

ATEN HDMI over IP Video Extender System Implementation Guide

Optimizing Your Network with
VE8900 / VE8950 / VE8952 / VE8962 / VE8662



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1. Introduction

The ATEN Networked AV Series delivers visually lossless 1080p/True 4K AV signals with low latency over long distance via a standard Gigabit network. The purpose of this guide is to ensure that installation project managers and site administrators are aware of ATEN's best practice guidelines for appropriate network structure and configuration for use with the ATEN Networked AV Series. The key elements and recommendations for success, including our suggestions for selecting a suitable network switch, will optimize your installation experience with our products and reduce potential problems.

2. ATEN Networked AV Series

The VE8900/VE8950/VE8952/VE8962/VE8662 provides an effective, easy-to-use and economical digital signage solution with many unique features that directly address the challenges system integrators encounter when implementing AV over IP systems.

- **Limitless flexibility and scalability:**

From a simple point-to-point setup, to thousands of endpoints, the ATEN Networked AV Series offers maximum flexibility and scalability, while offering multi-functionality in extender, splitter, matrix switch, video wall and daisy chain applications.

- **Pristine Clear Video Quality with Visually Lossless Compression:**

Achieve visually lossless, high-quality video up to 4096 x 2160 at 60 Hz (4:4:4) with ATEN's advanced compression technology. Extend True 4K HDMI signals over a single Cat5e/6a cable with ultra-low latency for an unparalleled viewing experience.

- **Flexible Mounting Options to Secure Installation:**

The built-in bracket allows the extender to be sturdily mounted in any rack environment, screwed on or zip tied in a network cabinet, or securely snapped on a din rail, ensuring a stable physical setup.

- **PoE & DC Power Redundancy for Better Reliability:**

PoE and DC power redundancy ensures optimum system uptime to sustain uninterrupted AV operations from any unexpected power failures.

- **No Complex IP Setup or Extra Server PCs/Software Required**

Effortlessly switch input sources and manage your AV system via top panel pushbuttons or web GUI with no complicated IP setup or additional server PCs/software required.

- **Effortless and Intuitive Control with Web GUI**

This Web GUI enables you to preview, monitor, and switch video sources while managing display schedules and staying updated on system changes.



Engineered to meet the demands of today's large scale, multi-display 1080p/True 4K signal transmission requirements, but designed to be uncomplicated to set up and easy to use, the ATEN Networked AV Series is suitable for use in a wide range of environments, including trade shows, airports, university campuses, conference centers, and shopping centers.

3. General Recommendations

The following general recommendations for installing your VE8900/VE8950/VE8952/VE8962/VE8662 system on a network have been provided here for easy reference.

- **Preparation**

Build and test the rack and test all hardware components before attending the installation site. Doing so will find any issues before moving to the hectic and time sensitive environment of the install itself. Knowing that a unit was working properly before installation makes it far easier to pinpoint the cause of the problem, saving time and money for your business.

- **Power**

Your installation is nothing without power. Use a UPS (Uninterruptible Power Supply) to ensure a clean, consistent power supply to all components in the rack. Be sure to calculate your total load and run time requirements ahead and leave enough room in the rack.

- **Software/Firmware & Tools**

Where possible ATEN ships all components with the most up-to-date firmware, however before starting any installation please check the downloads section of the products on aten.com to ensure there are no updates to your system components. Also don't forget to [download IP installer](#) – a handy tool to help you identify IPs of your connected units.

All third party hardware also needs to be updated with the latest firmware – particularly switches and TVs. For upgrade instructions please check with the relevant manufacturers.

- **Mounting/Installation**

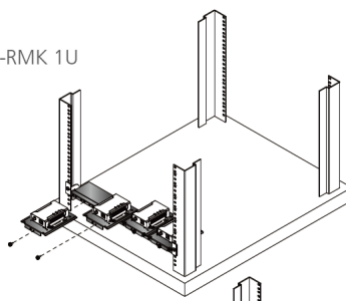
All ATEN products should be mounted so that the logo and text printed on the unit is correctly aligned. This will allow for the optimal airflow through the product. As already stated the vents should not be obstructed with adequate clearance. Units should be secured using suitable fixings.

