

# Deploying Avigilon Solutions: A Guide to Networking Best Practices

NVR Premium (NVR5-PRM, NVR4X-PRM, or HD-NVR4-PRM)

NVR Standard (NVR5-STD, NVR4X-STD, or HD-NVR4-STD)

NVR Value (NVR5-VAL, NVR4-VAL)

NVR Premium (AINVR-PRM)

AI NVR Standard (AINVR-STD)

AI NVR 2 Value (AINVR2-VAL)

AI NVR Value (AINVR-VAL)

HD Video Appliance (VMA-AS3)

AI Appliance (VMA-AIA1-CG or VMA-AIA2-CG)

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# Introduction

This document is intended to provide recommended networking architecture for optimum system performance when deploying Avigilon's video solutions. The networking topologies outlined in this guide cover many of the typical AI NVR, Network Video Recorder, HD Video Appliance, and AI Appliance deployments and offer guidance to optimize your video surveillance system.

# AI NVR Premium and Premium+

AI NVR Premium and Premium+ merges an enterprise-grade NVR with a built-in AI Appliance. This AI NVR includes four 1-GbE network ports and four 10GbE network ports that support up to 1500 Mbps of recording throughput.

Additionally, AI NVR Premium and Premium+ supports running server side Classified Object Detection, Avigilon Appearance Search, Face Recognition, and License Plate Recognition (LPR) on non-analytic cameras and analytic cameras such as H5A cameras. For more detailed information on the analytics capabilities, see the *AI NVR datasheet* or *Analytics Sizing Guide for Avigilon Hardware*, available at [avigilon.com](http://avigilon.com).

The AI NVR Premium and Premium+ is available with the Avigilon Hardened OS.

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

### NIC Teaming Enabled (recommended)

- Since the AI NVR Premium and Premium+ has four 1-GbE and four 10-GbE network ports, recording and client traffic can still be isolated on different networks using different IP subnets or VLANs. This can be achieved by creating two separate NIC teaming groups with two or more network ports per group.
- The network configuration is completed using the NIC teaming settings on the AI NVR Premium and Premium+ instead of configuring any of the AI NVR network ports individually.

### NIC Teaming Disabled

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the AI NVR Premium and Premium+ must be configured into unique IP subnets.
- Only one network port on the AI NVR Premium and Premium+ (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.

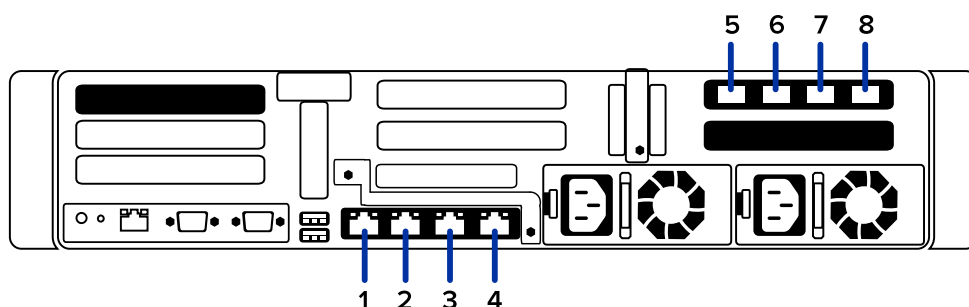
The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required	Recording Throughput Per AI NVR	Client Recorded Playback Throughput Per AI NVR (Or Live Throughput) <sup>1</sup>
One 1 GbE	One 1 GbE	Up to 900 Mbps	Up to 600 Mbps
Two 1 GbE	One or two 1 GbE	Up to 1500 Mbps	Up to 600 Mbps
One or more 10 GbE	One or more 1 GbE	Up to 1500 Mbps (max 1500 Mbps per port)	Up to 600 Mbps (max 600 Mbps per port)

<sup>1</sup>The maximum playback throughput for AI NVR Premium and Premium+ can be increased by reducing the recording throughput.

## Network Interface Connections

- It is recommended to use network ports 5-8 for recording traffic.
- It is recommended to use network ports 1-4 for client traffic or lower throughput recording traffic.



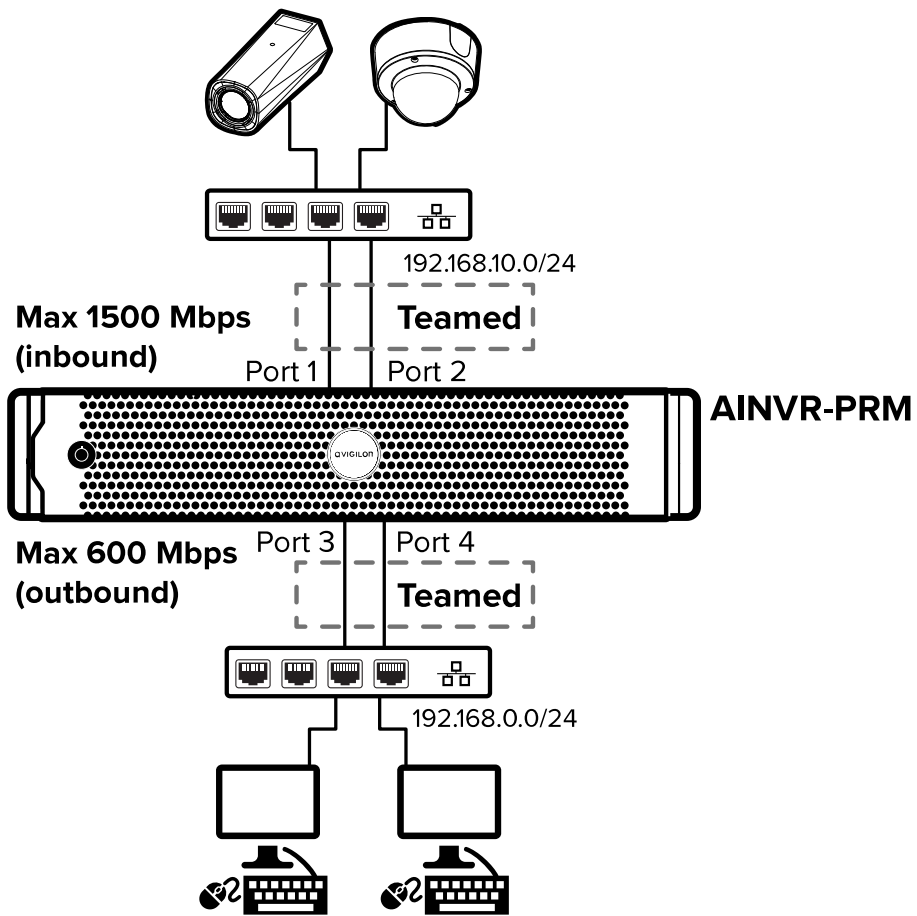
## Sample Network Topologies

### 1-GbE Networking

#### 1-GbE Network Topology with One AI NVR Premium

Suitable for sites with less than 1500 Mbps of recording throughput when using NIC teaming in adaptive load balancing mode. Using NIC teaming adds network redundancy and increases the recording throughput. If a single 1 GbE port is used, or two ports are teamed in active backup mode, the recording throughput will be 900 Mbps.

**Tip:** For more information on NIC teaming, see *NIC Teaming on AI NVR Premium and Premium+* on page 16.

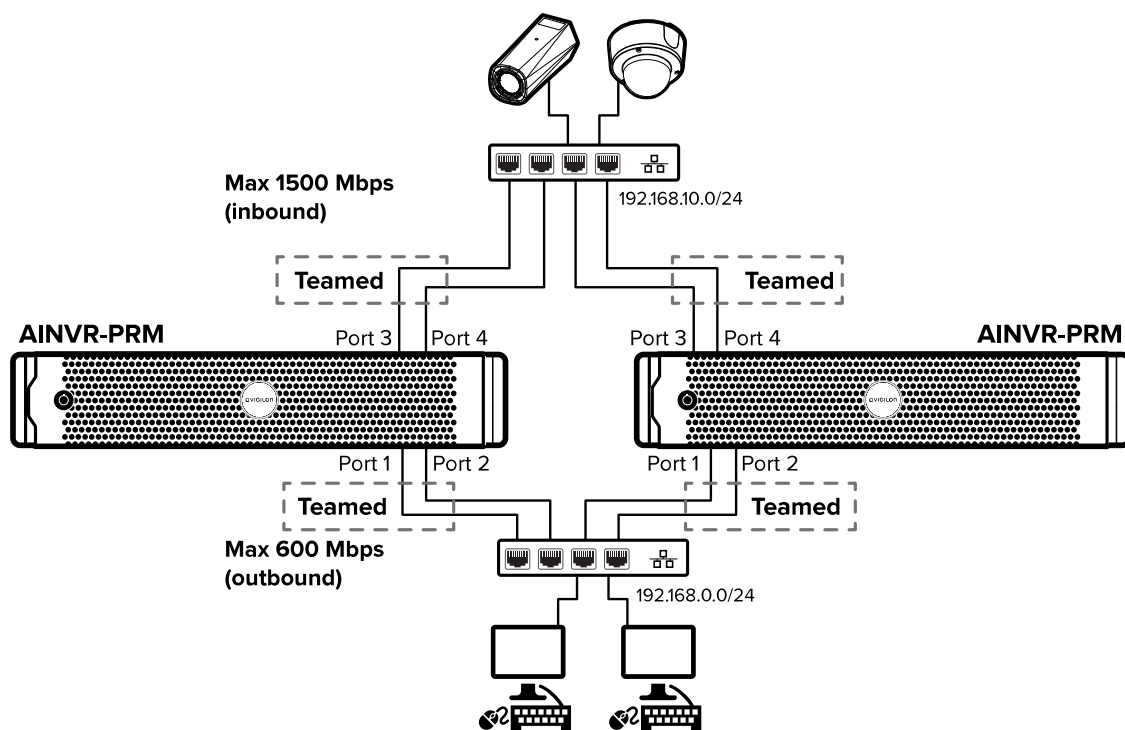




## Network Topology with Multiple AI NVR Premium

Suitable for deployments that require network redundancy. Connecting multiple AI NVRs ( $n$  AI NVRs) through the same IP subnets will ensure that cameras will continue to record in the event that a single AI NVR fails. Primary and secondary AI NVRs can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each AI NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary AI NVR.

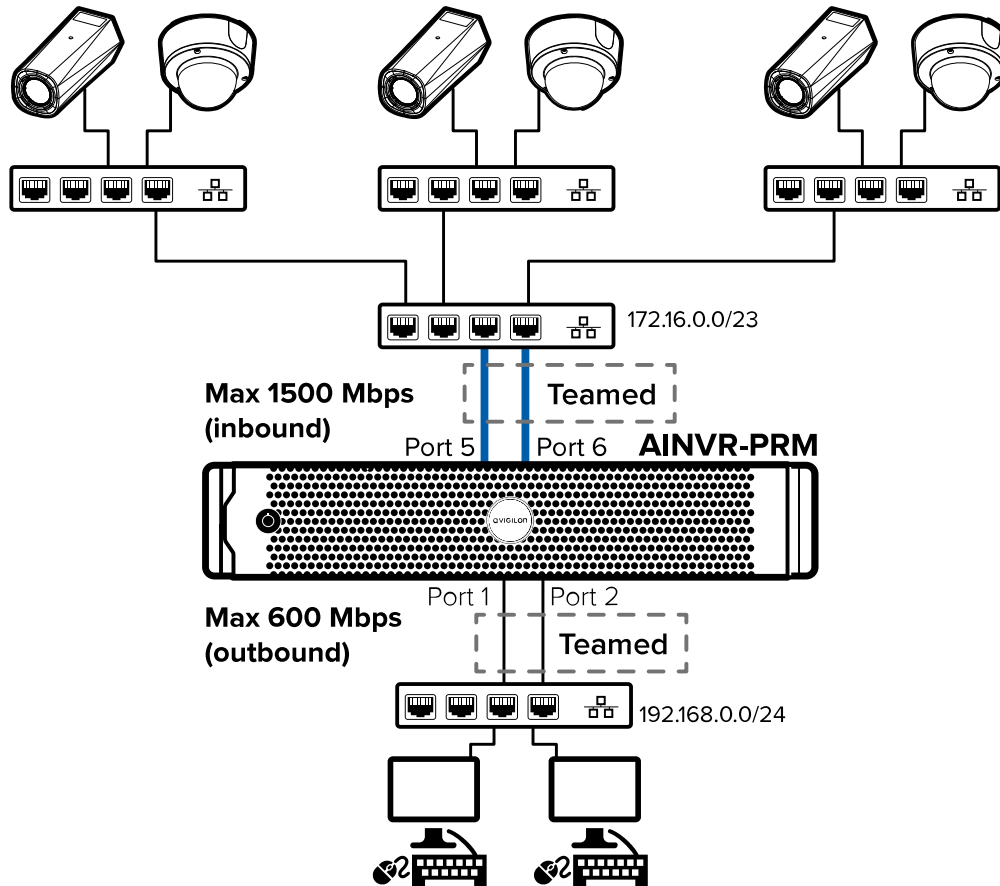
**Tip:** Teaming two or more 1 GbE ports on each AI NVR using adaptive load balancing mode can provide up to 1500 Mbps of recording throughput per AI NVR. For more information, see *NIC Teaming on AI NVR Premium and Premium+* on page 16.



## 10-GbE Networking

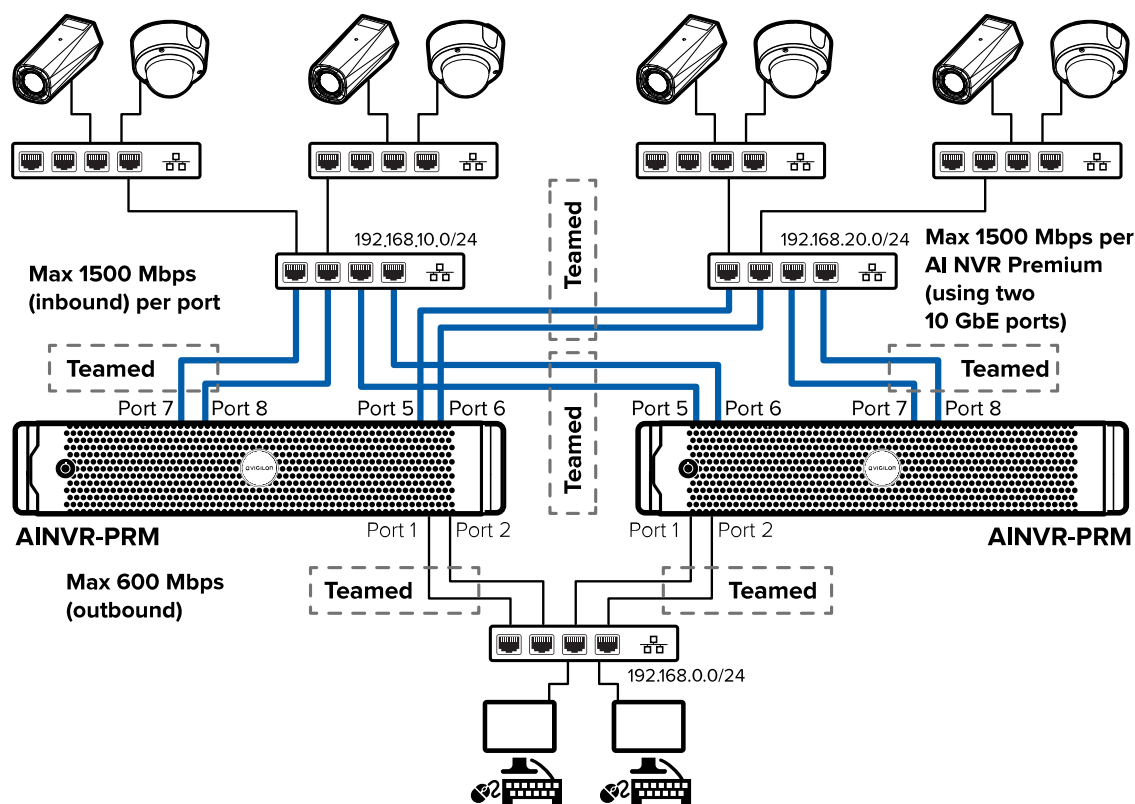
### 10-GbE Network Topology with One AI NVR Premium

Suitable for sites using 10-GbE networking with less than 1500 Mbps of recording throughput with two 10-GbE network ports configured to one NIC team. This simple deployment provides redundancy in the event that one 10-GbE network port on the AI NVR fails. See *NIC Teaming on AI NVR Premium and Premium+* on page 16 for steps on how to set up NIC teaming in active backup mode.



## 10-GbE Network Topology with Multiple AI NVR Premium

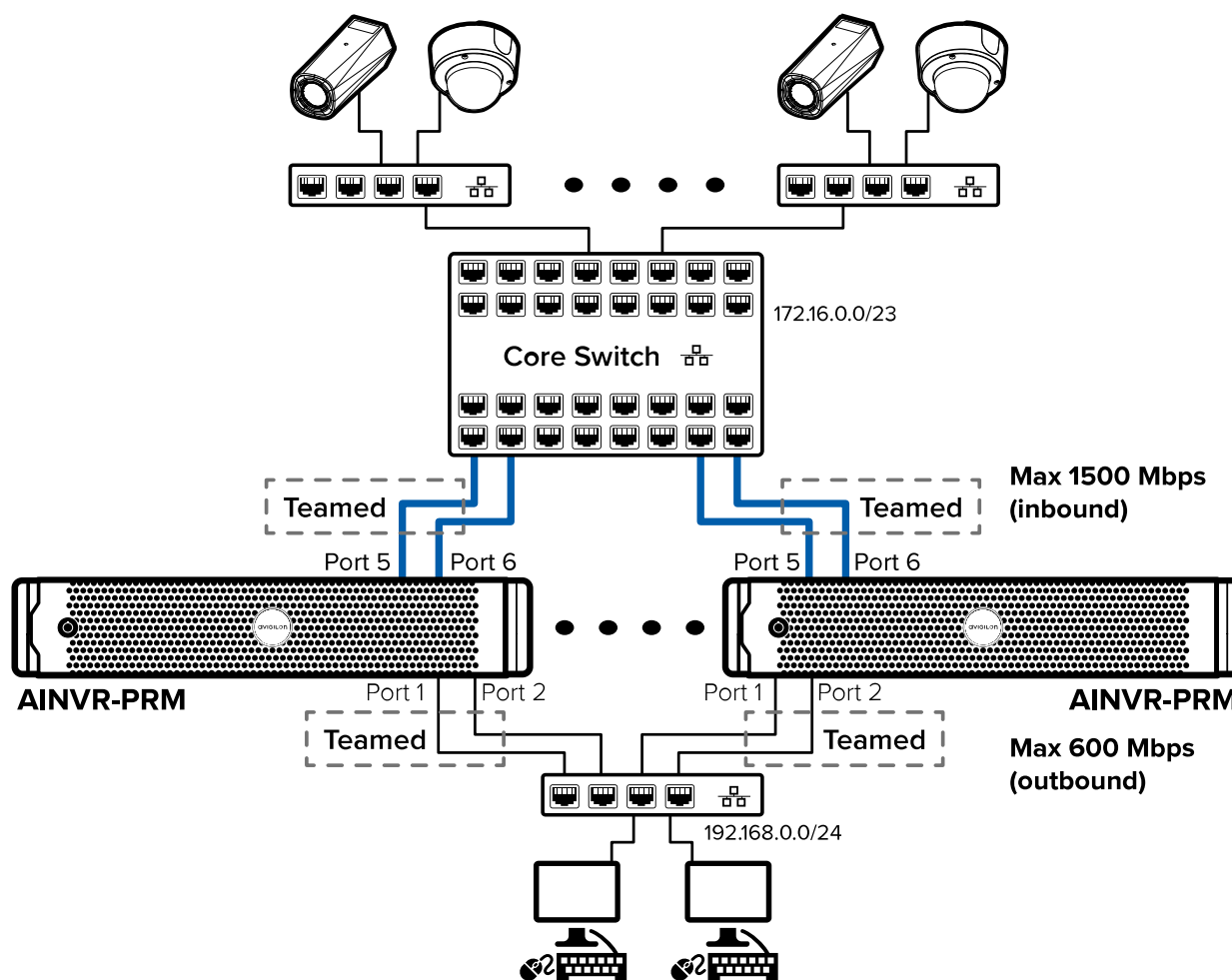
Suitable for deployments using 10-GbE Networking that require network redundancy. Connecting multiple AI NVRs ( $n$  AI NVRs) through the same switch will ensure that cameras will continue to record in the event that a single AI NVR fails. Primary and secondary AI NVRs can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each AI NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary AI NVR. Additionally the use of NIC teaming on the recording and playback ports provides redundancy in the event that one network port on the AI NVR Premium fails. See *NIC Teaming on AI NVR Premium and Premium+* on the next page for steps on how to set up NIC teaming in active backup mode.



## Enterprise Networking

### Enterprise Network Topology with Multiple AI NVR Premium

Suitable for deployments using 10-GbE networking that require robust network redundancy. An enterprise level core switch is used to simplify network connections with multiple AI NVRs ( $n$  AI NVRs). Primary and secondary AI NVRs should be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each AI NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary AI NVR. Additionally the use of NIC teaming on the recording and playback ports provides redundancy in the event that one network port on the AI NVR Premium fails. See *NIC Teaming on AI NVR Premium and Premium+* below for steps on how to set up NIC teaming in active backup mode.



### NIC Teaming on AI NVR Premium and Premium+

To further increase network resilience, it is recommended to use network interface controller (NIC) teaming. The AI NVR Premium and Premium+ supports three types of NIC teaming: Active Backup, Dynamic Link Aggregation (IEEE 802.3ad), and Adaptive Load Balancing.

## Active Backup

In this mode, one port out of the teamed network ports is designated as the primary port, and the others are set as the backup ports. While the primary network port is functioning properly, the backup ports will not be used. In the event that the primary network port fails, the backup network ports will take over. Both network ports work as unique virtual network interfaces with a single mac address visible to other network devices.

## Dynamic Link Aggregation (IEEE 802.3ad)

In this mode, all of the teamed network ports will be aggregated into a single connection that has a combined bandwidth equal to the sum of all the teamed port's individual bandwidth. All teamed network ports will be utilized simultaneously while in this mode and all devices using the teamed ports will operate at the same speed and duplex. If one network port were to fail, then all traffic will be forced through the remaining network ports and your bandwidth will be reduced to the sum of the remaining ports' bandwidth.

**Note:** This mode requires a switch that can support IEEE 802.3ad Dynamic Link Aggregation, and will require some setup on that switch.

## Adaptive Load Balancing

In this mode, both network ports will be used as separate 1 Gb/s or 10 Gb/s connections, but the AI NVR Premium or Premium+ will attempt to dynamically load balance the transmitted and received traffic that passes through each network port. Each network port can be connected to different network switches on the same IP subnet to increase redundancy. In the event that one network port fails, all traffic will be redirected to the remaining working network port.

This mode provides many of the benefits of Dynamic Link Aggregation without the need for any switch configuration or support. Additionally, this mode supports network ports of different speeds (10 Gb/s and 1 Gb/s) to be teamed together.

# AI NVR Standard

AI NVR Standard merges an enterprise-grade NVR with a built-in AI Appliance. This AI NVR includes four 1-GbE network ports that support up to 900 Mbps of recording throughput. Additionally, AI NVR Standard supports running server side Classified Object Detection, Avigilon Appearance Search, and Face Recognition on up to 10 non-analytic cameras, or can support Avigilon Appearance Search and Face Recognition on up to 100 H5A cameras.

The AI NVR Standard is available with the Avigilon Hardened OS.

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

### NIC Teaming Enabled (recommended)

- Since the AI NVR Standard has four network ports, recording and client traffic can still be isolated on different networks using different IP subnets or VLANs. This can be achieved by creating two separate NIC teaming groups with two network ports per group.
- The network configuration is completed using the NIC teaming settings on the AI NVR Standard instead of configuring any of the AI NVR Standard network ports individually.

### NIC Teaming Disabled

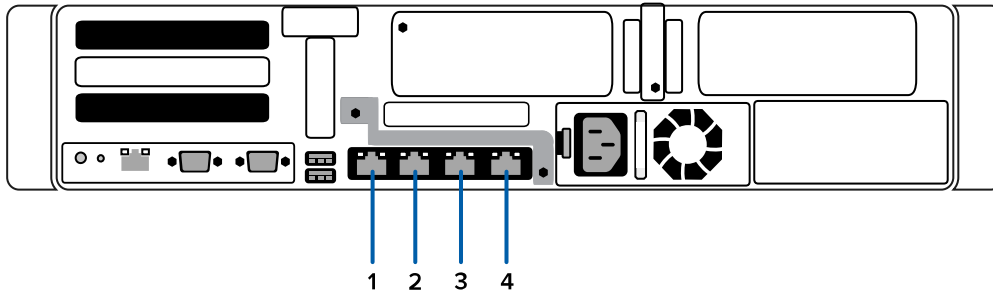
- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the AI NVR Standard must be configured into unique IP subnets.
- Only one network port on the AI NVR Standard (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.

The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required	Recording Throughput per AI NVR	Client Recorded Playback Throughput per AI NVR (Or Live Throughput)
One 1 GbE	One 1 GbE	Up to 900 Mbps	Up to 800 Mbps

## Network Interface Connections

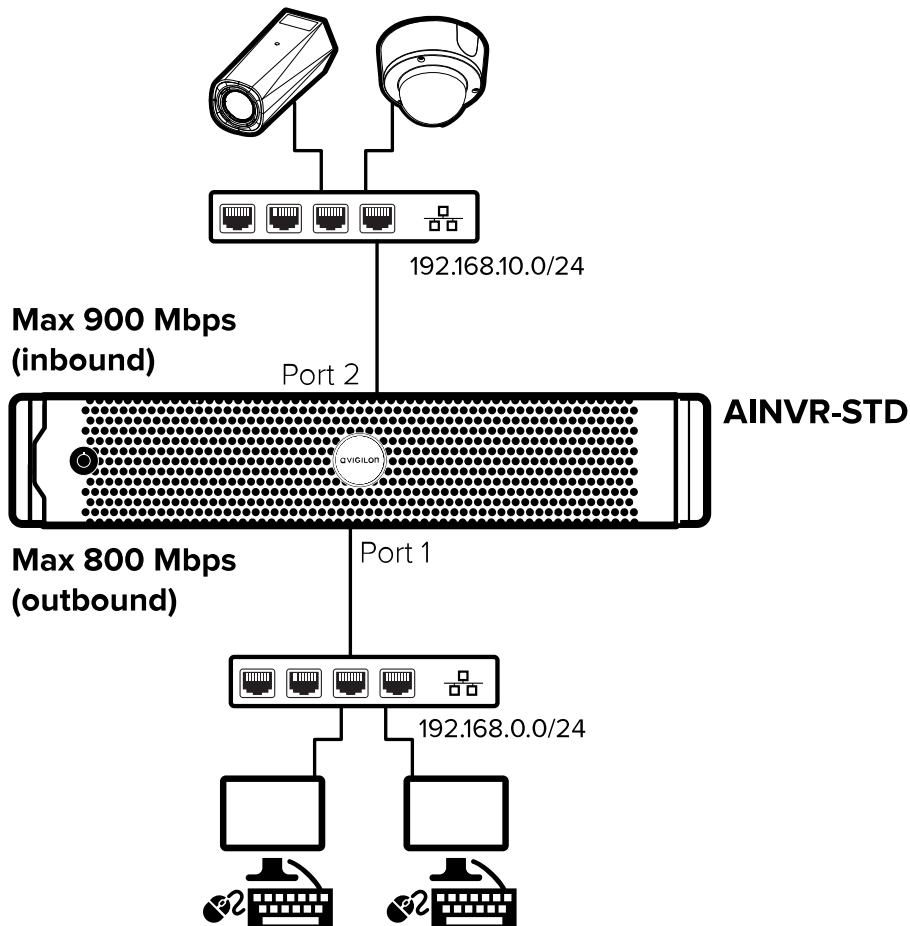
- Any of the 4 ports can be used for inbound or outbound traffic.



## Sample Network Topologies

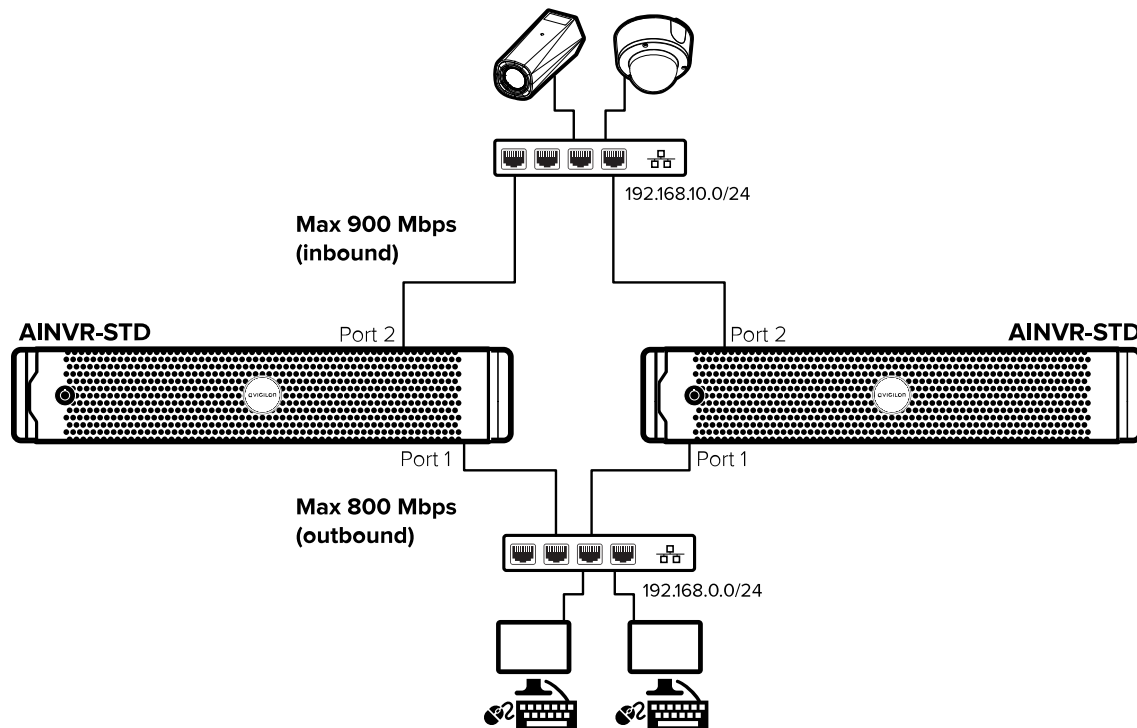
### Network Topology with One AI NVR Standard

Suitable for sites with less than 900 Mbps of recording throughput. This simple deployment does not provide any network redundancy.



## Network Topology with Multiple AI NVR Standard

Suitable for deployments that require network redundancy. Connecting multiple AI NVRs ( $n$  AI NVRs) through the same IP subnets will ensure that cameras will continue to record in the event that a single AI NVR fails. Primary and secondary AI NVRs can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each AI NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary AI NVR.



