VLAN Features

About VLAN

VLAN (Virtual Local Area Network) is used to logically divide a physical network into several broadcast domains. VLAN membership can be configured through software instead of physically relocating devices or connections. VLANs address issues such as scalability, security, and network management. Routers in VLAN topologies provide broadcast filtering, security, address summarization, and traffic-flow management. By using VLANs, one can control traffic patterns and react quickly to relocations. VLANs provide the flexibility to adapt to changes in network requirements and allow for simplified administration.

IEEE 802.1Q

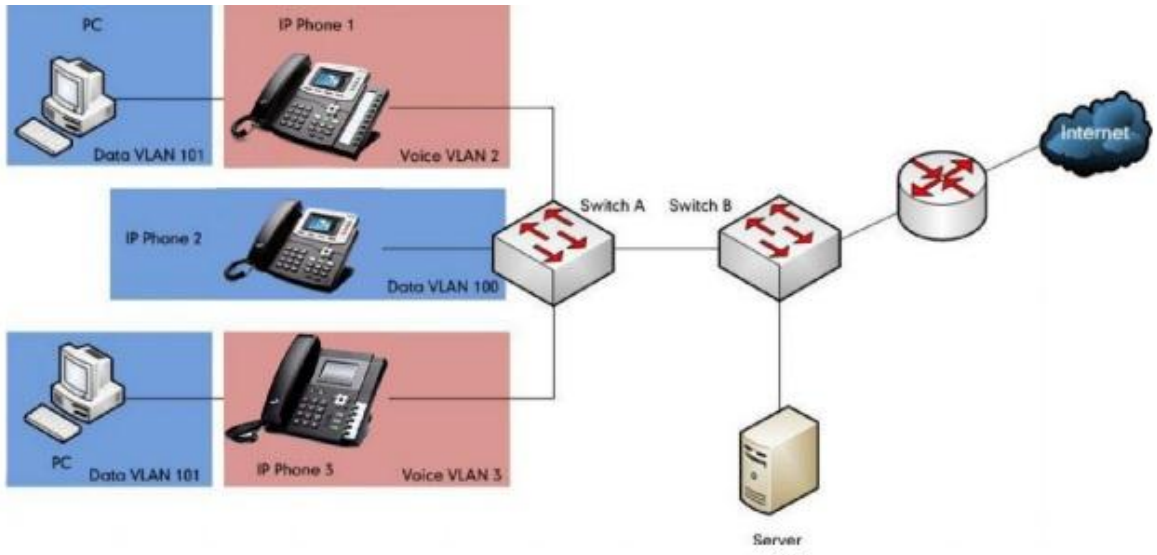
IEEE 802.1Q is the networking standard that supports VLANs on an Ethernet network. The specification defines a standard method for tagging Ethernet packets with VLAN membership information. Portions of the network which are VLAN-aware (i.e., IEEE 802.1Q conformant) can include VLAN tags. Traffic on a VLAN-unaware (i.e., IEEE 802.1D conformant) portion of the network will not contain VLAN tags. When a frame enters the VLAN-aware portion of the network, a tag is added to represent the VLAN membership of the frame's port or the port/protocol combination, depending on whether port-based or port-and-protocol-based VLAN classification is being used. Each frame must be distinguishable as being within exactly one VLAN. A frame in the VLAN-aware portion of the network that does not contain a VLAN tag is assumed to flowing on the native (or default) VLAN.

802.1Q adds a 4-byte tag between the source MAC address and the Ethernet type fields of the Ethernet frame. Two bytes are used for the tag protocol identifier (TPID), the other two bytes for tag control information (TCI). The TCI field is further divided into PCP(Priority Code Point), CFI (Canonical Format Indicator), and VID (VLAN ID).

Voice VLAN

As voice traffic is delay and jitter sensitive for the IP phone, it requires higher priority over data traffic to reduce delay and packet loss during transmission. To simplify configuration procedures and better manage voice transmission policies, the connected switch can be configured to provide voice VLAN function and transmit the voice traffic of the IP phone in a dedicated VLAN, called voice VLAN.

