visual engineering
LIGHTWARE

Application Notes

Multi-switch AV Network for VINX

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Document Information

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Introduction

1.1. The Purpose of the Document

The design of a VINX AV network is not limited to the application of only one network switch. When more Layer 2 (L2) switches are installed, the VINX system can be expanded to connect dozens of endpoint devices. This document shows the opportunities of a big VINX system through an example of a realized VINX AV network with seven connected L2 network switches.

This application note is about a test system that has been built in Lightware's Test Lab demonstrating the following main numbers:

- There are **7 network switches** in the system, **a core and six connected switches**.
- **63 encoder** and **55 decoder** VINX devices are in the system altogether.

Furthermore, you will find some tips on how to install more VINX devices into this system and/or expand it for even more VINX endpoints.

1.2. VINX Device Concept

The key feature of the VINX series is that the devices can be arranged into an Ethernet-based, distributed virtual matrix. In this network you can achieve point-to-point and point-to-multipoint connections as well. Furthermore, a video wall can be defined with features like scaling or rotating of the image. Besides, further data is handled as different layers like the transmission of RS-232, USB and Infrared signals.

INFO: The USB, Serial, and IR data transmission works independently from the video signal presence.

The working mode between two VINX devices can be **Multicast** or **Unicast**. For this kind of installation all VINX devices are used in **Multicast** mode.

DEFINITION: The **Unicast mode** is for point-point connection: assign an Encoder and a Decoder directly to each other. The devices can be connected directly or via the L3 switch.

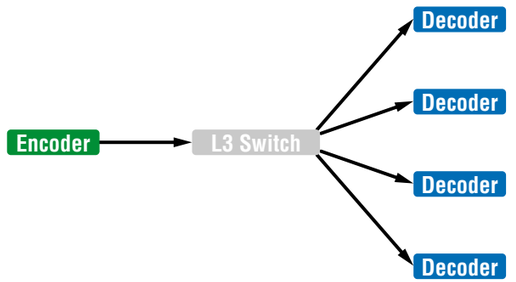
DEFINITION: The **Multicast mode** is for point-multipoint connection: assign an Encoder and many Decoders to each other (L3 switch is a must in this mode).

Unicast Mode (Point-to-Point Connection)

A Decoder is connected to an Encoder device.

Multicast Mode (Point-to-Multi point Connection)

Many Decoder devices are connected to the same Encoder via a network switch.