## NIC Teaming on AI NVR Standard

To further increase network resilience, it is recommended to use network interface controller (NIC) teaming. The AI NVR Standard supports three types of NIC teaming: Active Backup, Dynamic Link Aggregation (IEEE 802.3ad), and Adaptive Load Balancing.

### Active Backup

In this mode, one port out of the teamed network ports is designated as the primary port, and the others are set as the backup ports. While the primary network port is functioning properly, the backup ports will not be used. In the event that the primary network port fails, the backup network ports will take over. Both network ports work as unique virtual network interfaces with a single mac address visible to other network devices.

### Dynamic Link Aggregation (IEEE 802.3ad)

In this mode, all of the teamed network ports will be aggregated into a single connection that has a combined bandwidth equal to the sum of all the teamed port's individual bandwidth. All teamed network ports will be



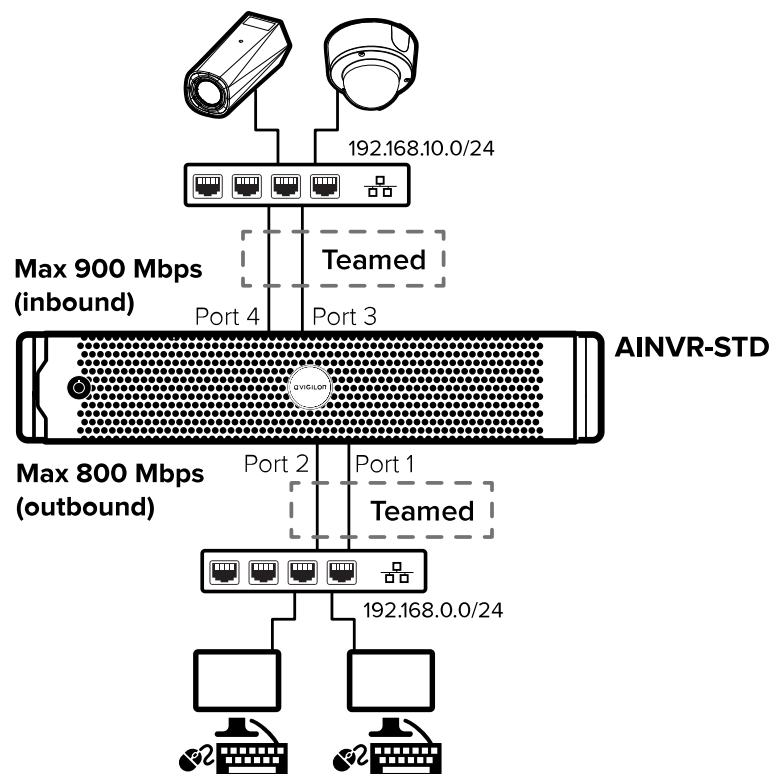
utilized simultaneously while in this mode and all devices using the teamed ports will operate at the same speed and duplex. If one network port were to fail, then all traffic will be forced through the remaining network ports and your bandwidth will be reduced to the sum of the remaining ports' bandwidth.

**Note:** This mode requires a switch that can support IEEE 802.3ad Dynamic Link Aggregation, and will require some setup on that switch.

## Adaptive Load Balancing

In this mode, both network ports will be used as separate 1 Gb/s connections, but the AI NVR Standard will attempt to dynamically load balance the transmitted and received traffic that passes through each network port. Each network port can be connected to different network switches on the same IP subnet to increase redundancy. In the event that one network port fails, all traffic will be redirected to the remaining working network port.

This mode provides many of the benefits of Dynamic Link Aggregation without the need for any switch configuration or support. Additionally, this mode supports network ports of different speeds (10 Gb/s and 1 Gb/s) to be teamed together.



# AI NVR 2 Value

AI NVR 2 Value brings together a high performance NVR and AI Appliance in a small 1U form factor. This budget-friendly AI NVR includes two 1 GbE network ports that can take in up to 550 Mbps of recording throughput on a single port. Additionally, if one of the optional Analytics Kit accessories is installed, the AI NVR 2 Value supports running server-side analytics with the following capabilities:

- AINVR2-VAL-ANK: Classified Object Detection, Avigilon Appearance Search, and Face Recognition on up to 3 non-analytic cameras, or can support Avigilon Appearance Search and Face Recognition on up to 31 H5A cameras.
- AINVR2-VAL-ANK-PLUS: Classified Object Detection, Avigilon Appearance Search, and Face Recognition on up to 8 non-analytic cameras, or can support Avigilon Appearance Search and Face Recognition on up to 70 H5A cameras.

The AI NVR 2 Value is available with the Avigilon Hardened OS.

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

### NIC Teaming Enabled (recommended)

- Since the AI NVR 2 Value only has two network ports, if NIC teaming is used, you will no longer be able to separate recording and playback traffic with IP subnets.
- The network configuration is completed using the NIC teaming settings on the AI NVR 2 Value instead of configuring any of the AI NVR 2 Value network ports individually.

### NIC Teaming Disabled

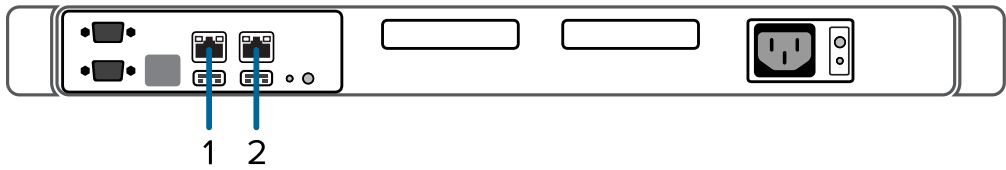
- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the AI NVR 2 Value must be configured into unique IP subnets.
- Only one network port on the AI NVR 2 Value (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.

The following table shows the recommended number of network interfaces for a given recording and client throughput.

AI NVR 2 Value Model	Recording Network Ports Required	Client Network Ports Required	Recording Throughput per AI NVR	Client Recorded Playback Throughput per AI NVR (Or Live Throughput)
6/12/24 TB	One 1 GbE	One 1 GbE	Up to 550 Mbps	Up to 300 Mbps
16 TB	One 1 GbE	One 1 GbE	Up to 450 Mbps	Up to 250 Mbps

## Network Interface Connections

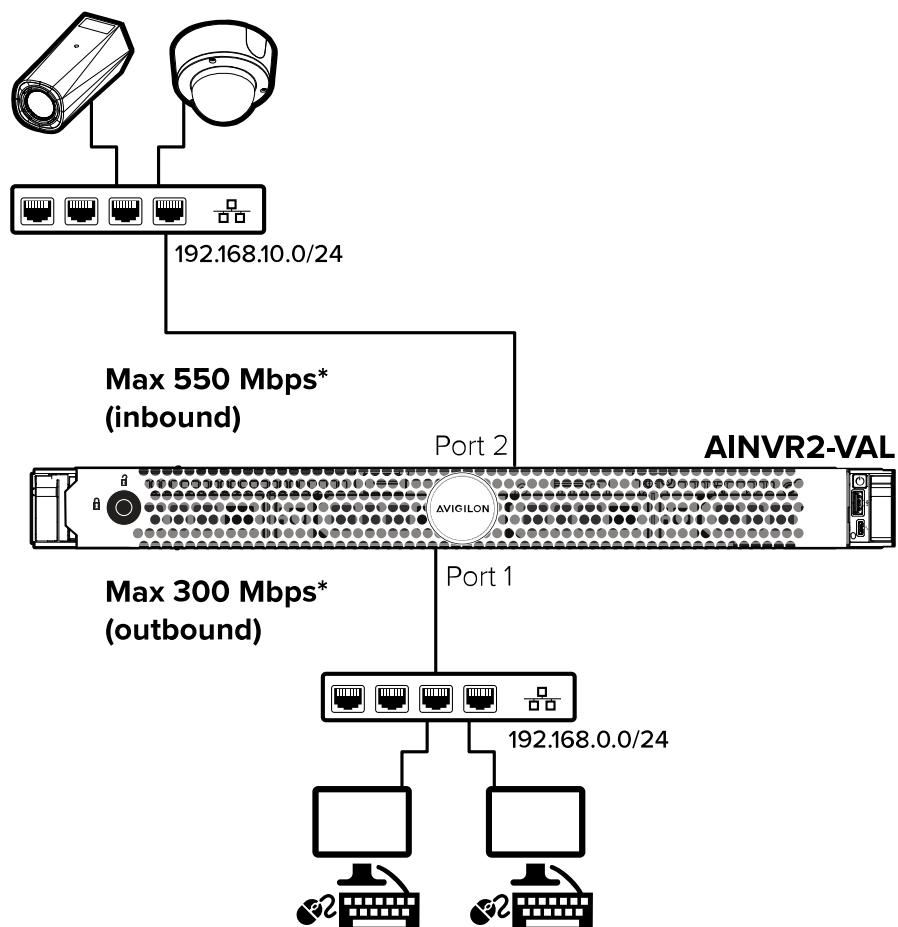
- Either port one or two can be used for inbound or outbound traffic.



## Sample Network Topologies

### Network Topology with One AI NVR 2 Value

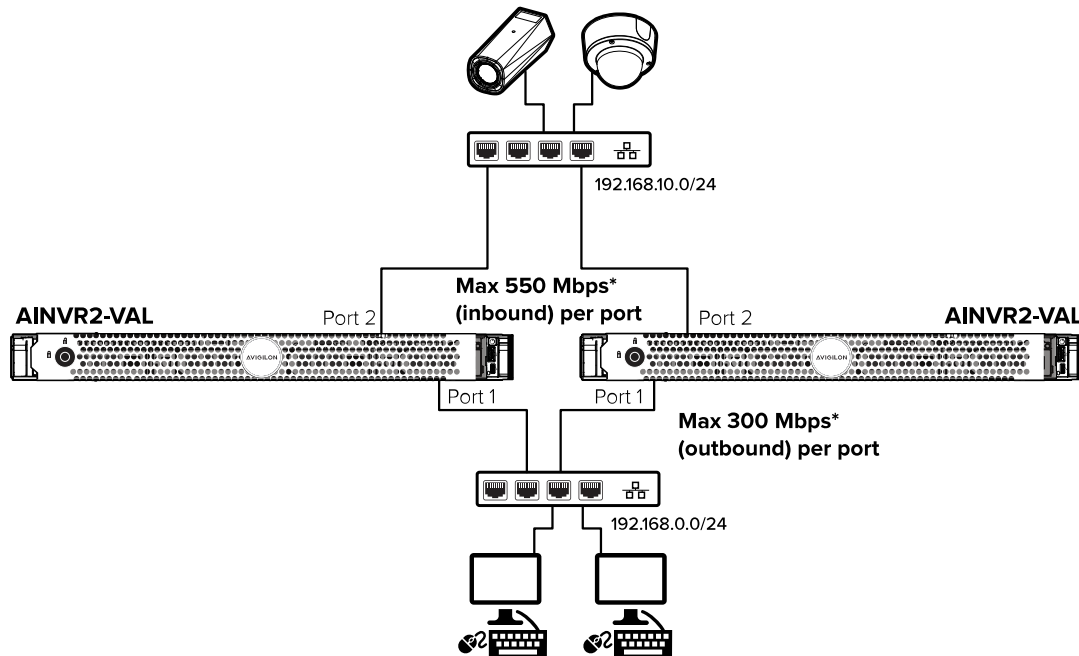
Suitable for sites with less than 550 Mbps\* of recording throughput. This is a simple deployment, but it does not provide any network redundancy.



\*The image above shows the inbound and outbound rates of the AI NVR 2 Value 6/12/24 TB. The rates for the AI NVR 2 Value 16 TB are listed in the table under *Network Environment* on page 22.

## Network Topology with Multiple AI NVR 2 Values

Suitable for deployments that require network redundancy. Connecting multiple AI NVRs ( $n$  AI NVRs) through the same IP subnets will ensure that cameras will continue to record in the event that a single AI NVR fails. Primary and secondary AI NVRs can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each AI NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary AI NVR.



\*The image above shows the inbound and outbound rates of the AI NVR 2 Value 6/12/24 TB. The rates for the AI NVR 2 Value 16 TB are listed in the table under *Network Environment* on page 22.

## NIC Teaming on AI NVR 2 Value

To further increase network resilience, it is recommended to use NIC teaming. The AI NVR 2 Value supports three types of NIC teaming: Active Backup, Dynamic Link Aggregation (IEEE 802.3ad), and Adaptive Load Balancing.

**Tip:** Since the AI NVR 2 Value only has two network ports, if NIC teaming is used, you will no longer be able to separate recording and playback traffic with IP subnets.

## Active Backup

In this mode, one of the two network ports are designated as the primary port, and the other is set as the backup port. While the primary network port is functioning properly, the backup port will not be used. In the event that the primary network port fails, the backup network port will take over. Both network ports work as

unique virtual network interfaces with a single mac address visible to other network devices.

## Dynamic Link Aggregation (IEEE 802.3ad)

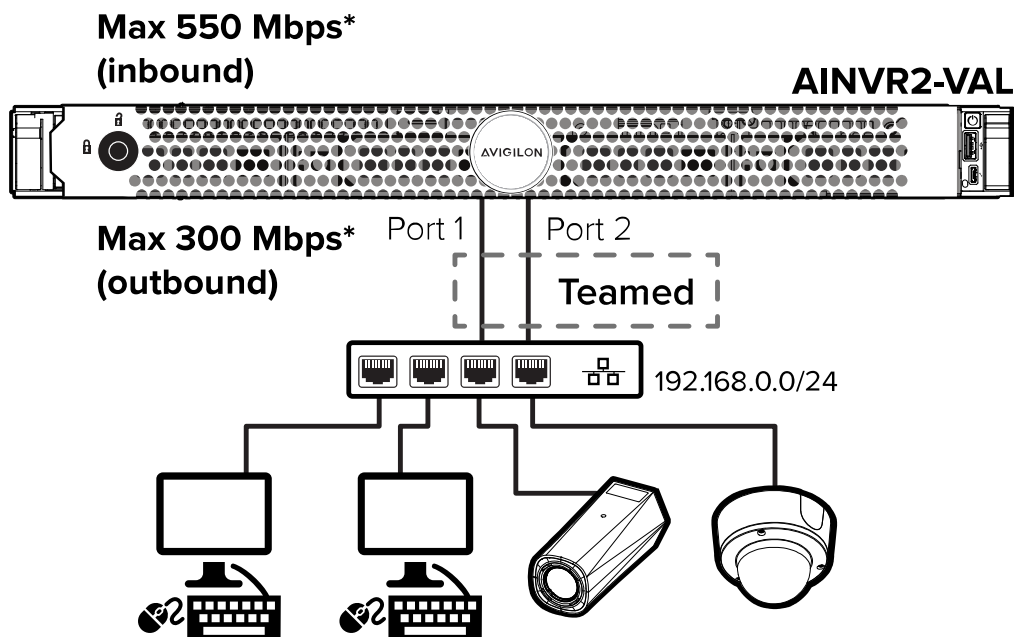
In this mode, the bandwidth of both network ports will be aggregated into a single 2 Gb/s connection. Both network ports will be utilized simultaneously in this mode and all devices using the teamed ports will operate at the same speed and duplex. If one network port were to fail, then all traffic will be forced through the remaining network port and your bandwidth will be reduced to 1 Gb/s.

**Note:** This mode requires a switch that can support IEEE 802.3ad Dynamic Link Aggregation, and will require some setup on that switch.

## Adaptive Load Balancing

In this mode, both network ports will be used as separate 1 Gb/s connections, but the AI NVR 2 Value will attempt to dynamically load balance the transmitted and received traffic that passes through each network port. Each network port can be connected to different network switches on the same IP subnet to increase redundancy. In the event that one network port fails, all traffic will be redirected to the working network port.

This mode provides many of the benefits of Dynamic Link Aggregation without the need for any switch configuration or support. Additionally, this mode supports network ports of different speeds (10 Gb/s and 1 Gb/s) to be teamed together.



\*The image above shows the inbound and outbound rates of the AI NVR 2 Value 6/12/24 TB. The rates for the AI NVR 2 Value 16 TB are listed in the table under *Network Environment* on page 22.

# AI NVR Value

AI NVR Value brings together a high performance NVR and AI Appliance in a small 1U form factor. This budget-friendly AI NVR includes two 1 GbE network ports that can take in up to 900 Mbps of recording throughput on a single port. Additionally, the AI NVR Value supports running server-side Classified Object Detection, Avigilon Appearance Search, and Face Recognition on up to 5 non-analytic cameras, or can support Avigilon Appearance Search and Face Recognition on up to 50 H5A cameras.

The AI NVR Value is available with the Avigilon Hardened OS.

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

### NIC Teaming Enabled (recommended)

- Since the AI NVR Value only has two network ports, if NIC teaming is used, you will no longer be able to separate recording and playback traffic with IP subnets.
- The network configuration is completed using the NIC teaming settings on the AI NVR Value instead of configuring any of the AI NVR Value network ports individually.

### NIC Teaming Disabled

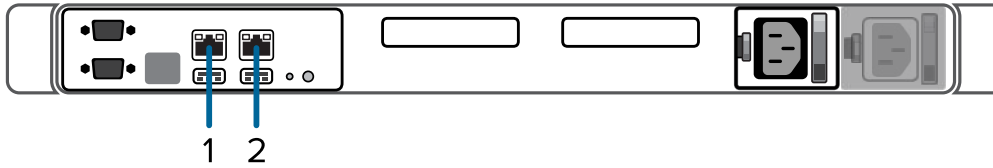
- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the AI NVR Value must be configured into unique IP subnets.
- Only one network port on the AI NVR Value (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.

The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required	Recording Throughput per AI NVR	Client Recorded Playback Throughput per AI NVR (Or Live Throughput)
One 1 GbE	One 1 GbE	Up to 900 Mbps	Up to 800 Mbps

# Network Interface Connections

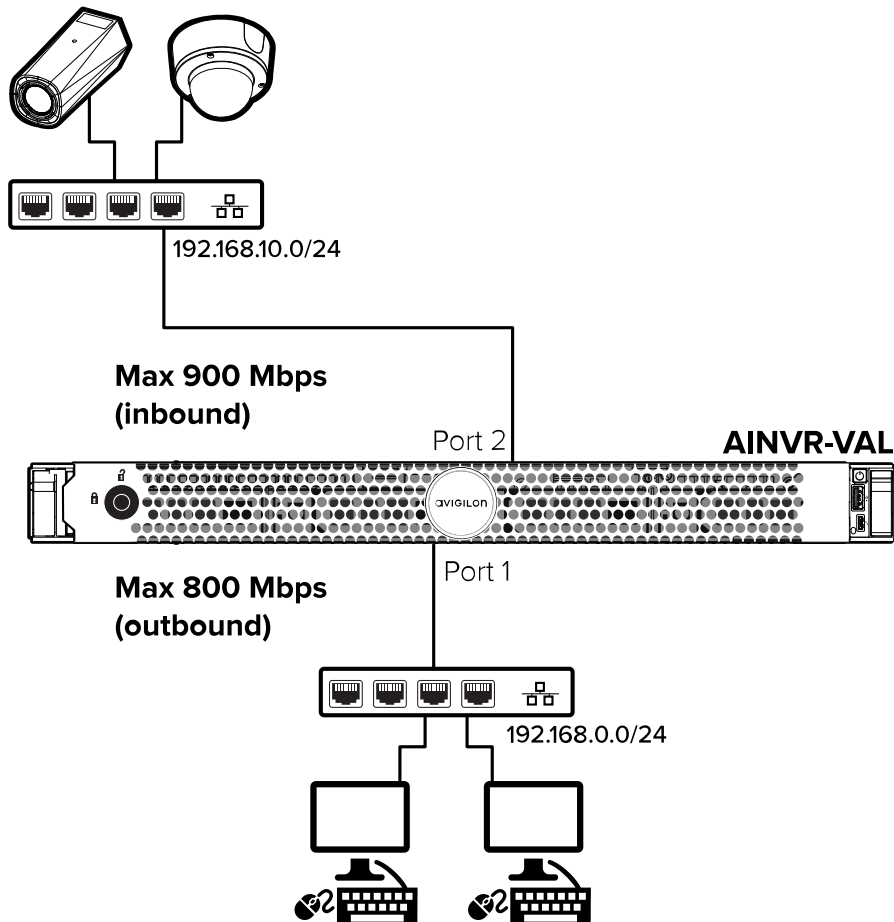
- Either port one or two can be used for inbound or outbound traffic.



## Sample Network Topologies

### Network Topology with One AI NVR Value

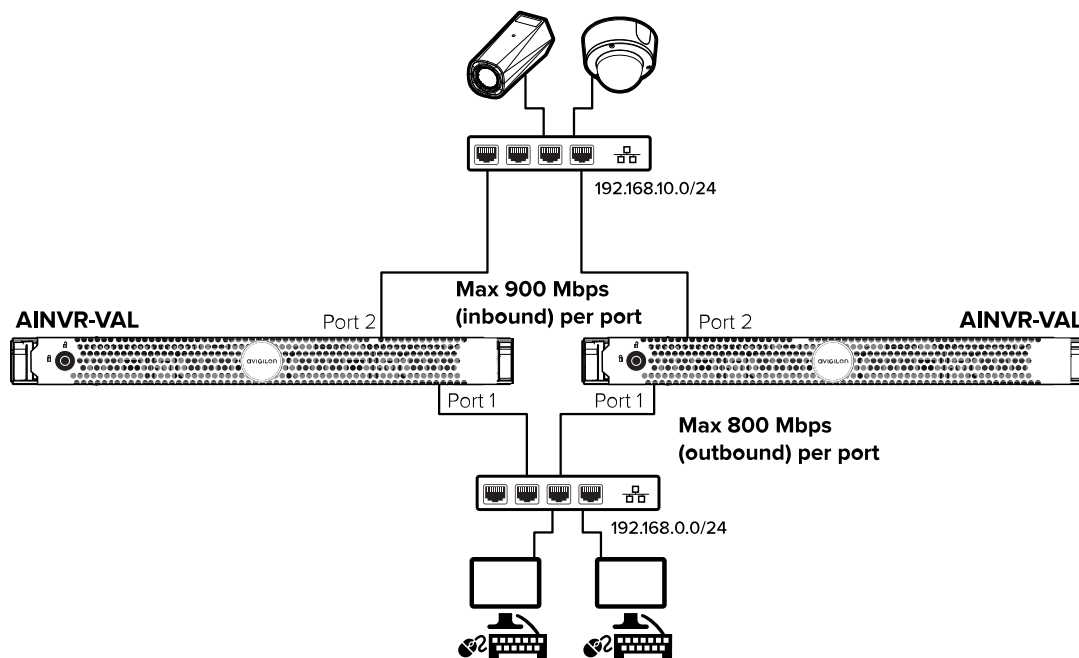
Suitable for sites with less than 900 Mbps of recording throughput. This is a simple deployment, but it does not provide any network redundancy.





## Network Topology with Multiple AI NVR Value

Suitable for deployments that require network redundancy. Connecting multiple AI NVRs ( $n$  AI NVRs) through the same IP subnets will ensure that cameras will continue to record in the event that a single AI NVR fails. Primary and secondary AI NVRs can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each AI NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary AI NVR.



## NIC Teaming on AI NVR Value

To further increase network resilience, it is recommended to use NIC teaming. The AI NVR Value supports three types of NIC teaming: Active Backup, Dynamic Link Aggregation (IEEE 802.3ad), and Adaptive Load Balancing.

**Tip:** Since the AI NVR Value only has two network ports, if NIC teaming is used, you will no longer be able to separate recording and playback traffic with IP subnets.

### Active Backup

In this mode, one of the two network ports are designated as the primary port, and the other is set as the backup port. While the primary network port is functioning properly, the backup port will not be used. In the event that the primary network port fails, the backup network port will take over. Both network ports work as unique virtual network interfaces with a single mac address visible to other network devices.

## Dynamic Link Aggregation (IEEE 802.3ad)

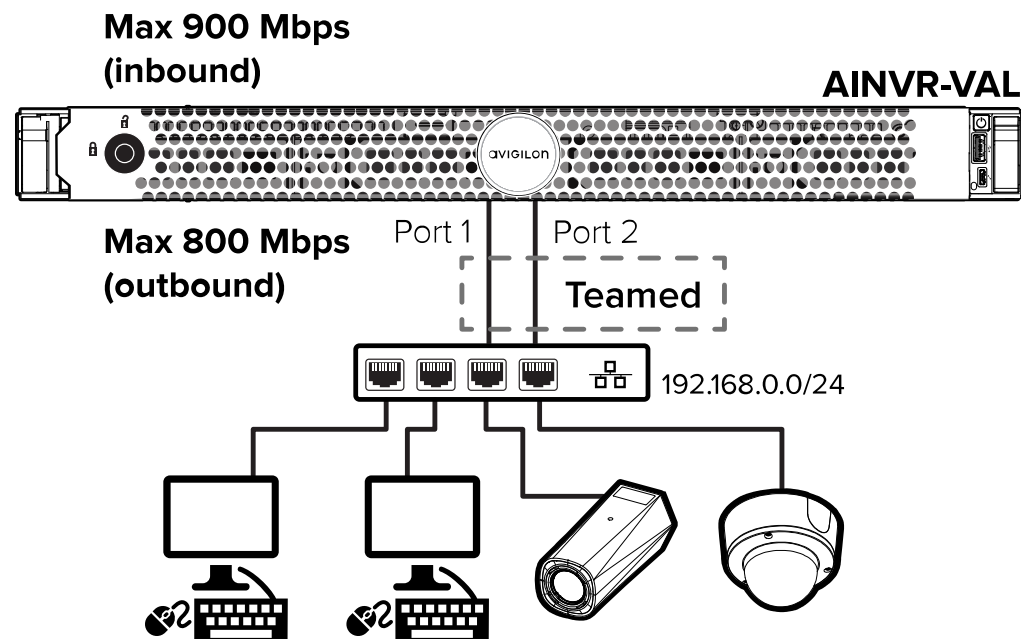
In this mode, the bandwidth of both network ports will be aggregated into a single 2 Gb/s connection. Both network ports will be utilized simultaneously in this mode and all devices using the teamed ports will operate at the same speed and duplex. If one network port were to fail, then all traffic will be forced through the remaining network port and your bandwidth will be reduced to 1 Gb/s.

**Note:** This mode requires a switch that can support IEEE 802.3ad Dynamic Link Aggregation, and will require some setup on that switch.

## Adaptive Load Balancing

In this mode, both network ports will be used as separate 1 Gb/s connections, but the AI NVR Value will attempt to dynamically load balance the transmitted and received traffic that passes through each network port. Each network port can be connected to different network switches on the same IP subnet to increase redundancy. In the even that one network port fails, all traffic will be redirected to the working network port.

This mode provides many of the benefits of Dynamic Link Aggregation without the need for any switch configuration or support. Additionally, this mode supports network ports of different speeds (10 Gb/s and 1 Gb/s) to be teamed together.



# NVR5 Premium (252/288/360/432 TB)

NVR5 Premium has extremely high storage density and performance. It is designed for exceptional performance with two 10-GbE and four 1-GbE Network ports, that support up to 2.1 Gbps of total throughput when all network ports are used. NVR5 Premium comes with Avigilon Appearance Search technology and secondary power supplies built-in. The NVR5 Premium is available with Windows Server 2019.

## Supported Accessories for NVR5 Premium (252/288/360/432 TB)

Additionally, the NVR5 Premium can easily be upgraded to take advantage of hot-plug power supplies, fiber-optic connections, and additional RAM. The following optional accessories must be ordered separately:

- **NVR5-10GBASET-B:** Install this network card, DP 10 G-Base-T, to add 10 G-Base-T networking to your NVR5 Premium (252/288/360/432 TB).
- **NVR5-SFPPLUS-SR-B:** SFP+ Transceivers, for short range (multi-mode) on server side, are used to connect your fiber 10G connection to the NVR5 Premium SFP+ port.
- **NVR5-SFPPLUS-LR-B:** SFP+ Transceivers, for long range (single-mode) between SAN switches, are used to connect your fiber 10G connection to the NVR5 Premium SFP+ port.
- **NVR5-SFPPLUS-DA:** Uses 3 m (10 ft) SFP+ 10 GbE Twinax Direct Attach cable to connect to the NVR5 Premium SFP+ port without a transceiver.
- **NVR5-RAM-16GB-B:** Install the RAM upgrade kit, for 1 CPU Processor Only—2 × 8 GB DDR4 3200 MT/s DIMMs, to increase the memory on your NVR5 Premium (252/288/360/432 TB).
- **NVR5-PSU-1000W:** Install the 1000 W flex slot titanium hot plug/swappable power supply kit to help ensure a stable NVR5 Premium power supply when uptime is critical.

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR must be configured into unique IP subnets.
- Only one network port on the NVR (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.

- When possible, attempt to equally distribute inbound (recording) traffic across all network ports, IP subnets or VLANs being used. The Avigilon System Design Tool can estimate traffic coming from groups of cameras.
- If you have multiple VLANs on an edge switch, ensure that the trunk back to the core is appropriately configured to handle multiple VLAN traffic.
- When using 10-GbE networking, be sure to use the correct direct attach cables or system-specific SFP+ transceivers. Unsupported direct attach cables and transceivers may cause performance degradation. For more information on supported accessories, see *Supported Accessories for NVR5 Premium (252/288/360/432 TB)* on the previous page or the NVR5 datasheet.
- On 10 GbE networks, both 10-GbE ports should be used for fault tolerance. Connect both 10-GbE network ports to the same switch with NIC teaming in fault tolerance mode. Note that this configuration has maximum recording throughput to 1500 Mbps which is an NVR system maximum, regardless of the number of ports used.
- Ensure that connected and in use NICs are **not** set to Public.

For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required <sup>1</sup>	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput) <sup>2</sup>
One, two or three 1 GbE	One 1 GbE	Up to 800 Mbps (max 800 Mbps per port)	Up to 800 Mbps (max 800 Mbps per port)
One or two 10 GbE <sup>3</sup>	One or more 1 GbE	Up to 1500 Mbps (max 1500 Mbps per port)	Up to 600 Mbps (max 600 Mbps per port)

<sup>1</sup> No playback throughput performance improvement is expected from NIC teaming. NIC teaming is recommended for redundancy.

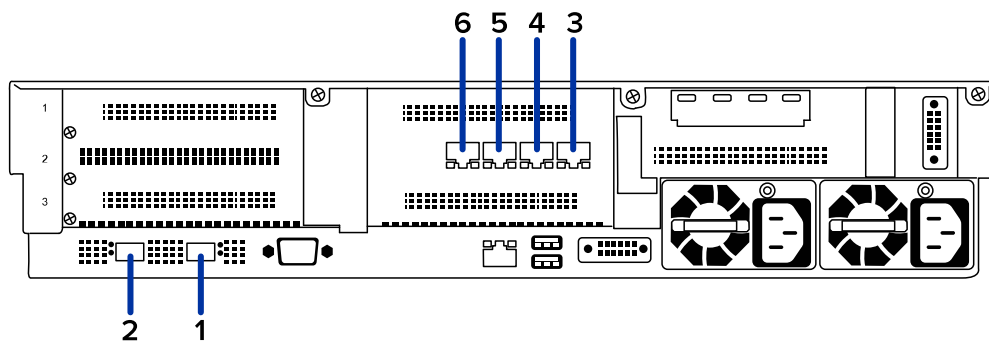
<sup>2</sup> The maximum playback throughput for NVR5 Premium can be increased by reducing the recording throughput.

