Interview Challenge

Kamaraj Barathraj
+65 98465581 (WhatsApp)

Challenge Solution Overview - Part 1

1. Stations are determined to be free or busy based on a occupied flag
    a. occupied = 0 (free)
    b. occupied = 1 (busy)
2. All stations broadcasts its own PAN ID, channel and occupied flag
3. Robots will wait at a pre-charging location and search for available stations
4. Robot will contact a station that is free and attempts communication by sending information about itself
5. Station, upon receiving, will change to occupied = 1. Then creates a session token, communication start time and communication frequency to send to robot

Challenge Solution Overview - Part 2

6. Both station and robot will begin real time communication of their statuses. This will not stop until robot leaves charger or error occurs
7. Robot will attempt to dock to station by moving from pre-charging location to the station itself
8. RT messages from robot will update station of when it has docked and is ready to charge. Station will begin charging from the status received
9. When Robot's battery is full or is tasked to undock, it will send a undocking status or charge complete status. Station will stop charging
10. Robot will finally send a 'bye' message to close session. Station will reset session token, after a delay, will reset occupied to 0

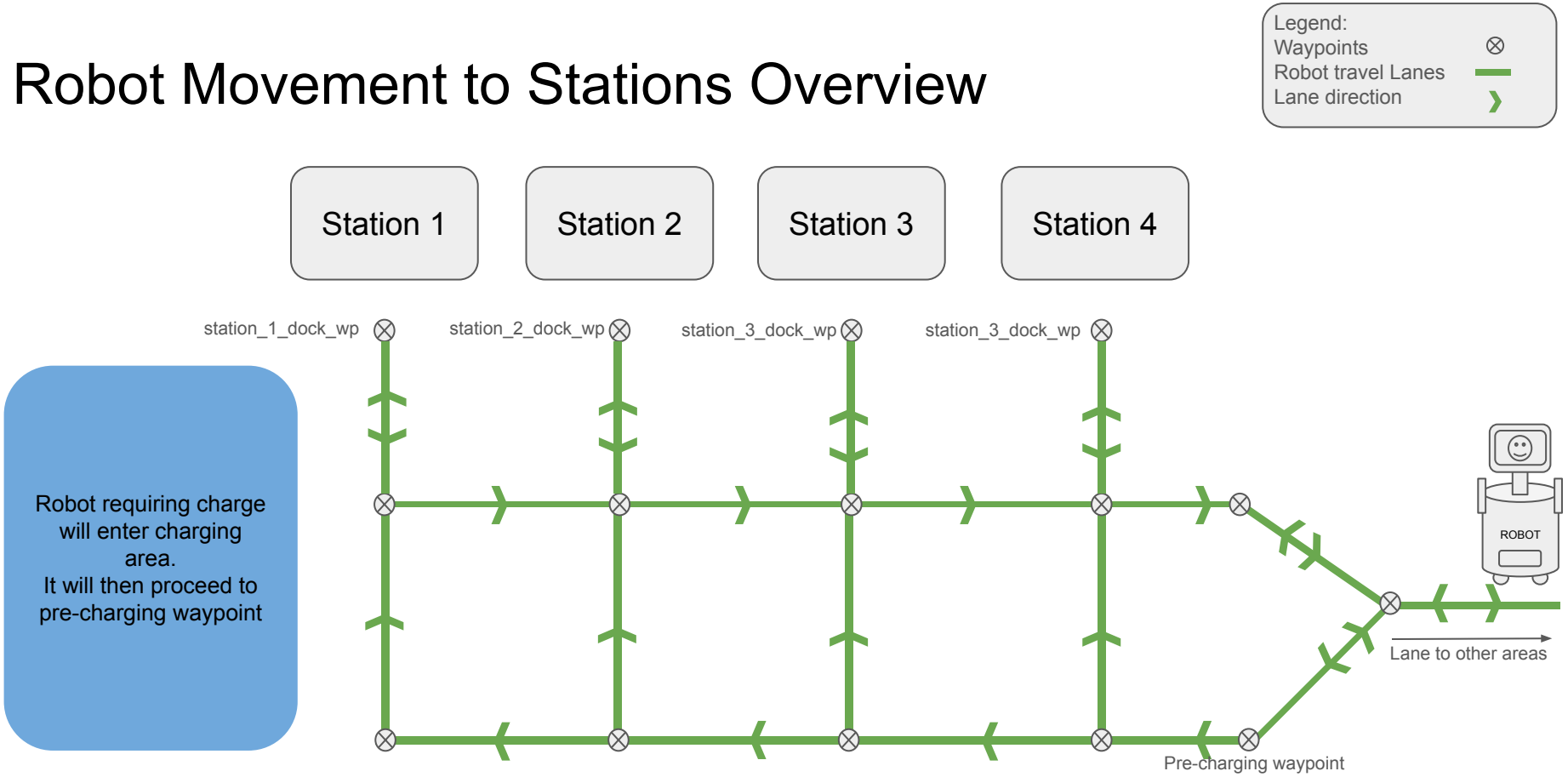
Data structure for MCU A and MCU B

- StationChoice is the data that the station will broadcast and robot will receive to choose stations
- HelloMsg is the robot's payload at contacting the station on first connection
- AcceptMsg is the station's response on accepting a robot's connection
