

A Guide to Simple IP Camera Deployment Using ZyXEL VLAN Solutions



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Overview:

This article contains guidelines on how to introduce IP cameras into your local network using ZyXEL switches. This article focuses on the fundamental design and data forwarding considerations. Methods on how to improve and troubleshoot VLANs will also be included. This article assumes that IP camera service is deployed for small to medium businesses and uses unicast instead of multicast. Interaction between the IP camera and server will be strictly through the same layer-2 domain and will not cross any gateways.

Objectives:

- Explain using VLAN to segregate the IP cameras' traffic
- Present VLAN configuration examples using Web GUI
- Troubleshooting guide for VLAN



Basic IP Camera Network Topology:

The topology shown in the above graphic explains the following: multiple IP cameras are installed throughout the building for security surveillance purposes. We divide these devices in the order of downlink to uplink: the End Devices, the Access Layer, the Aggregation Layer, and the Server Room.

End devices include your PCs, laptops, printers, access points, IP phones, and IP cameras. These devices are normally placed installed throughout the building and their physical locations are restricted by their Ethernet cables. In this topology, we will assume that there are other end devices connected to the switch. However, we will only focus on the IP cameras.

The Access Layer is the initial point where all the end devices access the internal network. These end devices are usually directly connected to a switch. In this topology, using a PoE supported switch has the advantage of offering your IP cameras (or other powered devices) more flexibility by not needing to worry about the distance between the IP cameras and the



power outlets. This allows the IP cameras to be placed at their most ideal locations.

The Aggregation Layer is where all devices in the Access Layer converge. Devices in this layer are usually connected to other switches. Distribution switches can also be connected to administrator tools such as servers and administrator terminals. However, the distribution switch is responsible for converging all other switches in the network. Therefore, ports are reserved for switches and installing a PoE switch model in this case will not be the best choice.

Finally, we have the Server Room. The server room, or in this case, the monitor room, will require constant data transfer between all IP cameras below the Access Layer. This is where all surveillance videos are sent to.

VLAN Consideration:



This topology assumes that the IP camera service is not available for non-authorized personnel. PC icons indicate that connected ports are for users or guests that only require Internet service. The USG indicates path to the Internet. Separating the traffic between IP cameras and other end devices can improve network management, service stability, and security.

The benefit to network administrators separating VLAN among the network's various services is that administrators may logically group end-stations or end-devices, which are independent from physical location or connection. This allows them to refine or modify different traffic across the network more conveniently.

Service stability is also an advantage of using VLAN. Administrators can configure the switch to give more priority to your IP camera traffic than users using the IEEE 802.1p. This ensures that if the bandwidth over a link is full, the switch will process the packets in the VLAN with a higher priority first. Service stability is also improved by cutting the broadcast domain smaller, thereby decreasing the overall packet transmission.

Security would be the most important concern in this scenario, especially if the IP cameras are



used for surveillance. If you allow all end points to access the same VLAN, your network will be open to spoofing attacks. Hackers can either copy sensitive information or disable some network services. The VLAN ID should be random to prevent this.

VLAN Configurations in Web GUI:

We will now try to configure the proposed topology using Web GUI. Since the purpose of this article is meant for IP camera deployment, we will assume IP camera service has a higher priority. As a reminder, the USG indicates path to the Internet.



Devices:

Device Name	Model
Switch-01	GS1920-24HP
Switch-02	GS1920-24HP
Switch-03	GS1920-24HP
Switch-Core	GS1920-48

Objectives:

- IP cameras and IP camera server will use VLAN 10.
- PC or non-IP camera devices will use VLAN 20.
- Only PC or non-IP camera devices can access Internet.
- VLAN 10 should have a higher traffic priority.

Procedure:

Step 1: Go to Advance Application -> VLAN -> VLAN Configuration -> Static VLAN Setup.

Create VLAN 10. "Fix" ports that goes to IP cameras, server, and neighboring switches. Set ports to IP cameras and server as "untagged".