<sup>3</sup> The recording and client throughput is the same for both 10G Base-T and SFP+ 10 GbE interfaces. 10G Base-T networking requires installation of the optional NVR5-10GBASET-B accessory.

## Network Interface Connections

### NVR5 Premium (252/288/360/432 TB)

- It is recommended to use network ports one and two for recording traffic. These are the 10 GbE network ports.
- It is recommended to use network ports three, four, five and six for client traffic or lower throughput recording traffic.

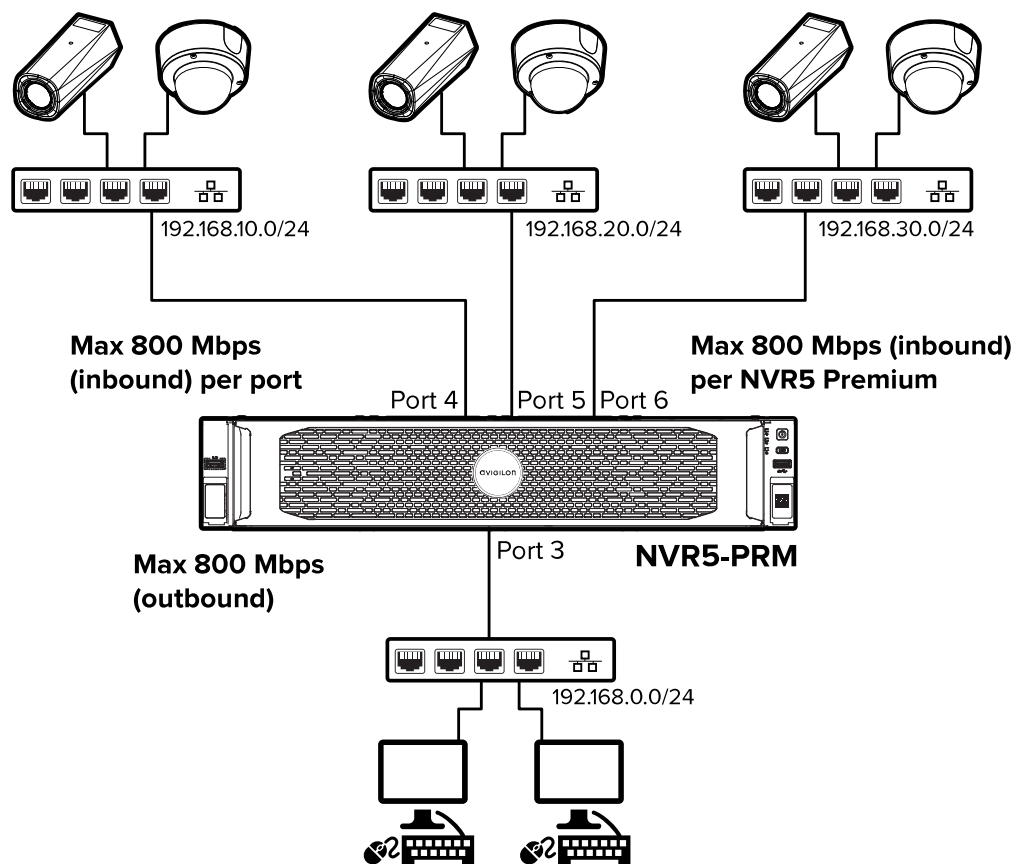


## Sample Network Topologies

### 1-GbE Networking

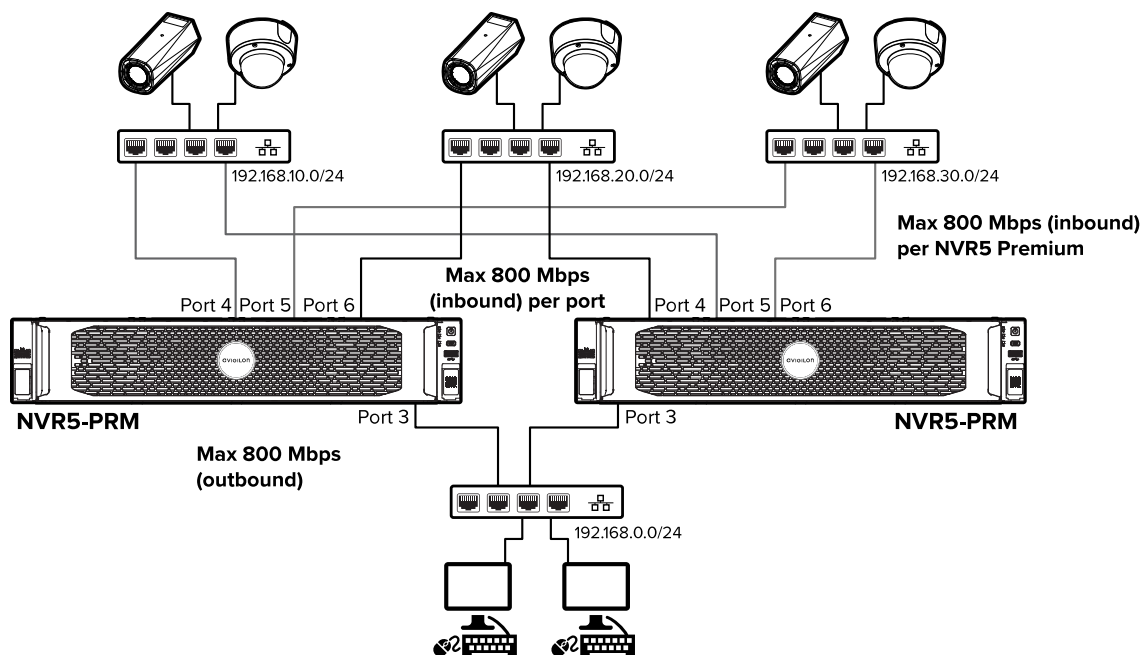
#### 1-GbE Network Topology with One NVR5 Premium

Suitable for sites using 1-GbE networking with less than 800 Mbps of recording throughput. This simple deployment does not provide any network redundancy.



## 1-GbE Network Topology with Multiple NVR5 Premium

Suitable for deployments using 1-GbE Networking that require network redundancy. Connecting multiple NVR5s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR5s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.

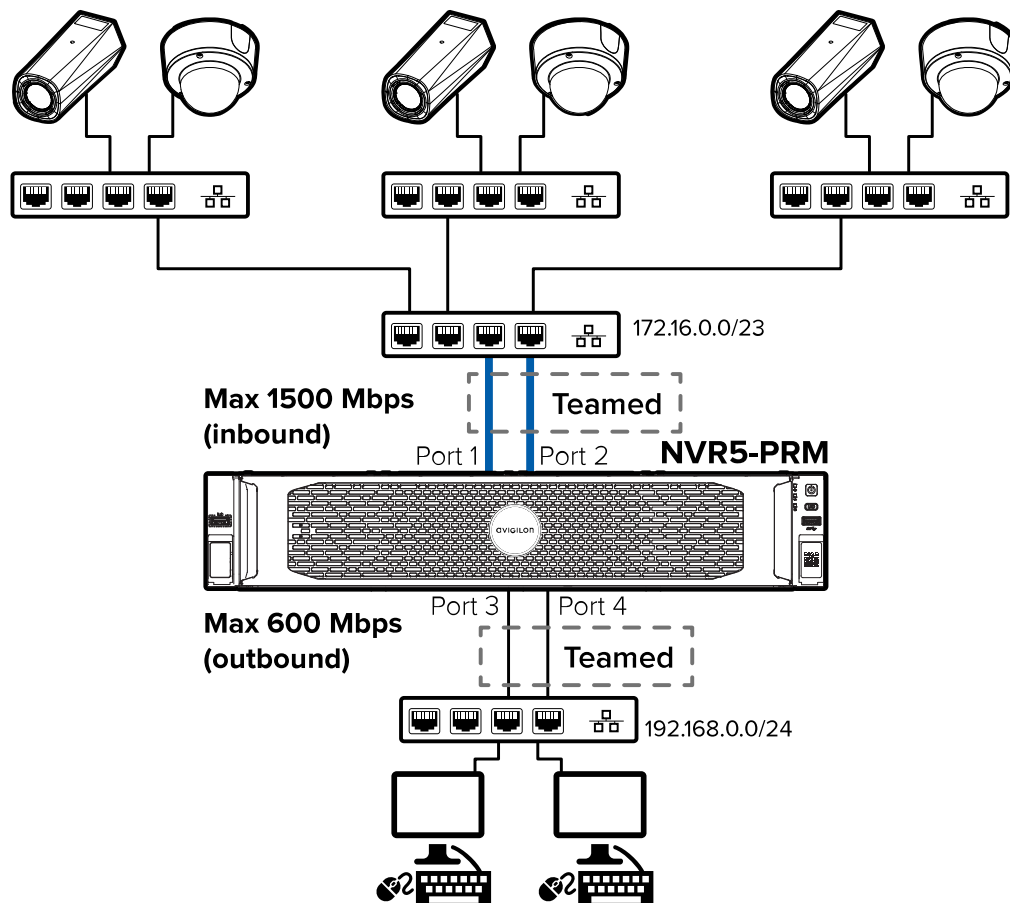


## 10-GbE Networking

**Important:** 10 GbE networking on the NVR5 Premium can use the SFP+ network ports that are included with the NVR, or can use the optional NVR5-10GBASET-B 10G-Base-T network card. This optional accessories must be ordered separately.

### 10-GbE Network Topology with One NVR5 Premium

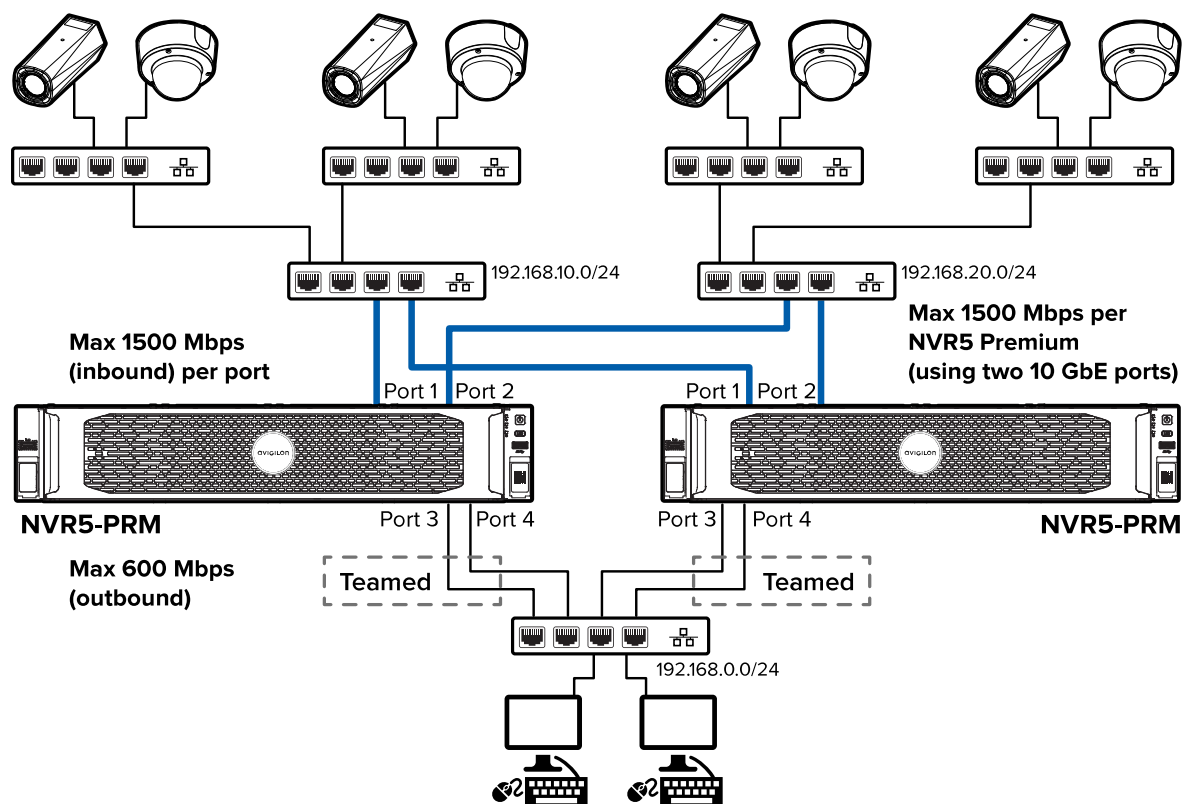
Suitable for sites using 10-GbE networking with less than 1500 Mbps of recording throughput with two 10-GbE network ports configured to one NIC team. This simple deployment provides redundancy in the event that one 10-GbE network port on the NVR5 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



## 10-GbE Network Topology with Multiple NVR5 Premium

Suitable for deployments using 10-GbE Networking that require network redundancy. Connecting multiple NVR5s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR5s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the playback ports provides redundancy in the event that one network port on the NVR5 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.

**Note:** NIC teaming is not used on the recording ports, as more robust redundancy can be achieved by using two switches.



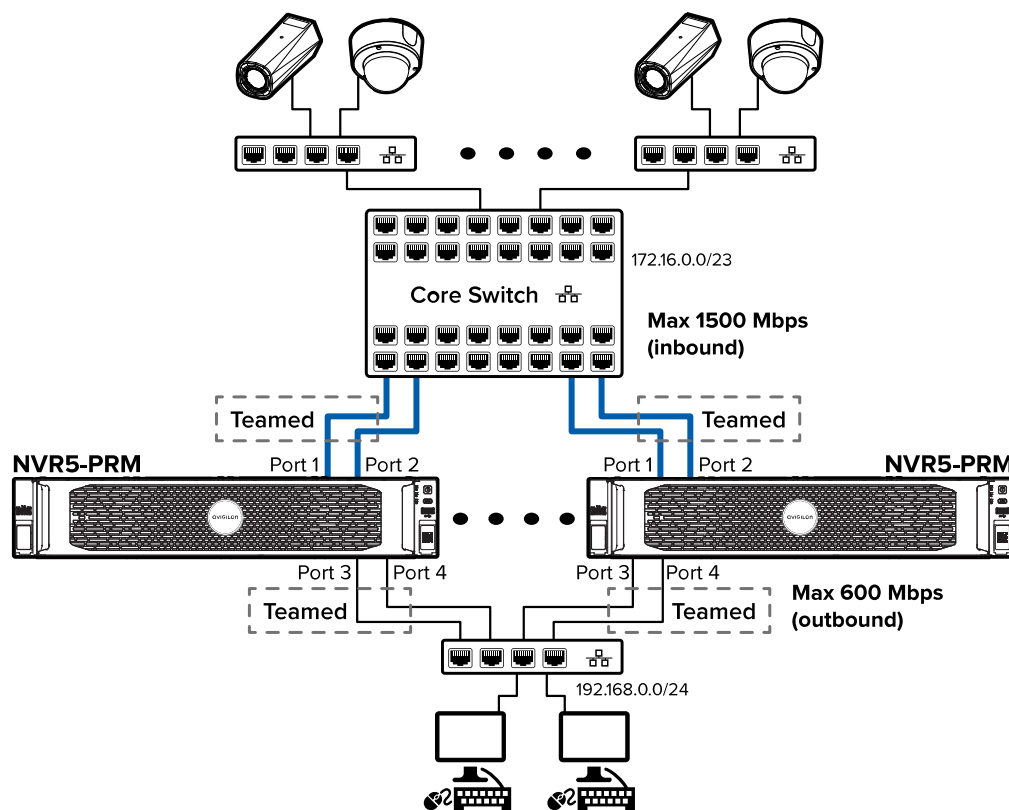


## Enterprise Networking

**Important:** 10 GbE networking on the NVR5 Premium can use the SFP+ network ports that are included with the NVR, or can use the optional NVR5-10GBASET-B 10G-Base-T network card. This optional accessories must be ordered separately.

### Enterprise Network Topology with Multiple NVR5 Premium

Suitable for deployments using 10-GbE networking that require robust network redundancy. An enterprise level core switch is used to simplify network connections with multiple NVR5s ( $n$  NVRs). Primary and secondary NVR5s should be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the recording and playback ports provides redundancy in the event that one network port on the NVR5 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



# NVR5 Premium (192/224 TB)

NVR5 Premium has extremely high storage density and performance. It is designed for exceptional performance with four 10-GbE and four 1-GbE Network ports, that support up to 2.1 Gbps of total throughput when all network ports are used. NVR5 Premium comes with Avigilon Appearance Search technology and secondary power supplies built-in. The NVR5 Premium is available with Windows Server 2019.

## Supported Accessories for NVR5 Premium (192/224 TB)

Additionally, the NVR5 Premium can easily be upgraded to take advantage of hot-plug power supplies, fiber-optic connections, and additional RAM. The following optional accessories must be ordered separately:

- **NVR5-10GBASET-A2:** Install this network card, QP 10 G-Base-T, to add 10 G-Base-T networking to your NVR5 Premium (192/224 TB).
- **NVR5-SFPPLUS-SR-A:** SFP+ Transceivers, for short range (multi-mode) on server side, are used to connect your fiber 10G connection to the NVR5 Premium SFP+ port.
- **NVR5-SFPPLUS-LR-A:** SFP+ Transceivers, for long range (single-mode) between SAN switches, are used to connect your fiber 10G connection to the NVR5 Premium SFP+ port.
- **NVR5-SFPPLUS-DA:** Uses 3 m (10 ft) SFP+ 10 GbE Twinax Direct Attach cable to connect to the NVR5 Premium SFP+ port without a transceiver.
- **NVR5-RAM-16GB-A:** Install the RAM upgrade kit, for 1 CPU Processor Only—2 × 8 GB DDR4 3200 MT/s DIMMs, to increase the memory on your NVR5 Premium.
- **NVR5-PRM-2NDCPU:** Install the 2nd CPU upgrade kit, 6 × 8 GB DDR4 3200 MT/s DIMMs, to increase the processing power of your NVR5 Premium.
- **NVR5-PSU-1100W-A2:** Install the 1100 W hot plug/swappable power supply kit to help ensure a stable NVR5 Premium power supply when uptime is critical.

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

# Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR must be configured into unique IP subnets.
- Only one network port on the NVR (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.
- When possible, attempt to equally distribute inbound (recording) traffic across all network ports, IP subnets or VLANs being used. The Avigilon System Design Tool can estimate traffic coming from groups of cameras.
- If you have multiple VLANs on an edge switch, ensure that the trunk back to the core is appropriately configured to handle multiple VLAN traffic.
- When using 10-GbE networking, be sure to use the correct direct attach cables or system-specific SFP+ transceivers. Unsupported direct attach cables and transceivers may cause performance degradation. For more information on supported accessories, see *Supported Accessories for NVR5 Premium (192/224 TB)* on the previous page or the NVR5 datasheet.
- On 10 GbE networks, at least two 10-GbE ports should be used for fault tolerance. Connect both 10-GbE network ports to the same switch with NIC teaming in fault tolerance mode. Note that this configuration has maximum recording throughput to 1500 Mbps which is an NVR system maximum, regardless of the number of ports used.
- Ensure that connected and in use NICs are **not** set to Public.

For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required <sup>1</sup>	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput) <sup>2</sup>
One, two or three 1 GbE	One 1 GbE	Up to 800 Mbps (max 800 Mbps per port)	Up to 600 Mbps (max 600 Mbps per port)
One or two 10 GbE <sup>3</sup>	One or more 1 GbE	Up to 1500 Mbps (max 1500 Mbps per port)	Up to 600 Mbps (max 600 Mbps per port)

<sup>1</sup> No playback throughput performance improvement is expected from NIC teaming. NIC teaming is recommended for redundancy.

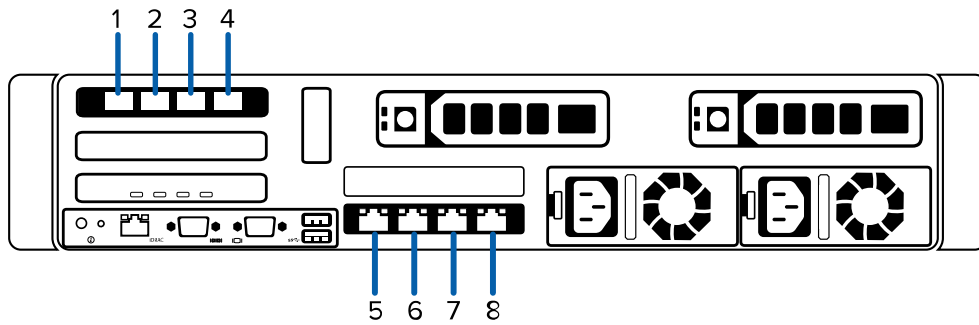
<sup>2</sup> The maximum playback throughput for NVR5 Premium can be increased by reducing the recording throughput.

<sup>3</sup> The recording and client throughput is the same for both 10G Base-T and SFP+ 10 GbE interfaces. 10G Base-T networking requires installation of the optional NVR5-10GBASET-A2 accessory.

# Network Interface Connections

## NVR5 Premium (192/224 TB)

- It is recommended to use network ports one, two, three, and four for recording traffic. These are the 10 GbE network ports.
- It is recommended to use network ports five, six, seven, and eight for client traffic or lower throughput recording traffic.

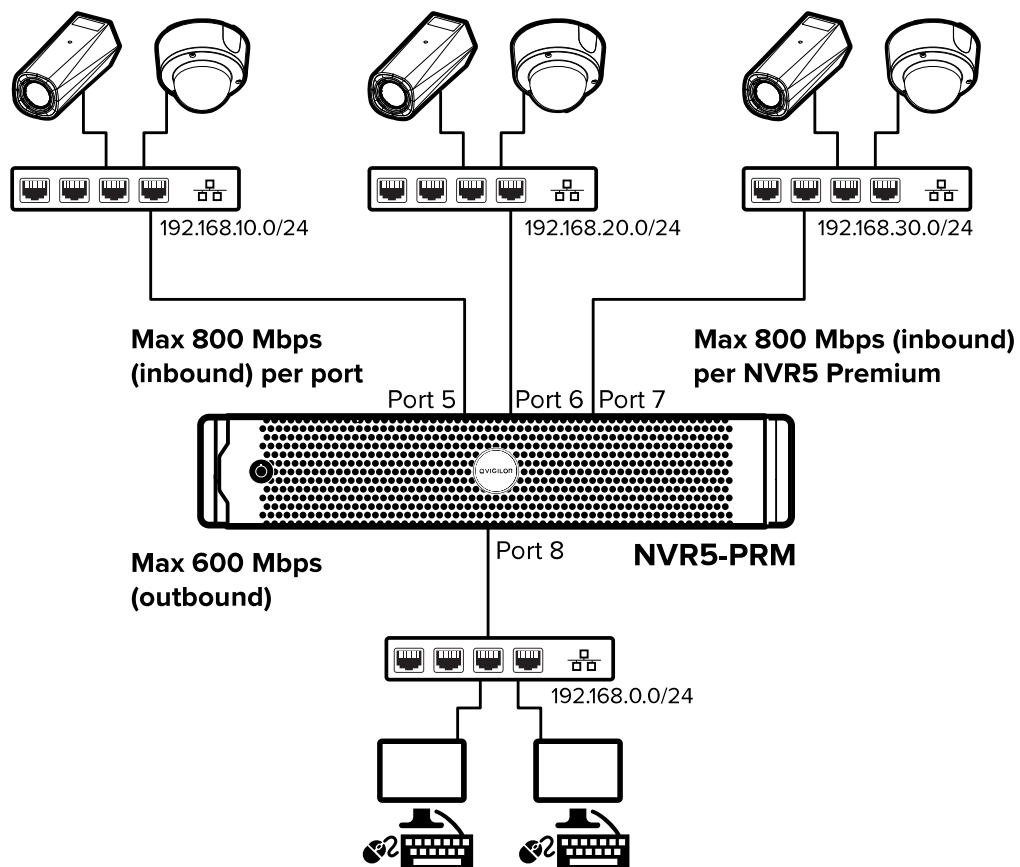


## Sample Network Topologies

### 1-GbE Networking

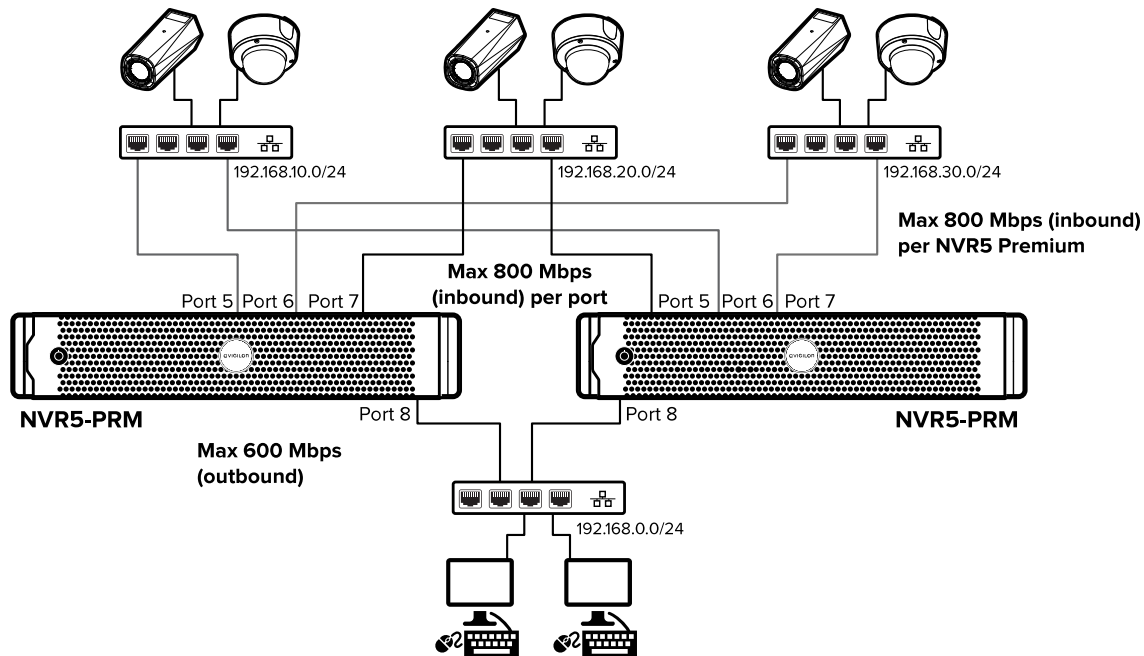
#### 1-GbE Network Topology with One NVR5 Premium

Suitable for sites using 1-GbE networking with less than 800 Mbps of recording throughput. This simple deployment does not provide any network redundancy.



## 1-GbE Network Topology with Multiple NVR5 Premium

Suitable for deployments using 1-GbE Networking that require network redundancy. Connecting multiple NVR5s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR5s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.

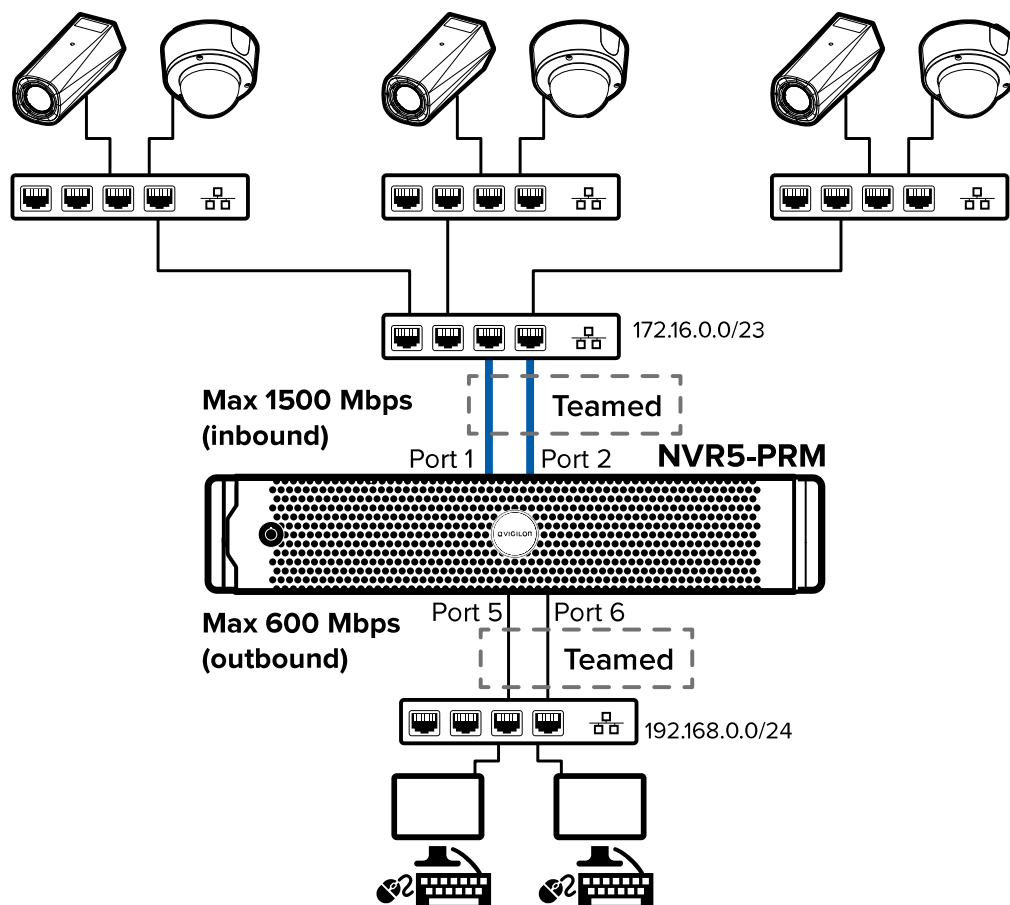


## 10-GbE Networking

**Important:** 10 GbE networking on the NVR5 Premium can use the SFP+ network ports that are included with the NVR, or can use the optional NVR5-10GBASET-A2 10G-Base-T network card. This optional accessories must be ordered separately.