- RTDataMsg is the parameters sent during the real-time message exchange. Both station and robot will use this actively
- ByeMsg is the robot's final message to complete the session

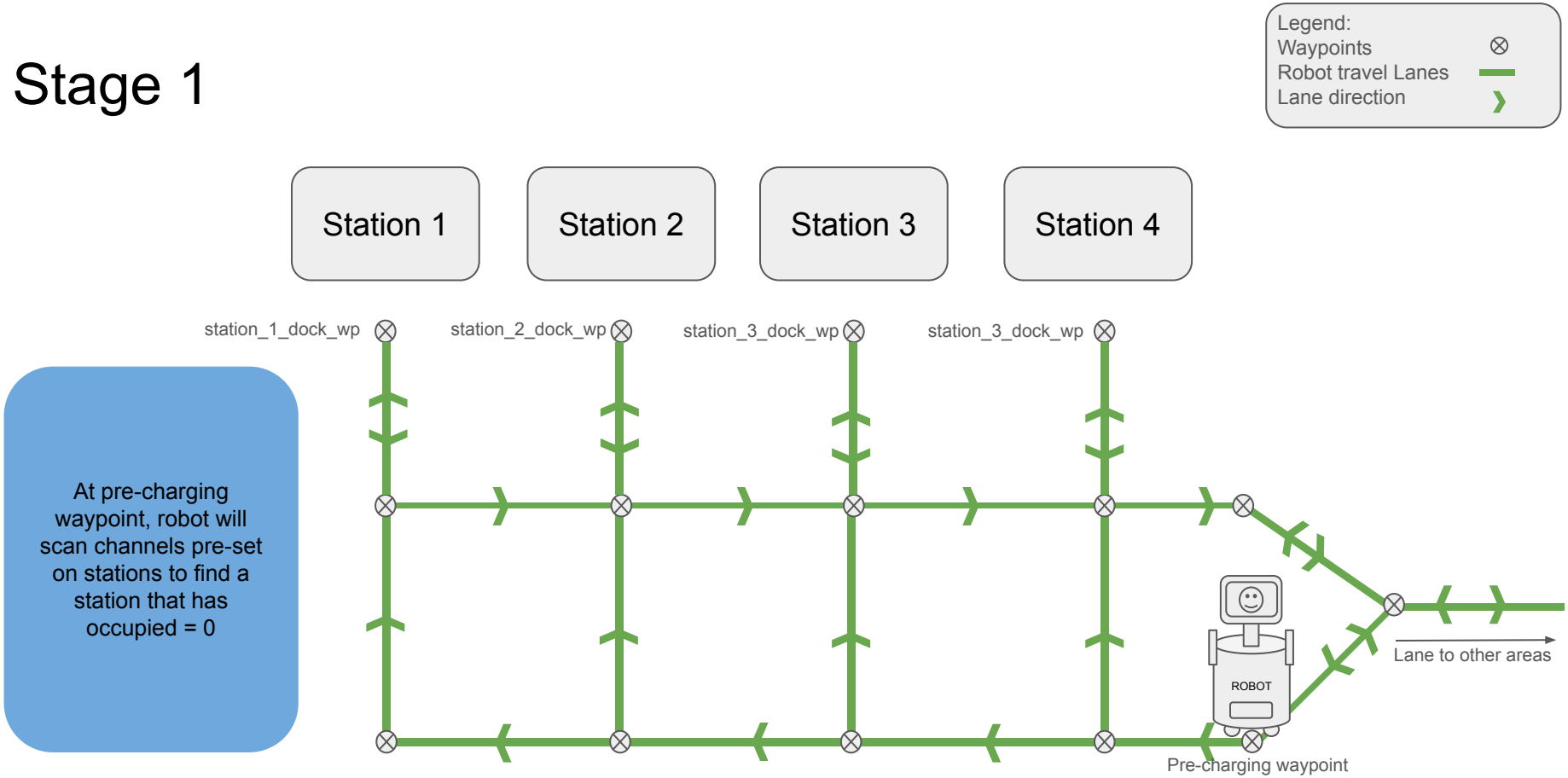
```
struct StationChoice
{
    bool valid{false};
    uint16_t pan_id{0};
    uint8_t channel{0};
    int8_t rssi_dbm{-127};
};

struct HelloMsg
{
    uint8_t robot_id;
    uint8_t hs_payload[100]; // simulation 100 bytes for handshake message
};
```

```
struct AcceptMsg
{
    uint16_t session_token;
    uint32_t start_time_ms;
    uint16_t period_ms;
};

struct RTDataMsg
{
    uint16_t session_token;
    uint8_t seq;
    uint8_t battery_percent;
    bool charging;
    uint32_t timestamp_ms;
    uint8_t rt_payload[50]; // simulate real time payload of 50 bytes
    bool docking;
    bool docked;
};

struct ByeMsg
{
    uint16_t session_token;
};
```