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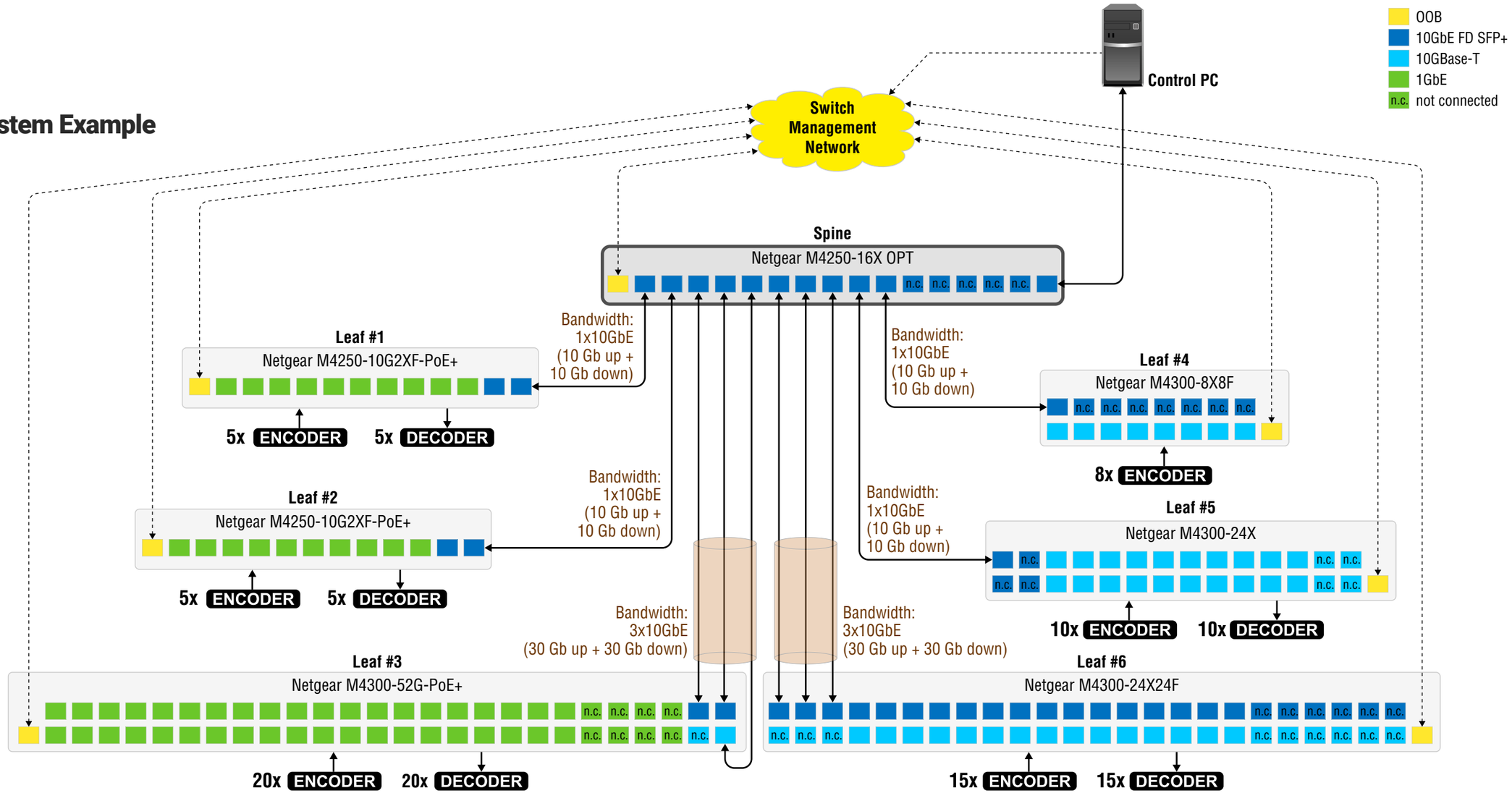
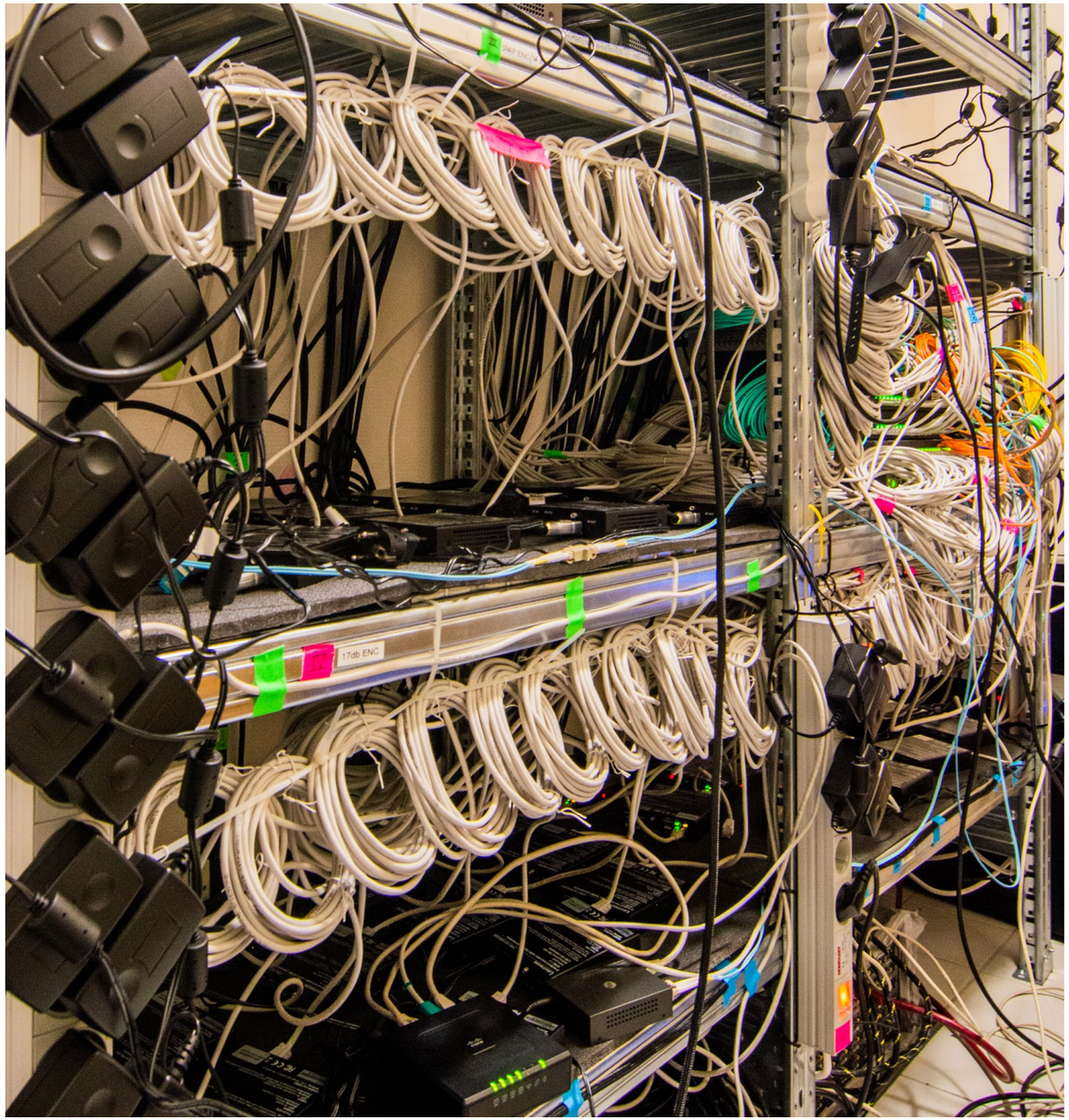
Multi-switch VINX System Example

2.1. System Design

INFO: There are built 3x10GbE uplink between the spine and leaf #3 / leaf #6 switches because of this schematic drawing describes an actually built multi-switch VINX system. It can be also built with 2x10GbE uplink and the recommendation of the switch manufacturer is that even number of ports shall be configured for the LACP groups.