### 10-GbE Network Topology with One NVR5 Premium

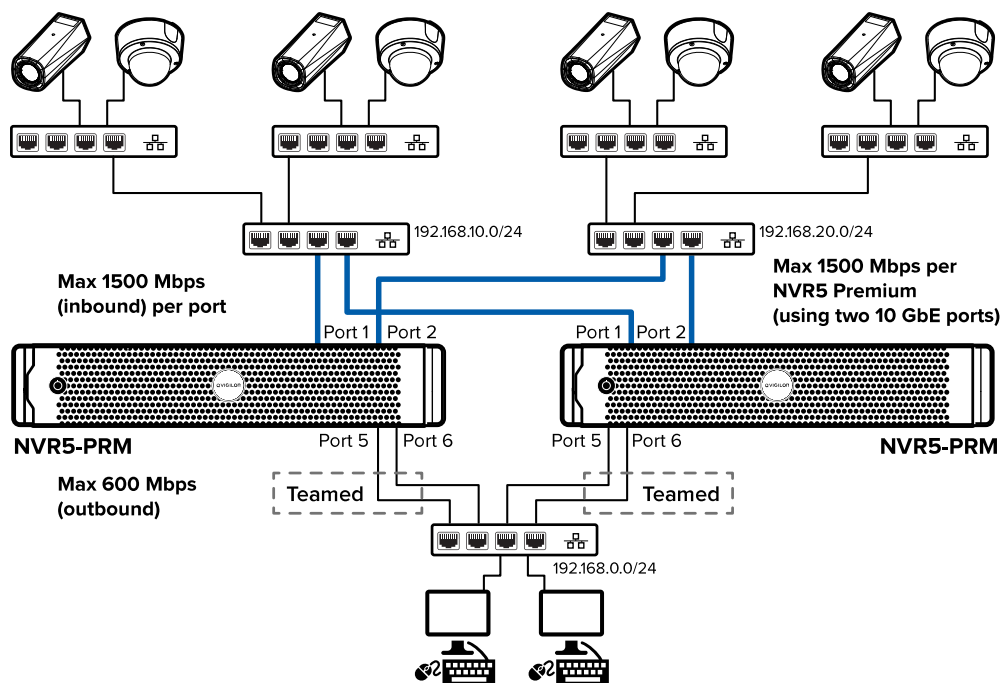
Suitable for sites using 10-GbE networking with less than 1500 Mbps of recording throughput with two 10-GbE network ports configured to one NIC team. This simple deployment provides redundancy in the event that one 10-GbE network port on the NVR5 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



## 10-GbE Network Topology with Multiple NVR5 Premium

Suitable for deployments using 10-GbE Networking that require network redundancy. Connecting multiple NVR5s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR5s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the playback ports provides redundancy in the event that one network port on the NVR5 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.

**Note:** NIC teaming is not used on the recording ports, as more robust redundancy can be achieved by using two switches.



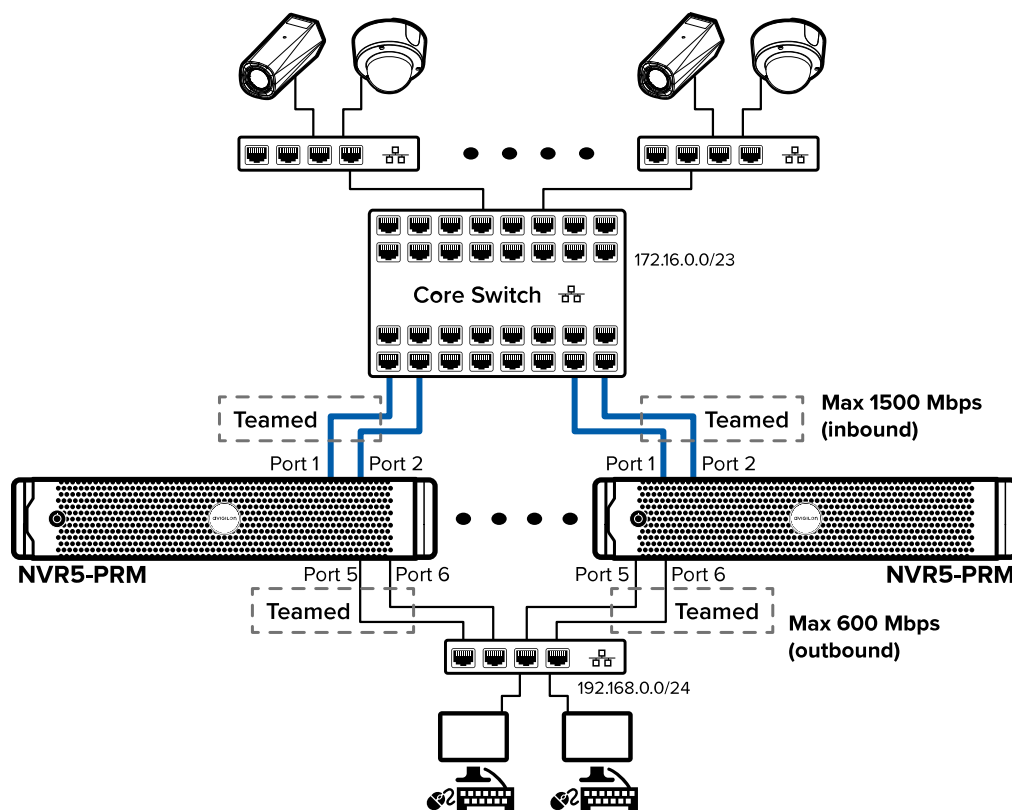


## Enterprise Networking

**Important:** 10 GbE networking on the NVR5 Premium can use the SFP+ network ports that are included with the NVR, or can use the optional NVR5-10GBASET-A2 10G-Base-T network card. This optional accessories must be ordered separately.

### Enterprise Network Topology with Multiple NVR5 Premium

Suitable for deployments using 10-GbE networking that require robust network redundancy. An enterprise level core switch is used to simplify network connections with multiple NVR5s ( $n$  NVRs). Primary and secondary NVR5s should be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the recording and playback ports provides redundancy in the event that one network port on the NVR5 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



# NVR5 Premium (96/128/160 TB)

NVR5 Premium has extremely high storage density and performance. It is designed for exceptional performance with two 10-GbE and six 1-GbE Network ports, that support up to 2.1 Gbps of total throughput when all network ports are used. NVR5 Premium comes with Avigilon Appearance Search technology and secondary power supplies built-in. The NVR5 Premium is available with Windows Server 2019.

## Supported Accessories for NVR5 Premium (96/128/160 TB)

Additionally, the NVR5 Premium can easily be upgraded to take advantage of hot-plug power supplies, fiber-optic connections, and additional RAM. The following optional accessories must be ordered separately:

- **NVR5-10GBASET-A1:** Install this network card, QP 10 G-Base-T, to add 10 G-Base-T networking to your NVR5 Premium (96/128/160 TB).
- **NVR5-SFPPLUS-SR-A:** SFP+ Transceivers, for short range (multi-mode) on server side, are used to connect your fiber 10G connection to the NVR5 Premium SFP+ port.
- **NVR5-SFPPLUS-LR-A:** SFP+ Transceivers, for long range (single-mode) between SAN switches, are used to connect your fiber 10G connection to the NVR5 Premium SFP+ port.
- **NVR5-SFPPLUS-DA:** Uses 3 m (10 ft) SFP+ 10 GbE Twinax Direct Attach cable to connect to the NVR5 Premium SFP+ port without a transceiver.
- **NVR5-RAM-16GB-A:** Install the RAM upgrade kit, for 1 CPU Processor Only—2 × 8 GB DDR4 3200 MT/s DIMMs, to increase the memory on your NVR5 Premium.
- **NVR5-PSU-1100W-A1:** Install the 1100 W hot plug/swappable power supply kit to help ensure a stable NVR5 Premium power supply when uptime is critical.

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR must be configured into unique IP subnets.
- Only one network port on the NVR (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.

- When possible, attempt to equally distribute inbound (recording) traffic across all network ports, IP subnets or VLANs being used. The Avigilon System Design Tool can estimate traffic coming from groups of cameras.
- If you have multiple VLANs on an edge switch, ensure that the trunk back to the core is appropriately configured to handle multiple VLAN traffic.
- When using 10-GbE networking, be sure to use the correct direct attach cables or system-specific SFP+ transceivers. Unsupported direct attach cables and transceivers may cause performance degradation. For more information on supported accessories, see *Supported Accessories for NVR5 Premium (96/128/160 TB)* on the previous page or the NVR5 datasheet.
- On 10 GbE networks, both 10-GbE ports should be used for fault tolerance. Connect both 10-GbE network ports to the same switch with NIC teaming in fault tolerance mode. Note that this configuration has maximum recording throughput to 1500 Mbps which is an NVR system maximum, regardless of the number of ports used.
- Ensure that connected and in use NICs are **not** set to Public.

For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required <sup>1</sup>	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput) <sup>2</sup>
One, two or three 1 GbE	One 1 GbE	Up to 700 Mbps (max 700 Mbps per port)	Up to 600 Mbps (max 600 Mbps per port)
One or two 10 GbE <sup>3</sup>	One or more 1 GbE	Up to 1500 Mbps (max 1500 Mbps per port)	Up to 600 Mbps (max 600 Mbps per port)

<sup>1</sup> No playback throughput performance improvement is expected from NIC teaming. NIC teaming is recommended for redundancy.

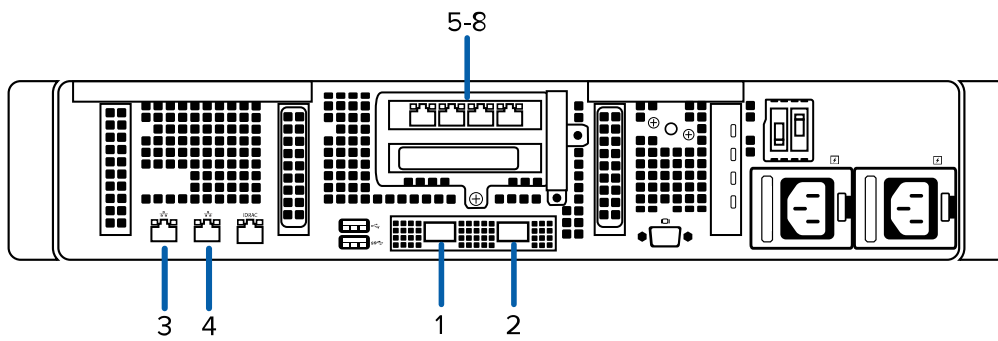
<sup>2</sup> The maximum playback throughput for NVR5 Premium can be increased by reducing the recording throughput.

<sup>3</sup> The recording and client throughput is the same for both 10G Base-T and SFP+ 10 GbE interfaces. 10G Base-T networking requires installation of the optional NVR5-10GBASET-A1 accessory.

## Network Interface Connections

### NVR5 Premium (96/128/160 TB)

- It is recommended to use network ports one and two for recording traffic. These are the 10 GbE network ports.
- It is recommended to use network ports three, four, five, six, seven and eight for client traffic or lower throughput recording traffic.

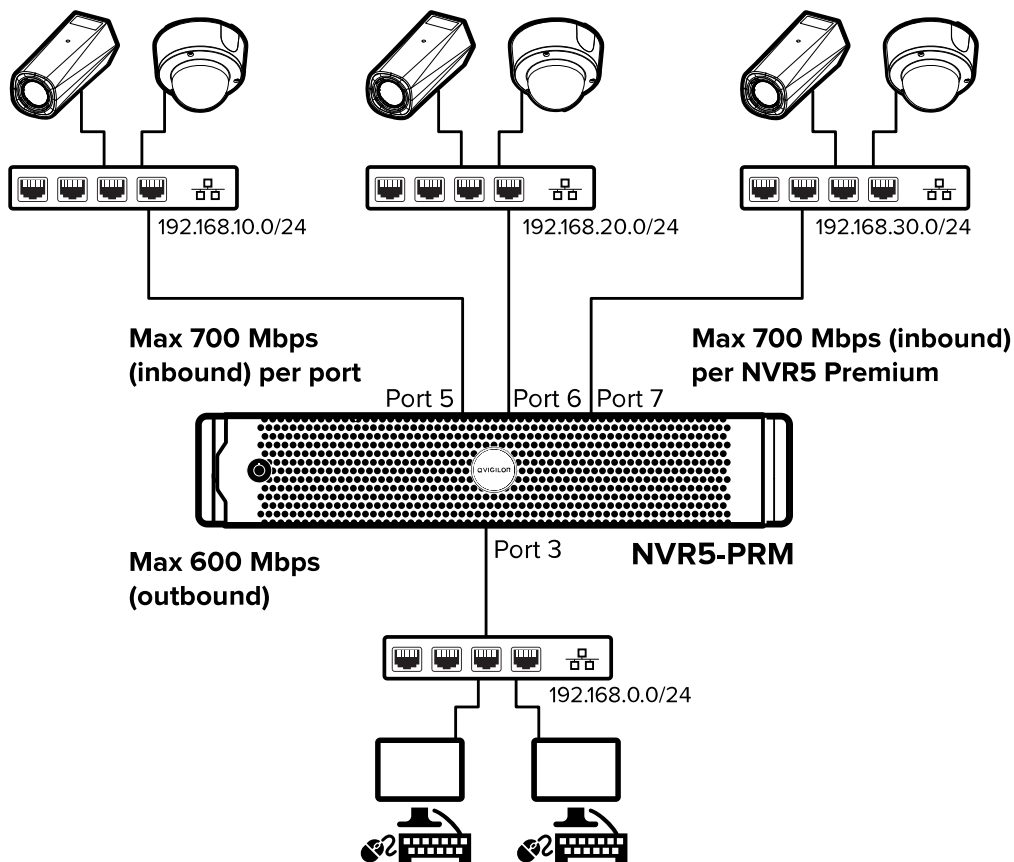


## Sample Network Topologies

### 1-GbE Networking

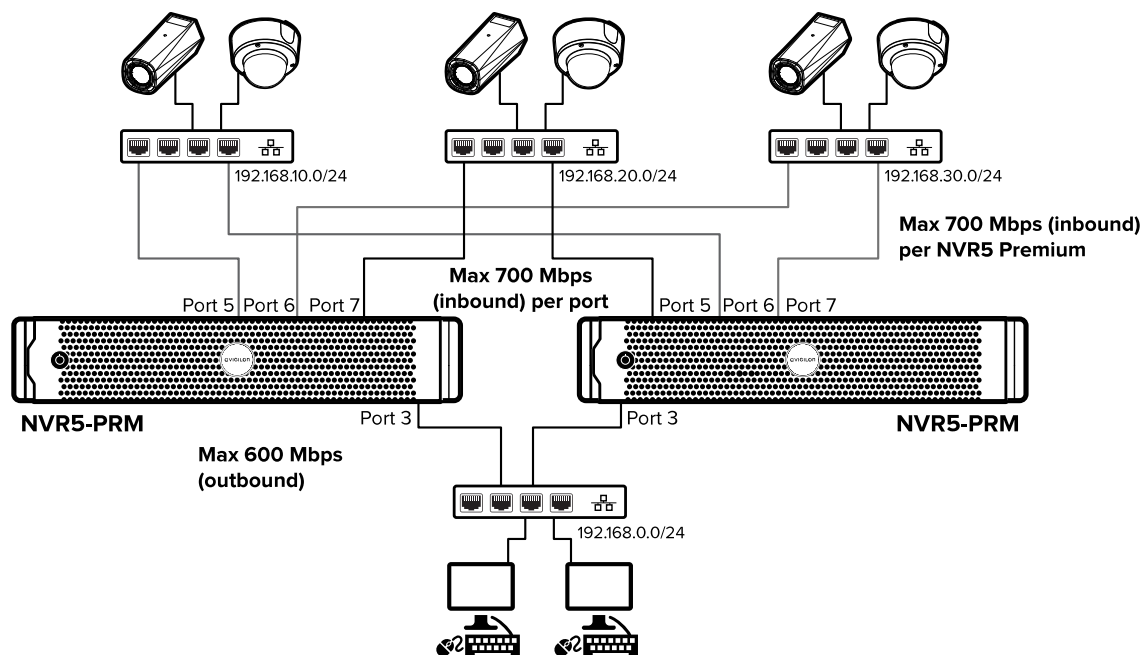
#### 1-GbE Network Topology with One NVR5 Premium

Suitable for sites using 1-GbE networking with less than 700 Mbps of recording throughput. This simple deployment does not provide any network redundancy.



## 1-GbE Network Topology with Multiple NVR5 Premium

Suitable for deployments using 1-GbE Networking that require network redundancy. Connecting multiple NVR5s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR5s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.

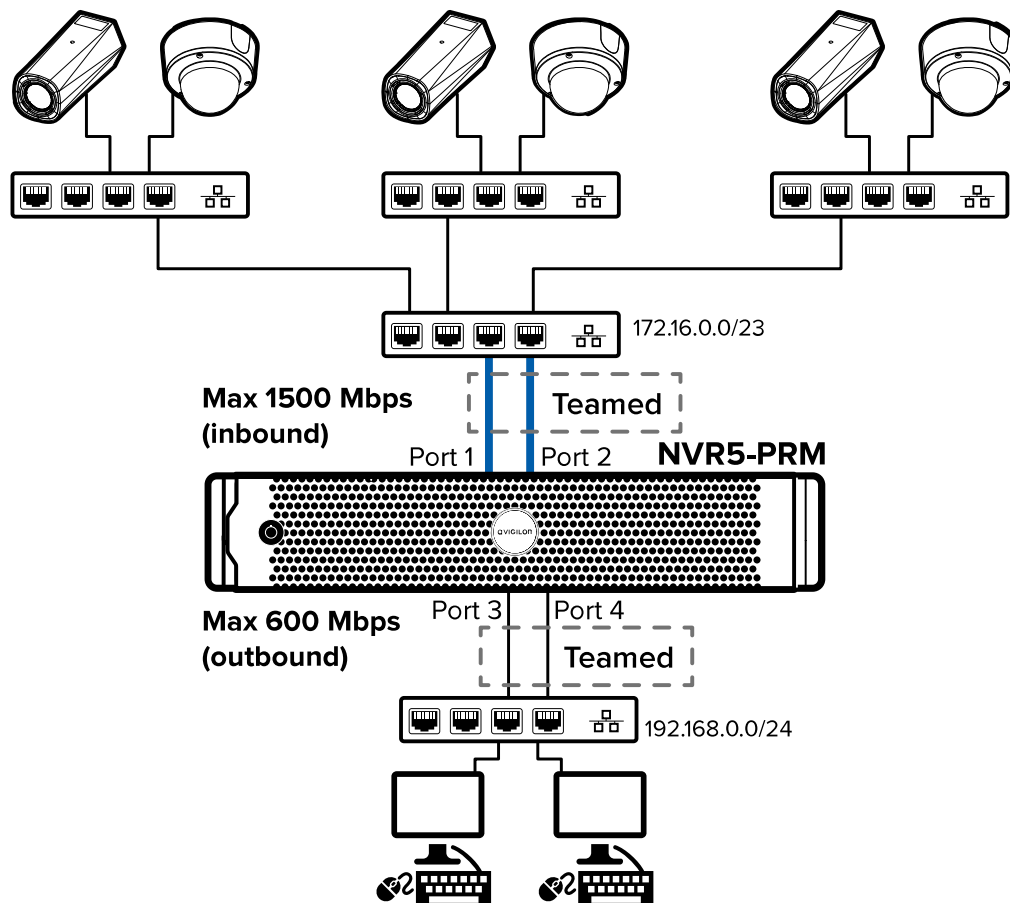


## 10-GbE Networking

**Important:** 10 GbE networking on the NVR5 Premium can use the SFP+ network ports that are included with the NVR, or can use the optional NVR5-10GBASET-A1 10G-Base-T network card. This optional accessories must be ordered separately.

### 10-GbE Network Topology with One NVR5 Premium

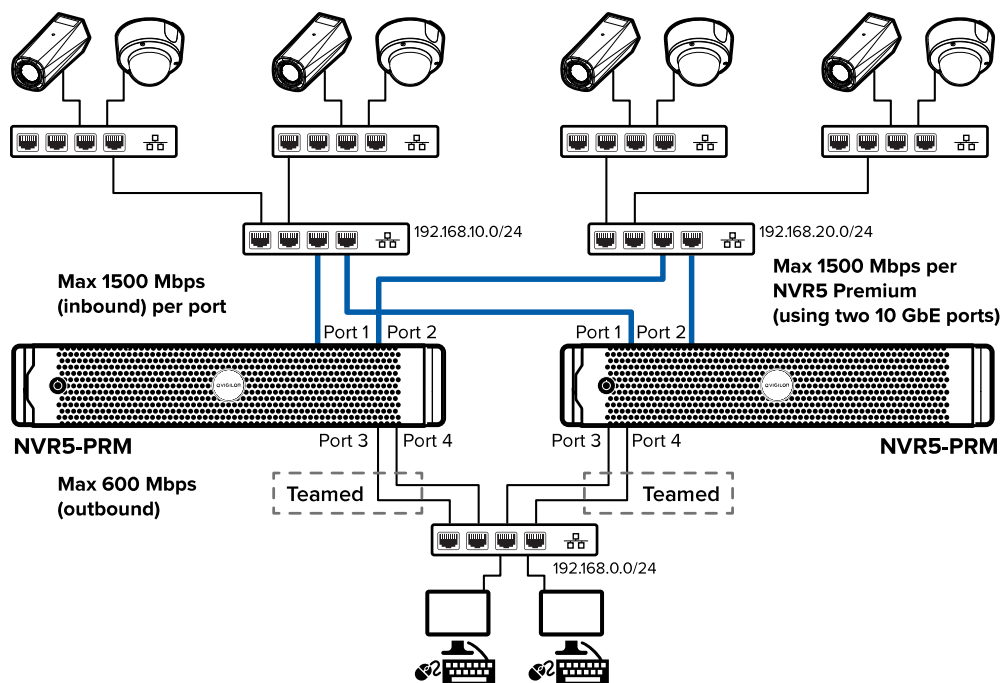
Suitable for sites using 10-GbE networking with less than 1500 Mbps of recording throughput with two 10-GbE network ports configured to one NIC team. This simple deployment provides redundancy in the event that one 10-GbE network port on the NVR5 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



## 10-GbE Network Topology with Multiple NVR5 Premium

Suitable for deployments using 10-GbE Networking that require network redundancy. Connecting multiple NVR5s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR5s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the playback ports provides redundancy in the event that one network port on the NVR5 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.

**Note:** NIC teaming is not used on the recording ports, as more robust redundancy can be achieved by using two switches.

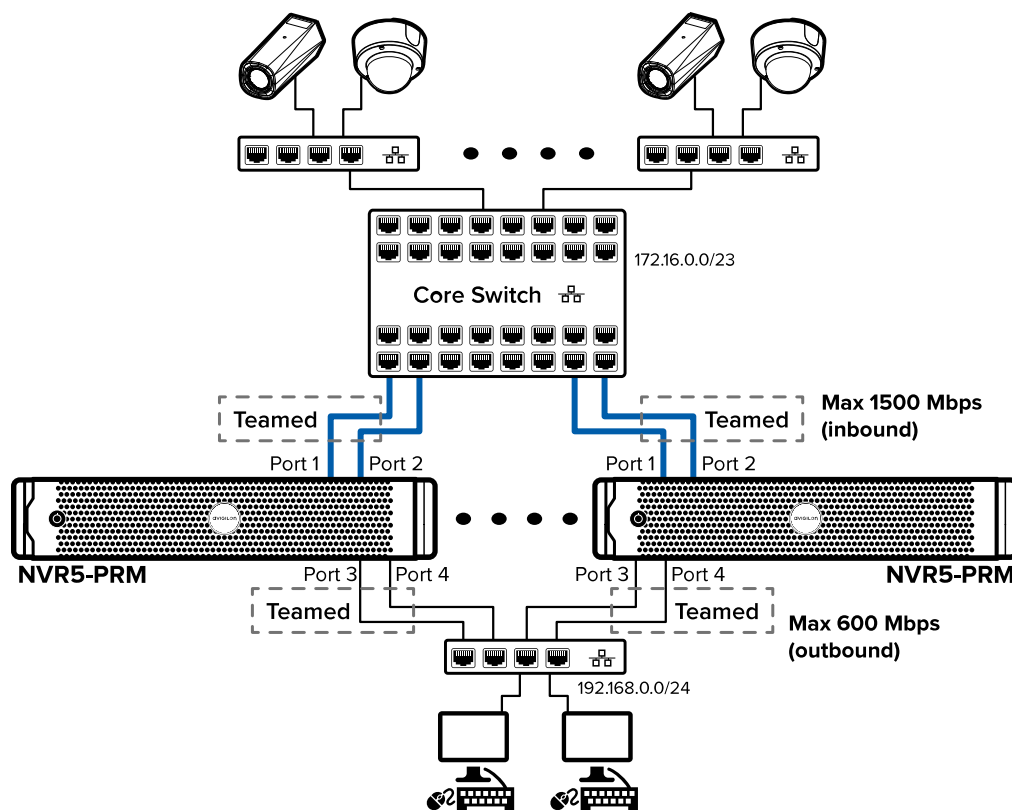


## Enterprise Networking

**Important:** 10 GbE networking on the NVR5 Premium can use the SFP+ network ports that are included with the NVR, or can use the optional NVR5-10GBASET-A1 10G-Base-T network card. This optional accessories must be ordered separately.

### Enterprise Network Topology with Multiple NVR5 Premium

Suitable for deployments using 10-GbE networking that require robust network redundancy. An enterprise level core switch is used to simplify network connections with multiple NVR5s ( $n$  NVRs). Primary and secondary NVR5s should be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the recording and playback ports provides redundancy in the event that one network port on the NVR5 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.





# NVR5 Standard

NVR5 Standard sets the standard for what a professional network video recorder should be. It includes six 1-GbE network ports that support up to 700 Mbps of recording throughput when three 1-GbE network ports are used, and has Avigilon Appearance Search technology built-in. The NVR5 Standard is available with Windows Server 2019.

## Supported Accessories for NVR5 Standard

Additionally, the NVR5 Standard can easily be upgraded to take advantage of increased capacity, secondary power supplies, 10 GbE SFP+ networking, 10 GbE BaseT networking, and additional CPUs. The following optional accessories must be ordered separately:

- **NVR5-STD-10GBE:** Install this network card accessory, DP 10 GbE SFP+, to add SFP+ 10 GbE networking to your NVR5 Standard.
- **NVR5-10GBASET-A1:** Install this network card, QP 10 G-Base-T, to add 10 G-Base-T networking to your NVR5 Standard. NVR5-STD-2NDCPU is required to install this network card on NVR5 Standard.
- **NVR5-SFPPLUS-SR-A:** SFP+ Transceivers, for short range (multi-mode) on server side, are used to connect your fiber 10G connection to the NVR5 Standard SFP+ port.
- **NVR5-SFPPLUS-LR-A:** SFP+ Transceivers, for long range (single-mode) between SAN switches, are used to connect your fiber 10G connection to the NVR5 Standard SFP+ port.
- **NVR5-SFPPLUS-DA:** Uses 3 m (10 ft) SFP+ 10 GbE Twinax Direct Attach cable to connect to the NVR5 Standard SFP+ port without a transceiver.
- **NVR5-RAM-16GB-A:** Install the RAM upgrade kit, for 1 CPU Processor Only—2 × 8 GB DDR4 3200 MT/s DIMMs, to increase the memory on your NVR5 Standard.
- **NVR5-STD-2NDCPU:** Install the 2nd CPU upgrade kit, 2 × 8 GB DDR4 3200 MT/s DIMMs, to increase the processing power of your NVR5 Standard.
- **NVR5-PSU-800W:** Install the 800 W hot plug/swappable power supply kit to help ensure a stable NVR5 Standard power supply when uptime is critical.

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

# Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR must be configured into unique IP subnets.
- Only one network port on the NVR (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.
- When possible, attempt to equally distribute inbound (recording) traffic across all network ports, IP subnets or VLANs being used. The Avigilon System Design Tool can estimate traffic coming from groups of cameras.
- When using 10-GbE networking, be sure to use the correct direct attach cables or system-specific SFP+ transceivers. Unsupported direct attach cables and transceivers may cause performance degradation. For more information on supported accessories, see *Supported Accessories for NVR5 Standard* on the previous page or the NVR5 datasheet.
- Ensure that connected and in use NICs are **not** set to Public.

For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required <sup>1</sup>	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput)
One, two or three 1 GbE	One 1 GbE	Up to 700 Mbps (max 700 Mbps per port)	Up to 600 Mbps (max 600 Mbps per port)
One or two 10 GbE <sup>2</sup>	One 1 GbE	Up to 800 Mbps (max 800 Mbps per port)	Up to 600 Mbps (max 600 Mbps per port)
<b>With the 2nd CPU upgrade kit installed (NVR5-STD-2NDCPU)</b>			
One or two 10 GbE <sup>2</sup>	One 1 GbE	Up to 1100 Mbps (max 1100 Mbps per port)	Up to 600 Mbps (max 600 Mbps per port)

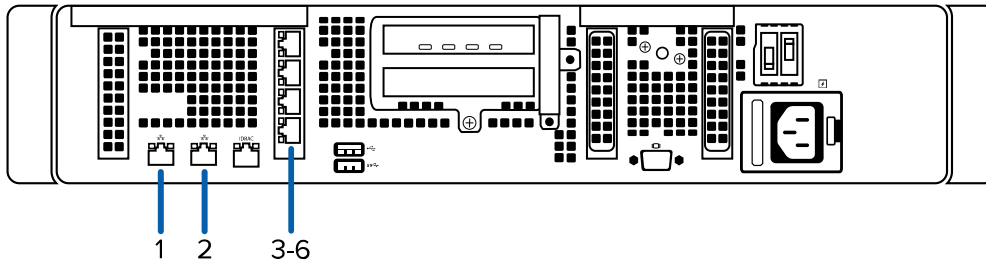
<sup>1</sup> No playback throughput performance improvement is expected from NIC teaming. NIC teaming is recommended for redundancy.

<sup>2</sup> 10 GbE networking requires installation of the optional NVR5-STD-10GBE or NVR5-10GBASET-A1 accessory. The recording and client throughput is the same for both 10G Base-T and SFP+ 10 GbE interfaces.