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Policy Rule	9	Normal	Fixed	Forbidden	🗹 Tx Tagging
Queuing Method	10	Normal	Fixed	Forbidden	Tx Tagging
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Step 2: Go to **Advance Application -> VLAN -> VLAN Configuration -> Static VLAN Setup.**

Create VLAN 20. "Fix" ports that goes to PC, Internet, and neighboring switches. Set ports to PC and Internet as "untagged".

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Step 3: Go to **Advance Application -> VLAN -> VLAN Configuration -> VLAN Port Setup.**

Configure the PVID. Ports to IP cameras and server will use PVID 10, while ports to PC and Internet will use PVID 20. You can ignore PVID of ports to neighboring switches.

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Static Multicast Forwarding - All - Static Multicast Forwarding 1 All - - All -	VLAN	Port	Ingress Check	PVID	GVRP	Acceptable Frame Type	VLAN Trunking	Isolation
State Multicast Forwarding Filtering 1 1 All • Spanning Tree Protocol 3 1 All • • Bandwidth Control 4 1 All • • • Broadcast Stom Control 4 1 All • • • • Broadcast Stom Control 6 1 All •	Static MAC Expression	*				All		
Classifier 2 1 All V Bandwidth Control 3 1 All V Bandwidth Control 4 1 All V Bandwidth Control 5 1 All V Mirroring 6 1 All V Port Authentication 7 1 All V Port Authentication 7 1 All V Port Security 9 10 All V Classifier 9 10 All V Policy Rule 10 20 All V Classifier 9 10 All V Policy Rule 10 20 All V Classifier 9 11 All V Policy Rule 11 All V All Loop Guard 11 All V I Layer 2 Protocol Tunneling PPPE 1 All <td>Static Multicast Ecoverding</td> <td>1</td> <td></td> <td>1</td> <td></td> <td>All 🔻</td> <td></td> <td></td>	Static Multicast Ecoverding	1		1		All 🔻		
Spanning Tree Protocol 3 1 All Image: Spanning Tree Protocol Broadcast Storm Control 4 1 All Image: Spanning Tree Protocol Broadcast Storm Control 5 1 All Image: Spanning Tree Protocol Broadcast Storm Control 6 1 All Image: Spanning Tree Protocol Link Aggregation 7 1 All Image: Spanning Tree Protocol Port Security 8 1 All Image: Spanning Tree Protocol Classifier 9 10 All Image: Spanning Tree Protocol Policy Rule 10 20 All Image: Spanning Tree Protocol Queuing Method 11 1 All Image: Spanning Tree Protocol Multicast 12 1 All Image: Spanning Tree Protocol Image: Spanning Tree Protocol Layer 2 Protocol Tunneling 15 1 All Image: Spanning Tree Protocol Private VLAN 18 1 All Image: Spanning Tree Protocol Image: Spanning Tree Protocol LDP 20 1 All Image: Spanning Tree Protocol Im	Filtering	2		1		All 🔻		
Bandwidth Control 4 1 All Image: Control of the second of the sec	Spanning Tree Protocol	3		1		All 🔻		
Broadcast Storn Control 5 1 All Image: Control of the state of the sta	Bandwidth Control	4		1		All 🔻		
Mirroing 6 1 All Image: Constraint of the state of the st	Broadcast Storm Control	5	_	1		All		
Link Aggregation 0 1 0 1 0 1 0	Mirroring	6		1				
Port Authentication , , , , , , , , , , , , , , , , , , ,	Link Aggregation	7		1				
