White Paper



Understanding and Using VLANs

Introduction

This document explains the function and benefits of using VLANs in a network setup. It also provides a walk-through for setting up VLANs in Araknis 300 series routers and switches.

What is a VLAN?

- Stands for Virtual Local Area Network.
- VLANs are created and managed by the network admin using managed network switches and routers with VLAN capability.
- VLANs structure communication between network devices:
 - Without VLANs, network broadcast traffic (packets) from any device is sent to all devices.
 - With VLANs, broadcast packets are tagged with a VLAN ID when they pass through an assigned VLAN port. Tagged packets are only sent to other devices that are members of the same VLAN.
- VLANs break a LAN into smaller sub-networks. For example, VLANs may be used to segment the LAN traffic in a large home network, based on the type of user:
 - VLAN 1 is used for entertainment and end user devices (phones, computers, tablets).
 - VLAN 20 is only for surveillance systems (NVRs, IP cameras).
 - VLAN 30 is only for home automation/control system equipment.
 - VLAN 40 is restricted Wi-Fi for guests.
- Devices can be part of a VLAN based on either:
 - Physical port number on a managed switch or router that a network device is connected to.
 - MAC address of device (VLAN is configured with a list of MAC addresses that are allowed or not allowed to connect to it).
- VLANs can be totally restricted (only devices in the same VLAN can talk to each other) or allow access from/to other VLANs. Inter-VLAN communication is controlled by the router or other Layer 3 devices.

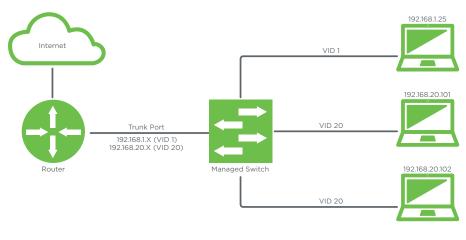


Figure 1. VLAN Network Topography Example

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Why Set up VLANs?

- Increased Security Unknown users can connect to a guest network but can't get access to other parts of the network unless you want them to.
- Minimize Network Equipment Instead of needing multiple switches to make multiple subnets, you can use one switch and assign each port to a VLAN as needed.

Basic VLAN Setup Recommendations

Planning is the key to success with VLANs. List equipment by the way you want to split up a network, then record what devices are connected to what ports. You need managed switches located correctly to ensure that configuration can be completed, and cables between switches and the router to move data efficiently.

After you have the network organized, you can begin configuring VLANs in the router. We recommend setting up the router before any switches to ensure you don't set the wrong VLAN and lose access to a device.

Use different subnets for different VLANs to make it clear which VLAN a device is in. Example:

- VLAN 1 uses "192.168.1.XXX" addresses.
- VLAN 20 uses "192.168.20.XXX" addresses.
- VLAN 30 uses "192.168.30.XXX" addresses.

Configuration Instructions

Note: These instructions detail the setup of an Araknis AN-300-RT-4L2W network router and AN-300 managed switch. Setup for other equipment should be similar. Consult the equipment manufacturer for specific setup instructions.

Step 1 - Set Up VLANs in the Router

By default, the entire network is on VLAN 1. Follow these instructions to configure new VLANs in the Araknis router.

A. Log into the router web interface as an administrator, and navigate to Advanced > VLANs.

Figure 2. AN-300-RT-4L2W VLANs Menu

araknis	VLANS		-	CLOUD SERVE	R: Connected	🕓 System T	ime: 2015-01-14	08:42:27	System Uptime: 1	ld 16:22:3
STATUS SYSTEM CLIENTS AND SERVICES	802.1Q LAN								(VID range is	s 2~4092)
PORTS	VLAN ID Desc	ription Routin		Device Management	Route Binding	LAN1	LAN2	LAN3	LAN4	Delete
	1 Defau		oled 🔹	Enabled V	None •	UnTagged 🔻	UnTagged 🔻	UnTagged 🔻	UnTagged 🔻	
WAN										Add
LAN										
FIREWALL									Apply	Cancel
DDNS PORT FORWARDING										
SECURITY										
MAINTENANCE										
PING										
DNS LOOKUP FILE MANAGEMENT										
RESTART										
LOGOUT										
ROUTING										
VLANS N										