# Network Interface Connections

## NVR5 Standard

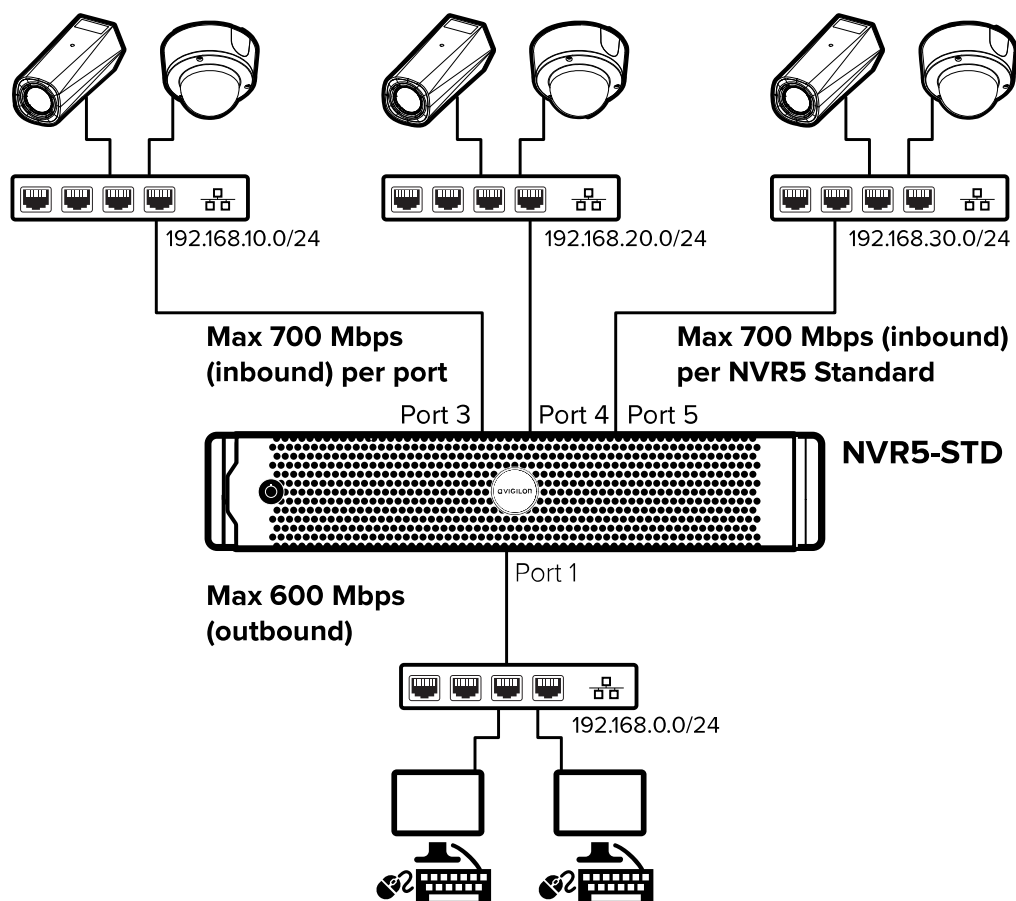
- It is recommended to use network ports one and two for client traffic.
- It is recommended to use network ports three, four, five and six for recording traffic.



## Sample Network Topologies

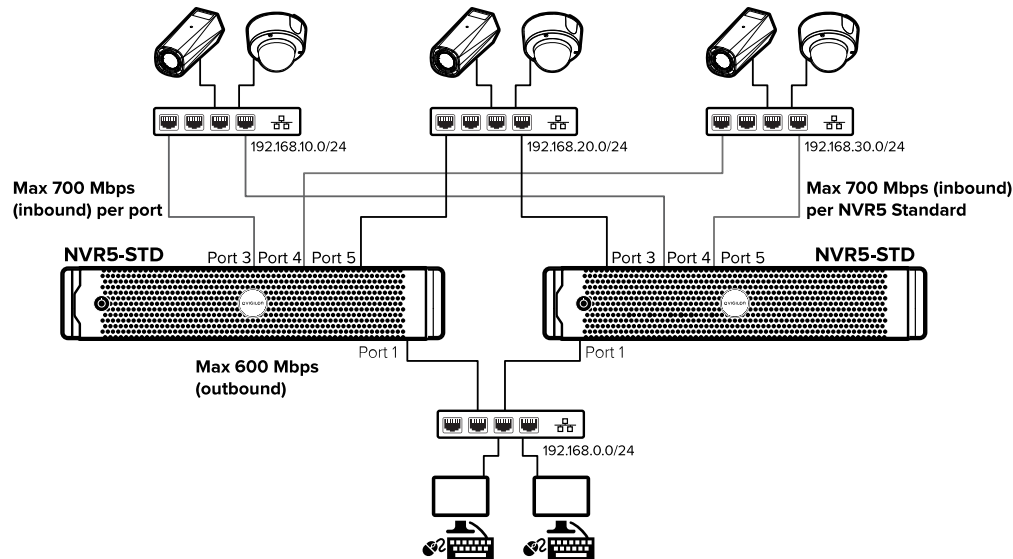
### Network Topology with One NVR5 Standard

Suitable for sites with less than 700 Mbps of recording throughput. This simple deployment does not provide any network redundancy.



## Network Topology with Multiple NVR5 Standard

Suitable for deployments that require network redundancy. Connecting multiple NVR5s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR5s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.

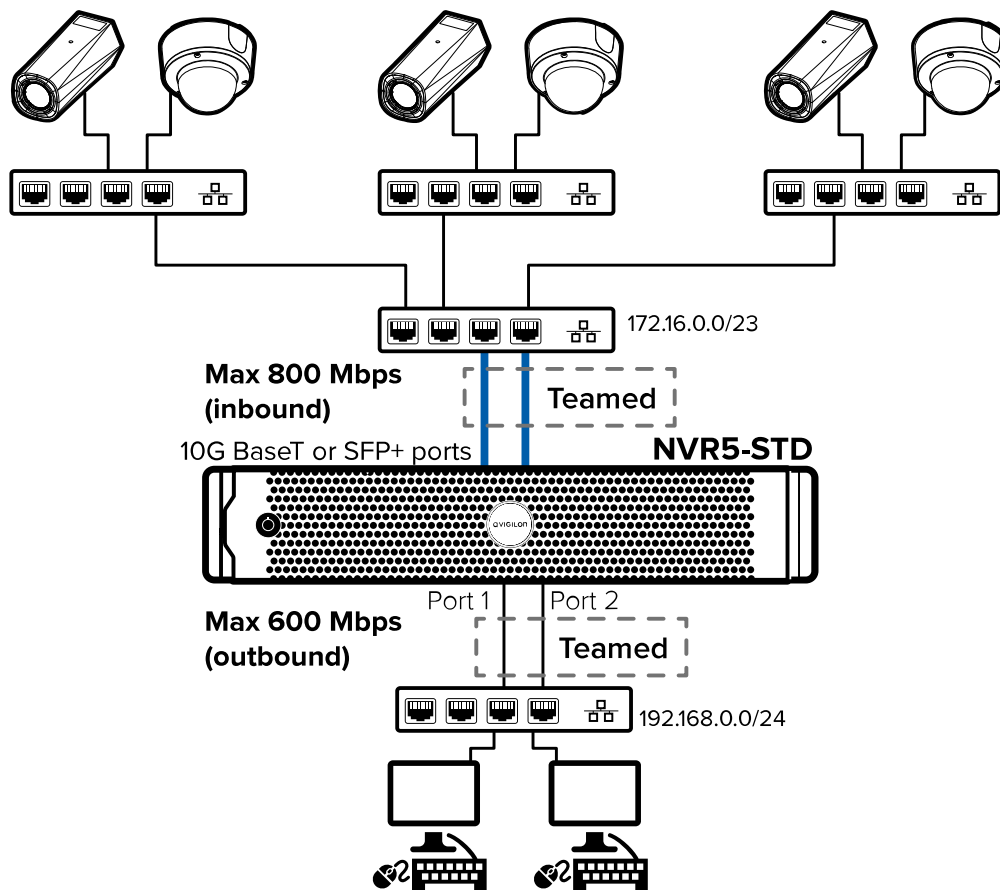


## 10-GbE Networking

**Important:** 10 GbE networking on the NVR5 Standard requires installation of the optional NVR5-STD-10GBE SFP+ network card or NVR5-10GBASET-A1 10G-Base-T network card. These optional accessories must be ordered separately.

### 10-GbE Network Topology with One NVR5 Standard

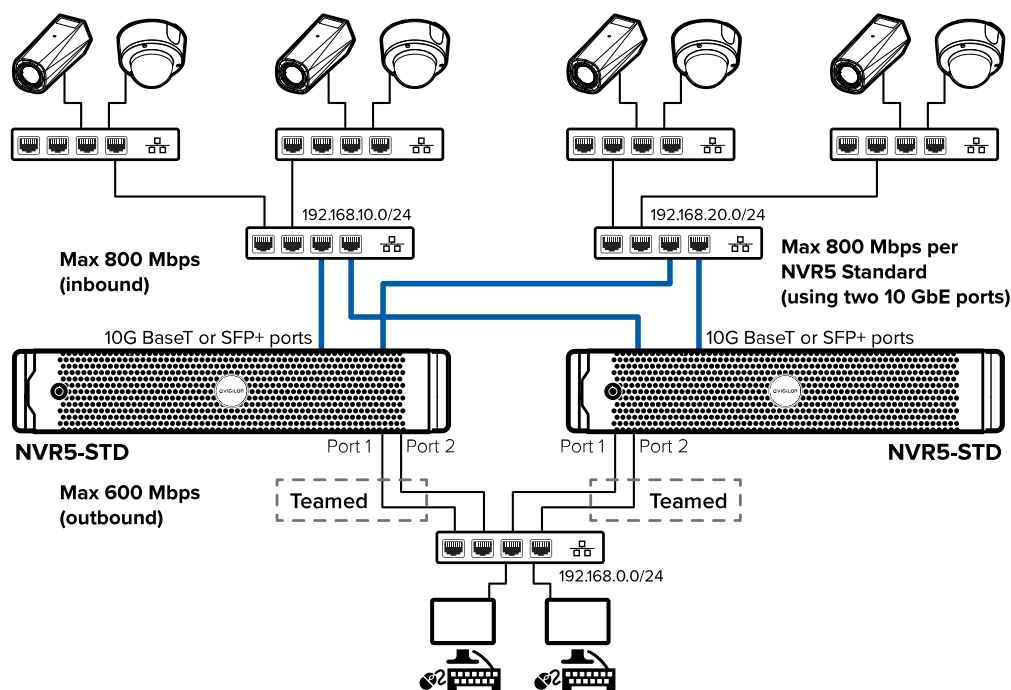
Suitable for sites using 10-GbE networking with less than 800 Mbps of recording throughput with two 10-GbE network ports configured to one NIC team. This simple deployment provides redundancy in the event that one 10-GbE network port on the NVR5 Standard fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



## 10-GbE Network Topology with Multiple NVR5 Standard

Suitable for deployments using 10-GbE Networking that require network redundancy. Connecting multiple NVR5s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR5s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the playback ports provides redundancy in the event that one network port on the NVR5 Standard fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.

**Note:** NIC teaming is not used on the recording ports, as more robust redundancy can be achieved by using two switches.

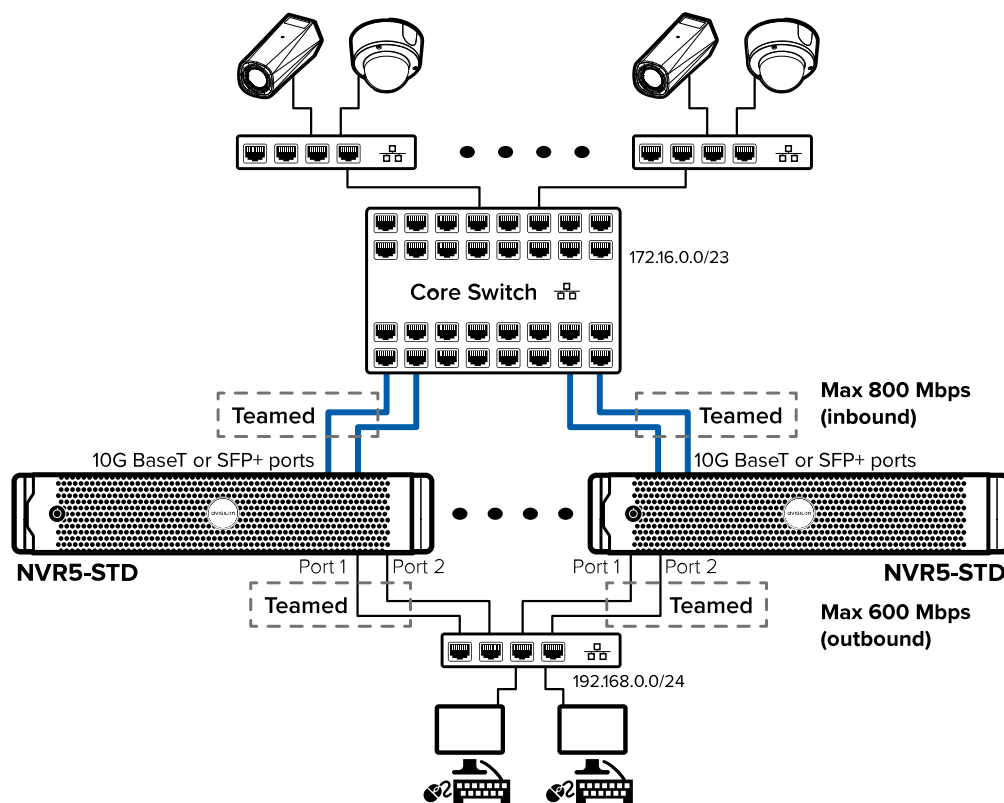


## Enterprise Networking

**Important:** 10 GbE networking on the NVR5 Standard requires installation of the optional NVR5-STD-10GBE SFP+ network card or NVR5-10GBASET-A1 10G-Base-T network card. These optional accessories must be ordered separately.

### Enterprise Network Topology with Multiple NVR5 Standard

Suitable for deployments using 10-GbE networking that require robust network redundancy. An enterprise level core switch is used to simplify network connections with multiple NVR5s ( $n$  NVRs). Primary and secondary NVR5s should be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the recording and playback ports provides redundancy in the event that one network port on the NVR5 Standard fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.





# NVR5 Value

NVR5 Value provides strong performance and various storage options in a 1U form factor. This budget-friendly NVR includes two 1 GbE network ports that can take in up to 300 Mbps of recording throughput when both network ports are used. Additionally, the NVR5 Value can be upgraded to take advantage of Avigilon Appearance Search™ technology with one of the optional Analytics Kits: NVR5-VAL-ANK or NVR5-VAL-ANK-PLUS.

The NVR5 Value is available with Windows 10 IoT Enterprise OS and can be upgraded to Windows Server 2019 with an optional OS upgrade kit (NVR5-S19-UPG).

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR5 Value must be configured into unique IP subnets.
- Only one network port on the NVR5 Value (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.
- Ensure that connected and in use NICs are **not** set to Public.

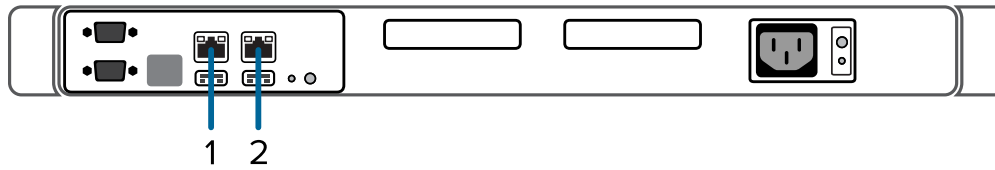
For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

The following table shows the recommended number of network interfaces for a given recording and client throughput.

NVR5 Value Model	Recording Network Ports Required	Client Network Ports Required	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput)
6/12/24 TB	One 1 GbE	One 1 GbE	Up to 300 Mbps	Up to 128 Mbps
16 TB	One 1 GbE	One 1 GbE	Up to 300 Mbps	Up to 100 Mbps

## Network Interface Connections

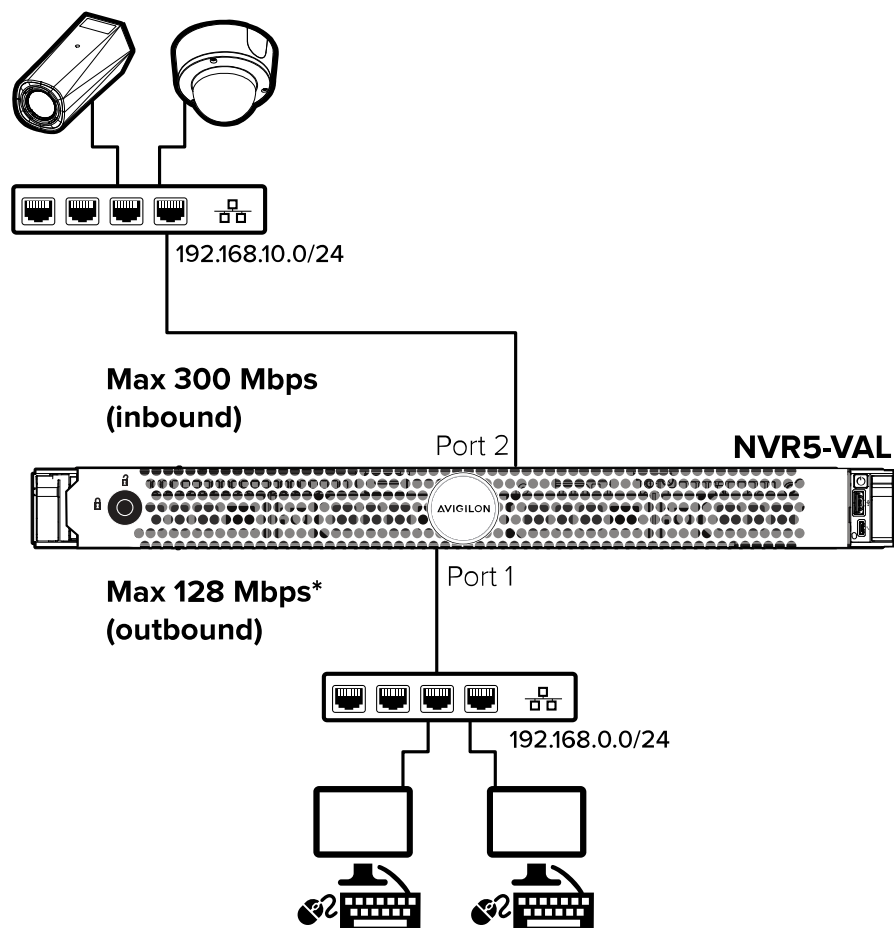
- Either port one or two can be used for inbound or outbound traffic.



# Sample Network Topologies

## Network Topology with One NVR5 Value

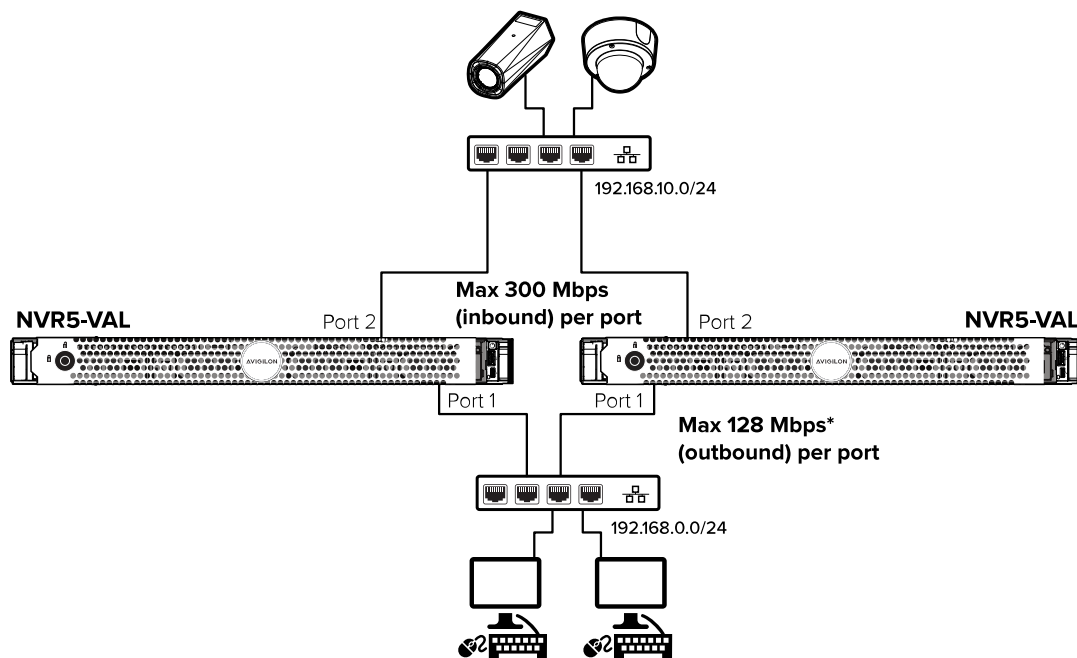
Suitable for sites with less than 300 Mbps of recording throughput. This is a simple deployment, but it does not provide any network redundancy.



\*The image above shows the inbound and outbound rates of the NVR 5 Value 6/12/24 TB. The rates for the NVR5 Value 16 TB are listed in the table under *Network Environment* on page 61.

## Network Topology with Multiple NVR5 Value

Suitable for deployments that require network redundancy. Connecting multiple NVR5s ( $n$  NVRs) through the same IP subnets will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR5s can be set up for each camera from within the ACC™ system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.



\*The image above shows the inbound and outbound rates of the NVR 5 Value 6/12/24 TB. The rates for the NVR5 Value 16 TB are listed in the table under *Network Environment* on page 61.

# NVR4X Premium

NVR4X Premium has extremely high storage density and performance. It is designed for exceptional performance with two 10-GbE and up to six 1-GbE Network ports, that support up to 2.1 Gbps of total throughput when all network ports are used. NVR4X Premium comes with Avigilon Appearance Search technology and secondary power supplies built-in. Additionally, it can easily be upgraded to take advantage of secondary power supplies, fiber-optic connections, and additional CPUs.

The NVR4X Premium is available with Windows Server 2016 and can be upgraded to Windows Server 2019 with an optional OS upgrade kit (NVR4-S19-COA).

The NVR4X Premium is designed for exceptional performance, supporting up to 2.1 Gbps of total throughput, with:

- Two 10-GbE and four 1-GbE Network ports - NVR4X-PRM-192/217TB
- Two 10-GbE and six 1-GbE Network ports - NVR4X-PRM-64/96/128/157TB

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR4X Premium must be configured into unique IP subnets.
- Only one network port on the NVR4X Premium (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.
- When possible, attempt to equally distribute inbound (recording) traffic across all network ports, IP subnets or VLANs being used. The Avigilon System Design Tool can estimate traffic coming from groups of cameras.
- If you have multiple VLANs on an edge switch, ensure that the trunk back to the core is appropriately configured to handle multiple VLAN traffic.
- On 10 GbE networks, both 10-GbE ports should be used on the NVR4X Premium:

- For fault tolerance, connect both 10-GbE network ports to the same switch with NIC teaming in fault tolerance mode. Note that this configuration will reduce the maximum recording throughput to 1250 Mbps.
- For maximum recording throughput, connect each 10-GbE network port to a separate switch and IP subnet or VLAN. This configuration maximizes the total recording throughput up to 1500 Mbps (with max 1250 Mbps per port).
- Ensure that connected and in use NICs are **not** set to Public.

For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

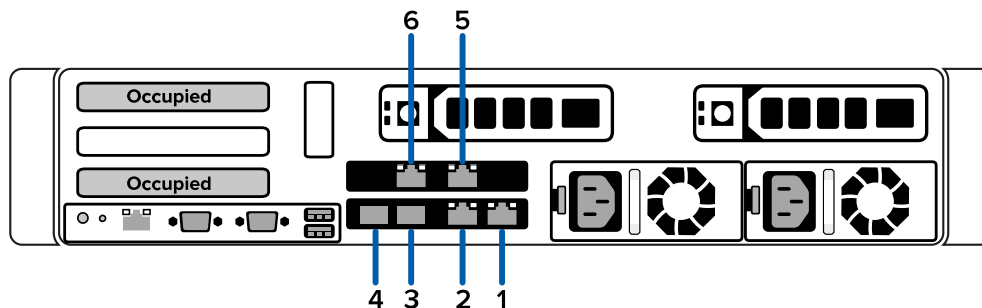
The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput)
One or two 1 GbE	One 1 GbE	Up to 600 Mbps	Up to 600 Mbps
Three 1 GbE	One 1 GbE	Up to 700 Mbps	Up to 600 Mbps
One 10 GbE	One 1 GbE	Up to 1250 Mbps	Up to 600 Mbps
Two 10 GbE	Two 1 GbE	Up to 1500 Mbps (max 1250 Mbps per port)	Up to 600 Mbps

## Network Interface Connections

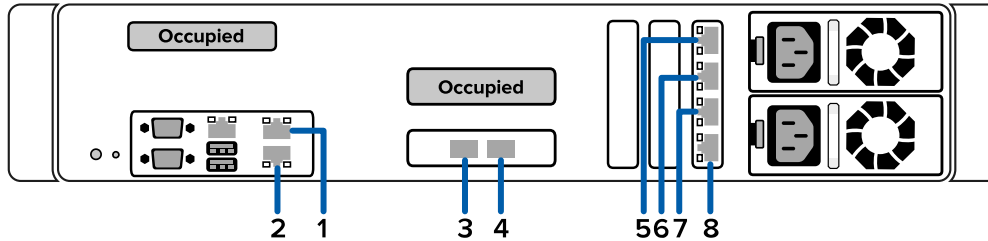
### NVR4X Premium (192/217 TB)

- It is recommended to use network ports three and four for recording traffic.
- It is recommended to use network ports one, two, five and six for client traffic or lower throughput recording traffic.



## NVR4X Premium (64/96/128/157 TB)

- It is recommended to use network ports three and four for recording traffic.
- It is recommended to use network ports one, two, five, six, seven and eight for client traffic or lower throughput recording traffic.

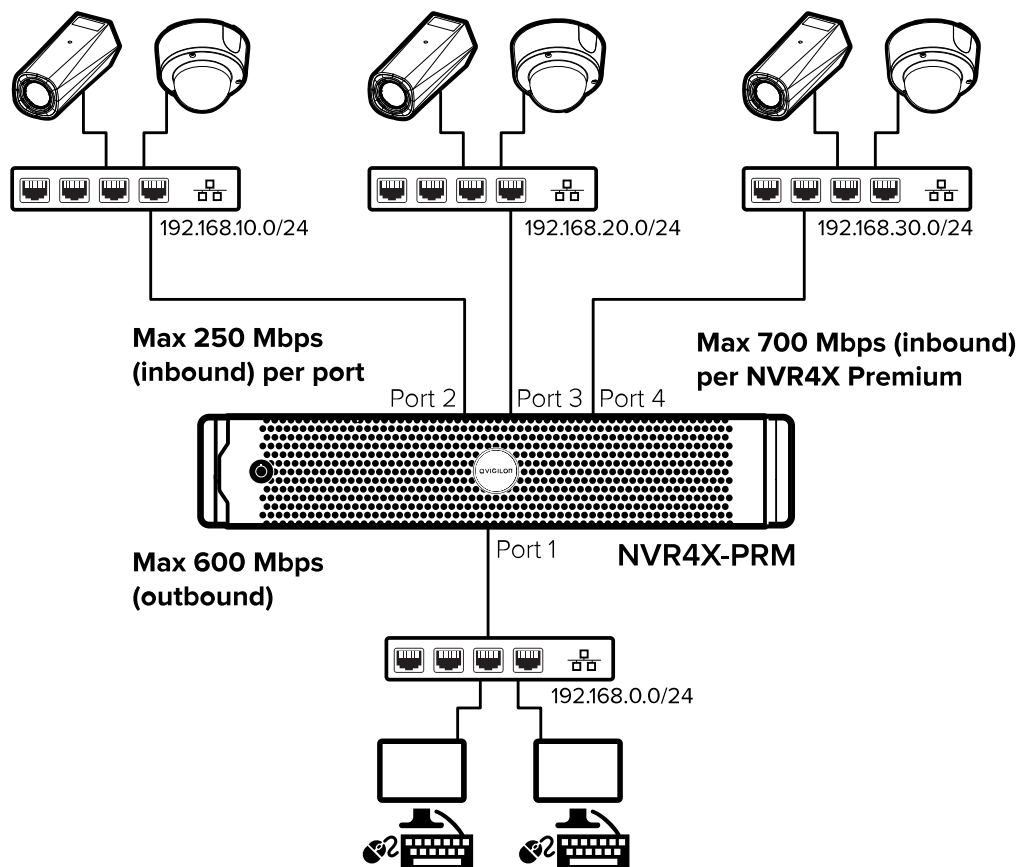


## Sample Network Topologies

### 1-GbE Networking

#### 1-GbE Network Topology with One NVR4X Premium

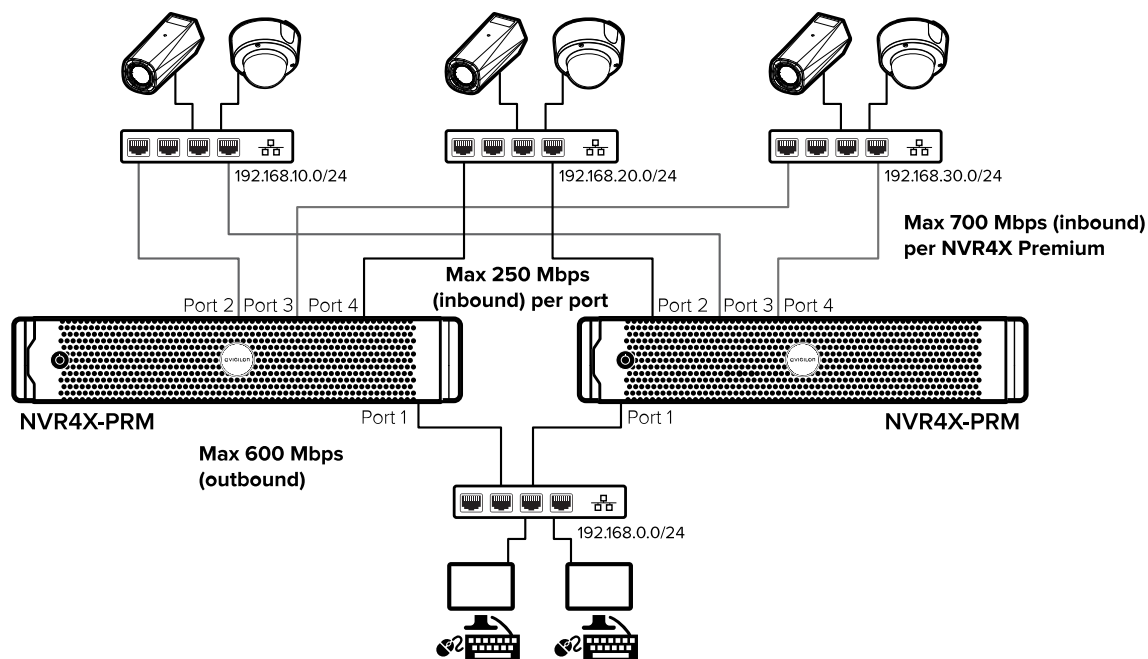
Suitable for sites using 1-GbE networking with less than 700 Mbps of recording throughput. This simple deployment does not provide any network redundancy.