The correct mounting of devices, particularly in the unforgiving environment of an AV or IT rack, is vital to any successful installation and the VE8900/VE8950/VE8952/VE8962/VE8662.

VE-RMK 1U



VE-RMK 1U



• **Source & Display Settings**

ATEN Networked AV Series uses the highest quality encoders available to provide visually lossless compression over a large number of displays. However, the compression can only be as good as the source content that is put in. ATEN Networked AV Series uses proprietary compression and supports HDCP 1.4. Thus, please make sure the source content supports HDCP1.4 or is without HDCP encryption. (NOT compatible with HDCP2.2) In addition, please make sure to turn off the video wall function of the display.

Supported Video Resolutions

Input Resolutions	Supported Models	
640x480p @ 59.94/60Hz (4:3)	VE8900/VE8950/ VE8952/VE8962/VE8662	
720x576p @ 50/200Hz (4:3)/(16:9)		
720x480p @ 59.94/60/119.88/120/239.76/240Hz (4:3)/(16:9)		
720x576p @ 100Hz (16:9)		
1280x720p @ 23.98/24/25/29.97/30/50/59.94/60/100/119.88/120 Hz (16:9)		
1280x720p @ 29.97/30/50/59.94/60/100/119.88/120Hz		
1440x480p @ 59.94/60Hz (4:3)/(16:9)		
1440x576p @ 50Hz (4:3)/(16:9)		
1920x1080i @ 50/59.94/60/100/119.88/120Hz (16:9)		
1920x1080p @ 23.98/24/25/29.97/30/50/59.94/60/100/119.88/120Hz (16:9)		
2880x480p @ 59.94/60Hz (4:3)/(16:9)		
1680x720p @ 23.98/24/25/29.97/30/50/59.94/ 60/100/119.88/120 Hz		
720 (1440)x576i @ 50/100/200Hz (4:3)/(16:9)		
720 (1440)x480i @ 59.94/60Hz (4:3)/(16:9)		
720 (1440)x288p @ 50Hz (4:3)/(16:9)		
720 (1440)x240p @ 59.94/60/119.88/120/239.76/ 240Hz (4:3)/(16:9)		
2560x1080p @ 23.98/ 24/25/29.97/30/50/59.94/60Hz		
3840x2160p @ 23.98/24/25/29.97/30Hz (16:9)		VE8950/VE8952/VE8962/ VE8662
4096x2160p @ 23.98/24/25/29.97/30Hz		
3840x2160 @ 60Hz (4:4:4)		VE8662/VE8962
4096x2160@60Hz (4:4:4)	VE8962	

4. Network Design

4.1. Choosing the right Cable

Testing & Certification

ATEN products are manufactured and tested to the highest standards but the best installation environment is paramount to successful installation. The only way to guarantee the installation is fit for purpose is to test and certify cables. All IT cable companies will certify cables throughout a network as standard, yet they are passing a fraction of the data in short bursts. Although testing a cable proves that it is correctly terminated, it does not show how much interference on the run is affecting bandwidth. Certification of every cable should always be performed before and after walls are sealed.

Cablings Guidelines

- Ensure source components are located next to encoders with HDMI cables that are as short as possible, as HDMI distances will reduce as content bandwidth increases.
- Use trunking so that cables can be easily replaced down the line.
- Never seal HDMI cables in the wall as they cannot be re-terminated or replaced easily.
- The use of patch panels, wall plates, cable extenders, kinks in cables, and electrical or environmental interference can have an adverse effect on HDMI transmission limiting performance. Steps should be taken to minimize these factors (or remove completely) during installation for best results.

ATEN Suggested Cables & Accessories

2L-7D05H
5 m High Speed HDMI
Cable with Ethernet



2L-7D03H
3 m High Speed HDMI
Cable



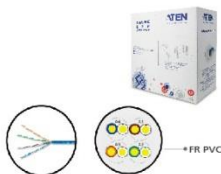
2L-7D02H-1
2 m High Speed HDMI
Cable



2L-29330
300 m HDBaseT 3.0 U/FTP
Cat 6A Cable



2L-2801
305 m Low Skew Cat 5e Cable



2X-EA12
LockPro – HDMI Cable Lock



4.2. Choosing a Network Switch

This section provides various general and specific recommendations for switches to use with ATEN Networked AV Series. However, there is no substitute for testing in real world situations. If you are in doubt about which network switch to use, the safest approach is to select one from the list of recommended switches below.