2.2. Technical Background

- The **central unit** is the Netgear M4250-16XF OPT switch with its 10GB-capable Ethernet ports.
- All network switches are **connected to the core switch directly**.
- PoE and SFP modules are supported only by the VINX-AP series devices.
- There is an OOB (Out Of Band) management port on each switch. These ports are connected to a **separate network,** which is used for configuring the switches.
- A **dedicated PC** is connected to the Switch Management Network to arrange the switches and monitor the network traffic.
- **There is one or more Ethernet ports** on the network switches that are dedicated trunk ports. They do the network traffic to and from the core switch.
- The following parameters have been set in **all switches**:
  - IP address setting
  - Jumbo frames
  - Switching fabric
  - Throughput
  - Packet buffer
  - IP Multicast routing entries
  - Multicast IGMP group membership

INFO: The network demonstrated here has been built by the available network devices. Some of them can be replaced with smaller devices (e.g. with less Ethernet ports).

2.3. Network Planning, Designing and Scaling

A VINX device needs 1 GB bandwidth – up or download – depending on the endpoint device: encoder or decoder. That is the base for calculating the cabling and the necessary bandwidth:

1Gb port	1x10Gb port	2x10Gb ports
1 Encoder or 1 Decoder	10 Encoders + 10 Decoders	20 Encoders + 20 Decoders

INFO: Direct or aggregated switch ports can accept 1 encoder or 1 decoder at the same time.

In the latter case two 10Gb Ethernet ports (SFP+) are connected between the core switch and the connected switches to have enough bandwidth.

If you take a closer look at the system diagram, you will see that it can be expanded as follows:

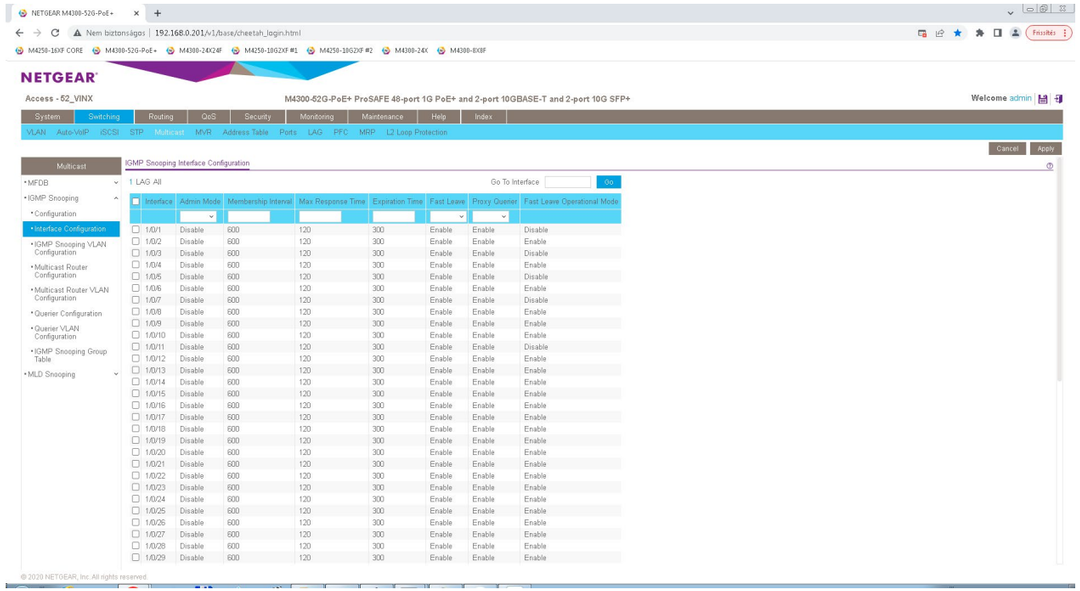
- **Switch #3** has 9 ports that are not used. A further 9 VINX devices (encoder or decoder) can be connected; the bandwidth is enough.
- **Switch #4** has 7 ports that are not used. A further 2 encoders and 5 decoders can be connected.
- **Switch #5** has 7 ports that are not used. A further 6 VINX devices can be connected if another connection is established towards the core switch by a trunk port.
- **Switch #6** has 15 ports that are not used. A further 15 VINX devices can be connected to the switch.