Voice VLAN is a special access port feature of the switch which allows IP phones to be automatically configured and easily associated with a logically separate VLAN. This feature provides various benefits, but one particular benefit is that when voice VLAN is enabled on a switch port, this port is also enabled to allow simultaneous access for a PC. This feature allows a PC to be daisy chained to an IP phone and the connection for both PC and IP phone to be trunked through the same physical Ethernet cable.The purpose of VLAN configurations on the IP phone is to insert tag with VLAN information to the packets generated by the IP phone. When VLAN is properly configured for the ports (Internet port and PC port) on the IP phone, the IP phone will tag all packets from these ports with the VLAN ID. The switch receives and forwards the tagged packets to the corresponding VLAN according to the VLAN ID in the tags described in IEEE Std 802.3.



Major Benefits of Using VLANs

VLANs offer many benefits that are not found in typical LANs. Major benefits of

segregating IP phones into VLAN(s) are listed as below:

- **Performance Enhancements:** VLAN is used to minimize the broadcast domain.Creating smaller domain for IP phone can reduce overhead and limit resource utilization. Additionally, less traffic will need to be routed, and the latency added by routers will be reduced.
- **Ease of Administration:** Much of the cost associated with network additions and relocations can be saved through the use of VLANs. IP phone can be shifted from one workgroup or department to another without installing new network cabling and reconfiguring hubs or routers.
- **Security:** VLANs can be used to create secure user groups and prevent others outside of the broadcast domain from receiving sensitive data of the IP phone. They can also be used to enhance firewall functions and restrict network access for one or more users. By segregating IP phones into VLANs, security filters can be implemented in the network to prevent the IP phones from receiving unnecessary traffic from other devices. This helps prevent disruption due to DoS attacks or attempts to compromise the devices. It also allows locking down access to configuration and servers to only allow access from the IP phones.

Lava IP Phones Compatible with VLAN

VLAN is available on Lava IP phones. Lava IP phones support three ways to get VLAN ID for Internet (WAN) port, but the VLAN used is chosen by priority of each method. The priority is: LLDP>Manual>DHCP VLAN. Lava IP phones only support one way to get VLAN ID for PC port: Manual. LLDP and Manual methods are available on Lava IP phones running firmware version 61 or later . DHCP VLAN method is available on Lava IP phones running firmware version 61 or later .

VLAN discovery method on lava ip phones

Automatic discovery method for vlan

LLDP

Introduction

LLDP (Link Layer Discovery Protocol) allows Ethernet network devices to receive and/or transmit device-related information to directly connected devices on the network that are also using the protocol, and store the information that is learned about other devices. Information gathered with LLDP is stored in the device as a management information database (MIB) and can be queried with the Simple Network Management Protocol (SNMP) as specified in RFC 2922. LLDP transmits information as packets called LLDP Data Units (LLDPDUs). An LLDPDU consists of a set of Type-Length-Value (TLV) elements, each of which contains a particular type of information about the device or port transmitting it.

Type	Length	Value
7 bits	9bits	0-510 octets

Each of the TLV components has the following basic structure:

LLDP supports advertising the following TLVs:

- **Mandatory LLDP TLVs:** Chassis ID, Port ID, and Time to Live (TTL) are included in an LLDPDU by default.
- **Optional LLDP TLVs:** System Name, System Description and so on, the phone sends the optional TLVs along with the mandatory TLVs in an LLDPDU.
- **Organizationally Specific TLVs:** MAC/PHY Configuration/Status and Port VLAN ID, which are defined in IEEE Standard 802.3 and 802.1 respectively.

The LLDP frame ends with a special TLV, named end of LLDPDU in which both the typeand length fields are 0.

LLDP -MED

LLDP -MED (Media Endpoint Discovery) is published by the Telecommunications Industry Association (TIA). It is an extension to LLDP that operates between endpoint devices and network connectivity devices. LLDP -MED specifically provides support for voice over

IP (VoIP) applications and provides the following capabilities:

- Capabilities Discovery—allows LLDP -MED endpoints to determine the capabilitiesthat the connected device supports and has enabled. It can be used to indicate whether the connected device is a phone, a switch, a repeater, etc.
- Voice VLAN Configuration—provides a mechanism for a switch to notify a devicewhich VLAN to use, which enables ―plug and play networking.
- Power Management—provides information related to how the device is powered, power priority, and how much power the device needs.
- Inventory Management—provides a means to manage device and the attributes of the device such as model number, serial number, software revision, etc.
- Location Identification Discovery—provides location information from the switch to the device when making an emergency call.