The Basics

In general, the network switches deployed in ATEN Networked AV Series installation must support the following:

- Gigabit (or faster) Ethernet port
- Multicast forwarding or filtering
- IGMP v2 Snooping (multicast)
- Support for jumbo frames (packets) up to 9216-byte size
- IGMP Snooping
- IGMP Querier
- IGMP Snooping Fast Leave/Immediate Leave
- High bandwidth connection between switches

Types of High Performance Switch

A high performance network switch is the means of a successful VE setup. When choosing a network switch, first select the type:

Layer 2 or Layer 3 Switches

You will need to determine whether you need a layer 2 or a layer 3 switch for your VE network. Layer 3 switches cost more than layer 2 switches because they are more complex and handle more network traffic. The best way to calculate which type of switch you need is to first determine if you will have a dedicated network for the VE devices or if the VE devices will be on a network that shares throughput with other network equipment such as computers, servers and printers. If they share the network with other devices its best to consider a layer 3 switch and use layer 2 switches exclusively for the VE device connections. For larger installations we recommend using Layer 3 switches.

The major differences are:

- Layer 3 Switch:
IP addresses in packets are examined and intelligent forwarding decisions are made. On a larger network broken into subnets across long distances, a layer 3 switch becomes the best choice as they

can improve network efficiency and provide better traffic flow. They are better at directing more traffic to different locations on a larger more complex network, and with layer 2 switches working below them.

- **Layer 2 Switch:**

Packets are examined and forwarded using only the MAC address. If you have a small central network, a layer 2 switch should do the job. If the network is exclusive and will only transmit the bandwidth of VE devices, layer 2 switches with the correct settings can get the job done effectively.

Further Considerations

Number of ports: Choose a switch that has enough ports to match the number of VE devices you will be installing. Switches typically come in 5, 8, 10, 16, 24, 28, 48, and 52-port configurations. If you are installing 13 VE transmitters and 13 VE receivers, you will need to purchase a switch with at least 28 ports.

Stackable versus Standalone

Stackable switches allow you to easily manage and configure ports spanning across multiple switches that the VE devices are connected through. This provides a centralized method to configure and troubleshoot the initial setup of VE devices on a network which makes fine tuning the bandwidth, data throughput and video quality easier. Stackable switches can be configured to direct the VE transmissions between many units more specifically and effectively. Standalone switches provide the same configuration features as Stackable switches but they must be set individually. Stackable switches provide an easy way to manage multiple switches, as one unit. For example, instead of configuring, managing, and troubleshooting 6 28- port switches individually, you can manage the six as if they are a single unit using Stackable Switches. The six switches (168 ports) function as a single switch and are managed from one web or GUI interface.

What Stackable Switches Can Do:

- Create a link aggregation group with one port in one unit of the stack and another port of that group in another switch in the stack.
- Select a port on one switch in the stack and mirror the traffic to a switch port on another unit of the stack; thus copy the configuration to direct traffic more effectively between VE devices.
- Apply custom ACL security settings to any port on any switch in the stack.

Stackable switches can be setup in a ring configuration, so that if a port or cable fails, the stack automatically routes around the failure, at microsecond speeds. Stackable Switches also allow you to add and remove stack “members” which are automatically updated and recognized as such.

Recommended Switches

The following models have been tested and found to produce favorable results, separate to two target application:

Standalone Network Switch:

Manufacturer	Model
ATEN	ES0154/ES0154P
Zyxel	GS2220 Series
Cisco	SG300
	Catalyst 2960-XR
	Catalyst 2960-X
Netgear	GS724T
D-Link	DGS-1510
Edgecore Networks	ECS-4120-52T
H3C	5120 Series

Cascading / Aggregation Network Switch:

Manufacturer	Model
Netgear	M4300-96X (10G modular, 12-slot empty Managed Switch)
	M4300-28G / 52G-PoE+ (28 / 48x1G PoE+)
	M4300-28G / 52G (24 / 48x1G)
	M4250-16XF (16x 1G/10G, Fiber SFP+)
	M4250-10G2XF-PoE+ (8x1G PoE+)
	M4250-26G4XF-PoE+ (24x1G PoE+)
	M4250-40G8XF-PoE+ (40x1G PoE+)
Zyxel	XS3800-28 (10G L2+ Managed Switch)
	XGS2210-28HP / 52HP (24 / 48-port GbE, PoE)
	XGS2210-28 / 52 (24 / 48-port GbE)
	XGS2220-30 / 30HP (24-port GbE/ 24-port GbE, PoE+)
	XGS2220-54 / 54HP / 54FP (48-port GbE / 48-port GbE, PoE+ / 48-port GbE, PoE+, 960W)

4.2.1 Facilitating Setup with ATEN Network Switches

For standalone network switch connection, simply connect VE8900/VE8950/VE8952/VE8962/VE8662 transmitters and receivers to ES0154/ES0154P network switch to deploy your AV network without the hassles of a complicated setup. With this pre-configured solution, there is no need to install additional software or configure devices.

- Device auto detection
- Supports IGMP Snooping, Fast Leave, Flow Control
- Supports IGMP v1/v2/v3 Snooping and IGMP v1/v2 Querier
- Supports 48 Gigabit Ethernet ports and 4 SFP uplink ports (10Gbps)
- High-performance Gigabit Ethernet L2 access switch with 176 Gbps switching capacity

ES0154P

54-Port Layer 2+ Gigabit Ethernet Managed Switch with PoE



4.3. Planning Network Architecture

Build Strategies

For optimum performance, the VE extenders require high amounts of data to be transferred across a network; therefore we recommend the following strategies to setup the VE devices. Using our suggestions will provide better performance and the highest video resolutions possible. Use each of the keys to ensure the best transmission of data and the highest throughput possible. Prior to setup we recommend laying out the plans for your VE installation using the following performance guide.

- **Build a Network Diagram**
To build an effective VE installation, start by mapping out the layout. Create a diagram with the VE devices, computers and routers along with how they will be connected across the network. It also helps to write out how the devices will interact. Use the diagrams below as the framework as you decide what devices to purchase and how to build the network effectively for the best data throughput.

Considerations:

- Use a flat cascaded layout (basic line cascaded structure) and avoid a tree or pyramid structure
- Limit cascades to two levels
- Install network switches as near to each other as possible
- Minimize the distance of all connections
- Ensure sufficient bandwidth between the switches to eliminate bottlenecks
 - For optimum performance, the VE8900/VE8950/VE8952/VE8962/VE8662 units should be on dedicated network
 - Ensure that all the VE8900/VE8950/VE8952/VE8962/VE8662 units you want to manage are located within the same subnet
- Determine the Distance:

Distance is an important factor when setting up networks, with a shorter distance and fewer hops through routers, data can be transmitted more efficiently. So whenever possible decrease the distance and direct network traffic effectively between subnets that communicate with each other to increase the data throughput.
- Ensure the Bandwidth:

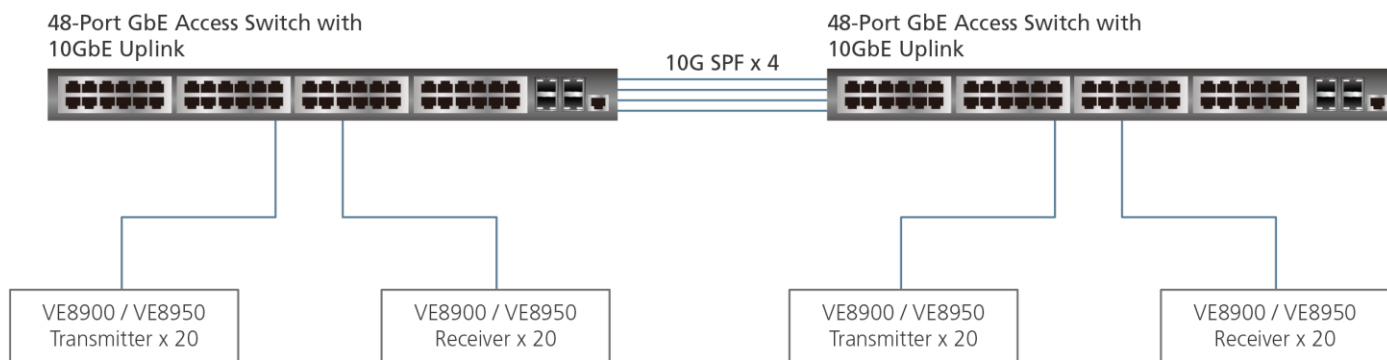
Ensuring the bandwidth ahead of time will guarantee performance before installing VE devices on a network. This will eliminate the primary cause of problems related to video quality and transmission of data. If the speed is right at all ends of your network, then the only other causes are derived from device failure or limits caused by a router, switch or device setting.

