RRC System Architecture - Complete MANET Implementation

RRC Middleware (rrc100)

c)

TDMA Slot Coordinator
- TDMA_SlotInfo tdma_slot_table[8]
- Slot assignment logic
- assign_tdma_slots()
- check_slot_conflicts()
- update_tdma_slot_assignments()
- Spatial reuse management

Uplink Processor
- Bidirectional data flow
- rrc_process_uplink_frame()
- forward_olsr_packet_to_l3()
- deliver_data_packet_to_l7()
- rrc_deliver_to_application_layer()
- convert_frame_to_app_packet()

FSM States:
- NULL: System off
- IDLE: Ready for connections
- CONNECTION_SETUP: Establishing resources
- CONNECTED: Active communication
- RECONFIGURATION: Handling mobility
- RELEASE: Cleaning up

PHY Monitor
- PHY_LinkMetrics phy_metrics[32]
- Quality thresholds
- update_phy_metrics_for_node()
- is_link_quality_good()
- Link quality monitoring
- Route quality triggers

FSM State Manager
- RRC_SystemState current_rrc_state
- RRC_ConnectionContext connection_pool[8]
- rrc_fsm_stats
- rrc_handle_power_on()
- rrc_handle_data_request()
- rrc_handle_route_change()
- rrc_periodic_system_management()
- rrc_transition_to_state()

Neighbor Discovery
- NodeCapability neighbor_capabilities[32]
- neighbor_stats
- parse_hello_packet_capabilities()
- update_neighbor_capabilities()
- get_neighbor_capability()
- cleanup_stale_neighbors()

Packet Processor
- process_custom_packet()
- map_data_type_to_priority()
- create_frame_from_rrc()
- enqueue_to_appropriate_queue()
- rrc_process_application_packet()
- Priority-based processing

Application Layer (L7)

CustomApplicationPacket
- uint8_t src_id
- uint8_t dest_id
- RRC_DataType data_type
- TransmissionType transmission_type
- uint8_t data[16]
- size_t data_size
- uint32_t sequence_number
- bool urgent

Static Memory Manager
- ApplicationMessage message_pool[16]
- PHY_LinkMetrics phy_metrics[32]
- NodeCapability neighbor_capabilities[32]
- TDMA_SlotInfo tdma_slot_table[8]
- init_message_pool()
- get_free_message()
- release_message()
- Static allocation only

External Team APIs

TDMA Team (L2)
- tdma_check_slot_available(next_hop, priority)
- tdma_request_nc_slot(payload, len, slot*)
- Slot management only
- No internal scheduling logic

PHY Team (L1)
- phy_get_link_metrics(node_id, rssi*, snr*, per*)
- phy_is_link_active(node_id)
- phy_get_packet_count(node_id)
- Link quality metrics
- Radio hardware abstraction

OLSR Team (L3)
- olsr_get_next_hop(dest_id)
- olsr_trigger_route_discovery(dest_id)
- Routing decisions only
- No internal routing logic

c Integration (L2)

Priority Queues
- analog_voice_queue (PTT Emergency)
- data_from_l3_queue[0-3] (Voice, Video, File, SMS)
- rx_queue (Relay)
- olsr_hello_queue (Network Control)
- enqueue(queue*, frame)
- dequeue(queue*)
- is_empty() / is_full()

Frame Structure
- uint8_t source_add
- uint8_t dest_add
- uint8_t next_hop_add
- bool rx_or_l3
- int priority
- DATATYPE data_type
- char payload[16]
- int payload_length_bytes

Static Allocation Benefits:
✓ No malloc/calloc/free
✓ Deterministic memory usage
✓ Real-time friendly
✓ ARM Cortex-A53 optimized
✓ Zero memory fragmentation

Connection labels: TX/RX coordination · Bidirectional flow · Delivered packets · Slot management · Quality metrics · Route queries · Capability coordination · Routing decisions · Metrics storage · Connection management · Capability storage · Message allocation · Input packets · Uplink frames · Downlink frames · Frame structures