Robot Movement to Stations Overview



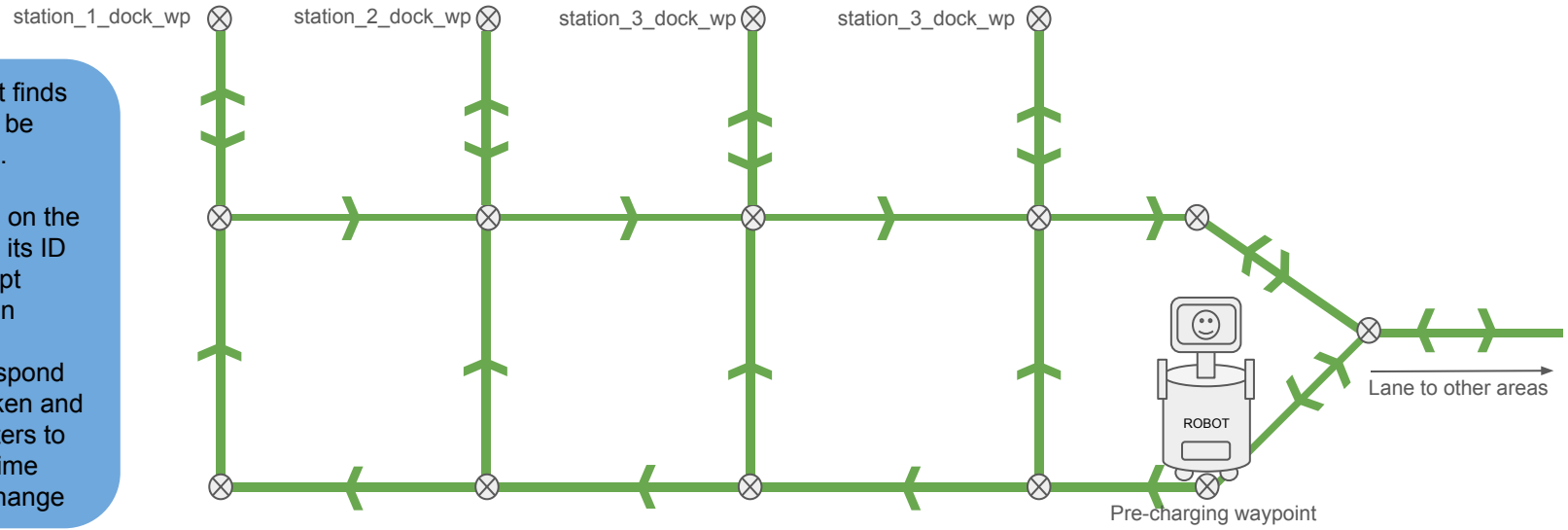
Stage 1


Legend:
Waypoints
Robot travel Lanes
Lane direction
Station 1
Station 2
Station 3
Station 4
station_1_dock_wp
station_2_dock_wp
station_3_dock_wp
station_3_dock_wp
At pre-charging waypoint, robot will scan channels pre-set on stations to find a station that has occupied = 0
ROBOT
Lane to other areas
Pre-charging waypoint

Stage 2

Legend:
Waypoints
Robot travel Lanes
Lane direction

Station 1 | Station 2 | Station 3 | Station 4



Let's say robot finds station 2 to be available.

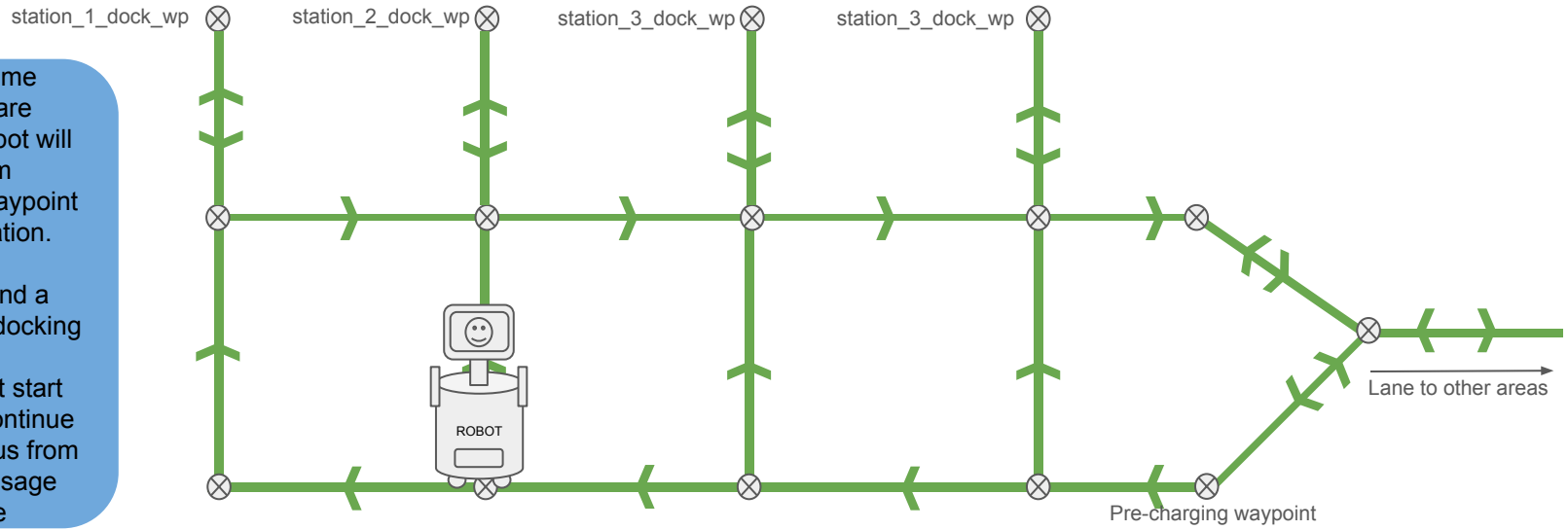
Robot will send on the same channel its ID and attempt connection