Port Security 0 1 Ail Image: Classifier Policy Rule 0 20 All Image: Classifier Policy Rule 10 20 All Image: Classifier Queuing Method 11 1 All Image: Classifier Multicast 12 1 All Image: Classifier AAA 12 1 All Image: Classifier Loop Guard 14 1 All Image: Classifier Loop Guard 14 1 All Image: Classifier Proce 16 1 All Image: Classifier Proce 16 1 All Image: Classifier Private VLAN 18 1 All Image: Classifier Green Ethernet 19 1 All Image: Classifier LLOP 20 1 All Image: Classifier	Port Authentication			4		All •		
Classifier 9 10 All Image: Classifier Policy Rule 10 20 All Image: Classifier Oueuing Method 11 1 All Image: Classifier Multicast 12 1 All Image: Classifier AAA 13 1 All Image: Classifier Loop Guard 14 1 All Image: Classifier Layer 2 Protocol Tunneling 15 1 All Image: Classifier Private VLAN 18 1 All Image: Classifier Green Ethernet 19 1 All Image: Classifier LDP 1 All Image: Classifier Image: Classifier 21 1 All Image: Classifier Image: Classifier 22 1 All Image: Classifier Image: Classifier	Port Security	0				All		
Policy Rule 10 20 All • Queuing Method 11 1 All • AAA 12 1 All • AAA 13 1 All • Loop Guard 14 1 All • Layer 2 Protocol Tunneling 15 1 All • PProE 16 1 All • • Errdisable 17 1 All • • Private VLAN 18 1 All • • Green Ethernet 19 1 All • • LDP 20 1 All • •	Classifier	9		10		All		
Oueuing Method 11 1 All V Multicast 12 1 All V AAA 12 1 All V IP Source Guard 13 1 All V Loop Guard 14 1 All V Layer 2 Protocol Tunneling 15 1 All V PPPE 16 1 All V O Errdisable 17 1 All V O Private VLAN 18 1 All V O Q0 1 All V O O 20 1 All V O O 21 1 All V O O	Policy Rule	10		20		All 🔻		
Multicast 12 1 All Image: Constraint of the state of the	Queuing Method	11		1		All 🔻		
AAA 13 1 All • IP Source Guard 14 1 All • Loop Guard 14 1 All • Layer 2 Protocol Tunneling 15 1 All • PPPoE 17 1 All • • Private VLAN 18 1 All • • Green Ethernet 19 1 All • • LDP 20 1 All • • • 21 1 All • • • • • 22 1 0 0 • • • • •	Multicast	12		1		All 🔻		
IP Source Guard 14 1 All Image: Constraint of the source of the s	AAA	13		1		All 🔻		
Layer 2 Protocol Tunneling 15 1 All PPPoE 16 1 All Errdisable 17 1 All Private VLAN 18 1 All Green Ethernet 19 1 All LDP 20 1 All <td>IP Source Guard</td> <td>14</td> <td></td> <td>1</td> <td></td> <td>All</td> <td></td> <td></td>	IP Source Guard	14		1		All		
Layer 2 Protocol Tunneling 1 <th1< th=""> 1 <th1< th="" th<=""><td>Loop Guard</td><td>15</td><td></td><td>1</td><td></td><td></td><td></td><td></td></th1<></th1<>	Loop Guard	15		1				
Pryote I All I Errdisable 17 1 All I Private VLAN 18 1 All I Green Ethernet 19 1 All I 20 1 All I I 21 1 All I I 22 1 All I I	Layer 2 Protocol Tunneling	16		1				
Enrolsable 17 1 All • Private VLAN 18 1 All • Green Ethernet 19 1 All • LDP 20 1 All • 21 1 All • • 22 1 All • •	PPP0E Errdiable	47		4		All •		
Time v Low 18 1 All Image: constraint of the state of the	Private VLAN	17		1		All		
Image: Construction of the second s	Green Ethernet	18		1		All		
20 1 All V 21 1 All V 22 1 All V	LIDP	19		1		All		
		20		1		All 🔻		
		21		1		All 🔻		
		22		1		All 🔻		
23 1 All T		23		1		All 🔻		
24 1 All 🔻		24		1		All 🔻		