B. Click the Add button to the right and enter a new VLAN ID in the field. For this example, we will add new VLAN 20. *If you add a new entry and do not use it, delete the entry using the Delete* (**m**) *button before applying other changes.*

Figure 3. New VLAN Entry

	<u>araknis</u>				CLOUD SERVE	R: Connected	🕓 System T	ime: 2015-01-14	08:47:20 🕚 §	system Uptime: 1	d 16:27:27
0		VLANS 802.1Q LA	N							(VID range is	; 2~4092)
	PORTS	VLAN ID	Description	Inter VLAN Routing	Device Management	Route Binding	LAN1	LAN2	LAN3	LAN4	Delete
	SETTINGS SYSTEM	1	Default	Disabled V	Enabled •	None V	UnTagged 🔻	UnTagged 🔻	UnTagged 🔻	UnTagged 🔻	
	WAN	20 <u> </u>		Disabled •	Disabled •	None 🔻	Excluded •	Excluded •	Excluded •	Excluded •	ŵ
	LAN FIREWALL DDNS										Add
	PORT FORWARDING SECURITY									Apply	Cancel

- C. Click **Apply** in the bottom-right corner to save the new entry. Now that the VLAN has been added in this menu, a new DHCP server and subnet has automatically been enabled in the LAN menu.
- D. Navigate to the LAN menu and review the settings for the new VLAN. *Note the new subnet and DHCP server settings entries listed for VLAN 20.*

Figure 4. LAN Menu - New VLAN 20

a raknis	LAN				CLOUD S	ERVER: Connec	ted 🕓 System Ti	me: 2015-01-	14 13:29:46	 System Uptim 	ie: 1d 21:09:5
STATUS SYSTEM	Port Set	tings									
CLIENTS AND SERVICES	Interface	e Name			Spi	ed		Dup	plex		
PORTS	LAN1	LAN1			Au	10 🔻		Ful	•		
SETTINGS SYSTEM	LAN2	LAN2			Au	to 🔻		Fu	•		
WAN	LAN3	LAN3			Au	to •		Ful	•		
→LAN	LAN4	LAN4			Au	to 🔻		Ful			
FIREWALL	Subnet	Pattings									
DDNS PORT FORWARDING	Subnet	settings		Subnet Mas	k		VLAN ID		DHCP Mode		Delete
SECURITY	192,168	1.1		255 255 255			1		Server		<u></u>
MAINTENANCE	192.168.			255.255.255			20		Server		<u></u>
PING DNS LOOKUP FILE MANAGEMENT				200.200.200.		_	£.V	_	Conten	_	Add
RESTART	DHCP S	erver Settings		_				Lease			
LOGOUT	VLAN	DHCP Server	Subnet Mask	Enable	Server Name	DHCP Mode	IP Range/Relay Server	Time (Mintues)	DNS Server Mode	DNS	Delete
Quick Setup	1 •	192.168.1.1	255.255.255.0		default	Server •	192.168.1.100 192.168.1.149	1440	Proxy •	1: 0.0.0.0 2: 0.0.0.0	Û
	20 💌	192.168.20.1	255.255.255.0			Server •	192.168.20.100 192.168.20.149	1440	Proxy •	1: 0.0.0.0 2: 0.0.0.0	Û
		eservation Table								c	Create VLAN
		Static IP Address			MAC Addre	\$\$		Name	_		Delete
											Add
											Add
										Apply	Cancel

E. The default settings for the DHCP server are ideal for most VLANs that require it. Change these settings if desired, then click **Apply** in the bottom-right to save the changes. Your router is now configured to issue DHCP IP addresses and handle traffic on VLAN 20.



Step 2 - Switch Configuration

Follow these instructions to configure the VLANs in your AN-300 managed switch.