To sum up: with these possibilities a further 37 VINX devices can be connected to the current system.

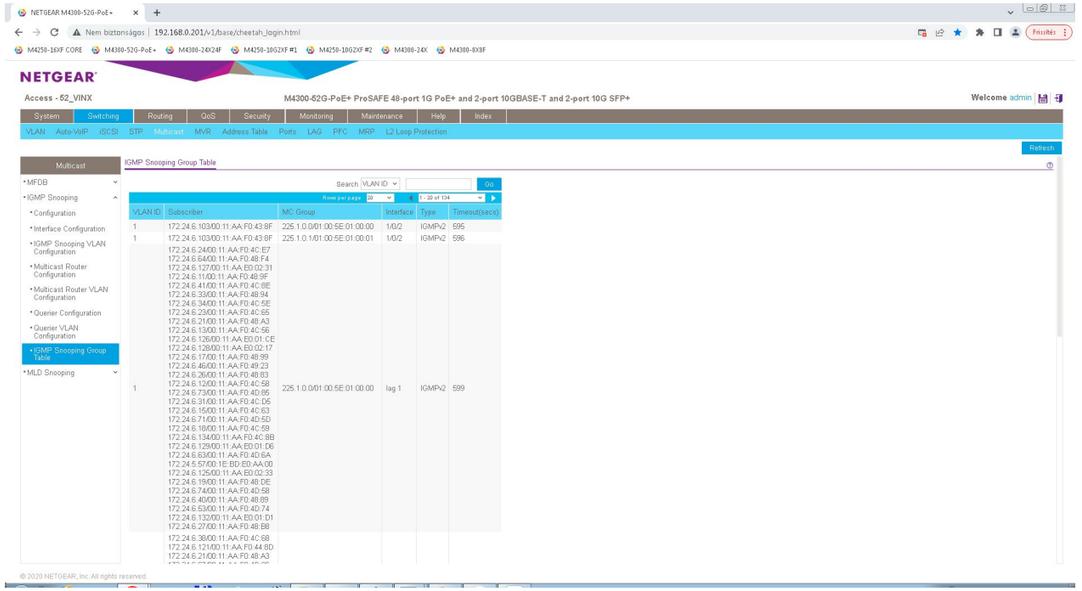
2.4. Brief Overview of the Configuration

The following sections contain screenshots about the control software and web pages of the devices installed in the system.

2.4.1. Core Switch



Port Configuration (Fast leave and Querier are enabled)



IGMP Snooping Group Table

Deep Technical Settings

The important settings and parameters of the nework switches are described in the following Application note:

https://lightware.com/pub/media/lightware/filedownloader/file/Application-Note/Installation_and_Network_Setup_Guide_for_VINX.pdf

2.4.2. Switch Automations

Netgear M4250 and M4300 series network switches have built-in automatic configuration feature. The related settings are the following:

Auto-Trunk

Auto-Trunk provides an effortless ability to configure multiple VLANs onto an uplink Ethernet port or any unused Ethernet port. By simply setting up the pre-configured network profile or VLANs on a specified port, the M4250 automatically configures the enabled, unused Ethernet port (preferably used for interconnect) to support all the VLANs configured on the switch.

Here are the quick and easy steps to verify if Auto-Trunk is enabled globally and is configured to a specific interconnect port:

- Auto-Trunk is enabled by default on all M4250 series switches. Using the AV User Interface, click on 'Network Profiles'. The global Auto-trunk switch should be enabled.
- After the network profiles and specific ports are configured, the enabled interconnect port will display an "A" in the lower corner of the port. In the example below, we used VLAN 1, 3, and 4 for the configured VLANs and Ethernet port 0/9 as the interconnect port.

Auto-LAG

The Auto-LAG feature automatically creates Dynamic LAG between two or more M4250 series switches and have more than one link connected between them. In the M4250 series switches, the Auto-LAG feature piggybacks onto the Auto-Trunk feature. Hence, when there are 2 or more Auto-Trunk ports, the ports will automatically enable Dynamic Link Aggregation Protocol or LACP between the Auto-Trunk ports.

Quick easy steps to verify if Auto-LAG is globally enabled and Auto-LAG is configured onto two or more Auto-Trunk ports:

- Auto-LAG is enabled by Default on all M4250 series switches. Using the AV User Interface, click on 'Link Aggregation'. The global Auto-LAG switch should be enabled and showing green.
- After the Auto-Trunks are created, the specific enabled interconnect port will show an "L1" on the corner on each of the pairs of Ethernet ports showing that they are in Link Aggregation Group mode. In the example below, we used Ethernet ports 0/9 and 0/10. Each port is already configured with Auto-Trunk with VLAN 1, 3, and 4, therefore, we are grouping 2Gbps between 2 M4250 switches.