Cascaded Switch Networking

If more devices are required, it is recommended to cascade switches. When using 1Gbs connections between switches - bidirectional data flow must not equal more than 1000Mbps between the core switch and extended switches, whilst leaving enough headroom for additional traffic. By taking a typical transmitter bitrate of 300~500Mbps, for example, the number of transmitters connected to a single extended switch should be not more than 4, leaving 200Mbps of headroom. Under this condition, we highly recommend to select a Netgear or Zyxel Switch for cascading to save trouble since these network switches are fine-tuned and built-in with a specific Network AV mode for ATEN video over IP products. Example of the large scale network architecture as below:

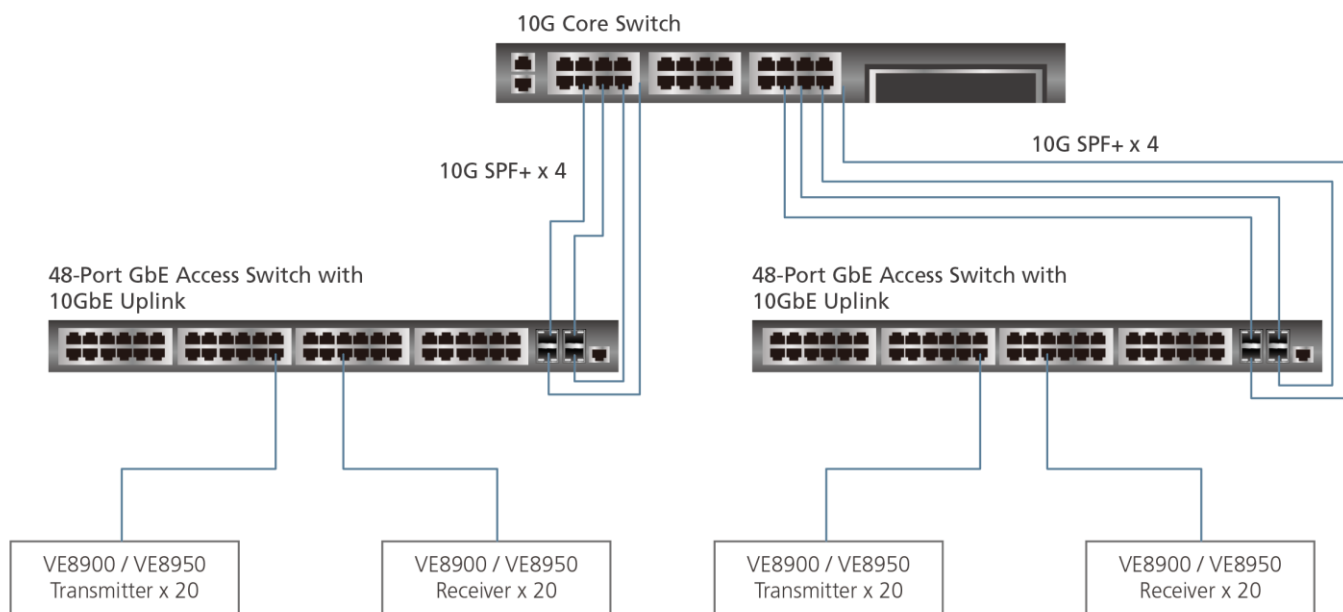
Note: This diagram uses the VE89 series for demonstration purposes, but the setup is applicable across the ATEN Networked AV series.

