MiR network requirements

Technical Documentation

Documentation for software release 2.X.X

Table of contents

1   Introduction

This document specifies general network requirements for the MiR robots and MiRFleet. The following sections cover which network standards, security protocols, IP configurations, ports and DNS servers must be used and why.

2   Wireless antenna

The small antenna shipped with the robot is used for connecting the robot to your in-house wireless network. It is designed for 2.4GHz and it does not have a powerful gain. Therefore, consider replacing it with an antenna that suits your network.

The placement of the antenna is very important. If you put a metal case on top of the robot, you must relocate the antenna.

3   Wireless network standards

The robot can use five main wireless network standards. A compatibility level of these is detailed below.

- Compatible as default:
    - **802.11a**
    - **802.11b**
    - **802.11g**
- Compatible with minor modification: *
    - **802.11n**
    - **802.11ac**

    * These standards sometimes have incompatibility problems with Linux-based systems and to interfere with other standards. Therefore, these have been disabled in the robot starting from versions 1.9.14 and 2.0.14 but may be reactivated in the WiFi settings menu of the robot if required.

4   Network security

The MiR robots support different security protocols for wireless networks. All compatible protocols are listed below:

- **Open**
- **WPA/WPA2 Personal**
- **WPA/WPA2 Enterprise**:
    - LEAP
    - PEAP
    - EAP-TLS: Certificates only accepted in *.pem or *.p12 format.

Note: The robot is also able to connect to a hidden SSID.

5   IP configuration of the robots

By default, the robot is set up to use DHCP, but the robot also supports setting up a static IP from the user interface. If this option is used, the user can specify the IP, netmask and gateway for the robot.

Note: The robots only work with IPv4. The system is not compatible with IPv6, and this is disabled internally in the robot.

6   Ports

All ports stated below are open on the robot's own network (the internal router). If any of the listed functionalities are to be used on an external network (e.g. your company network), these ports must be opened.

- **Port 22**: needed for access through SSH (Secure Shell) for MiR personnel.
- **Port 80**: needed to access the Robot interface of the robot.
- **Port 502**: required if Modbus is used through the company's network.
- **Port 8080**: used for communication through the REST protocol. This port MUST be open if the robots are used in MiRFleet or if you control the robots through REST commands.
- **Port 8888**: needed to access the recovery Robot interface of the robot. This interface allows you to connect the robot to a WiFi network, connect it remotely for technical support or restore to an old version of the software or the database.
- **Port 9090**: used for ROSbridge, a communication suite that allows interaction between non-ROS programs (like a web interface) and ROS (Robot Operating System) based devices like MiR robots. If this port is blocked, certain functions of the Robot interface, for example the manual joystick will not work.
- Ports in range **43001** to **48000**: Used for remote access for MiR personnel. The remote connection can be enabled and disabled through the robot interface. This port range can be left closed if remote support is not requested.

7   DNS

MiR robots can work with company-specific DNS servers. Per default the robots have the Google DNS: 8.8.8.8 and 8.8.4.4

8   Requirements for WLAN

- Minimum bandwidth of 1 Mbit per robot with a maximum latency of 150 mS.

- Signal strength not less than -75 dBm. Signal to noise level 20 dB.

- Full coverage of WiFi signal throughout the travelling path of the robot.

Note: The robots will be able to perform some tasks under worse conditions than mentioned above; however, key features such as collision detection, auto-charging / staging, Limit-robot zones (Fleet), data synchronisation between robots and fleet order execution will not work fully.

9 Requirements for MiRFleet

- MiRFleet must be connected to the network through Ethernet - do not use WiFi for MiRFleet.

- MiRFleet must be in the same physical location as the robot. Geographical distance will cause delay between MiRFleet and robots.

10 Tips for improving connection between the robot and your network

- Turn down signal power of internal router.

- Switch the channel of the internal router so it does not interfere with the company WiFi.

- Put a better antenna on the robot and/or move the antenna to a better location.

- Make sure that "load balancing" on the access points are turned off for the robot. It needs to be able to roam freely.

- To secure that roaming happens without any authentication errors, make sure that the company network access points are controlled by the same controller if there is a WLAN controller.

11 Change log

Version	Date	Changes
0.1	13.09.2017	Document created
0.2	06.11.2017	Release review
0.3	21.02.2018	Protocol errors corrected
0.4	20.08.2018	Full rework + new sections
0.5	13.02.2019	MiR500 and MiRFleet added to scope. Changes to sections Network security and Ports