IGMP Plus™

IGMP Plus automatically configures IGMP snooping for VLANs, which is used to build forwarding lists for multicast traffic. On the M4250 series switches, each of the pre-configured network profiles enable IGMP Plus by default. Therefore, when a network profile is configured for Video or Audio, IGMP Plus is enabled. The following IGMP snooping features are automatically enabled for the VLAN:

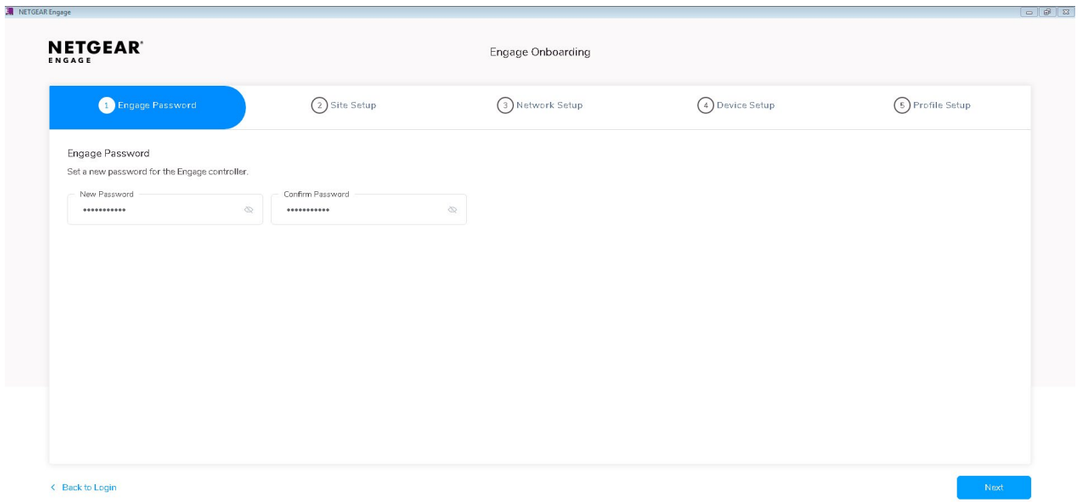
- Admin mode
- Fast-Leave
- Proxy Querier
- Report Flood Mode
- Exclude Mrouter Interface Mode
- Installs reserved Multicast MAC addresses into the system.

2.4.3. Netgear Engage Software

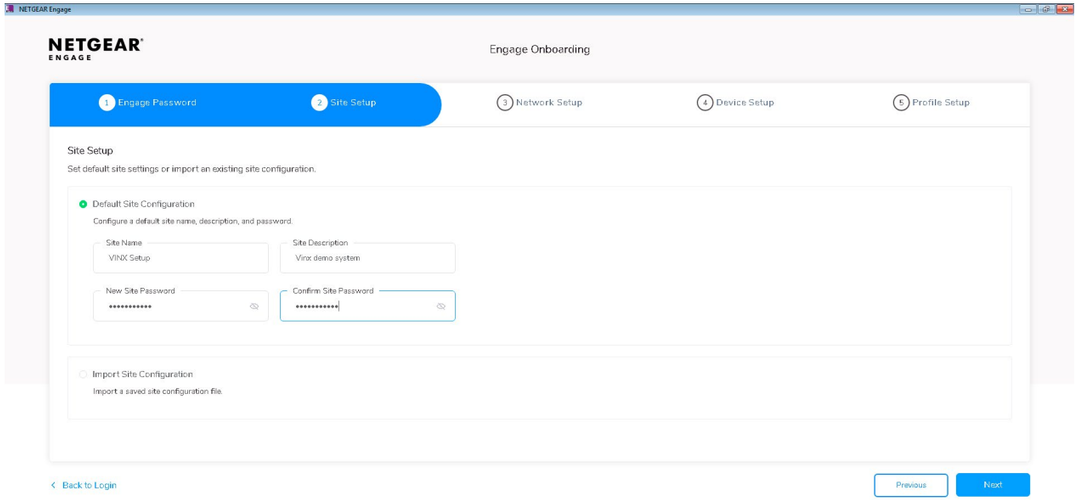
Netgear Engage is a central managent software of M4250 and M4300 series network switches used in AV networks. The tool detects automatically the switches in the network and makes possible to configure the devices easily, applies centralized firmware update in case of compatibilty issues and provides quick overview about your AV system.