Station will respond with session token and other parameters to begin real-time message exchange

Stage 3

Legend:
Waypoints
Robot travel Lanes
Lane direction

Station 1 | Station 2 | Station 3 | Station 4

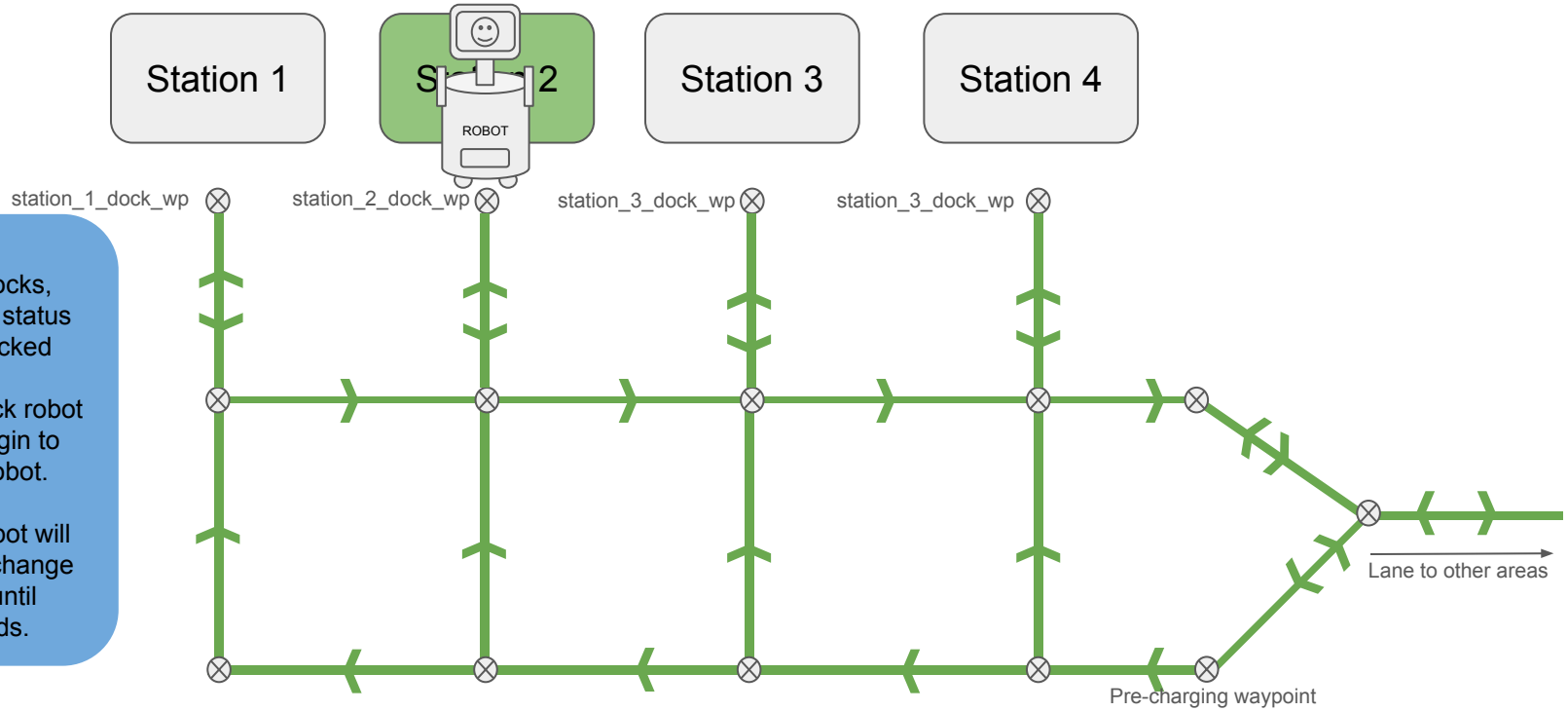


While real-time messages are exchanged, robot will move from pre-charging waypoint to dock to station.

