



# MESHMERIZE

## AGV Connectivity Solution

### Summary

Automated Guided Vehicles (AGVs) and Autonomous Mobile Robots (AMRs) are key robotic systems in factories and logistics centers, responsible for transporting goods alongside human workers. These robots range from compact units to larger machines for heavy loads.

Their reliability is crucial for customer operations, relying on their continuous, efficient function. Seamless communication between AGVs/AMRs and the Warehouse Management System (WMS) is vital for efficient order processing, workload distribution, and safety.

Advanced AGVs/AMRs use swarm intelligence within a fully interconnected network. In these scenarios, a resilient, low-latency mesh network is critical to maintain constant connectivity between the AGVs/AMRs and WMS, ensuring 24/7 operational efficiency.

### Key Solution Benefits

- **EXCELLENT RELIABILITY THROUGH MULTI-PATH ROUTING**  
No single point of failure, all devices are APs.
- **HIGHLY MOBILE SYSTEMS**  
Fast roaming by cooperative node connecting.
- **ENABLE SWARM INTELLIGENCE**  
Direct mesh connections support swarm intelligence, even with sub-swarms.
- **SOFTWARE PRODUCT**  
Hardware-independent, compatible with most industrial APs and robots.
- **LEAVE CONNECTION TROUBLES TO THE EXPERTS**  
Meshmerize and the integration partners ensure a network for continuous operation.
- **RESILIENT NETWORK BACKUP**  
Reliable partner in mission critical operations.
- **HIVE - NETWORK MANAGEMENT**  
Automating deployment and network operation with cloud-based Hive management.



## How does it work?

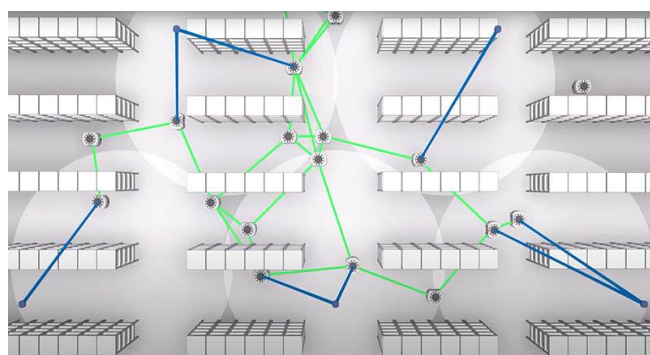
Meshmerize provides a software upgrade for industrial connectivity hardware used in AGVs/AMRs.

By deploying a multi-path mesh network to connect to multiple access points simultaneously, Meshmerize creates a very reliable, low-latency overlay network.

As a result, the likelihood of disconnections due to rapid movement - roaming is virtually eliminated, allowing the AGVs/AMRs to operate at full speed without the need for manual intervention.

Meshmerize - enabled access point infrastructure is installed specifically for reliable mesh operation as anchor points, or integrated into existing Wi-Fi infrastructure as an update. Meshmerize closely works with system integrators to ensure flawless integration between the robot vendors and end customers.


In addition to enabling swarm intelligence applications to leverage direct connections between robots, Meshmerize also significantly enhances throughput and reduces manual labor costs.



## Hardware selection

Implementing Meshmerize in warehouses offers flexibility in the hardware selection, allowing customers to choose from a selection of devices that suit their specific needs.





## Static hardware recommendations

The primary devices are installed as static hardware throughout the site to provide comprehensive network coverage. They are strategically positioned, taking into consideration factors like size and obstacles. Detailed tips and suggestions, along with key hardware requirements for static nodes, are provided below for reference.

Key device specifications	
WLAN	802.11 n/ac/ax
Number of Radios	2+
Power	POE (optional) 9-48 VDC
Antenna	Omni / Directional / Helical depending on placement
Suggested Hardware	<a href="#">Acksys AirSeries</a>

More information on the Meshmerize-enabled devices can be found on the individual [device pages](#).



## Mobile node recommendations

In addition to the static hardware installations, Meshmerize also offers to equip mobile nodes, such as shuttles, with hardware to further enhance connectivity in the warehouse. These mobile devices can be equipped with different hardware options to establish additional connections, improving both reliability and coverage in the most challenging areas.

Given the small size of the shuttles and the fact that they carry items on top, deciding on suitable antennas is challenging, as it is difficult to determine where they can be effectively installed. It's advisable to consider Omni, Dash, or Puck antennas for the shuttle, depending on the specific location where they will be mounted.

Key hardware requirements for mobile nodes are provided below.

Key device specifications	
WLAN	802.11 n/ac/ax
Number of Radios	2+
Antenna	Omni / Dash/ Puck
Power	9-48 VDC
Suggested Hardware	<a href="#">Acksys AirSeries</a> , Moxa AWK 1137C

More information on the Meshmerize-enabled devices can be found on the individual [device pages](#).

# Mesh Performance

Depending on the choice of hardware, Meshmerize AS/RS solution provides reliable network coverage and failover ability in the event of a fiber breakage.