Configuration Steps in our Example

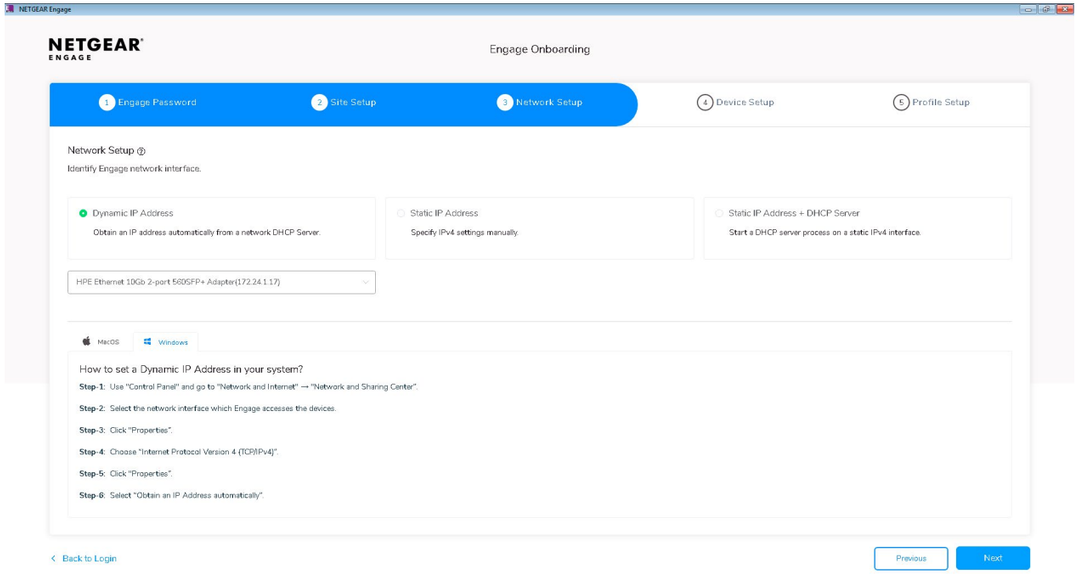
Step 1. Set up a password for the software.



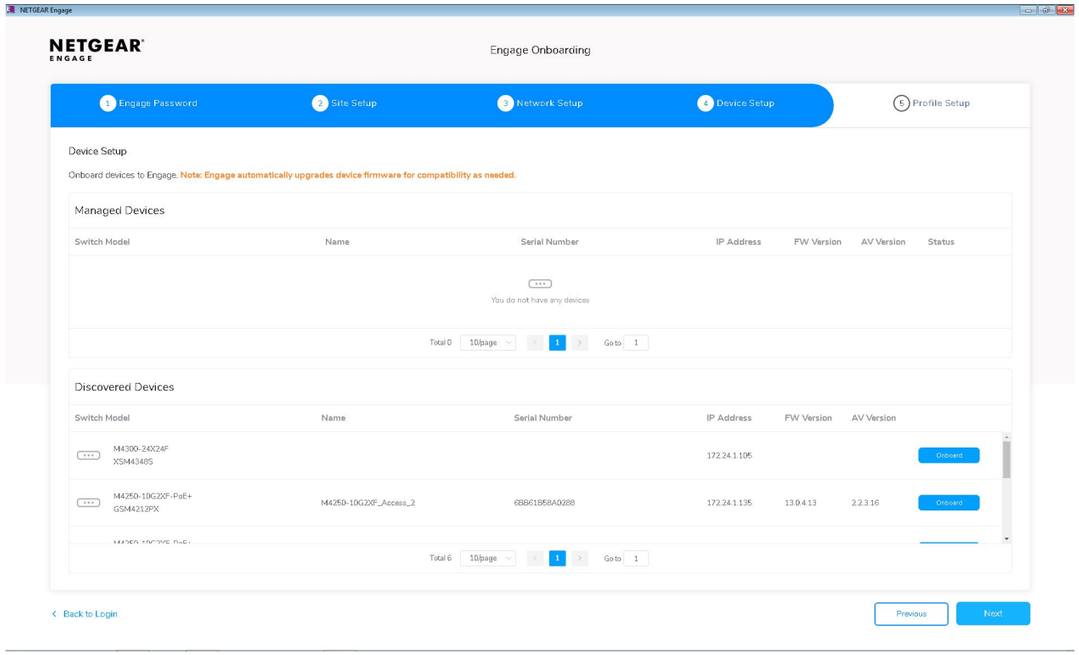
Step 2. Set default site settings or import an existing site configuration.



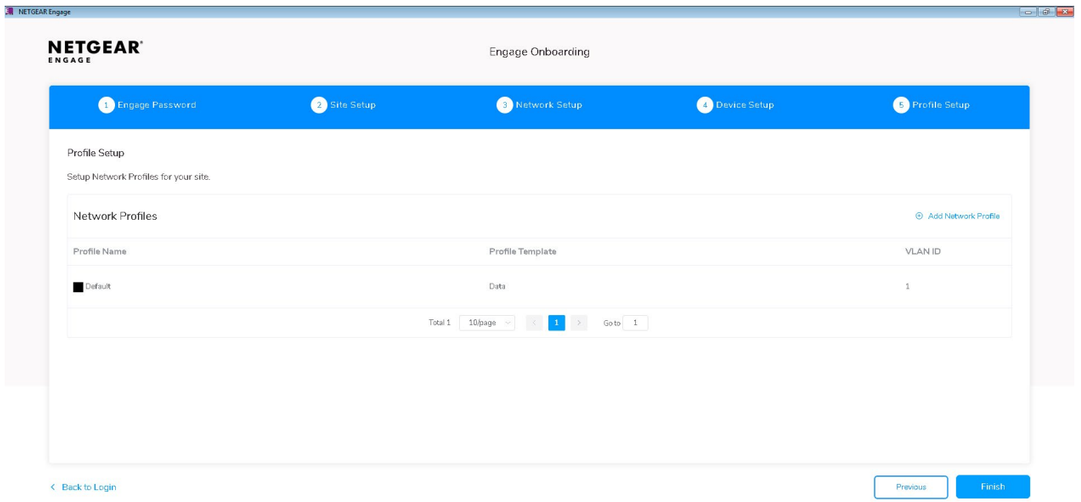
Step 3. Set up the network configuration.