Robot will send a status that it is docking

Station will not start charging but continue monitoring status from real-time message exchange

Stage 4

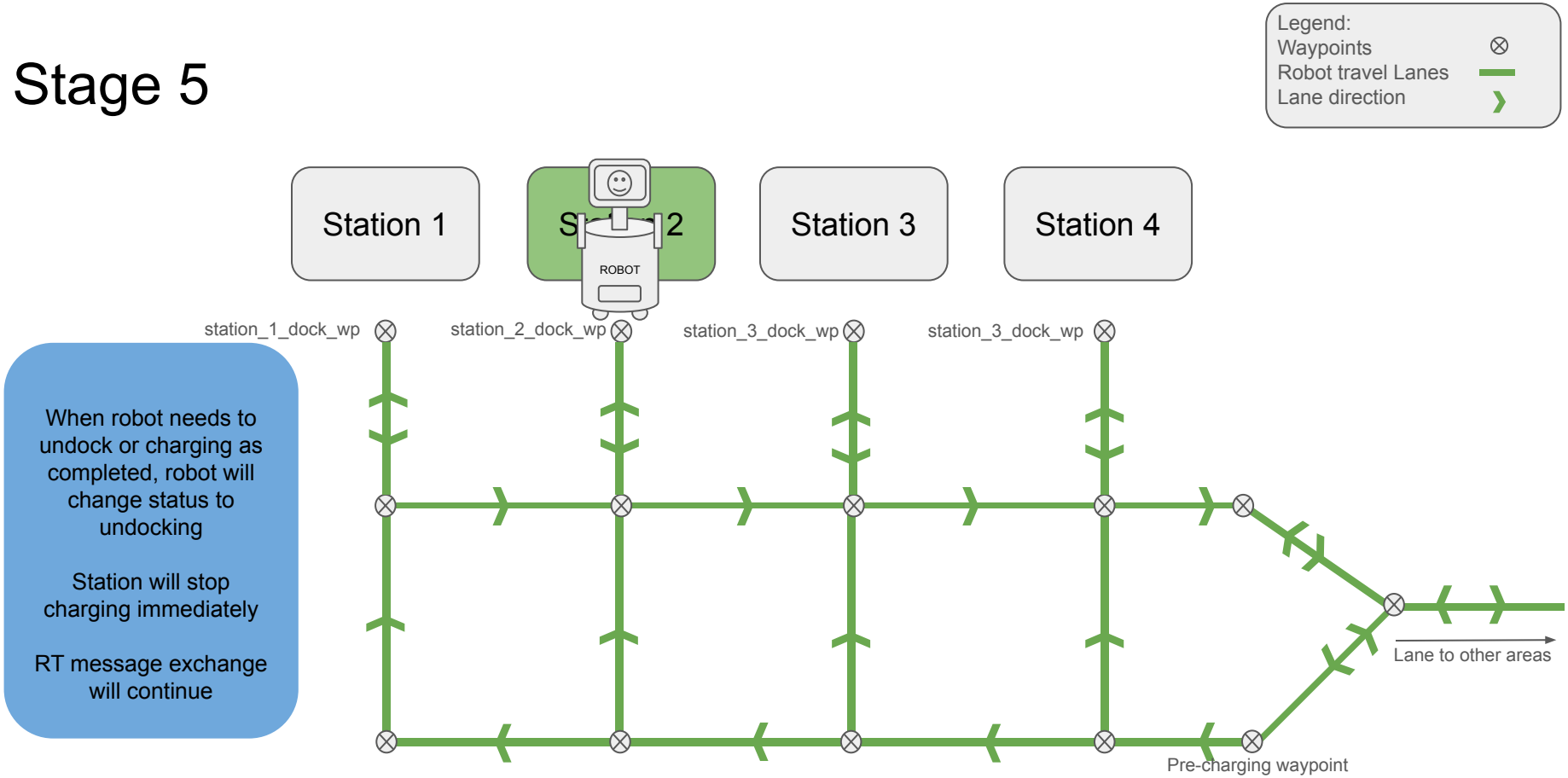


After robot docks, robot will send status that it has docked

Station will check robot status and begin to charge the robot.