In addition to the TLVs advertised by LLDP, LLDP -MED also supports advertising the following TLVs:

- LLDP -MED capabilities TLV
- Network policy TLV
- Power management TLV
- Inventory management TLV
- Location identification TLV (not supported by IP phones)

It should be noted that either LLDP or LLDP -MED—but not both—can be used at any given time on an interface between two devices

LLDP Feature on Lava IP Phones

Lava IP phones support LLDP. LLDP provides exceptional interoperability benefits, IP telephony troubleshooting, automatic deployment of policies and advanced PoE (Power over Ethernet). When LLDP feature is enabled on IP phones, the IP phones periodically advertise their own information to the directly connected LLDP -enabled switch. The IP phones can also receive LLDP packets from the connected switch. When the application type is “voice”, IP phones decide whether to update the VLAN configurations obtained from the LLDP packets. When the VLAN configurations on the IP phones are different from the ones sent by the switch, the IP phones perform an update and reboot. This allows IP phones to be plugged into any switch,

obtain their VLAN IDs, and then start communications with the call control.

Supported TLVS of IP Phones

TLVs supported by IP phones are summarized in the following table:

TLV Name	TLV Type	Description
Mandatory TLVs	Chassis ID	Specifies the IP address of the sending port.
	Port ID	Specifies the MAC address of the IP phone.
	Time to Live	Specifies the life of the transmitted information on the IP phone.The default value is 180sec.
	End of LLDPDU	Marks the end of the TLV sequence in the LLDPDU. No further processing of TLVs after this is necessary. This is a mandatory TLV and therefore must be present at the end of the data stream.
Optional TLVs	System Name	Specifies the administratively-assigned name for the IP phone The default value is Lava
	System Description	Specifies the description of the IP phone. The default value is IP Phone.
	System Capabilities	Specifies the supported and enabled capabilities of the IP phone. The supported capabilities are Bridge, Router and Telephone. The enabled capabilities are Bridge and Telephone by default.
	Port Description	Specifies the description of the sending port. The default value is "WAN PORT".
IEE Std 802.3 Organizationally Specific TLV	MAC/PHY Configuration/Status	Specifies duplex and bit rate settings of the IP phone. The Auto Negotiation is supported and enabled by default. The advertised capabilities of PMD Auto-Negotiation are: 100BASE-TX (full duplex mode) 100BASE-TX (half duplex mode) 10BASE- T (full duplex mode) 10BASE- T (half duplex mode)
LLDP-MED TLVs	Media Capabilities	Specifies the MED device type of the IP phone and the supported LLDP-MED TLV type can be encapsulated in LLDPDU. The supported LLDP -MED TLV types are: - LLDP-MED Capabilities - Network Policy - Extended Power via MDI-PD - Inventory
	Network Policy	Specifies the port VLAN ID, application type, L2 priority and DSCP value
	Extended Power-via-MDI	Specifies power type, source, priority and value.
	Inventory-Firmware revision	Specifies the firmware revision of IP phone
	Inventory – Serial	Specifies the serial number of IP phone

	Number	
	Inventory – Manufacturer Name	Manufacturer name of IP phone.
	Inventory – Model Name	Specifies the model name of IP phone.
	Asset id	Specifies the asset identifier of IP phone. The default value is “asset”

Configuring LLDP Feature

LLDP is enabled on IP phones by default. You can configure LLDP via web user interface or using the configuration file. You can also configure the sending frequency of LLDP packet. The default sending frequency is 120s.

To configure LLDP feature via web interface:

1. Log into the web interface

(The default administrator user name and password are both “admin”)

2. Click on Network->Advanced.

3. In the LLDP block, select the desired value from the pull-down list of Active.

4. Enter the desired time (in seconds) in the Packet Interval (1~3600s) field.

are:

5. Click SaveSet to accept the change.

Verifying the Configuration

After LLDP feature is enabled, the IP phone performs the following:

- Periodically advertises information (e.g., hardware revision, firmware revision, serial number) of the IP phone to a multicast address on the network.
- Allows LLDP packets to be received from the Internet (WAN) port.
- Supports the MAC/PHY configuration (e.g., speed rate, duplex mode).
- Obtains VLAN info from the network policy , this takes precedence over manual settings.

The following figure shows the LLDP packets sent and received by the IP phone, each packet contains multiple TLVs.