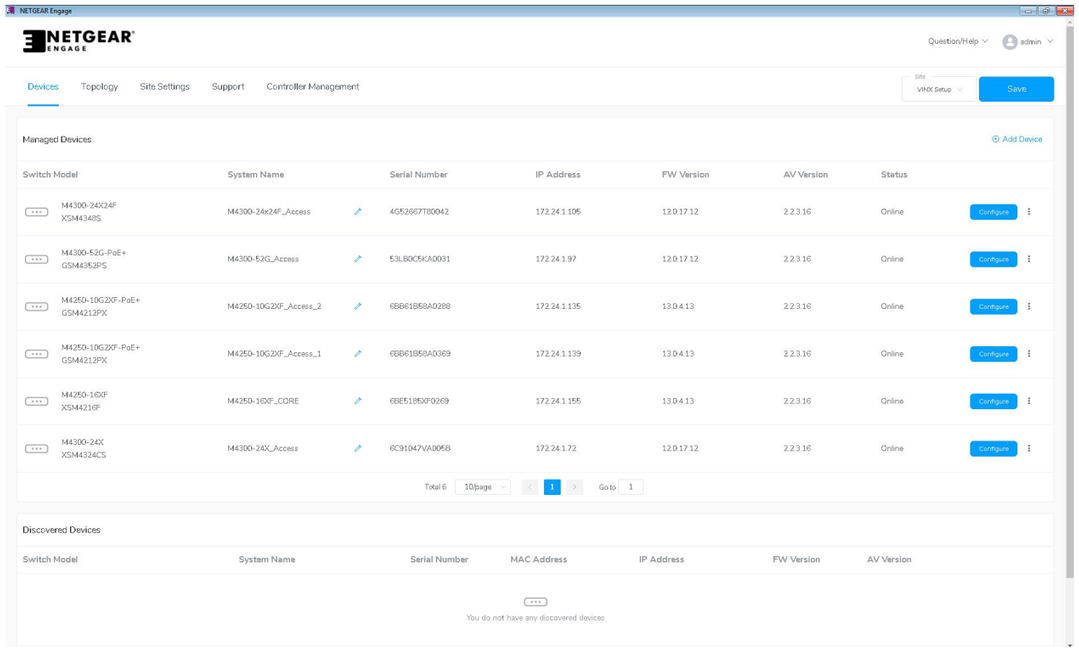
Step 4. Set up the devices on the network.



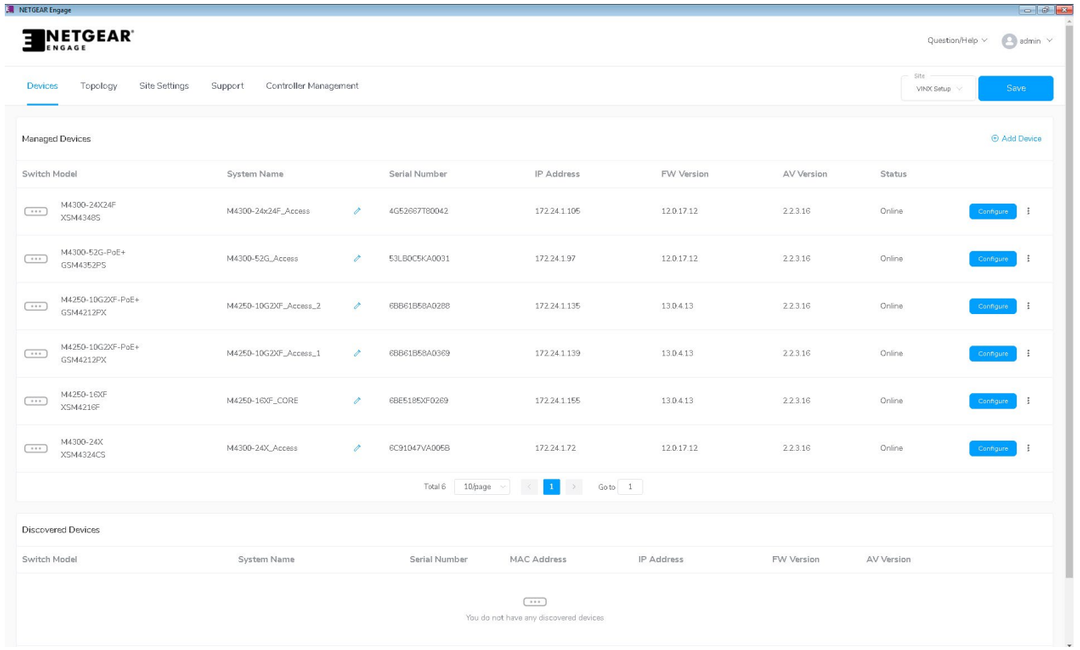
Step 5. Set up the network profile.