## 1-GbE Network Topology with Multiple NVR4X Premium

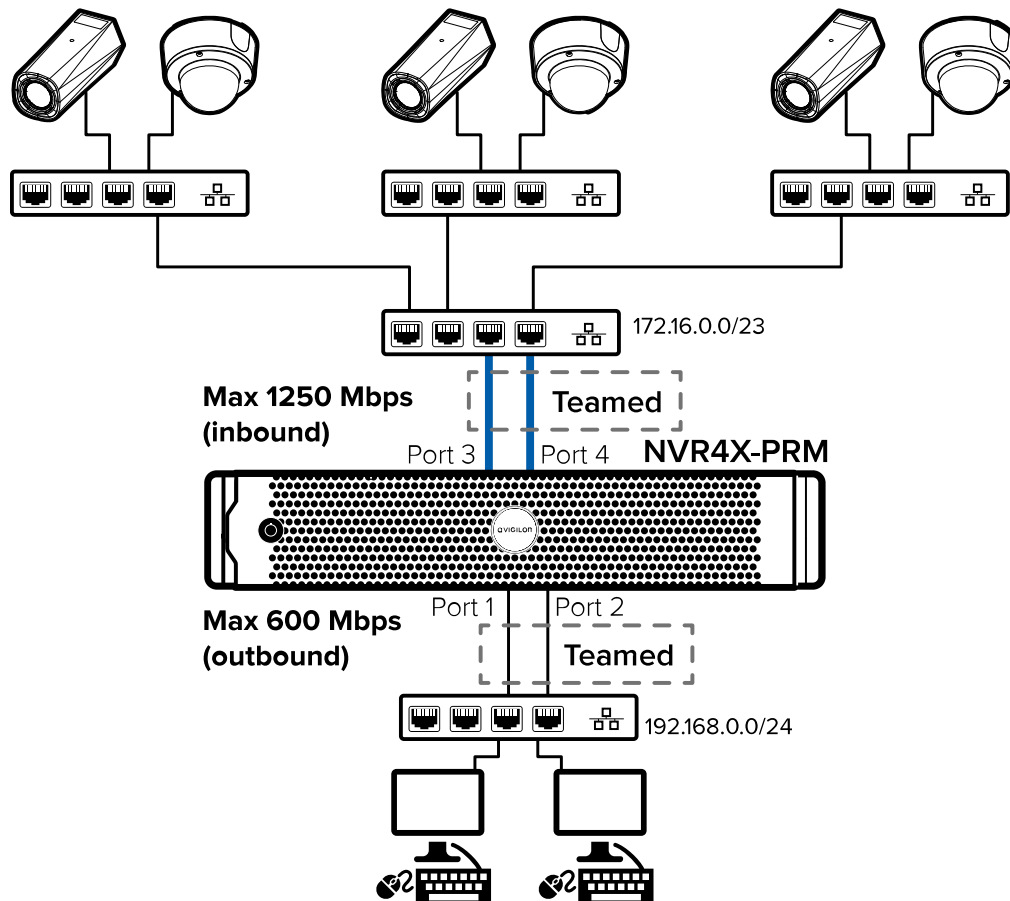
Suitable for deployments using 1-GbE Networking that require network redundancy. Connecting multiple NVR4Xs ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR4Xs can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.



## 10-GbE Networking

### 10-GbE Network Topology with One NVR4X Premium

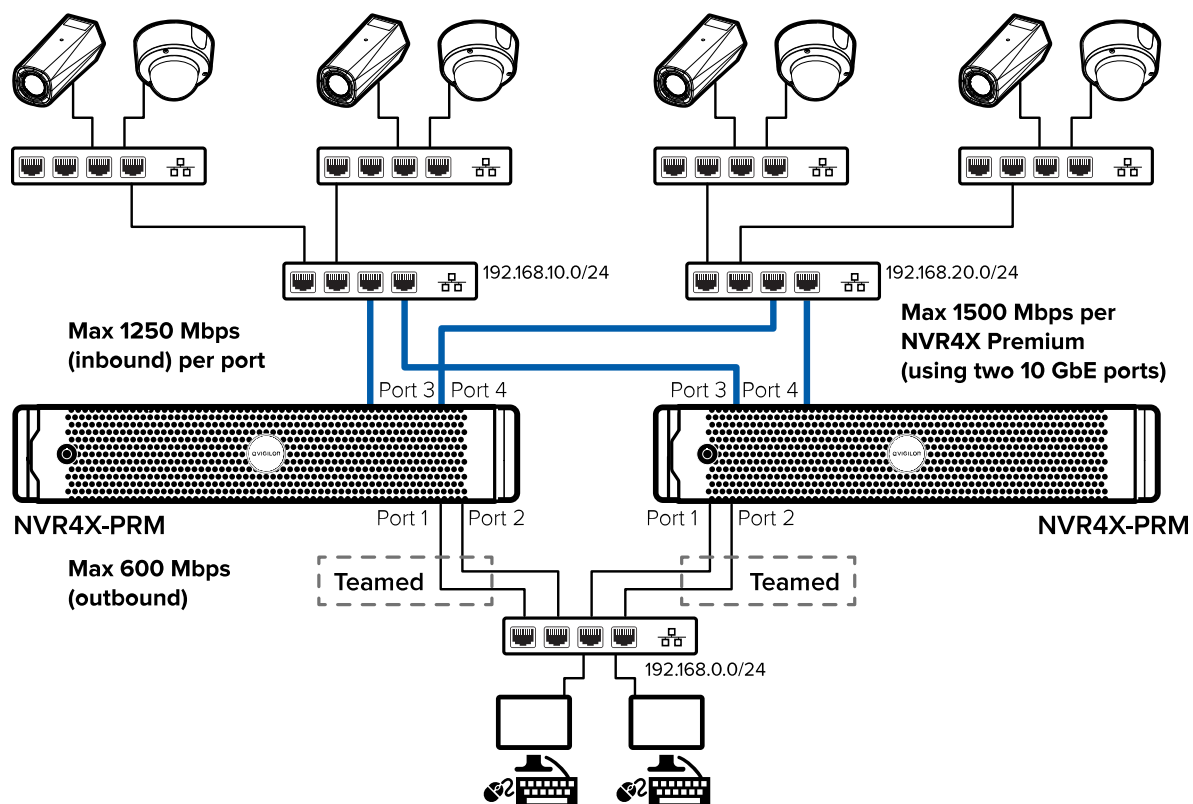
Suitable for sites using 10-GbE networking with less than 1250 Mbps of recording throughput with two 10-GbE network ports configured to one NIC team. This simple deployment provides redundancy in the event that one 10-GbE network port on the NVR4X Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



## 10-GbE Network Topology with Multiple NVR4X Premium

Suitable for deployments using 10-GbE Networking that require network redundancy. Connecting multiple NVR4Xs ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR4Xs can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the playback ports provides redundancy in the event that one network port on the NVR4X Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.

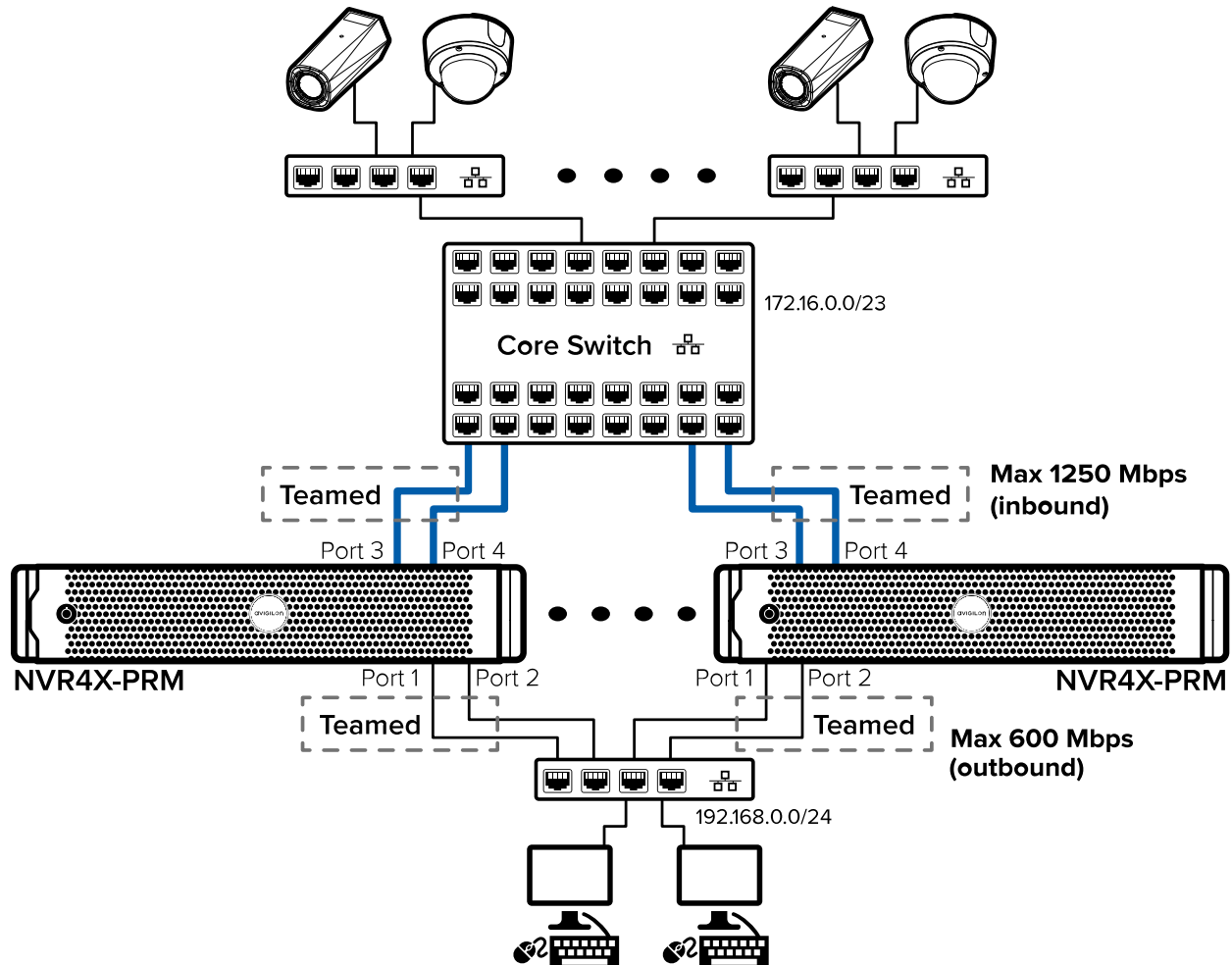
**Note:** NIC teaming is not used on the recording ports, as more robust redundancy can be achieved by using two switches.



# Enterprise Networking

## Enterprise Network Topology with Multiple NVR4X Premium

Suitable for deployments using 10-GbE networking that require robust network redundancy. An enterprise level core switch is used to simplify network connections with multiple NVR4Xs ( $n$  NVRs). Primary and secondary NVR4Xs should be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the recording and playback ports provides redundancy in the event that one network port on the NVR4X Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



# NVR4X Standard

NVR4X Standard sets the standard for what a professional network video recorder should be. It includes four 1-GbE network ports that support up to 700 Mbps of recording throughput when three 1-GbE network ports are used, and has Avigilon Appearance Search technology built-in. Additionally, it can easily be upgraded to take advantage of increased capacity, secondary power supplies, 10 GbE networking, and additional CPUs.

The NVR4X Standard is available with Windows 10 IoT Enterprise or Windows Server 2016 and can be upgraded to Windows Server 2019 with an optional OS upgrade kit (NVR4-S19-COA).

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR must be configured into unique IP subnets.
- Only one network port on the NVR (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.
- When possible, attempt to equally distribute inbound (recording) traffic across all network ports, IP subnets, or VLANs being used. The Avigilon System Design Tool can estimate traffic coming from groups of cameras.
- Ensure that connected and in use NICs are **not** set to Public.

For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput)
One 1 GbE	One 1 GbE	Up to 700 Mbps <sup>1</sup>	Up to 600 Mbps
One or two 10 GbE <sup>2</sup>	One 1 GbE	Up to 250 Mbps	Up to 450 Mbps
Two 1 GbE	One 1 GbE	Up to 450 Mbps	Up to 450 Mbps
Three 1 GbE	One 1 GbE	Up to 700 Mbps	Up to 450 Mbps

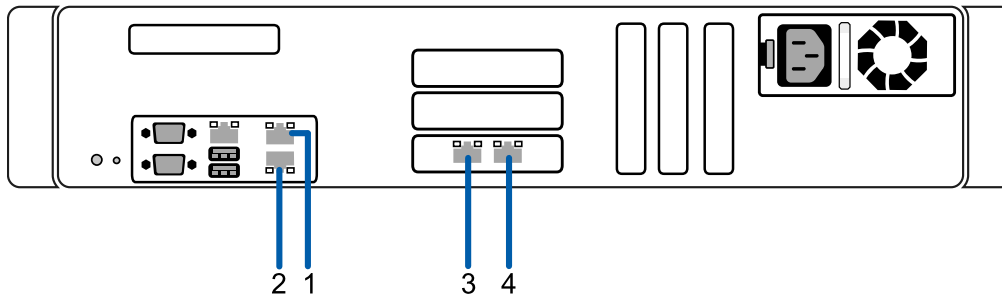
<sup>1</sup> The max recording throughput for STD can be increased to 800 Mbps. Requires the use of multiple 1 GbE

ports in a team using LACP/ALB mode.

<sup>2</sup> 10 GbE networking requires installation of the optional NVR5-STD-10GBE accessory.

## Network Interface Connections

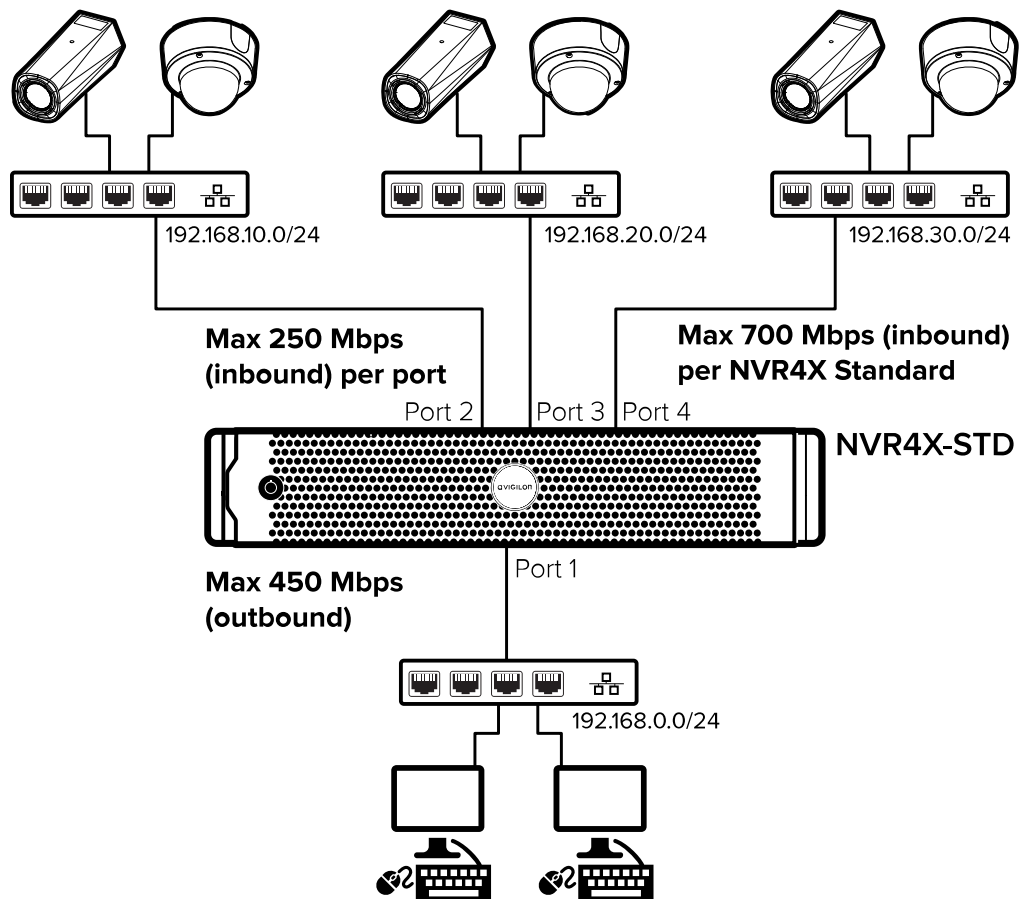
- It is recommended to use network ports three and four first for recording traffic. Ports one and two share the same network controller hardware and should be primarily used for client traffic, but one of them can be used for recording traffic if needed.



## Sample Network Topologies

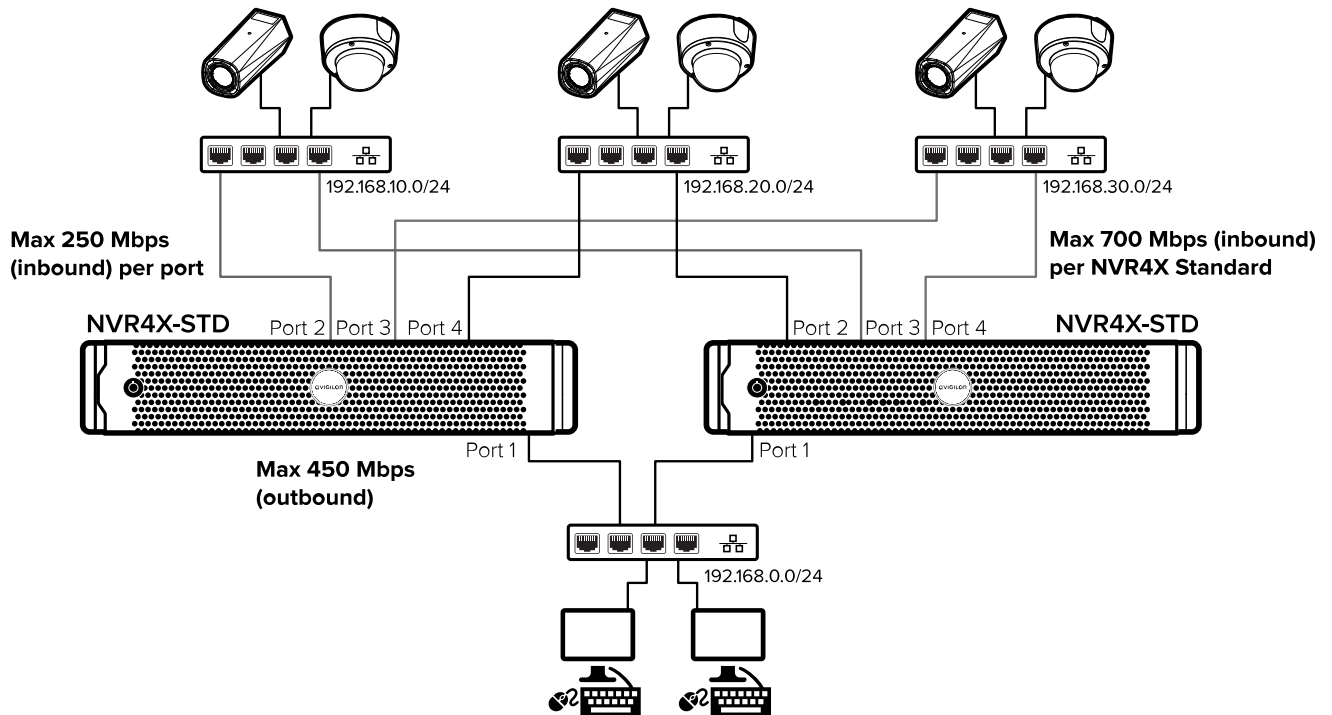
### Network Topology with One NVR4X Standard

Suitable for sites with less than 700 Mbps of recording throughput. This simple deployment does not provide any network redundancy.



## Network Topology with Multiple NVR4X Standard

Suitable for deployments that require network redundancy. Connecting multiple NVR4Xs ( $n$  NVRs) through the same IP subnet will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR4Xs can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.





# NVR4 Premium

NVR4 Premium has extremely high storage density and performance. It is designed for exceptional performance with two 10-GbE and two 1-GbE Network ports, that support up to 2.1 Gbps of total throughput when all network ports are used. NVR4 Premium comes with Avigilon Appearance Search technology and secondary power supplies built-in. Additionally, it can easily be upgraded to take advantage of secondary power supplies, fiber-optic connections, and additional CPUs.

The NVR4 Premium is available with Windows Server 2016 and can be upgraded to Windows Server 2019 with an optional OS upgrade kit (NVR4-S19-COA).

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR4 Premium must be configured into unique IP subnets.
- Only one network port on the NVR4 Premium (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.
- When possible, attempt to equally distribute inbound (recording) traffic across all network ports, IP subnets or VLANs being used. The Avigilon System Design Tool can estimate traffic coming from groups of cameras.
- If you have multiple VLANs on an edge switch, ensure that the trunk back to the core is appropriately configured to handle multiple VLAN traffic.
- On 10 GbE networks, both 10-GbE ports should be used on the NVR4 Premium:
  - For fault tolerance, connect both 10-GbE network ports to the same switch with NIC teaming in fault tolerance mode. Note that this configuration will reduce the maximum recording throughput to 1250 Mbps.
  - For maximum recording throughput, connect each 10-GbE network port to a separate switch and IP subnet or VLAN. This configuration maximizes the total recording throughput up to 1500 Mbps (with max 1250 Mbps per port).
- Ensure that connected and in use NICs are **not** set to Public.

For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

The following table shows the recommended number of network interfaces for a given recording and client

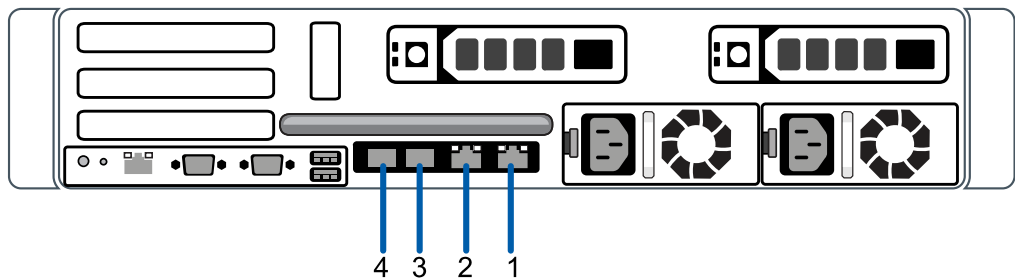
throughput.

Recording Network Ports Required	Client Network Ports Required	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput)
One or two 1 GbE	One 1 GbE	Up to 600 Mbps	Up to 600 Mbps
One 10 GbE	One 1 GbE	Up to 1250 Mbps	Up to 600 Mbps
Two 10 GbE	Two 1 GbE	Up to 1500 Mbps (max 1250 Mbps per port)	Up to 600 Mbps

## Network Interface Connections

### NVR4 Premium

- It is recommended to use network ports three and four for recording traffic.
- It is recommended to use network ports one and two for client traffic or lower throughput recording traffic.

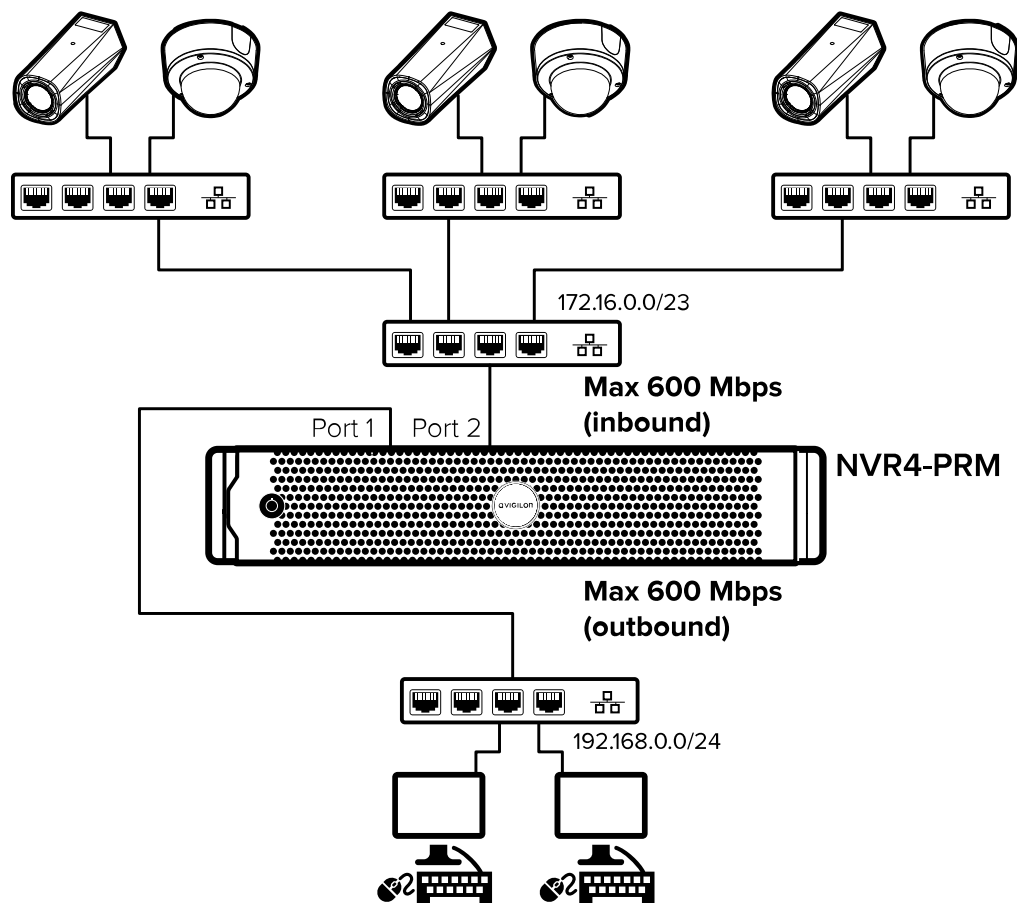


# Sample Network Topologies

## 1-GbE Networking

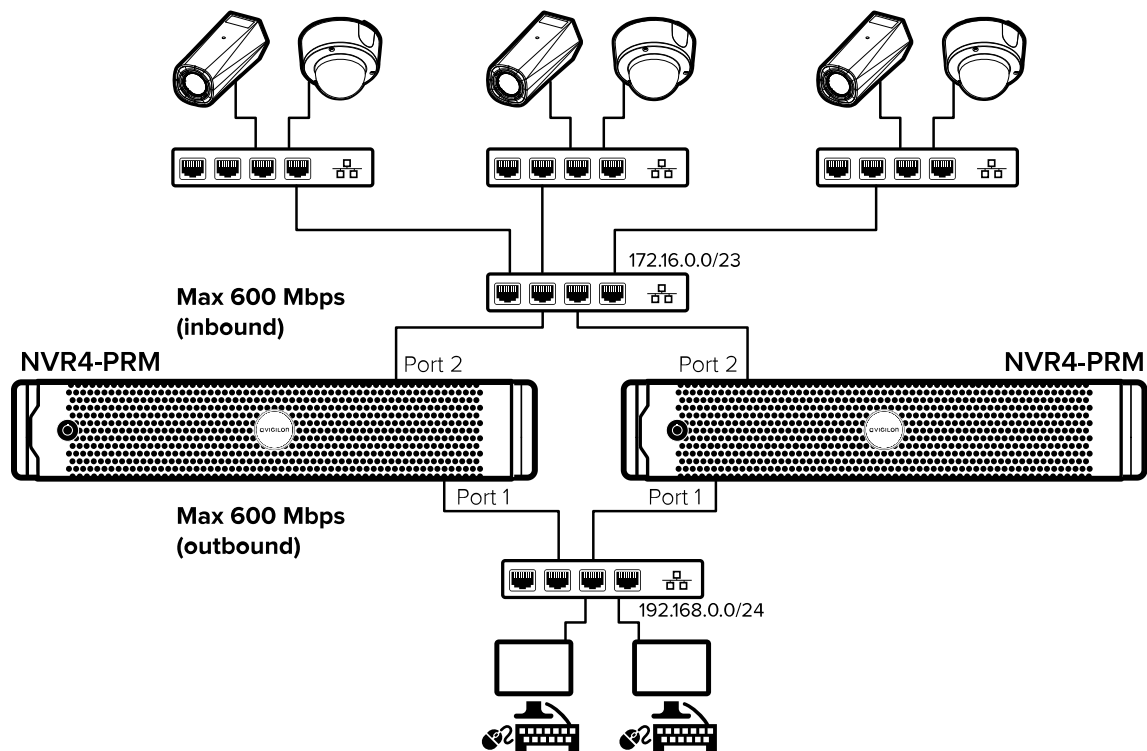
### 1-GbE Network Topology with One NVR4 Premium

Suitable for sites using 1-GbE networking with less than 600 Mbps of recording throughput. This simple deployment does not provide any network redundancy.



## 1-GbE Network Topology with Multiple NVR4 Premium

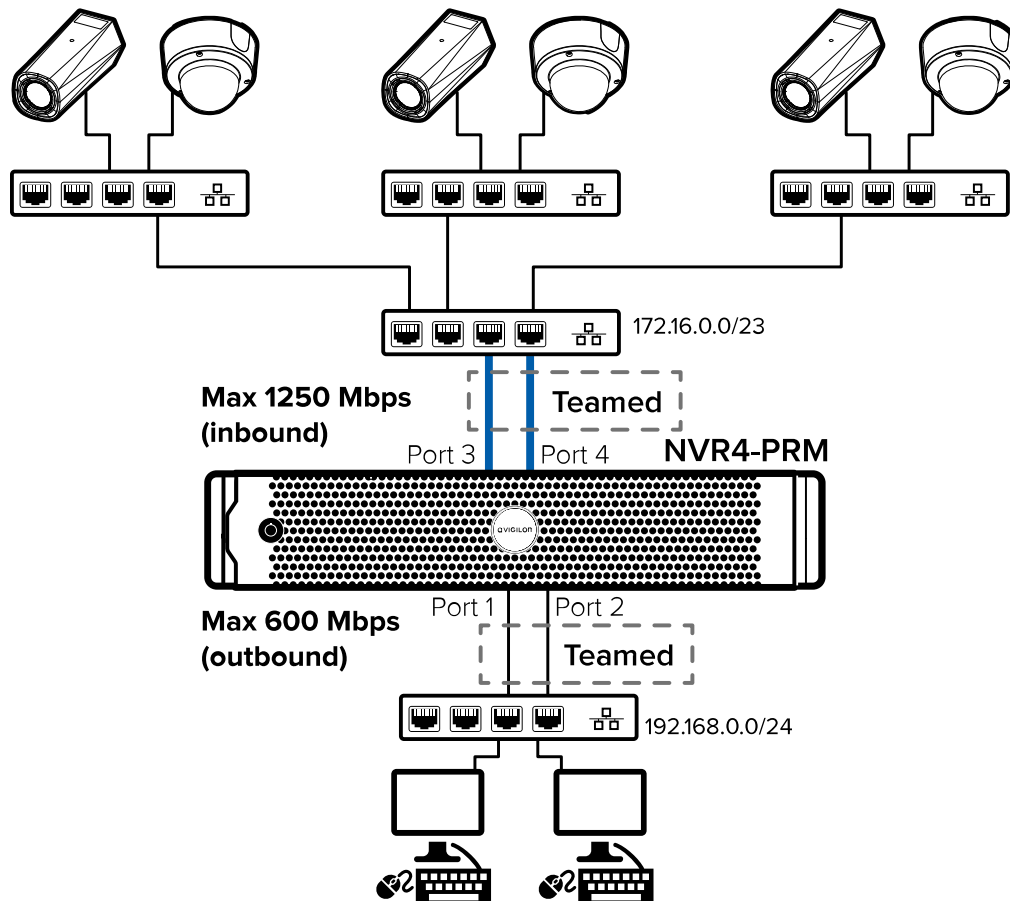
Suitable for deployments using 1-GbE Networking that require network redundancy. Connecting multiple NVR4s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR4s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.