Two Switches Cascading



Note: To decrease the data flow bandwidth, it is highly recommended that you use equal quantities of VE8900 transmitters and receivers when you setup the network architecture.

More than Two Switches Aggregation:



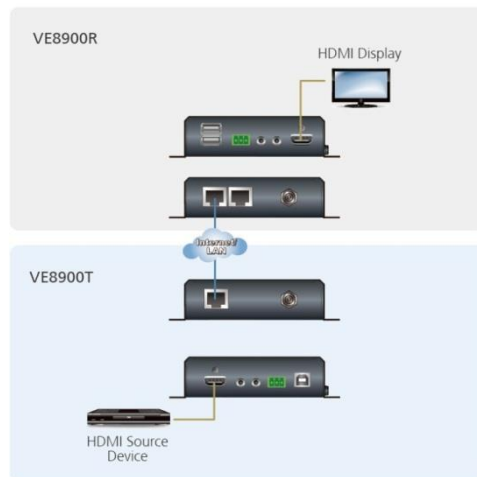
Note: To decrease the data flow bandwidth, it is highly recommended that you use equal quantities of VE8900 transmitters and receivers when you setup the network architecture.

4.4 Network Setup Examples

One Transmitter to One Receiver

A single transmitter and receiver can be linked directly or via the LAN, to send video from a source to a display in another location. If linked directly the CAT5e/6 cable linking them should not run more than 100m/328ft.

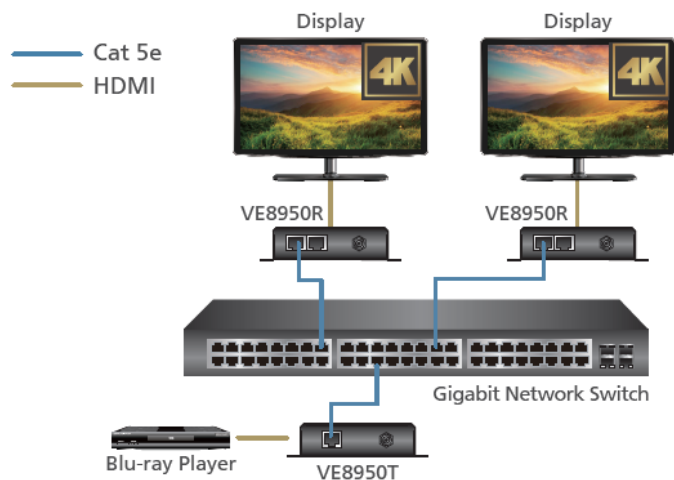
The devices will not automatically connect and must first be selected receiver. The ID number must match with transmitter ID number to establish the link.



One Transmitter to Multiple Receivers

Using VE8900/VE8950/VE8952/VE8962 for one-to-many installations dramatically decreases the amount of equipment required at the source location, each transmitter can be located up to 100m/355ft from the switch.

- Scenario A (with Ethernet switch)



- Scenario B (without Ethernet switch)

In a single source input scenario for video splitter application, the distance between receivers (point-to-point) can be up to 100m.