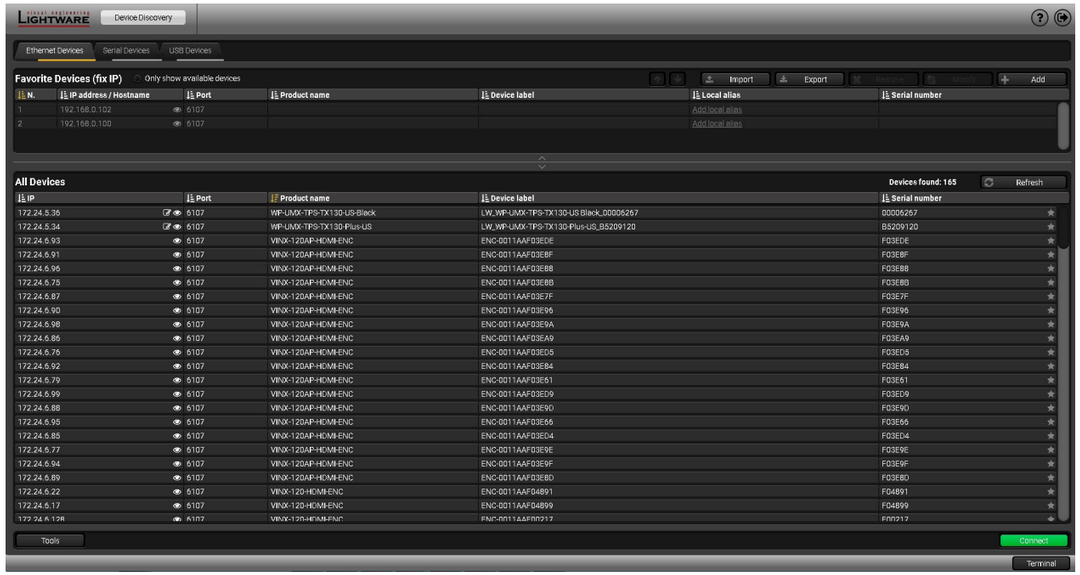
Step 6. Overview of the devices.



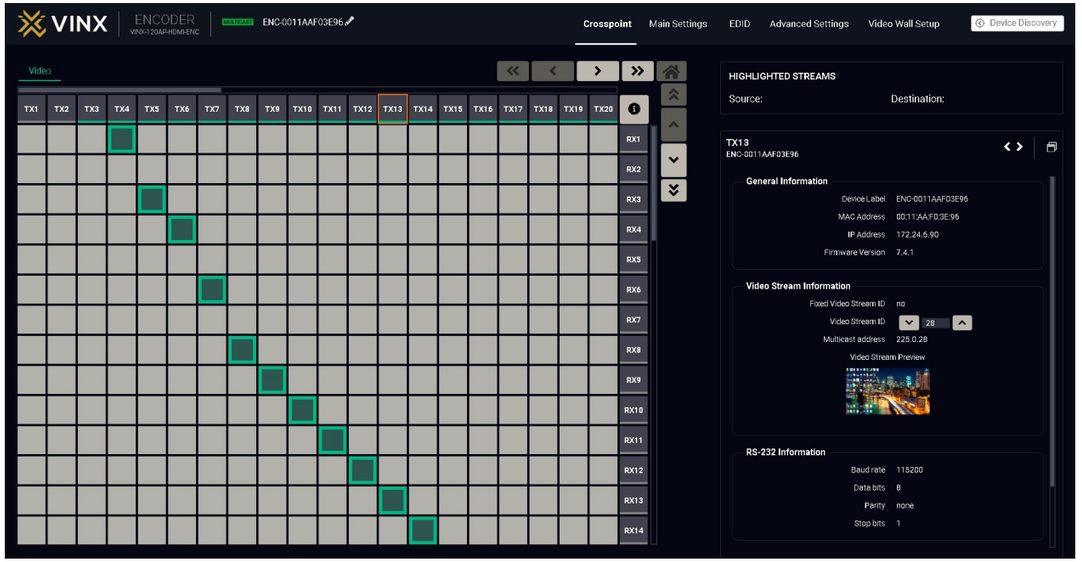
Step 7. Overview of the topology.



2.4.4. Lightware Device Controller (LDC)



Device Discovery Window



Grid View of the Crosspoint