DHCP VLAN

IP phones support VLAN discovery via DHCP. When the VLAN Discovery method is set to DHCP, the IP phone will detect DHCP option for a valid VLAN ID. The predefined option 132 is used to supply the VLAN ID by default. You can customize the DHCP option used to detect the VLAN ID.

Configuring DHCP option on a Tftpd 32:

Before using DHCP VLAN feature on IP phones, you must make sure that the DHCP option on the DHCP server is configured properly . This section provides instructions on how to configure a DHCP option for windows using Tftpd 32.

To configure DHCP option on a Tftpd 32:

1. Start the Tftpd 32 application.
2. Select the Current Directory and Server interfaces.
3. Click the DHCP server Tab .
4. Click the “Settings” button.
5. Select the DHCP Server
6. Select the DHCP Tab and configure the options.
7. Click the “OK” button .

Open the DHCP VLAN on the Lava IP Phones

DHCP VLAN is No on IP phones by default. You can open DHCP VLAN via web interface. The DHCP option is 132.

To configure DHCP VLAN feature via web interface:

1. Log into the web interface.

The default username and password are both “admin”.

2. Click on Network->Advanced.
3. In the DHCP VLAN field, Click the “Yes” button
4. Click the “SaveSet” button

Verifying the Configuration

When the IP phone is configured to use DHCP for VLAN discovery, and the DHCP option is set to 132, the following processes occur:

1. The IP phone broadcasts a DHCP Discover message to find out if there is a DHCP server available.

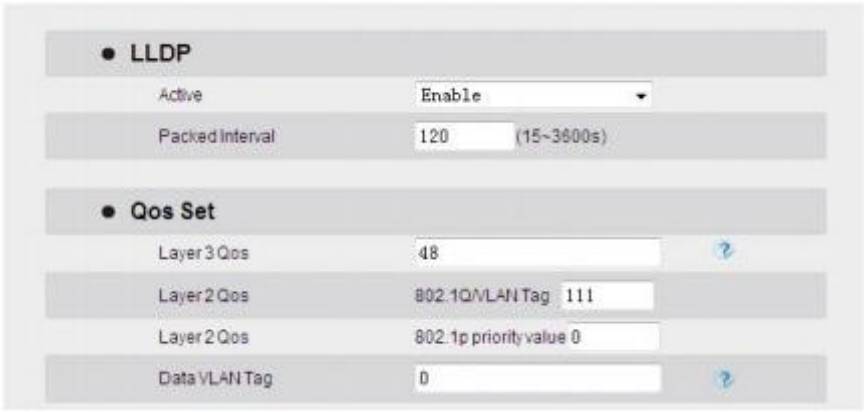
2. If the DHCP server sends a DHCP Offer message with the Option 132, the phone will accept the Offer, send a DHCP Request, and save the VLAN ID provided by the DHCP server in the DHCP option 132.

3. After the DHCP server has sent the ACK message to the phone, the phone will release the leased IP address and start a new DHCP Discover cycle using the now known Voice VLAN ID tag.

After this process, the phone will send all packets with the VLAN ID learned from the DHCP server in the DHCP option 132.

The following figure shows the DHCP messages sent and received by the IP phone:

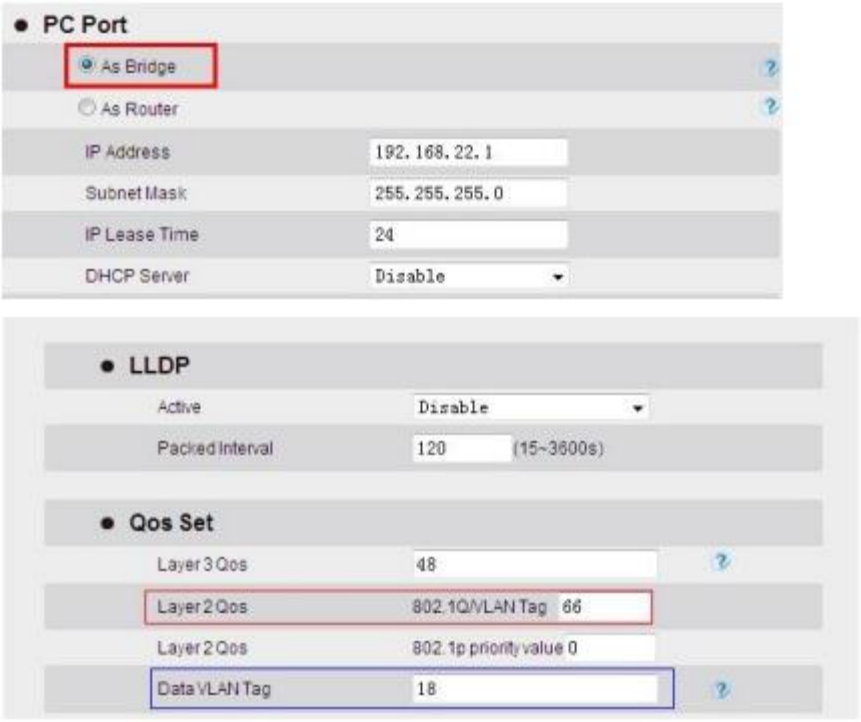
The following figure shows the result:



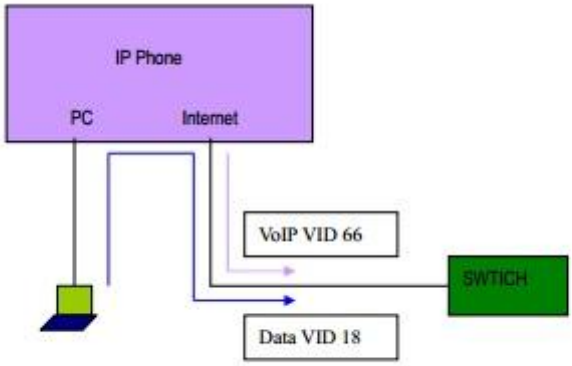
VLAN under Bridge Mode

When using Bridge Mode, Data VLAN Tag is supported. When your PC is connected to LAN Port, data (from your PC to switch) will be tagged with "Data VLAN Tag".

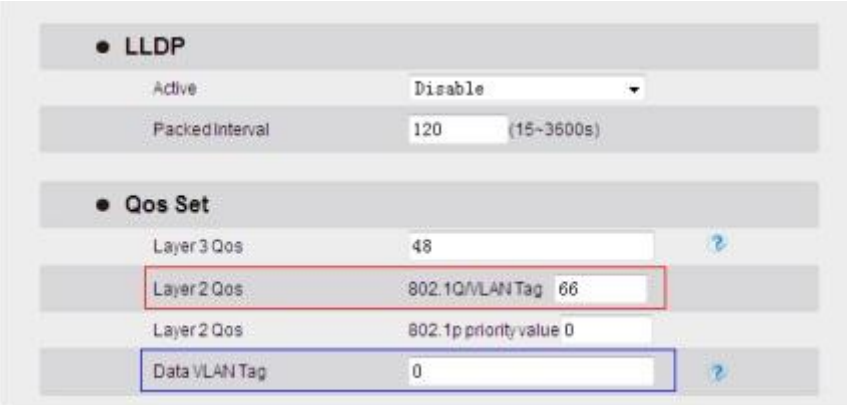
Network-->Basic (PC Port is LAN)

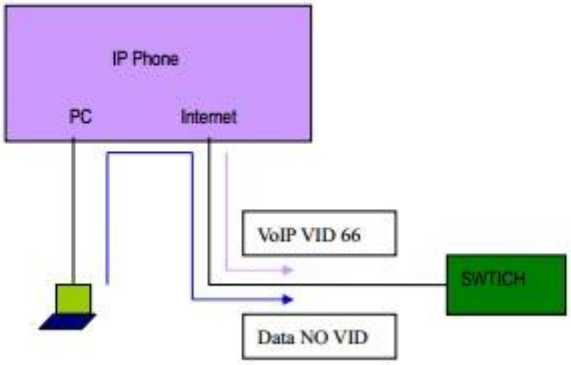


Then VOIP (SIP RTP) packets send out from device will be tagged with VLAN id 66, Data packets which send from your PC to switch will be tagged with VLAN id 18.



Or Data VLAN Tag is 0 (UNTAG VLAN ID), then VOIP (SIP RTP) packets send out from device will be tagged with VLAN id 66, Data packets which send from your PC to switch will **UNTAG VLAN ID.**





VLAN under NAT Mode

When using NAT mode, VLAN id is based port, you can't set Data VLan id. If VLAN id arrange to the device is 66, then please set VLAN id:

Network-->Basic (PC Port is LAN)

In this case, all Ethernet packets sent out from device will be tagged with VLAN id 66.