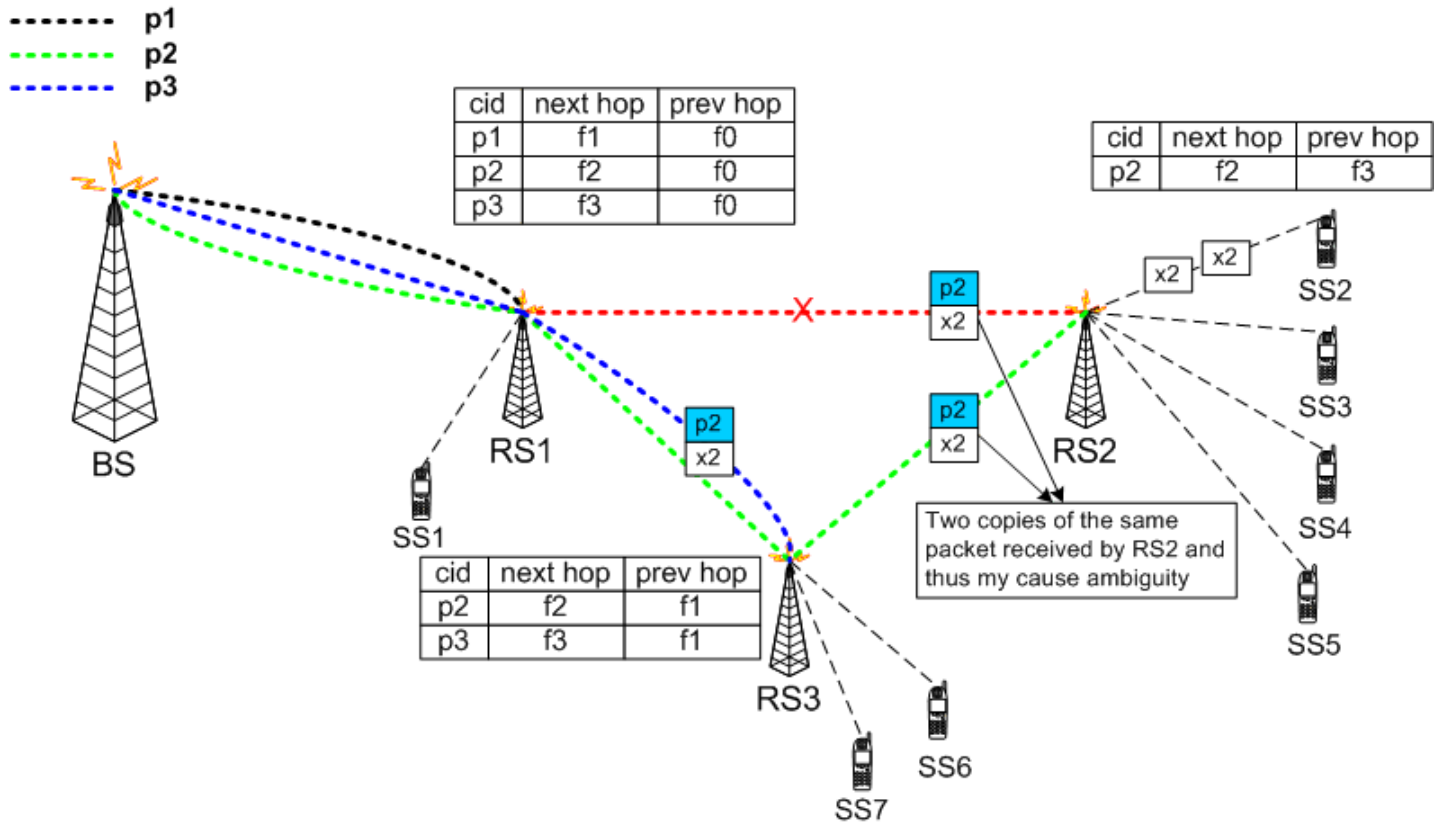


- **CID:** forwarding CID that identifies the next hop when sending.
- **Type:** 6 for DL and 5 for UL.
- **CID_0:** the path CID.
- **P:** Priority level of the packet
- **TTL:** time-to-live value.