Switch-Core

ZyXEL							
MENU							a a
Basic Setting		AN Port Settin	ıg			VLAN C	ontiguration
Advanced Application		GVRP					
IP Application							
Management							
2	Port	Ingress Check	PVID	GVRP	Acceptable Frame Type	VLAN Trunking	Isolation
VLAN	*				All		
Static MAC Forwarding	1		1		All T		
Static Multicast Forwarding	2						
Filtering	2		1				0
Spanning Tree Protocol	3				All		U
Bandwidth Control	4		1		All		
Broadcast Storm Control	5		1		All		
Link Aggregation	6		1		All		
Port Authentication	7		1		All 🔻		
Port Security	8		1		All 🔻		
Classifier	9		1		All 🔻		
Policy Rule	10		1		All		
Queuing Method	11		1		All		
Multicast	12		1		All		
AAA	13		1		All		
IP Source Guard	14		1				
Loop Guard	15		1				
Layer 2 Protocol Tunneling	15						
PPPoE	16				All		
Errdisable	17		1		All		
Private VLAN	18		1		All		
Green Etnemet	19		1		All 🔻		
	20		10		All 🔻		
	21				All 🔻		
	22		1		All		
	23		1		All 🔻		
	24		20		All		



Step 4: Go to Basic Settings -> Port Setup.

Now we need to give IP camera video traffic a higher priority. In this case, we will need to configure all ports to IP cameras and server with an 802.1p priority of 5.

Switch-01

ZyXEL							
MENU							
Basic Setting		ort Set	tup				
Advanced Application	Port	Active	Name	Туре	Speed / Duplex	Flow Control	802.1p Priority
IP Application				٦	Auto		0 -
Management			0 04	40/400/400014	Auto		
		Z	Camera-01	10/100/1000M	Auto		5.
System Info	2	S	PC	10/100/1000M	Auto		0 •
General Setup	3			10/100/1000M	Auto		0 🔻
Switch Setup	4	1		10/100/1000M	Auto 🔻		0 🔻
IP Setup	5			10/100/1000M	Auto		0 •
Port Setup	6			10/100/1000M	Auto		0 🔻
PoE Setup	7			10/100/1000M	Auto		0 🔻
Interface Setup	8	_		10/100/1000M	Auto		0 🔻
IPv6	9			10/100/1000M	Auto		
E.	10			10/100/1000M	Auto		0 -

Switch-02

	ort Se	tup				
Port	Active	Name	Туре	Speed / Duplex	Flow Control	802.1p Priority
	0		1	A	-	
			-	Auto	<u> </u>	UT
1	2		10/100/1000M	Auto		0 •
2	2		10/100/1000M	Auto	• III	0 🔻
3	1		10/100/1000M	Auto	•	0 🔻
4		Camera-02	10/100/1000M	Auto	•	(5 7)
5			10/100/1000M	Auto	•	0 •
6			10/100/1000M	Auto	-	0 -
7			10/100/1000M	Auto	-	0 🔻
8		PC	10/100/1000M	Auto	-	
			10/100/1000M	Auto		<u> </u>
9	<u>.</u>		10/100/100000	Auto	<u> </u>	U •
	Port * 1 2 3 4 5 6 7 8 9 9	Port Se Port Active 1 2 3 4 5 7 8 9 0	Port Setup Port Active Name Port Active Camera-02	Port Setup Port Active Name Type 1 - 10/100/1000M 2 - 10/100/1000M 3 - 10/100/1000M 4 - Camera-02 10/100/1000M 5 - 10/100/1000M 6 - 10/100/1000M 7 - 10/100/1000M 8 PC 10/100/1000M 9 - 10/100/1000M	Port Setup Port Active Name Type Speed / Duplex 1 - Auto 1 - 10/100/1000M Auto 2 - 10/100/1000M Auto 3 - 10/100/1000M Auto 4 - Camera-02 10/100/1000M Auto 5 - 10/100/1000M Auto 6 - 10/100/1000M Auto 7 - 10/100/1000M Auto 9 - 10/100/1000M Auto 9 - 10/100/1000M Auto	Port Setup Port Active Name Type Speed / Duplex Flow Control * - Auto • 1 @ 10/100/1000M Auto • 2 @ 10/100/1000M Auto • 3 @ 10/100/1000M Auto • 4 @ Camera-02 10/100/1000M Auto • 5 @ 10/100/1000M Auto • • 7 @ 10/100/1000M Auto • • 8 @ PC 10/100/1000M Auto • • 9 @ 10/100/1000M Auto • • •