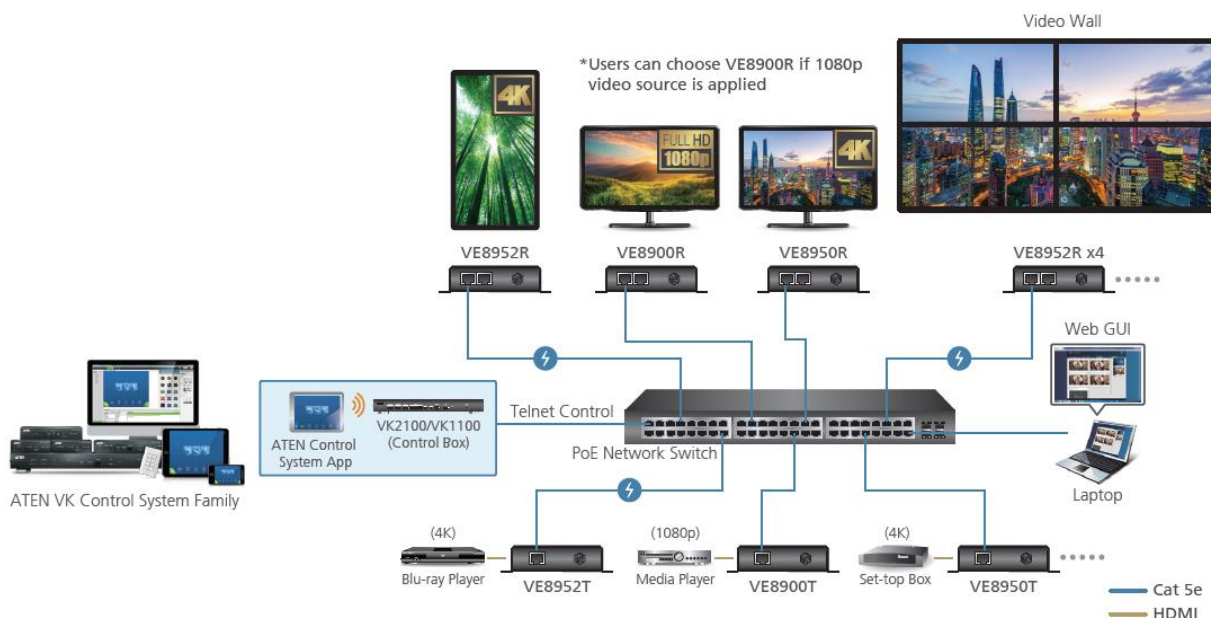
Note: This scenario doesn't apply to VE8662.

Multiple Transmitters to Multiple Receivers

The truly modular nature of the VE8900/VE8950/VE8952/VE8962/VE8662 over IP topology allows an AV distribution of almost any number of sources and displays.

Video Wall

The versatility of VE8900/VE8950/VE8952/VE8962/VE8662's powerful video wall functionality lets a collection of displays to display multiple images or a single image and any combination in between. It supports up to 16 x 16 wall with image rotation and portrait video walls, as well as traditional landscape modes. It can also easily switch layout profiles, preview and drag-and-drop video sources via the intuitive web-based GUI.



4.5. Configuring the Network Switch

IGMP and Other Settings

Configuring the switch correctly will pass data more efficiently, allowing a better stream across the network to each VE device. The following settings will help optimize your network traffic through a switch:

- Enable IGMP Snooping on L2 switches
- Enable IGMP Querier on the L3 switch
- Enable IGMP Fast Leave/Immediate Leave on all switches where VE units are directly connected
- Enable Jumbo frames (Jumbo packets) in order to correctly convey the necessary data
- Enable Spanning Tree Protocol (STP) on all switches and enable Portfast exclusively on switch ports that have VE units connected
- Pick an appropriate forwarding mode on all switches. Use Cut-through if available, or Store and Forward

The following table shows the recommended settings for various networking topologies:

Switch Feature	Single Switch Networking	Cascaded Switch Networking	
		Core Switch	Extended Switch
Green or energy-saving	Disable	Disable	Disable
Multicast forwarding / filtering	Filter unregistered multicast or Disable unknown multicast flood		
IP Address of IGMP Querier	Must be assigned a valid value		N/A
Jumbo frames	Enable	Enable	Enable
IGMP Snooping	Enable	Enable	Enable
IGMP Querier	Enable	Enable	Disable
IGMP Snooping fast leave/immediate leave (only for VE89 Series)	Enable	Disable	Enable
IGMP Snooping fast leave/immediate leave (only for VE8662)	Disable	Disable	Disable
Flow control	Enable	Enable	Enable

ES0154P Switch

Switch Feature	Single Switch Networking	Cascaded Switch Networking	
		Core Switch	Extended Switch
IGMP Snooping / General / Unregistered Data Flooding (only for VE8962)	N/A	N/A	Enable

ZYXEL Switch

Switch Feature	Single Switch Networking	Cascaded Switch Networking	
		Core Switch	Extended Switch
IGMP Snooping / Unknown Multicast Frame	N/A	N/A	Drop
IGMP Snooping / Unknown Multicast Frame to Querier Port	N/A	N/A	Forwarding

Note: Please refer to your switch's user guide as different brands and models may have different names for these features



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