## 10-GbE Networking

### 10-GbE Network Topology with One NVR4 Premium

Suitable for sites using 10-GbE networking with less than 1250 Mbps of recording throughput with two 10-GbE network ports configured to one NIC team. This simple deployment provides redundancy in the event that one 10-GbE network port on the NVR4 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



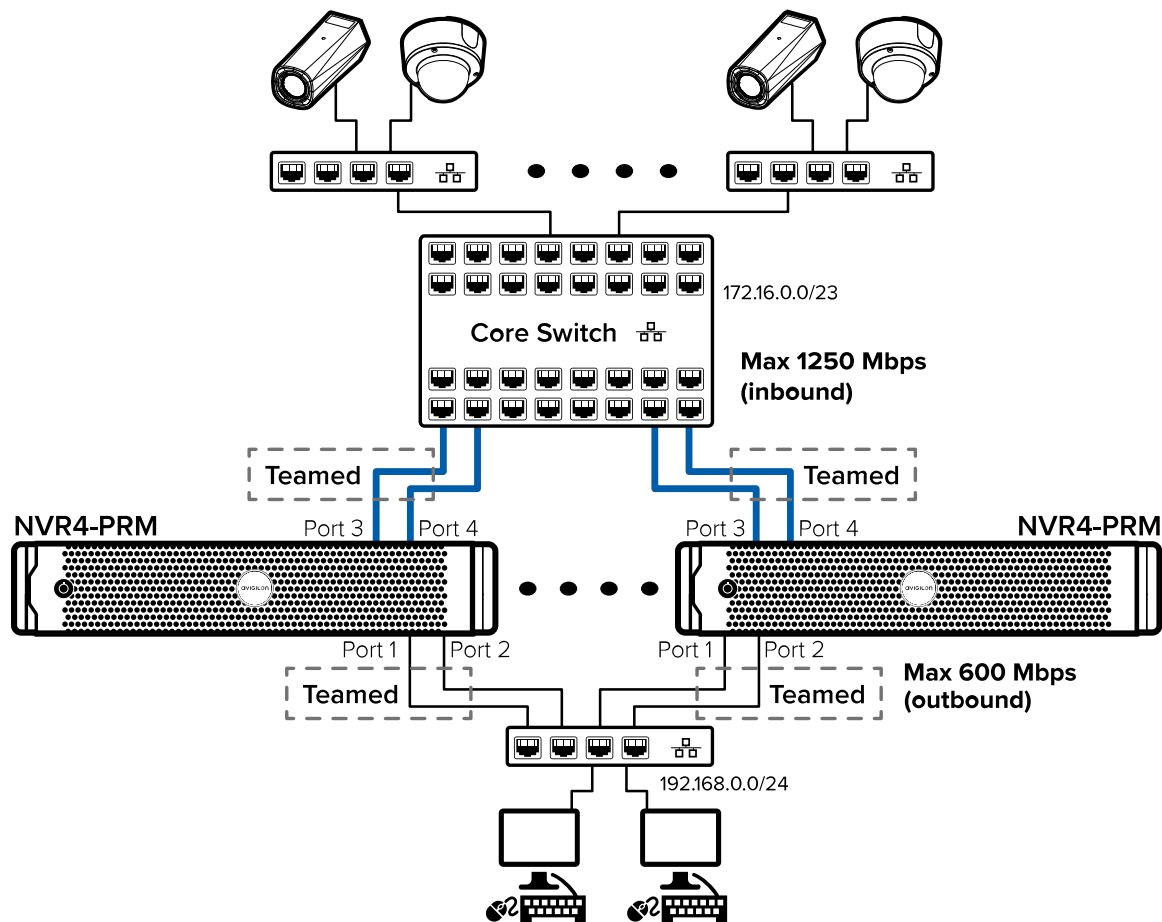
Suitable for deployments using 10-GbE Networking that require network redundancy. Connecting multiple NVR4s ( $n$  NVRs) through the same switch will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR4s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the playback ports provides redundancy in the event that one network port on the NVR4 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.

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## Enterprise Networking

### Enterprise Network Topology with Multiple NVR4 Premium

Suitable for deployments using 10-GbE networking that require robust network redundancy. An enterprise level core switch is used to simplify network connections with multiple NVR4s ( $n$  NVRs). Primary and secondary NVR4s should be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR. Additionally the use of NIC teaming on the recording and playback ports provides redundancy in the event that one network port on the NVR4 Premium fails. See *NIC Teaming Overview* on page 105 for steps on how to set up NIC teaming in fault tolerant mode.



# NVR4 Standard

NVR4 Standard sets the standard for what a professional network video recorder should be. It includes four 1-GbE network ports that support up to 700 Mbps of recording throughput when three 1-GbE network ports are used, and has Avigilon Appearance Search technology built-in. Additionally, it can easily be upgraded to take advantage of increased capacity, secondary power supplies, 10 GbE networking, and additional CPUs.

The NVR4 Standard is available with Windows 10 IoT Enterprise or Windows Server 2016 and can be upgraded to Windows Server 2019 with an optional OS upgrade kit (NVR4-S19-COA).

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR must be configured into unique IP subnets.
- Only one network port on the NVR (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.
- When possible, attempt to equally distribute inbound (recording) traffic across all network ports, IP subnets, or VLANs being used. The Avigilon System Design Tool can estimate traffic coming from groups of cameras.
- Ensure that connected and in use NICs are **not** set to Public.

For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput)
One 1 GbE	One 1 GbE	Up to 700 Mbps <sup>1</sup>	Up to 600 Mbps
One or two 10 GbE <sup>2</sup>	One 1 GbE	Up to 250 Mbps	Up to 450 Mbps
Two 1 GbE	One 1 GbE	Up to 450 Mbps	Up to 450 Mbps
Three 1 GbE	One 1 GbE	Up to 700 Mbps	Up to 450 Mbps

<sup>1</sup> The max recording throughput for STD can be increased to 800 Mbps. Requires the use of multiple 1 GbE

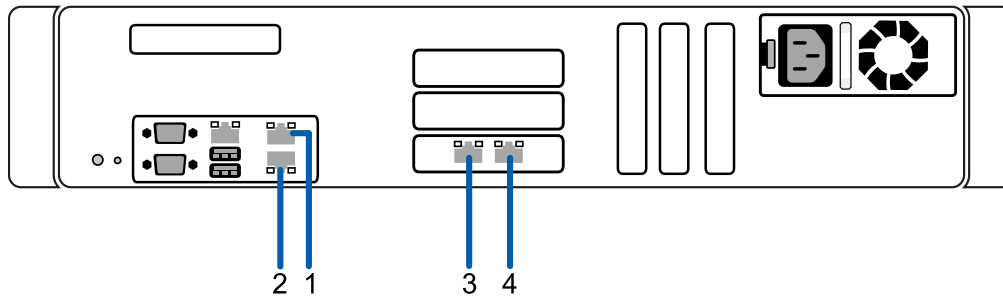


ports in a team using LACP/ALB mode.

<sup>2</sup> 10 GbE networking requires installation of the optional NVR5-STD-10GBE accessory.

## Network Interface Connections

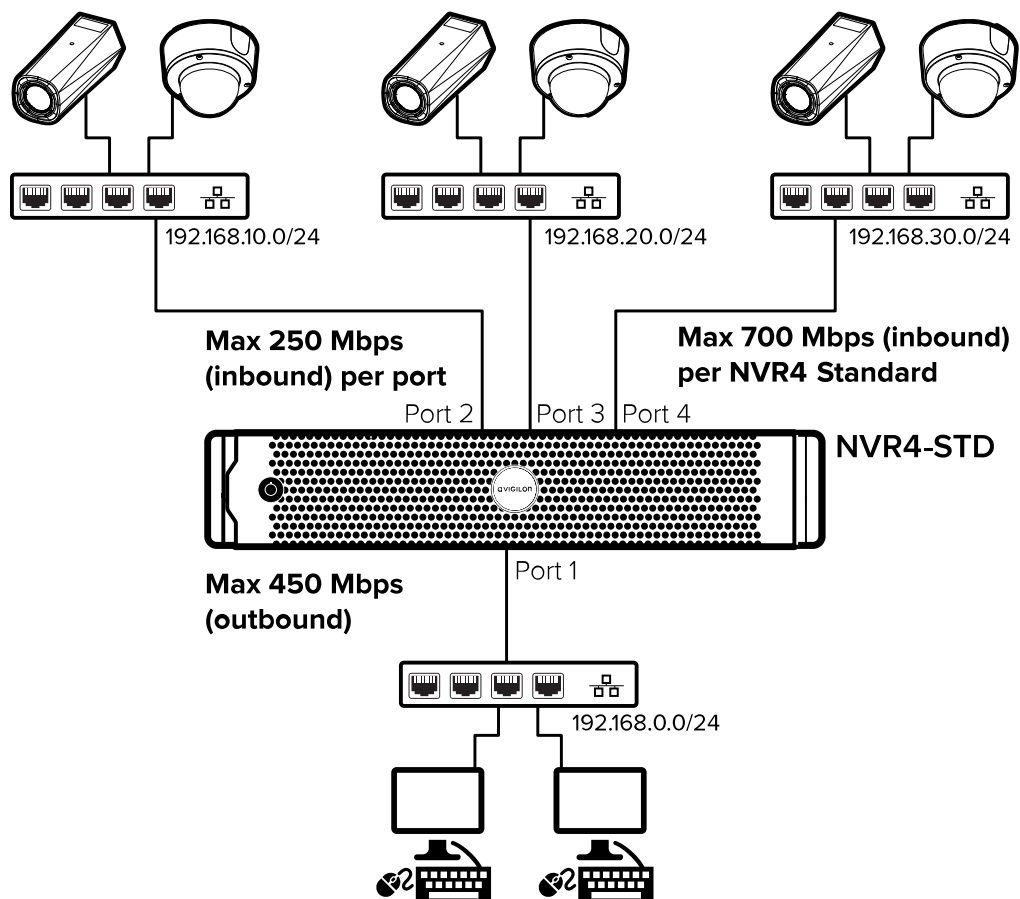
- It is recommended to use network ports three and four first for recording traffic. Ports one and two share the same network controller hardware and should be primarily used for client traffic, but one of them can be used for recording traffic if needed.



## Sample Network Topologies

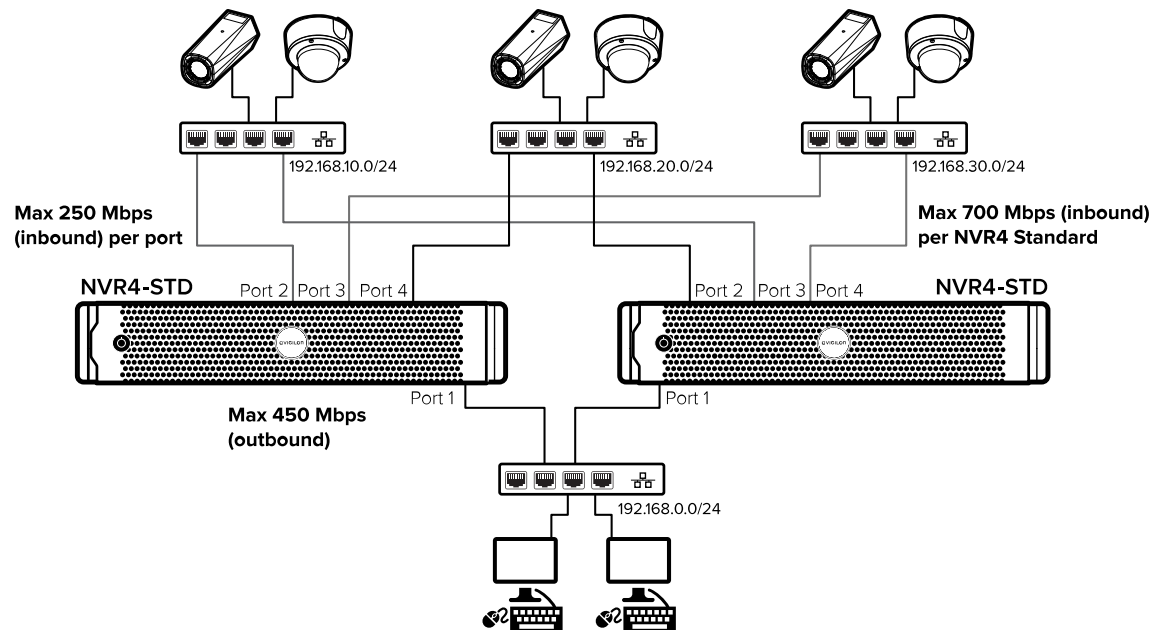
### Network Topology with One NVR4 Standard

Suitable for sites with less than 700 Mbps of recording throughput. This simple deployment does not provide any network redundancy.



## Network Topology with Multiple NVR4 Standard

Suitable for deployments that require network redundancy. Connecting multiple NVR4s ( $n$  NVRs) through the same IP subnet will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR4s can be set up for each camera from within the ACC system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.



# NVR4 Value

NVR4 Value provides strong performance and various storage options in a 1U form factor. This budget-friendly NVR includes two 1 GbE network ports that can take in up to 300 Mbps of recording throughput when both network ports are used. Additionally, the NVR4 Value can be upgraded to take advantage of Avigilon Appearance Search™ technology with the optional Analytics Kit (NVR-ANK2-1).

The NVR4 Value is available with Windows 10 IoT Enterprise OS and can be upgraded to Windows Server 2019 with an optional OS upgrade kit (NVR4-S19-COA).

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the NVR4 Value must be configured into unique IP subnets.
- Only one network port on the NVR4 Value (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.
- Ensure that connected and in use NICs are **not** set to Public.

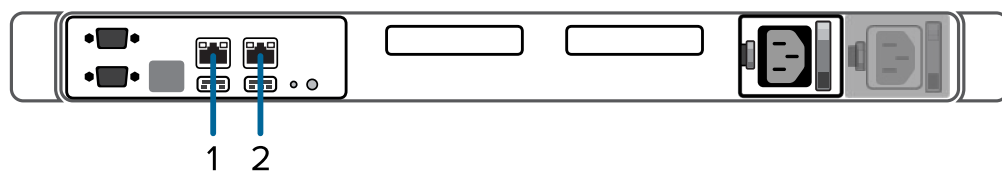
For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

The following table shows the recommended number of network interfaces for a given recording and client throughput.

Recording Network Ports Required	Client Network Ports Required	Recording Throughput per NVR	Client Recorded Playback Throughput per NVR (Or Live Throughput)
One 1 GbE	One 1 GbE	Up to 300 Mbps	Up to 128 Mbps

## Network Interface Connections

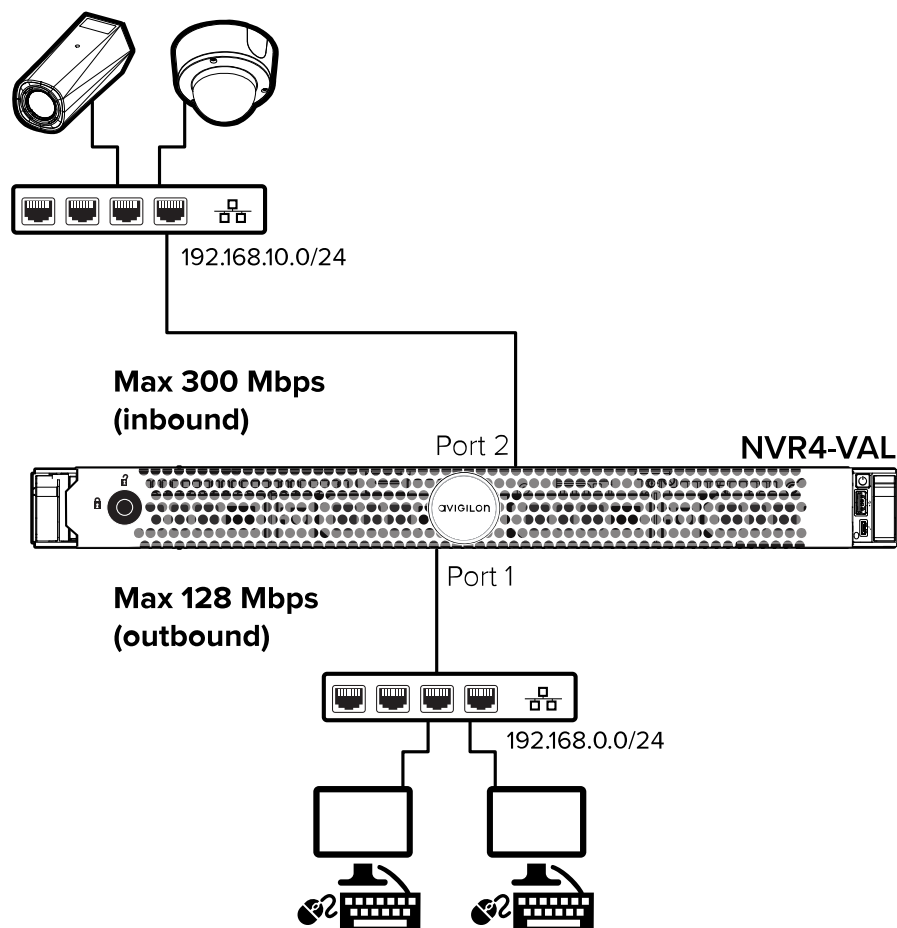
- Either port one or two can be used for inbound or outbound traffic.



# Sample Network Topologies

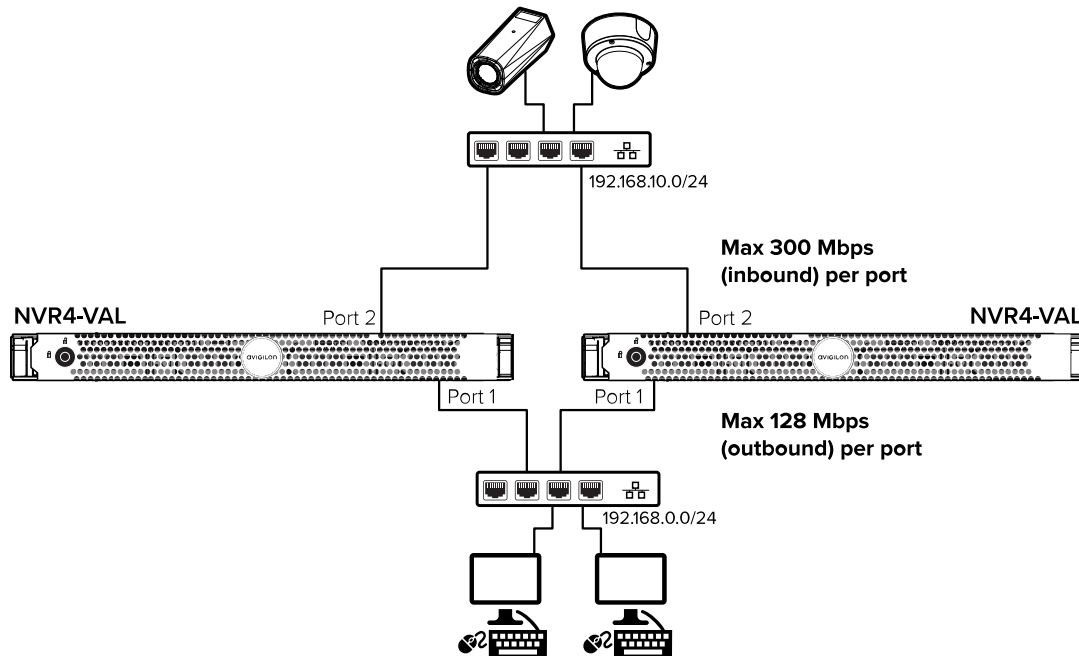
## Network Topology with One NVR4 Value

Suitable for sites with less than 300 Mbps of recording throughput. This is a simple deployment, but it does not provide any network redundancy.



## Network Topology with Multiple NVR4 Value

Suitable for deployments that require network redundancy. Connecting multiple NVR4s ( $n$  NVRs) through the same IP subnets will ensure that cameras will continue to record in the event that a single NVR fails. Primary and secondary NVR4s can be set up for each camera from within the ACC™ system. When deploying this solution, ensure that  $1/n$  of each NVR's throughput is available to take over traffic from cameras that have been disconnected from their primary NVR.



# HD Video Appliance

The new generation of Avigilon Video Appliances provide an all-in-one security solution with improved performance and higher capacity that help reduce installation time and overall complexity of the surveillance system. The Video Appliance line integrates our ACC™ video management software with a high-powered PoE switch and a client workstation to provide a cost effective recording and video management solution that is capable of supporting multi-megapixel IP cameras.

## Network Architectures

- Avoid cascading switches as this will reduce fault tolerance and may create network bottlenecks.
- Having multiple layers of switches on a critical path increases the chances that a single switch failure can sever the connection to a large group of cameras.

## Network Environment

- Keep inbound (recording) traffic and outbound (client) traffic isolated on different networks using different IP subnets or VLANs.
- Every network port used on the HD Video Appliance must be configured into unique IP subnets.

**Important:** Make sure the WebUI network port is configured on a different IP subnet from the Internal Cameras network port.

When multiple HD Video Appliances are on the same network, change the default IP addresses of the WebUI (192.168.2.99) and internal switch (192.168.2.1) so they are unique for each unit.

- Only one network port on the HD Video Appliance (typically the client network port) must be configured with a default gateway IP address. The remaining network ports must only be configured with the IP address and subnet mask.
- Ensure that connected and in use NICs are **not** set to Public.

For more information, see Knowledge article, *How to Set Windows-based Server NIC Profile to Private or Domain* in the Avigilon Support Community ([article 10245](#)).

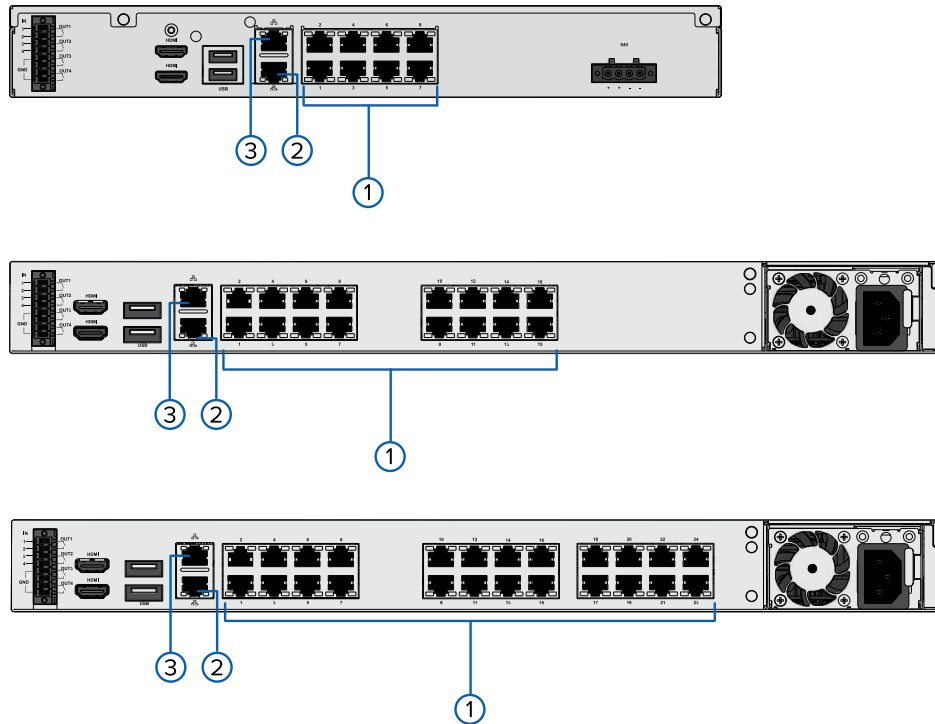
## Network Interface Connections

The HD Video Appliance has multiple network interfaces:



1. 8, 16 or 24 Fast Ethernet 10/100 Mbps network ports with PoE+ support (please refer to the HDVA datasheet for PoE budget information) for camera connection.
2. One 1GbE Camera network uplink port connection to remote cameras that are connected via a remote PoE switch or connect to other HDVA units.
3. One 1GbE Corporate network uplink port connection to the corporate network so that video can be accessed from a client over the network.
4. One 1GbE WebUI network port that is connected to the internal PoE switch and is used to access the switch WebUI. There is no physical connection visible to this network port.

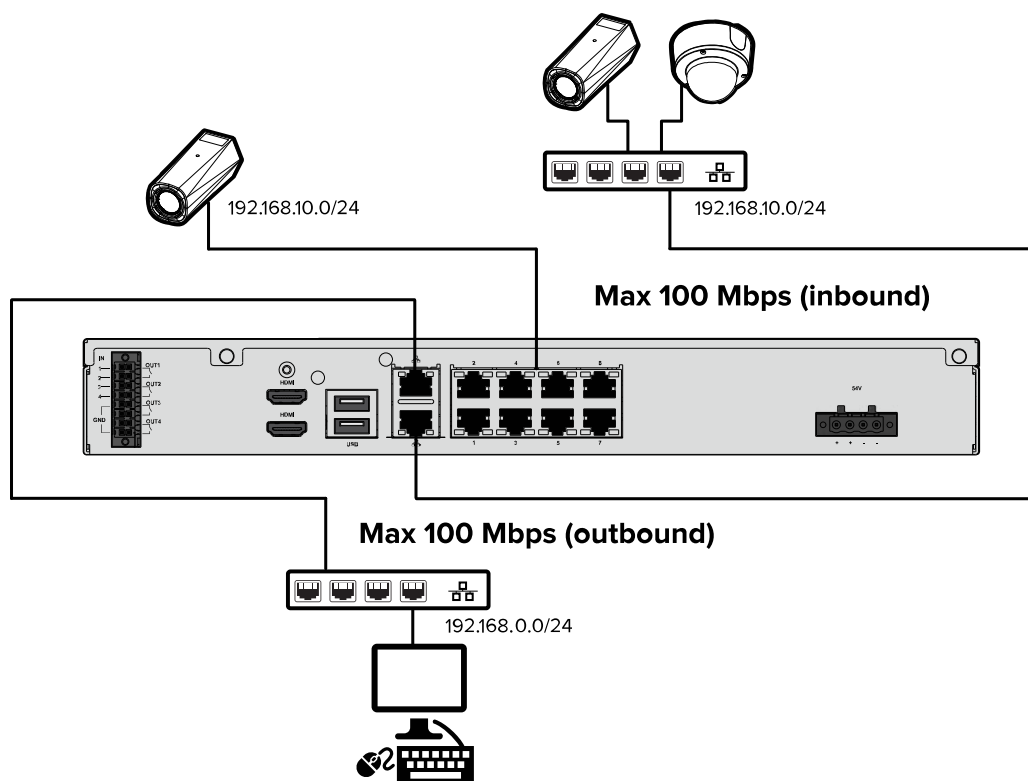
## Rear View



## Sample Network Topologies (8-Port HDVA)

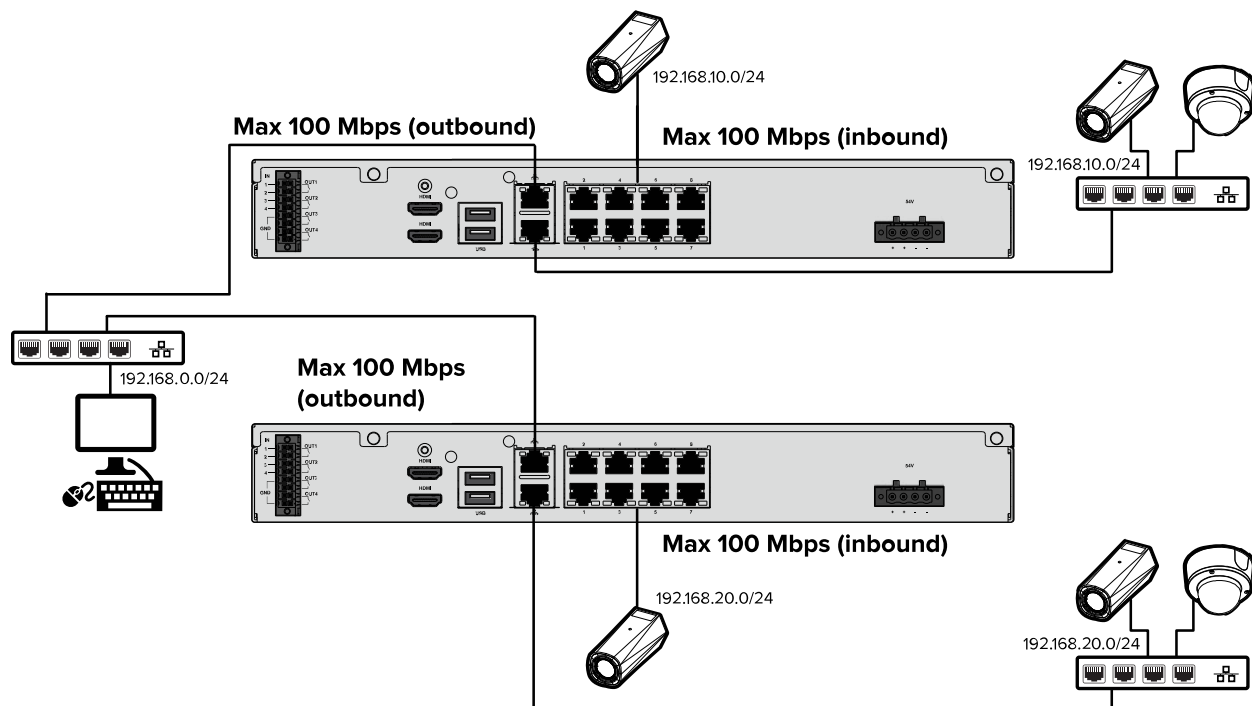
### Network Topology with One 8-Port HD Video Appliance

Suitable for smaller sites with only one VMA-AS3-8P per ACC Site and up to a maximum of 100 Mbps recording throughput coming from the built in PoE switch or external camera PoE switch. If a remote monitoring workstation is required, the maximum live and playback throughput on the Corporate network uplink port is 100 Mbps.