A. Log into the switch web interface. (Default IP: 192.168.20.254) and navigate to Settings > VLANs.

Figure 5. AN-300 Switch - VLANs Menu

			0.	System Time: 2015-01-14 1	5.55.12 G System Op	ume. 1012.04.5	• • Dudget Oulizatio
	VLAN	s Settings					
ATUS							PREV
stem							-
ts						Port Me	embers
TTINGS	VLAN		VLAN Name	D	elete 1 2	3 4 5	6 7 8 9
stem	1	defau	t				
ts							New
	ADVANCED S	ETTINGS					_
	no miloco o			1	Port V		
/LANs							
k Aggregation	Port	Port Type	Ingress Filtering	Frame Type	Mode	ID	Tx Tag
	Port All Ports	Port Type	Ingress Filtering	Frame Type			Tx Tag
k Aggregation					Mode	ID	-
k Aggregation INTENANCE g	All Ports	< •		 	Mode	1 1	
k Aggregation	All Ports	<> V Unaware V			Mode <> V Specific V	ID 1	<> • Untag_pvid •
k Aggregation INTENANCE g Management start Device	All Ports 1 2	<> T Unaware T Unaware T		<>	Mode Specific • Specific •	ID 1 1 1 1 1	<> ▼ Untag_pvid ▼ Untag_pvid ▼
k Aggregation INTENANCE 9 e Management start Device gout	All Ports 1 2 3	Unaware Unaware Unaware Unaware		All T All T	Mode <> ▼ Specific ▼ Specific ▼ Specific ▼	ID 1 1 1 1	<> Vuntag_pvid Untag_pvid Untag_pvid Vuntag_pvid Vun
k Aggregation INTENANCE g Management start Device	All Ports 1 2 3 4	<> Vinaware Unaware Unaware Unaware Unaware Vinaware Vin		<> All All All All All	Mode <> ▼ Specific ▼ Specific ▼ Specific ▼ Specific ▼	ID 1 1 1 1 1 1	<> Untag_pvid Untag_pvid Untag_pvid Untag_pvid Untag_pvid
k Aggregation INTENANCE 9 e Management start Device gout	All Ports 1 2 3 4 5	<> Vnaware Unaware V Unaware V Unaware V Unaware V		<> V All V	Mode <> Specific Specif	ID 1 1 1 1 1 1 1 1 1 1 1 1 1	<> • Untag_pvid •
k Aggregation INTENANCE 9 e Management start Device gout	All Ports 1 2 3 4 5 6	Image: Constraint of the second se		All •	Mode Specific • Specific • Specific • Specific • Specific • Specific •	ID 1 1 1 1 1 1 1 1 1 1 1 1 1	<> Vintag_pvid V
k Aggregation INTENANCE 9 e Management start Device gout	All Ports 1 2 3 4 5 6 7	<> • Unaware •		Image: Constraint of the second sec	Mode Specific • Specific • Specific • Specific • Specific • Specific • Specific •	ID 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	<> Vintag_pvid Untag_pvid Untag_pvid Untag_pvid Untag_pvid Untag_pvid Untag_pvid Untag_pvid

B. Click **New VLAN** on the right and enter the same ID from the router (20) into the VLAN ID field. Name the VLAN anything you'd like using the VLAN Name field.

Figure 6. AN-300 Switch - New VLAN Entry

Ports								Po	ort M	embe	ers			
III) SETTINGS	VLAN ID	VLAN Name	D	Delete	1	2	3	4	5	6	7	8	9	10
	1	default			\checkmark									
System Ports	20	VLAN 20 I	j	8	T	7	_	F	Y	7	7	T	7	—
Ports													New	VLAN

C. Select which ports you want the VLAN to operate on under the **Port Members** section. Click the box for each port to toggle the checkmark (☑) on the ports using the new VLAN, and toggle the corresponding boxes on the existing VLAN to be unincluded (☑).

Figure 7. Assigning Switch Ports to VLANs



D. Leave both VLANs enabled (☑) for the port connected to the router, as seen below with Port 4. This is called the Trunk Port. This port will carry the traffic between all VLANs and the router.