Example of Data Forwarding

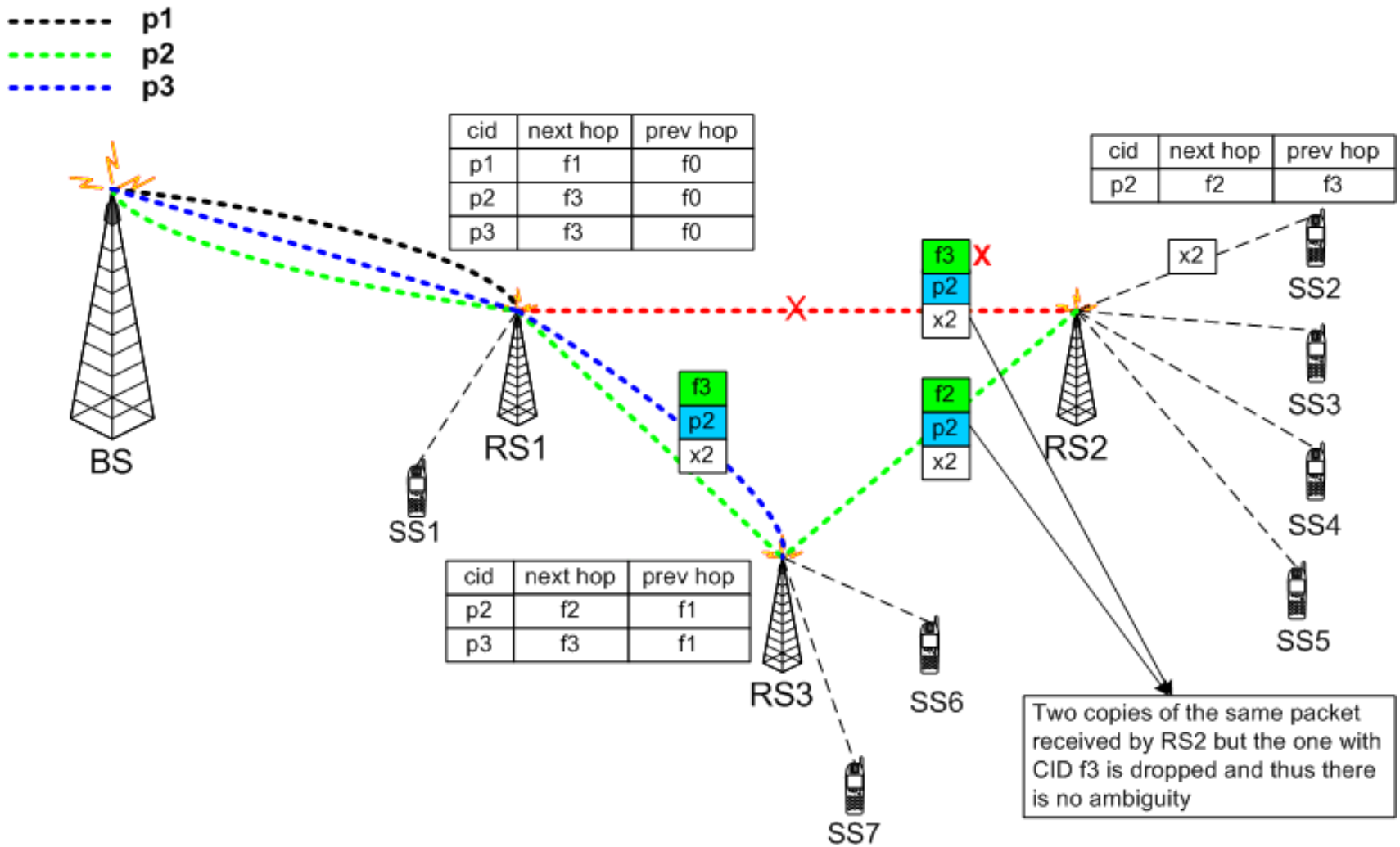


Ambiguity may be Caused with Path CID only Forwarding Method



- To avoid the ambiguity, DL-MAP has to be checked with every received packet given the path CID is in its routing table.