Minimum / Average / Maximum expected Throughput Mbits/sec			
	1 hop	2 hops	3 hops
<b>Acksys Air Series</b>	24/ <b>34</b> /40	6/ <b>10</b> /15	2/ <b>4</b> /7
<b>Moxa AWK 1137C</b>	20/ <b>39</b> /47	1/ <b>5</b> /11	1/ <b>3</b> /8

Minimum / Average / Maximum expected Latency ms			
	1 hop	2 hops	3 hops
<b>Acksys Air Series</b>	2/ <b>3</b> /6	3/ <b>5</b> /10	5/ <b>6</b> /9
<b>Moxa AWK 1137C</b>	1/ <b>5</b> /85	2/ <b>6</b> /43	2/ <b>7</b> /30

The performance figures mentioned above are based on the assumption of accurate setup and configuration. The actual measured numbers can vary due to a range of factors that are beyond the control of the Meshmerize software, including wireless environment, hardware selection, antenna positioning, and other.

If there is a deviation in the measured service quality compared to the provided numbers, it is important to ensure that the setup adheres to our recommendations. If performance issues persist, [Meshmerize Support](#) should be contacted for further assistance.

# Deploying Meshmerize

## Software

Deploying Meshmerize devices involves initial steps of installing Meshmerize and setting up a default configuration. Depending on the chosen hardware, Meshmerize may come pre-installed, requiring only activation. If Meshmerize is not included in the factory firmware, installation instructions specific to the device can be found on the device's respective page. At this stage, all Meshmerize instances will be unlicensed.

For assistance, the [Meshmerize Quick Start Guide](#) provides detailed instructions on get started with the first Meshmerize installation, connecting to devices, setting up Meshmerize, installing a license, and customizing configurations.

## Configuration

For optimal performance of the wireless network, adapting the wireless configuration of the devices to suit the specific deployment environment and its surroundings is necessary.

This is to ensure that the network avoids unwanted external interference. Configuration of the mesh network should be done to operate on a Wi-Fi channel that is isolated for the specific deployment.

Achieving the highest possible Wi-Fi transmission speeds requires selecting the least occupied frequency available.

### Meshmerize - Quick Start Guide

User guide for first steps after successful installing MeshmerizeOS

#### Meshmerize - Quick Start Guide

This guide leads you through the necessary steps to successfully deploy and test the Meshmerize mesh network. The primary goal is to ping multiple devices from your computer.

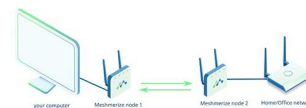
To achieve this, the guide will walk you through the following key steps in detail:

1. Meshmerize out-of-the-box Test
2. Connect to your Meshmerize device
3. Install the Meshmerize license
4. Set up a simple connection between two Meshmerize devices
5. Short introduction on how to configure Meshmerize and general network settings.

Please note that these steps assume that you have already installed MeshmerizeOS on your devices. If you want to know how to install Meshmerize, go to the [respective device's guide installation section](#).

#### Quick out-of-the-box test

Let's start with a quick out-of-the-box demonstration of Meshmerize by connecting your computer to the internet. This requires at least two Meshmerize-enabled devices and a running DHCP server, for instance from your home or office router that you already use. Power on both Meshmerize devices (nodes) and connect the LAN port of your first node with one of the Ethernet ports of your office/home network. Next, connect the LAN port of the second node to your computer. Your setup should look as depicted in the graphic.



Your computer will automatically establish a connection using the DHCP server of your office network to join the network. You should now be connected to the internet through the Meshmerize network, and you can freely move around while enjoying seamless connectivity. To test your internet connectivity, you can use your preferred terminal to `ping meshmerize.net`. Optionally, you can turn on a third Meshmerize device (or more) and place it slightly at a distance to enjoy the range extension of your network.

Voilà! You have a self-healing mesh network.

For more information visit our website without restrictions for 30 minutes after powering up the device. Please

## Support

For inquiries related to open questions or specific requirements and configurations, the [Meshmerize Wiki Documentation](#) or [Meshmerize Support](#) can be referenced for assistance.

# Cloud-based Network Management

Hive is a comprehensive network management tool which allows network monitoring, configuring and control. It is available as a cloud-hosted service, as well as a self-hosted variant if internet access is not possible at the site. Consulting the [Getting Started Guide](#) is advised for detailed steps on how to connect devices to Hive.

Hive enables the execution of a suite of provided actions to configure and customize device settings across the deployment, tailored to each device's role in the network. This ensures proper configuration for all devices fine-tuned for the AGV use case, eliminating manual configuration with individual device handling.



## PERFORMANCE BASED TROUBLESHOOTING

Proactively identify and resolve network issues.



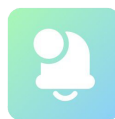
## HASSLE-FREE NODE PROVISIONING

Conveniently add, remove or relocate nodes.



## BIRD'S EYE VIEW OF THE NETWORK

Visualize and accurately position all nodes, both static and mobile, on a map or floor plan.



## ALERTS AND NOTIFICATIONS

Receive real-time alerts on network state changes for quick issue resolution.



## MANAGE DEVICES IN BULK, WITH EASE

Effortlessly modify configurations across multiple devices.



## API INTEGRATIONS

Integrates the network nodes into your other tools, such as the WMS, using RESTful API calls.