Figure 8. Assigning the Trunk Port

	VLANs Settings								
STATUS									
System									
Ports									
Ports	VLANID	VLAN Name	Delete	1 2	3 4	Port M	embers	8	9 10
-	VLAN ID	VLAN Name default	Delete	1 2	3 4	Port M	embers 6 7	8	9 1

E. Next, scroll down the VLANs menu to Advanced Settings.

F. Under Advanced Settings, set the Trunk Port (4 in the example) to a C-Port from the Port Type dropdown menu. *Do not change the VLAN ID from default (1).*

Figure 9. Configuring the Trunk Port to C-Type

Port	Port Type	Ingress Filtering	Frame Type	Port VL		Tx Tag
PUIL	Porciype	ingress rintering	Frame type	Mode	ID	1x Tag
All Ports	0 1	8	0 1	0 1	1	0 7
1	Unaware •	8	AI •	Specific *	20	Untag_pvid 🔻
2	Unaware •	8	AI •	Specific *	20	Untag_pvid 🔻
3	Unaware		AL •	Specific *	20	Untan rivid T
4	C-port •	8	AI •	Specific *	1	Untag_pvid •
5	Unaware		AI *	Specific *	1	Untag_pvid *
6	Unaware 🔻		AI T	Specific *	1	Untag_pvid *
7	Unaware •		AI T	Specific *	1	Untag_pvid *
8	Unaware •		AI T	Specific *	1	Untag_pvid *
2	Unaware •		AI T	Specific *	1	Untag_pvid *
10	Unaware •		AI *	Specific *	1	Untag_pvid *

G. Change the VLAN ID for the remaining ports to match the VLAN assigned in Figure 6.

Figure 10. Configuring the Advanced Port VLAN ID

Port	Port Type	Ingress Filtering	Frame Type	Port V	LAN	Tx Tag
POIL	Port Type	ingress rintering	Frame type	Mode	D	TX Tag
All Ports	0 7		0 1	0.1	1	0 7
1.00	Unaware •	8	AI •	Specific *	20	Untag_pvid •
2	Unaware •		AI •	Specific *	20	Untag_pvid *
3	Unaware •		AI ·	Specific *	20	Untag_pvid ·
4	C-port •		AI ·	Specific *	1	Untag_pvid *
5	Unaware T		AI ·	Specific *	1	Untag_pvid *
6	Unaware •		AI *	Specific *	1	Untag_pvid *
7	Unaware •		AI *	Specific *	1	Untag_pvid *
0	Unaware •		AI *	Specific *	1	Untag_pvid *
9	Unaware •		AI •	Specific *	1	Untag_pvid *
10	Unaware *		AI •	Specific *	1	Untag pvid *

- H. Click **Apply** in the bottom right corner to save the new settings.
- I. See the screenshot of the complete setup below. Ports 1-3 have been assigned to VLAN 20 and ports 5-10 remain on the default VLAN 1. The trunk port (port 4) has been assigned to allow access to both VLAN 20 and default and set to port type C.

Figure 11. Completed Switch VLAN Settings

	VLAN ID 1 20		VLAN Name default		elete 1 2	Port Me 3 4 5	nbers 6 7 8
	1		default	i			
ADVAN	20					Image:	
ADVAN			VLAN 20				F F
	NCED SETTINGS						
ion E	Port	Port Type	Ingress Filtering	Frame Type	Port VI		Tx Tag
-	All Ports	· · · · · ·		0 T	Mode	ID 1	0
nent	1	Unaware •		All	Specific •	20	Untag pvid
e	2	Unaware •		All	Specific V	20	Untag pvid
	3	Unaware 🔻		All 🔻	Specific •	20	Untag_pvid
	4	C-port T		All 🔻	Specific 🔻	1	Untag_pvid
	5	Unaware 🔻		All 🔻	Specific 💌	1	Untag_pvid
	6	Unaware 🔹		All	Specific •	1	Untag_pvid
	7	Unaware 🔻		All	Specific 🔻	1	Untag_pvid
	8	Unaware 🔻		All	Specific *	1	Untag_pvid
	9	Unaware 🔻		All 🔻	Specific •		Untag_pvid
					Specific .	1	Untag pvid



Verifying New VLANs

Use these methods to verify whether a VLAN has been correctly configured:

- Connect your computer to an assigned VLAN port and check to see if it was assigned a new DHCP IP address in the proper subnet.
- Check the IP settings of a connected device to verify that it has a DHCP IP address in the proper subnet.

Contacting Technical Support

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