ZyXEL							
MENU							
Basic Setting		ort Se	tup				
Advanced Application	Port	Active	Name	Туре	Speed / Duplex	Flow Control	802.1p Priority
IP Application	*	0			Auto		0 -
Management				40/400/400014	Auto		0 -
				10/100/10000	Auto		<u> </u>
System Info	2	1		10/100/1000M	Auto 🔻		0 🔻
General Setup	3	1		10/100/1000M	Auto 🔻		0 🔻
Switch Setup	4			10/100/1000M	Auto 🔻		0 🔻
IP Setup	5	1	-	10/100/1000M	Auto		0 •
Port Setup	6		-	10/100/1000M	Auto 🔻		0 🔻
PoE Setup	7			10/100/1000M	Auto •		0 •
Interface Setup	8	-		10/100/1000M	Auto 🔻	1 0	0 •
IPv6	9		Camera-03	10/100/1000M	Auto		5 7
	10		PC	10/100/1000M	Auto 🔻	1 0	0 -



Switch-Core

ZyXEL							
MENU							
Basic Setting	11	1		10/100/1000M	Auto	•	0 🔻
Advanced Application	12			10/100/1000M	Auto	•	0 🔻
IP Application	13			10/100/1000M	Auto	• •	0 🔻
Management	14	1		10/100/1000M	Auto	-	0 🔻
	15	1		10/100/1000M	Auto	-	0 🔻
System Info	16			10/100/1000M	Auto	-	0 🔻
General Setup	17			10/100/1000M	Auto	•	0 •
Switch Setup	18	1		10/100/1000M	Auto	-	0 •
IP Setup	19			10/100/1000M	Auto	-	0 🔻
Port Setup	20		Server Room	10/100/1000M	Auto		5 7
PoE Setup	21			10/100/1000M	Auto	7 6	0 7
Interface Setup	22			10/100/1000M	Auto		0 7
11- 10	23			10/100/1000M	Auto		0 -
	24		Internet	10/100/1000M	Auto		0 -

Optional: You can configure the Queuing Method. For more details on Queuing Method behavior, refer to

http://kb.zyxel.com/KB/searchArticle!viewDetail.action?articleOid=014142&lang=EN

Troubleshooting VLAN:

1. From the port connected to the IP camera, ping the IP camera server's IP address. A successful ping shows that traffic is flowing both ways. If ping is unsuccessful, verify that packets are processed in the correct VLAN.

a. Go to **Management -> MAC Table.**

- b. Select condition: All.
- c. Click the "Search" button.

Index	MAC Address	VID	Port	Туре
1	00:0c:29:75:2b:5a	100	1	Dynamic
2	00:0c:29:cb:38:d7	100	2	Dynamic
3	00:0c:29:28:4f:ae	100	3	Dynamic
4	00:0c:29:11:d4:51	100	4	Dynamic
5	00:0c:29:2e:98:b9	100	5	Dynamic
6	4c:9e:ff:6f:90:3f	1	24	Dynamic
7	64:66:b3:50:08:1e	1	24	Dynamic
8	74:d4:35:f4:6b:4e	1	24	Dynamic
9	b0:b2:dc:6f:3a:d3	1	24	Dynamic
10	b0:b2:dc:6f:55:db	1	24	Dynamic

- d. A list should appear similar to the image above.
- e. Look for the MAC address of the IP camera. If MAC address does not appear, then IP camera most likely has not sent any packets to the switch within the past five minutes. If MAC address of the IP camera does appear in the MAC table but in an incorrect VLAN, then there is a strong indication of misconfiguration.
- 2. The ZyXEL VLAN concept follows three rules: the ingress, forwarding, and egress rule. This refers to the PVID, normal/fix/forbidden ports, and Tx-tagging; respectively. Make



sure all three rules meet your network policy.

3. If the MAC address of the IP camera does appear in MAC table of your uplink switches and are processed in the correct VLAN, the final thing to consider is if the packets sent to either the IP cameras or server carries any VLAN tag. End-devices by default cannot process packets with VLAN tags. Make sure that ports leading to your IP cameras or servers are set to "untagged".