Station and robot will continue to exchange messages until session ends.

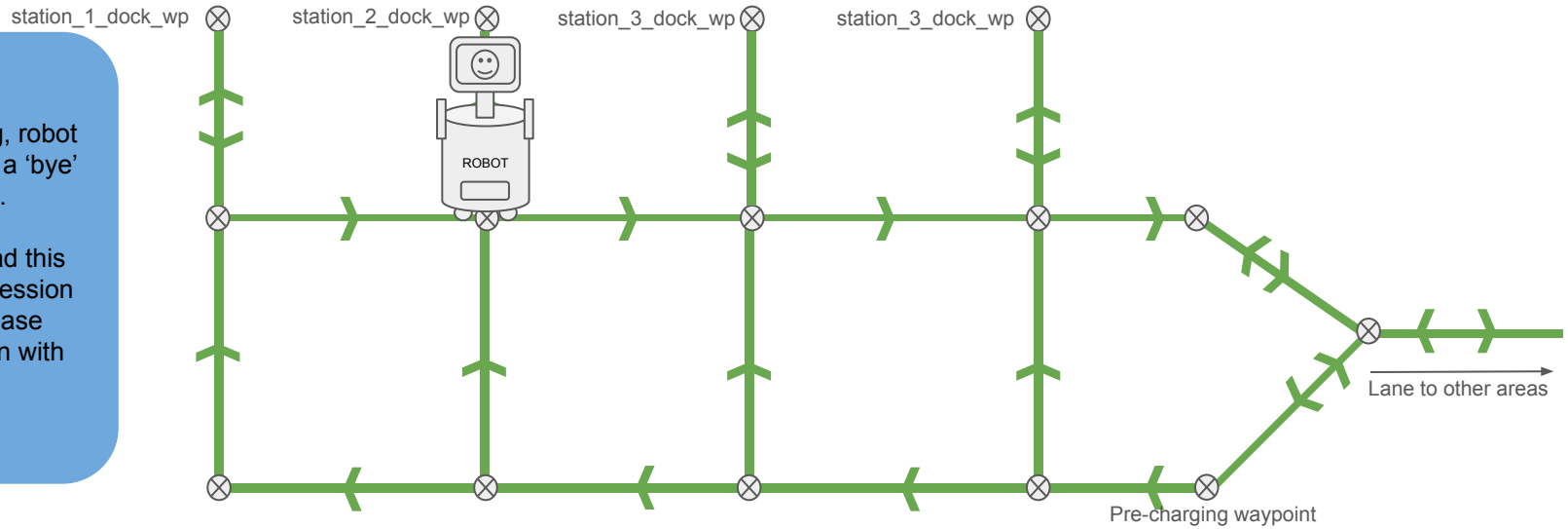
Stage 5


Legend:
Waypoints
Robot travel Lanes
Lane direction
Station 1
Station 3
Station 4
ROBOT
station_1_dock_wp
station_2_dock_wp
station_3_dock_wp
station_3_dock_wp
When robot needs to undock or charging as completed, robot will change status to undocking
Station will stop charging immediately
RT message exchange will continue
Lane to other areas
Pre-charging waypoint

Stage 6

Legend:
Waypoints
Robot travel Lanes
Lane direction

Station 1 | Station 2 | Station 3 | Station 4



After undocking, robot will finally send a ‘bye’ message.

Station will read this and reset the session token to release communication with robot

Stage 7 - Final