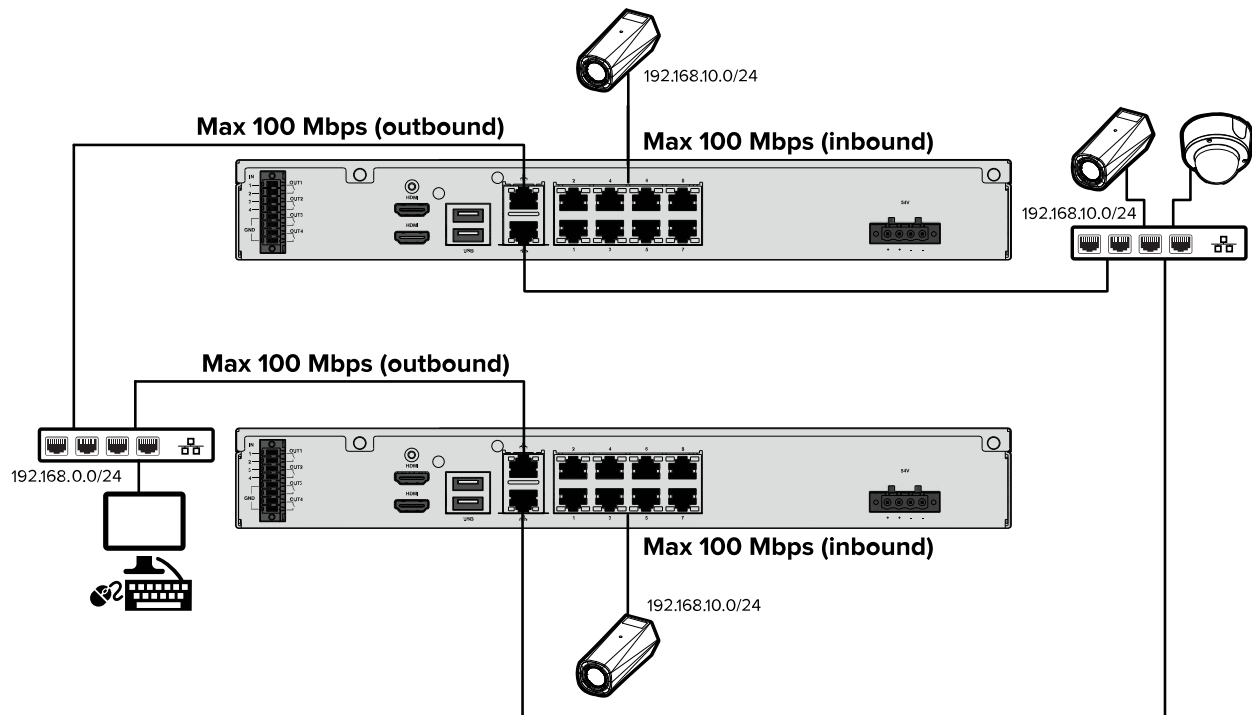
## Network Topology with Multiple 8-Port HD Video Appliances without Camera Failover

Suitable for sites with multiple VMA-AS3-8P per ACC Site without camera failover and up to a maximum of 100 Mbps recording throughput coming from the built in PoE switch of each HD Video Appliance or external camera PoE switch. If a remote monitoring workstation is required, the maximum live and playback throughput on the Corporate network uplink port of each HD Video Appliance is 100 Mbps.



## Network Topology with Multiple 8-Port HD Video Appliances with Camera Failover

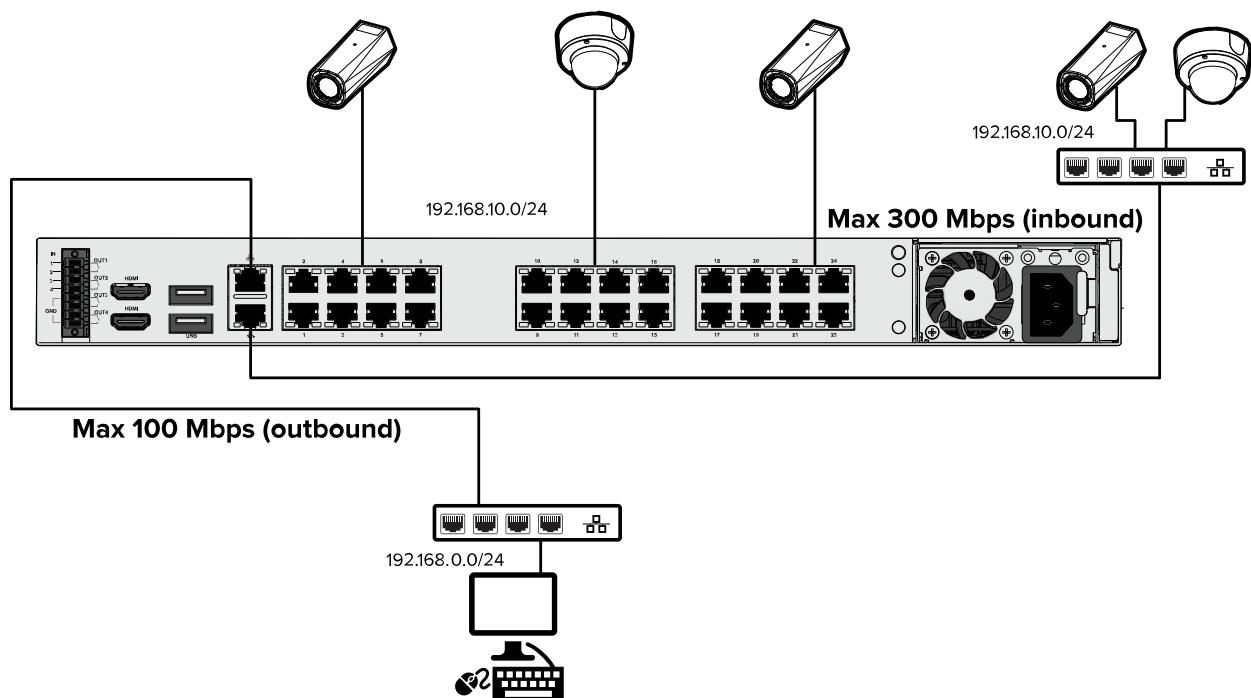
Suitable for sites with multiple VMA-AS3-8P per ACC Site with camera failover and up to a maximum of 100 Mbps recording throughput coming from the built in PoE switch of each HD Video Appliance or external camera PoE switch. If a remote monitoring workstation is required, the maximum live and playback throughput on the Corporate network uplink port of each HD Video Appliance is 100 Mbps.



## Sample Network Topologies (16/24-Port HDVA)

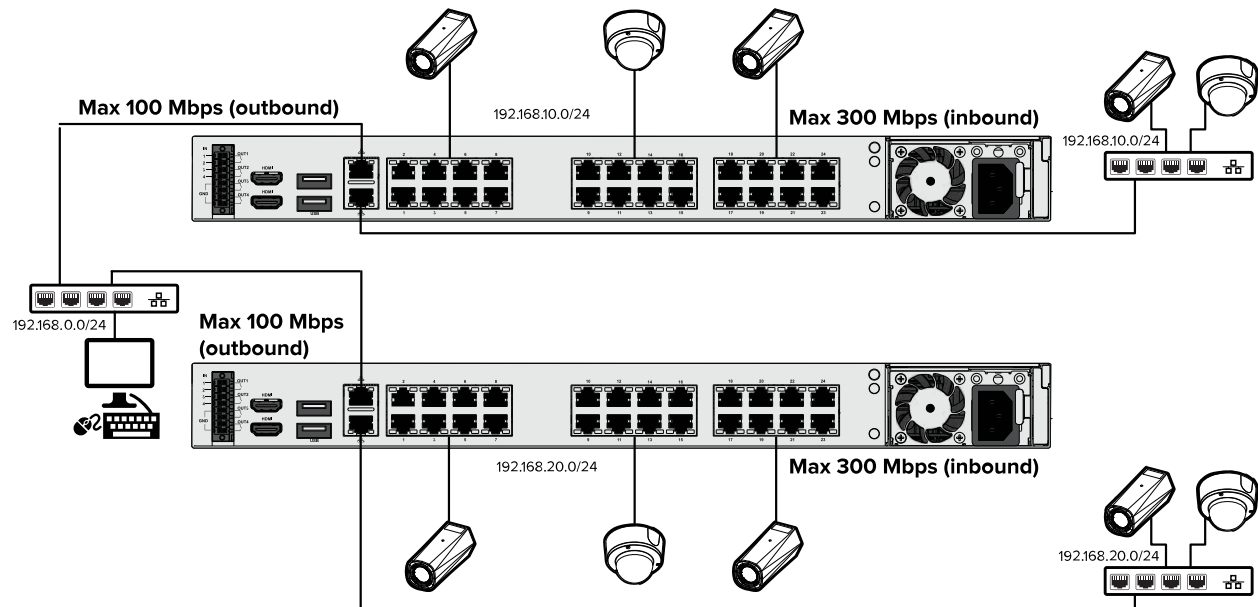
### Network Topology with One 16-Port or 24-Port HD Video Appliance

Suitable for smaller sites with only one VMA-AS3-16P or VMA-AS3-24P per ACC Site and up to a maximum of 300 Mbps recording throughput coming from the built in PoE switch or external camera PoE switch. If a remote monitoring workstation is required, the maximum live and playback throughput on the Corporate network uplink port is 100 Mbps.



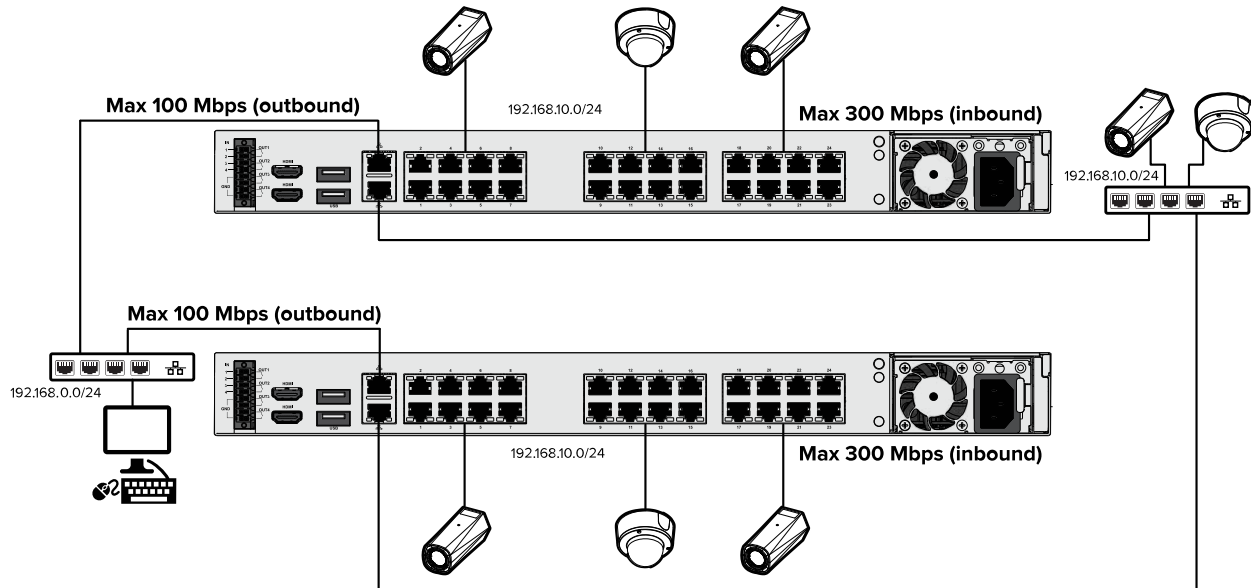
## Network Topology with Multiple 16-Port or 24-Port HD Video Appliances without Camera Failover

Suitable for sites with multiple VMA-AS3-16P or VMA-AS3-24P per ACC Site without camera failover and up to a maximum of 300 Mbps recording throughput coming from the built in PoE switch of each HD Video Appliance or external camera PoE switch. If a remote monitoring workstation is required, the maximum live and playback throughput on the Corporate network uplink port of each HD Video Appliance is 100 Mbps..



## Network Topology with Multiple 16-Port or 24-Port HD Video Appliances with Camera Failover

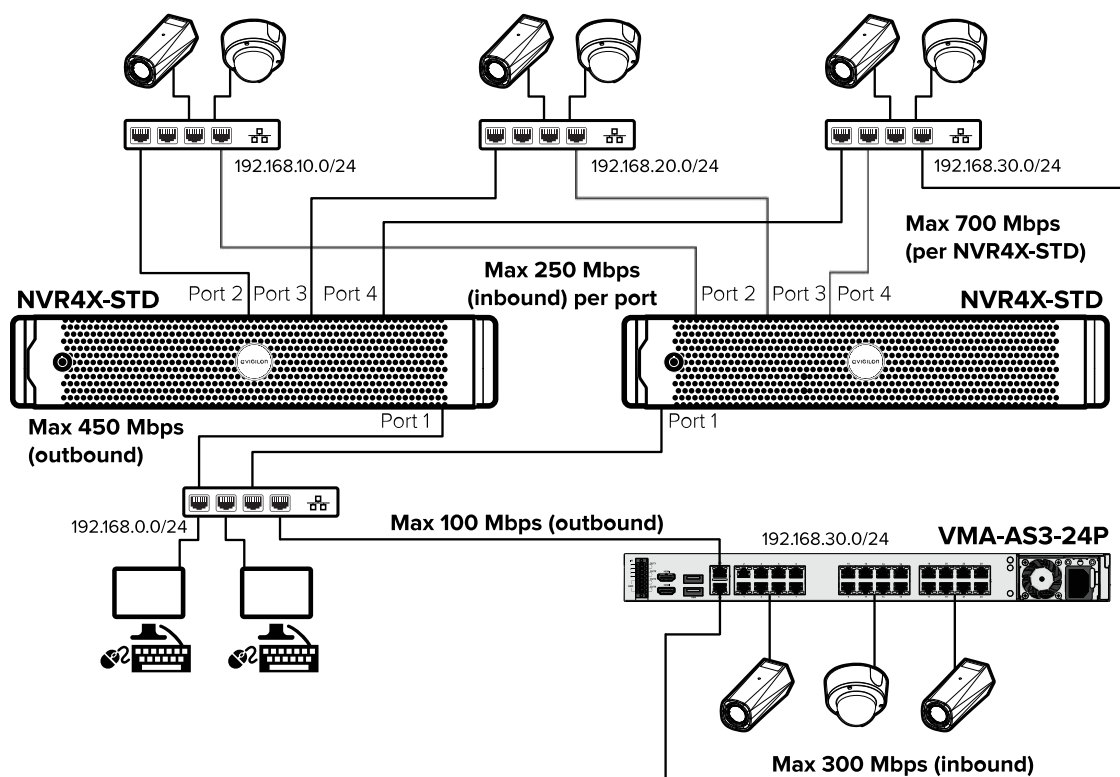
Suitable for sites with multiple VMA-AS3-8P per ACC Site with camera failover and up to a maximum of 100 Mbps recording throughput coming from the built in PoE switch of each HD Video Appliance or external camera PoE switch. If a remote monitoring workstation is required, the maximum live and playback throughput on the Corporate network uplink port of each HD Video Appliance is 100 Mbps.



## Sample Network Topologies (HDVA & NVR)

### Network Topology with HD Video Appliances and NVR

Suitable for sites with multiple recorders including VMA-AS3 and NVR per ACC Site with camera failover. Please consult the recorder datasheet for information about the maximum recording and live/playback throughput of each recorder as these need to be taken into consideration. The diagram below shows a generic architecture. For different designs or if you have any questions on how to design an architecture with multiple recorders, please contact your local Sales Engineer.



## IP Addressing and Subnetting

For further information about how to set the HD Video Appliances IP addresses and subnetting, please refer to the HD Video Appliance User Guide. Following in this guide you can find a summary of the detailed content of the User Guide for your reference.

It is recommended that you plan an IP addressing strategy for your appliances, and that you change the IP address on every HD Video Appliance internal switch WebUI. You can use separate subnets for each appliance, or a single subnet for all appliances, as long as all of the IP addresses for each HD Video Appliance are unique.

An example of IP addresses for three HD Video Appliances using multiple IP subnets. This configuration is recommended for ACC sites running with multiple HD Video Appliances that don't require camera failover:

Video Appliance		Internal Switch	WebUI Port
Video Appliance 1	Default IP Address	192.168.2.1	192.168.2.99
	New Unique IP Address	192.168.10.99	192.168.10.100
Video Appliance 2	Default IP Address	192.168.2.1	192.168.2.99
	New Unique IP Address	192.168.20.99	192.168.20.100
Video Appliance 3	Default IP Address	192.168.2.1	192.168.2.99
	New Unique IP Address	192.168.30.99	192.168.30.100

An example of IP addresses for three Video Appliances using one IP subnet for all appliances. This



configuration is recommended for ACC sites running with multiple HD Video Appliances that require camera failover.

For example, this table shows an addressing scheme for three appliances in an 192.168.100.0/24 IP subnet:

Video Appliance		Internal Switch	WebUI Port
Video Appliance 1	Default IP Address	192.168.2.1	192.168.2.99
	New Unique IP Address	192.168.100.11	192.168.100.12
Video Appliance 2	Default IP Address	192.168.2.1	192.168.2.99
	New Unique IP Address	192.168.100.21	192.168.100.22
Video Appliance 3	Default IP Address	192.168.2.1	192.168.2.99
	New Unique IP Address	192.168.100.31	192.168.100.32

## Configuration of the Windows 10 Network Connections

The HD Video Appliances list three network adapters:



**Corporate LAN** - is a network port directly connected to the computer side of the HD Video Appliance. It does not connect or relate to the internal PoE switch. This network adapter is primarily used to connect the HD Video Appliance to the site Corporate Network for remote video monitoring. This network adapter is generally configured with all network parameters such as IP address, subnet mask, default gateway and DNS.

**Internal Camera LAN** - is the internal uplink between the recorder side of the HD Video Appliance and the internal PoE switch. This network adapter is used to establish a connection between the recorder and the cameras connected to the internal PoE switch or cameras connected to an external PoE switch that is connected to the internal switch uplink port.

If the Corporate LAN network adapter is used, the Internal Camera LAN network adapter is configured only with IP address and subnet mask. If the Corporate LAN network adapter is not used, the Internal Camera LAN network adapter is configured with all network parameters such as IP address, subnet mask, default gateway and DNS.

This adapter can be used to access the internal switch administration WebUI if configured on the same subnet.

**WebUI** - is the internal uplink between the computer side of the HD Video Appliance and the internal PoE switch used for switch administration. This network adapter also establishes a connection between the recorder and the cameras connected to the internal PoE switch or cameras connected to an external PoE switch that is connected to the internal switch uplink port, however it does not provide the same throughput as the Internal Camera LAN interface.

This port should be used only to access the internal switch administration WebUI. This requires that the

internal switch IP address is configured on a different subnet from the cameras subnet.

For most of the applications, the WebUI network adapter is configured only with IP address and subnet mask on the same subnet as the internal switch administration IP address.

Note - If you configure the internal switch administration WebUI IP address on the same subnet as the cameras, you should disable the WebUI network adapter to prevent having two network adapters configured on the same subnet. In this case, the access to the WebUI is already established by the Internal Camera LAN interface and the WebUI network adapter is not required.

# Deploying an AI Appliance

**Note:** The following guidelines apply to both the Avigilon AI Appliance 1 and AI Appliance 2

## AI Appliance and NVR Interoperability Considerations

- Video analytic processing on the Avigilon AI Appliance will source live video from enabled cameras through the NVRs in the site (note the video streaming is not direct from a camera). From a NVR throughput performance perspective, this video streaming is equivalent to ACC Client live streaming and does not degrade or consume NVR camera recording capacity.
- Upgrades, restarts and other outages on the Avigilon AI Appliance will not affect NVR video recording and will not interrupt camera to NVR connections. The only result of an outage will be gaps in analytic events, metadata and appearance search results for searches within the outage window. Expect the following when an Avigilon AI Appliance fails:
  - Motion recording will stop for non-analytic cameras that are configured for classified object motion detection and not configured for pixel motion detection.
  - Rules and alarms related to analytic events for cameras linked to the AI appliance will not trigger, and will not display on the Focus of Attention tab.
- Recorded video analytic and appearance search data is persisted on the NVR and will be retained on the NVR even after the AI Appliance is removed. Archives from the NVR will also contain this data.
- **At initial setup time, the ACC Client PC must be on a network with connectivity to the AI Appliance and the ACC site. Once the AI Appliance has joined the ACC site, this is no longer a requirement.**

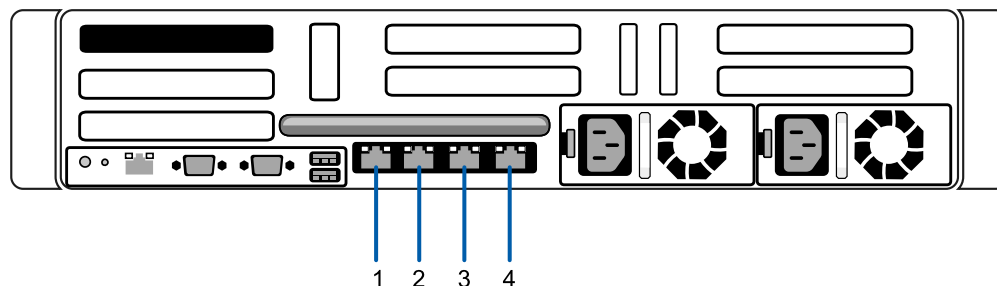
## Network Architectures

- Enabling  $n$  cameras with AI Appliance video analytic processing will result in  $n$  video live streams between the NVR and AI Appliance.

E.g. Enabling video analytic processing on 50 x 2 Mbps cameras will result in at most 50 x 2 Mbps live streams from the NVR to AI Appliance. This bandwidth may be reduced for HDSM SmartCodec™ enabled cameras.
- The AI Appliance sends analytics data to connected NVRs. This traffic has a negligible network load (less than 100 Kbps per enabled camera).
- The AI Appliance must be installed with network connectivity to all ACC Site member NVRs and does not require network connectivity to cameras.
- To limit cross-network traffic, it is preferable that the AI Appliance is co-located with the ACC NVRs connected to the cameras on which the AI Appliance will be performing video analytic processing.
- The AI Appliance will still function well in non co-located deployments given sufficient network throughput and reasonable latency between NVR and AI Appliance.

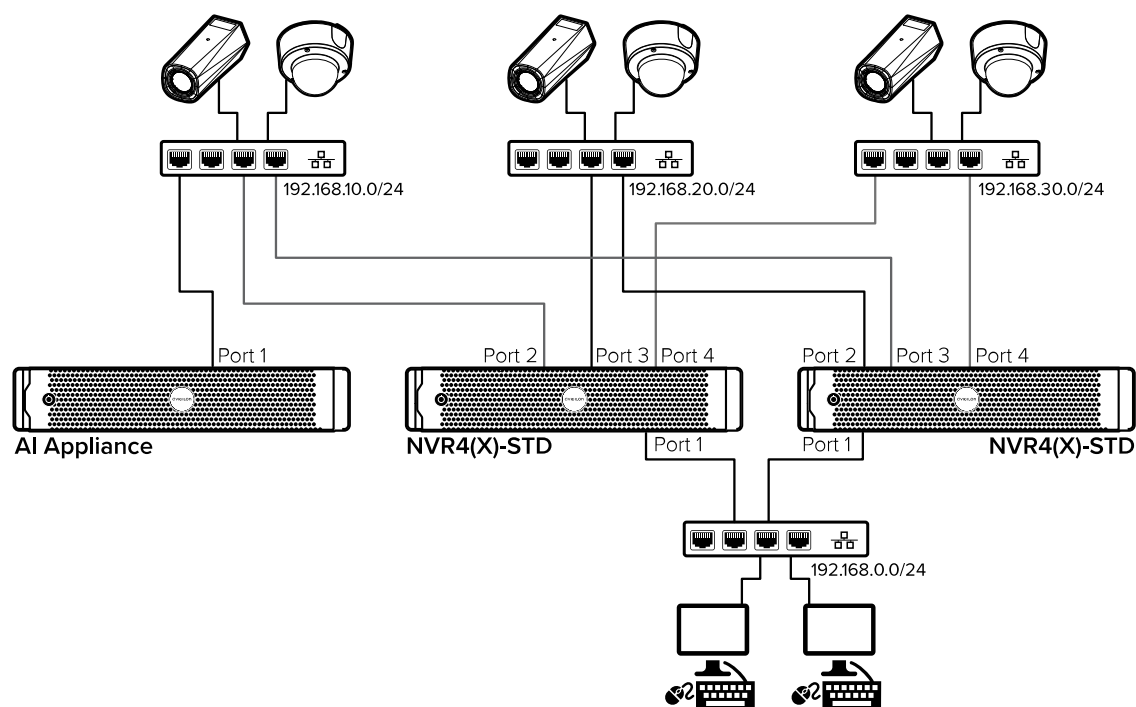
# Network Interface Connections

The AI Appliance requires only a single network connection to handle its rated 600 Mbps of video analytics processing throughput. However, up to 4 network interfaces are available to accommodate advanced site networking deployments and traffic segmentation and distribution in the future.



## Sample Network Topologies

### AI Appliance Networking



# NIC Teaming Overview

**Note:** The NIC teaming described in this section applies to the NVR4 and NVR4X windows-based NVRs. For more information on NIC teaming with AI NVRs, see *NIC Teaming on AI NVR 2 Value* on page 25 or *NIC Teaming on AI NVR Standard* on page 20.

NIC teaming in fault tolerance mode is currently supported on NVR4(X) Premium. It is handled at the NVR level through Windows Server 2016. Refer to the following sections to set it up.

## Introduction

### Purpose

The purpose of this document is to provide an overview of the switch independent, active/standby Network Interface Controller (NIC) teaming strategy and its configuration details as recommended by Avigilon for the fourth-generation NVR Premium.

### Scope

This overview discusses the benefits, setup details, expected behavior, and the limitations that arise when implementing the switch independent, active/standby NIC teaming strategy. This NIC teaming strategy is used with the intent of providing redundancy when the NVR is connected to two segmented networks or subnets with one camera network and one client network.

**Note:** NIC teams that provide bandwidth aggregation require switch-side configuration. These types of network topologies are not supported and are outside the scope of this document.

### Audience

This document is intended to be used by installers who want to set up their NVR with the switch independent, active/standby NIC teaming configuration.

## Design and Implementation

### Link Aggregation Overview

Link aggregation is used to configure more than one physical NIC into a single logical group that behaves as if it were a single NIC. The logical group has its own modified IP address, but it uses the MAC address of a group member. The native implementation of link aggregation in Windows Server 2016 is called NIC teaming.

When NIC teaming is aggregated using a suitable configuration, it can provide one or both of the following benefits:

- Failover during NIC failure → Increased availability
- Increased performance → Load sharing and bandwidth aggregation

In Windows Server 2016, to configure NIC teaming to allow bandwidth aggregation requires switch-side configuration as well.

## Recommended Strategy

The NIC teaming strategy supported on the NVR provides failover during NIC failure. Bandwidth aggregation is not a requirement.

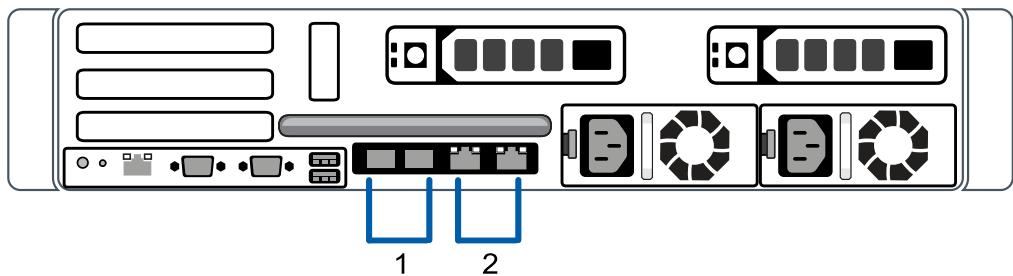
To implement this strategy, configure the NIC teaming to be switch independent, active/standby:

- Switch independent means that the NIC team is not confined to one switch and switch-side configuration is not required, allowing for a wider range of possible network topologies. In Windows Server 2016, this strategy assumes that teams will have exactly two essential NICs.
- Active/standby means that the NIC team operates with one NIC active and all other team members in standby mode. The active NIC serves all traffic for the NIC team, while those in standby mode transfer no data.

This strategy requires only configuration done in Windows.

## Port Configuration

The NVR Premium has two 10GbE ports and two 1GbE ports, for a total of four NICs. The recommended server NIC teaming configuration uses two NIC teams: two 10GbE NICs in one team and two 1GbE NICs in the other team. Both teams are configured in a similar way. A sample topology using this strategy is outlined below:



NIC Team	Team Name	Network Segment
1	10GbE NIC Team	Camera Network (inbound data)
2	1GbE NIC Team	Client Network (outbound data)

**Note:** Combining one or more 10GbE NICs in a team with one or more 1GbE NICs will limit the speed of the teamed 10GbE NICs to match the speed of the 1GbE NICs. A requirement for NIC teaming is that all NICs have to be of the same speed.

## Failover Behavior and Limitations

Upon failure of the active NIC, network traffic will failover to the standby NIC and data transfer interruption will be mitigated. The described NIC teaming configuration will provide redundancy in the event that a NIC fails or in the event that one NIC per connected network segment fails.

During a failover event, data transfer is taken over immediately by the standby NIC with minimal packet loss. When the active NIC resumes functioning, it carefully takes over data transfer from the standby NIC with no packet loss.

The IP address of the NIC team is shared by all team members. During a failover event, Windows Server 2016 handles the hand-off of the NIC team IP address and MAC address assignment.

The following limitations arise when using this NIC teaming configuration:

- Bandwidth aggregation is not provided.
- Failure of two NICs on one network connection will result in a network interruption.
- Only two networks can be connected to the NVR using 1GbE and 10GbE ports.
- The server will experience some packet loss during a failover event.

This NIC teaming topology is useful for providing NIC redundancy and graceful failover of network traffic in the event of a NIC failure. Other scenarios are not provided for this configuration.

## Recommended Configuration Details

Use the Server Manager in Windows Server 2016 to configure the two NIC teams.

For the first NIC team, use the following configuration details when adding a new team:

<b>Team name</b>	10GbE NIC Team
<b>Member adapters</b>	NIC1. NIC2
<b>Teaming mode</b>	Switch Independent
<b>Load balancing mode</b>	Address Hash
<b>Standby adapter</b>	NIC2

For the second NIC team, use the following configuration details when adding a new team:

<b>Team name</b>	1GbE NIC Team
<b>Member adapters</b>	NIC3. NIC4
<b>Teaming mode</b>	Switch Independent
<b>Load balancing mode</b>	Address Hash
<b>Standby adapter</b>	NIC4

# Troubleshooting

## Issues with Frame Drops, Packet Loss and Timeline Gaps

Non-analytic cameras — such as H4SL, H5SL, and third-party ONVIF cameras — that have Unusual Motion Detection (UMD) enabled and are covering busy scenes with many objects entering and leaving the field of view can consume significantly more of the system's CPU processing power than Analytic cameras (such as H4A and H5A cameras).

If your system has a significant amount of non-analytic cameras covering busy scenes with UMD enabled, Avigilon recommends sizing your system more conservatively to avoid frame drops, packet loss, timeline gaps, system instability, and reboots. If all the cameras in your system are non-analytic, we recommend sizing your system 33% below the maximum recording throughput that is recommended in this guide.

Alternatively, you can disable UMD on non-analytic cameras from their ACC Client device setup dialog. For more information, see the *ACC Client User Guide*.