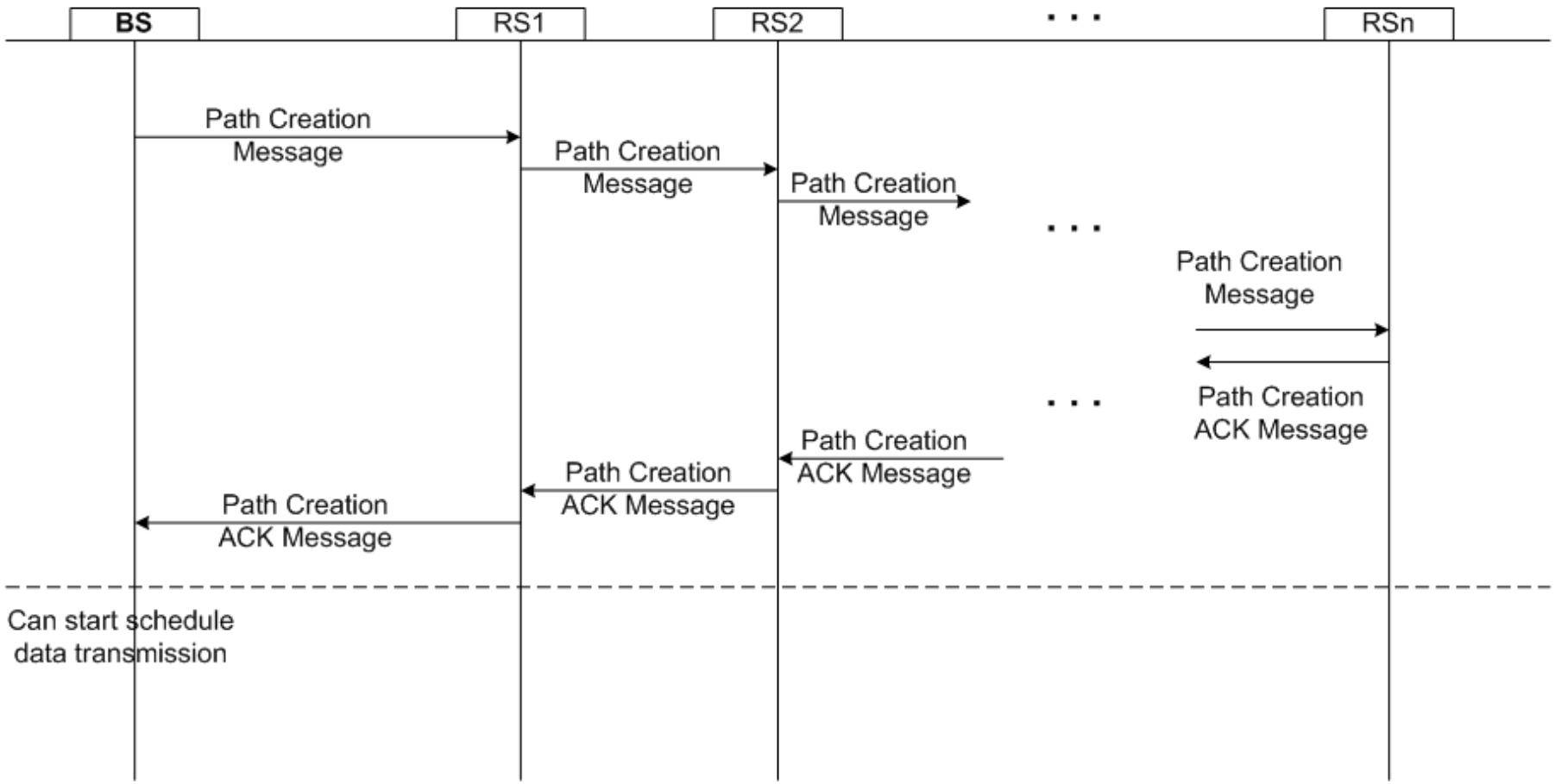
Forwarding CID helps in Eliminating the Ambiguity



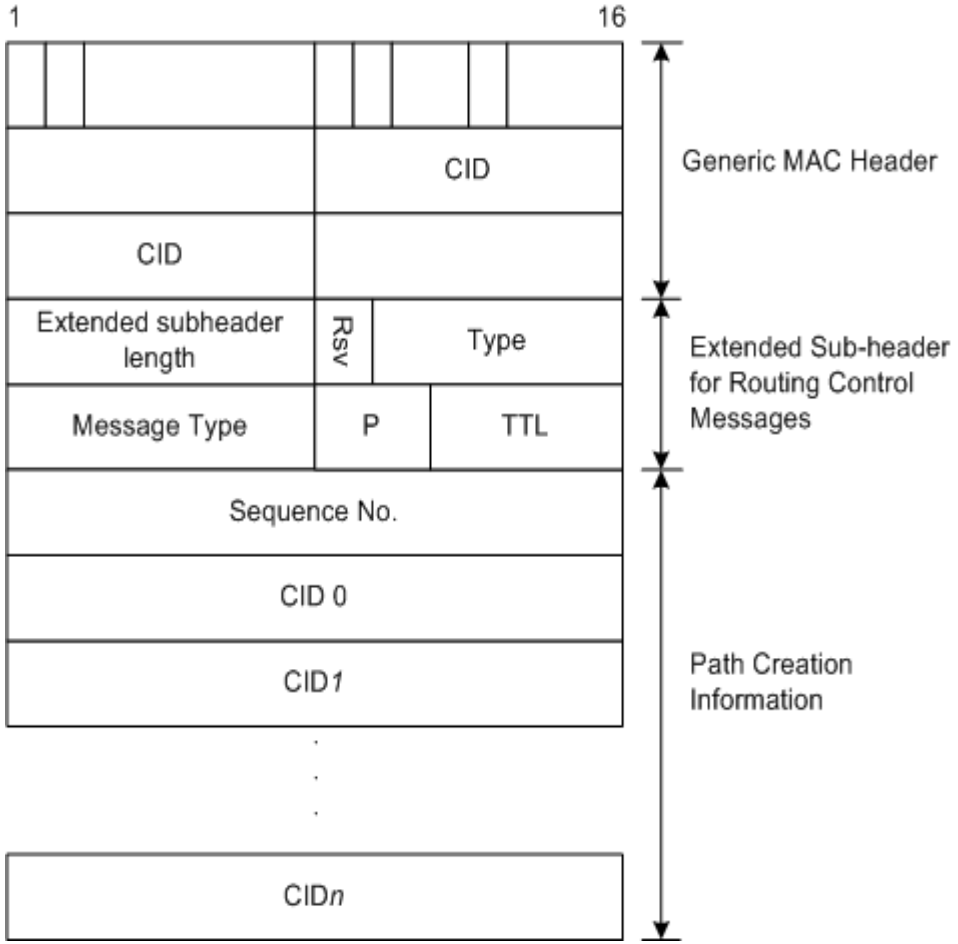
Path Setup/Creation

- We consider centralized routing scheme is used and the BS selects the routing path according to the topology information collected from network.
- Path Creation message is sent by BS and forwarded along the selected path.
- The intermediate RS nodes update their routing tables according to this path creation message.
- The target RS node should send back an acknowledgement along the path created.

Path Setup/Creation Method

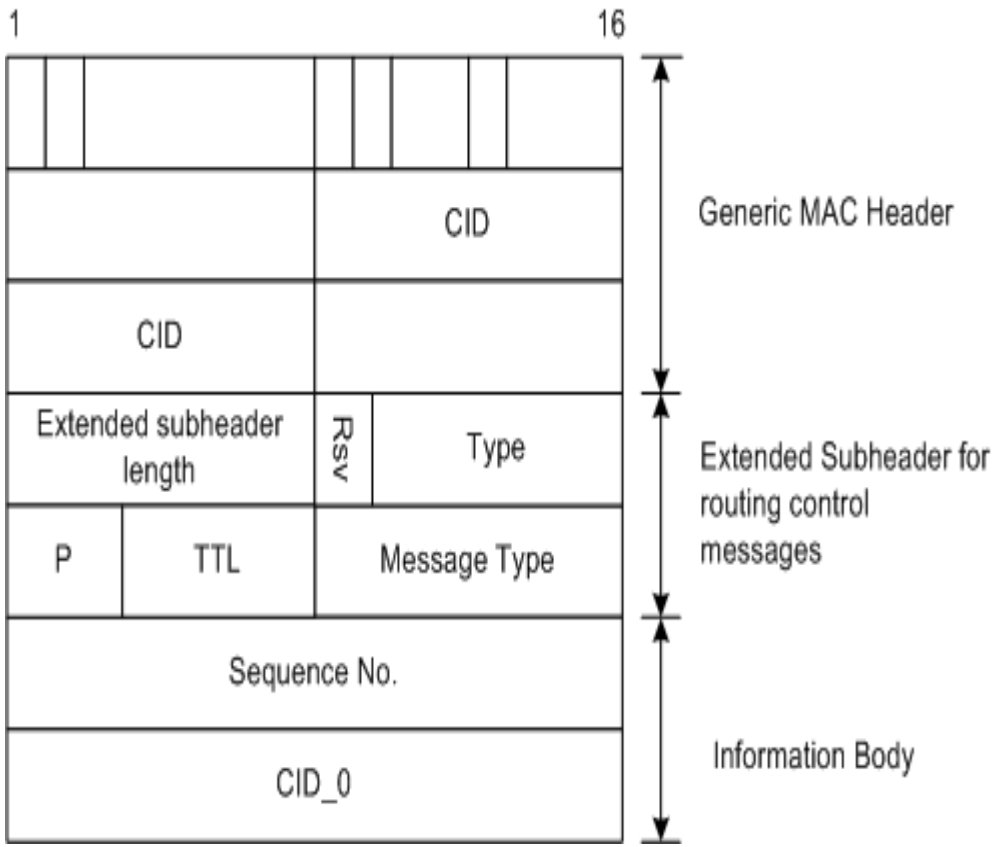


Path Creation Message



- **CID:** forwarding CID.
- **Type:** 7 for DL and 6 for UL
- **Message Type:** path creation
- **P:** Priority.
- **TTL:** time-to-live.
- **Sequence No:** sequence number of the message.
- **CID_0:** path CID.
- **CID1 — CIDn:** the forwarding CID of RSs on the path.

Path Creation ACK



- **CID:** forwarding CID
- **Type:** 7 for DL and 6 for UL
- **P:** Priority
- **TTL:** Time-to-Live
- **Message Type:** Path creation ACK message
- **Sequence No:** Sequence number.
- **CID_0:** Path CID.