

Yealink Technical White Paper

Virtual Local Area Network (VLAN)

Apr. 2017

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. Grouping devices with a common set of requirements regardless of their physical location can greatly simplify network design. VLANs can address issues such as scalability, security, and network management.

IEEE 802.1Q

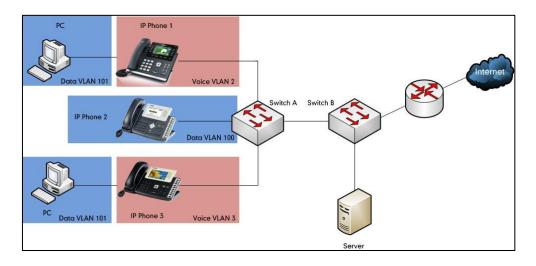
IEEE 802.1Q is the networking standard that supports VLANs on an Ethernet network. The specification defines a standard method for tagging Ethernet packets with VLAN membership information. A VLAN-aware device is the one which understands VLAN memberships and VLAN formats. When a packet from the IP phone enters the VLAN-aware portion of the network, a tag is added to represent the VLAN membership of the IP phone. Each packet must be distinguishable as being within exactly one VLAN. A packet in the VLAN-aware portion of the network that does not contain a VLAN tag is assumed to be 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 signaling servers to only allow access from the IP phones.

Yealink IP Phones Compatible with VLAN Method

There are four ways to get VLAN ID for Internet (WAN) port, but the VLAN used is chosen by the priority of each method (from highest to lowest): LLDP/CDP>Manual>DHCP VLAN. There is only one way to get VLAN ID for PC port: Manual.

Yealink SIP VP-T49G IP phones support VLAN in the wireless network. The method that the phones use to obtain VLAN ID in the wireless network is the same as the one in the wired network.

Method	IP Phone Models	Firmware Version			
LLDP	All IP phones	All Versions			
Manual	All IP phones Note : The Manual method for PC port is not available on Yealink W52P and W56P IP phones.	All Versions			
	W52P	Firmware version 40 or later.			
	T46G, T42G, T41P and CP860	Firmware version 71 or later			
DHCP VLAN	T48G	Firmware version 72 or later.			
DHCP VLAN	T58V/A, T56A, T49G, T40P, T29G, T27P, T23P/G, T21(P) E2, T19(P) and W56P	Firmware version 80 or later			
	T54S, T52S, T48S, T46S, T42S, T41S, T40G, T27G	Firmware version 81 or later			
CDP	T58V/A, T56A, T49G, T48G, T46G, T42G, T41P, T40P, T29G, T27P, T23P/G, T21(P) E2, T19(P) E2, CP860	Firmware version 80 or later			

The table below lists the methods supported by Yealink SIP IP phones with different versions.

Note LLDP and CDP methods have the same priority to get VLAN ID. Normally, the VLAN ID get for the IP phone by LLDP and CDP methods will be the same.

Method	IP Phone Models	Firmware Version
	T54S, T52S, T48S, T46S, T42S, T41S, T27G	Firmware version 81 or later

VLAN Discovery Method on Yealink IP Phones

Automatic Discovery Method for VLAN

LLDP

Introduction

LLDP (Link Layer Discovery Protocol) allows IP phones 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.

Each of the TLV components has the following basic structure:

Туре	Length	Value
7 bits	9 bits	0-511 octets

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 **type** and **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 capabilities that 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 device which 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 placing 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 Yealink IP Phones

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 the 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

TLV Type	TLV Name	Description					
	Chassis ID	Specifies the IP address of the IP phone.					
	Port ID	Specifies the MAC address of the IP phone.					
Mandatory TLVs	Time to Live	Specifies the lifetime of the transmitted information on the IP phone. The default value is 180s.					
	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.					
	System Name	Specifies the administratively-assigned name for the IP phone (per RFC3418).					
		For more information, refer to Appendix B: System Names on page 35.					
	System Description	Specifies the description of the IP phone.					
Ontional		Specifies the supported and enabled capabilities of the IP phone.					
Optional TLVs		For Yealink CP860, W52P, W56P,					
	System	SIP-T58V/T58A/T56A, SIP VP-T49G,					
	Capabilities	SIP-T54S/T52S/T48G/T48S/T46G/T46S/T42G/					
		T42S/T41P/T41S/T40P/T40G/T29G/T27P/T27G/T23P/ T23G/T21(P) E2/T19(P) E2:					
		The supported capabilities are Telephone.					
		The enabled capabilities are Telephone by default.					
		Specifies the description of the sending port.					
	Port Description	The default value is "WAN PORT".					
		Specifies duplex and bit rate settings of the IP phone.					
IEEE Std 802.3	MAC/PHY	The Auto-Negotiation is supported and enabled by default.					
Organization	Configuration/St	The advertised capabilities of PMD Auto-Negotiation are:					
ally Specific	atus	• 10BASE-T (half duplex mode)					
TLV		• 10BASE-T (full duplex mode)					
		• 100BASE-TX (half duplex mode)					

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

TLV Type	TLV Name	Description
		• 100BASE-TX (full duplex mode)
		• 1000BASE-T (full duplex mode).
		Note : By default, all phones have the PMD Advertised Capability set for 10BASE-T and 100BASE-TX. Yealink CP860/SIP-T58V/T58A/T56A/SIP VP-T49G/SIP-T54S/T52S/T48G/T48S/T46G/T46S/T42G/ T42S/T29G/T27G/T23G phones that have Gigabit Ethernet support PMD Advertise Capability also contain set 1000BASE-T.
		Specifies the MED device type of the IP phone and the supported LLDP-MED TLV type can be encapsulated in LLDPDU.
	Media Capabilities	The supported LLDP-MED TLV types are:
		LLDP-MED Capabilities
		Network Policy
		Extended Power via MDI-PD
LLDP-MED		Inventory
	Network Policy	Specifies the port VLAN ID, application type, L2 priority and DSCP value.
TLVs	Extended	Specifies power type, source, priority and value.
	Power-via-MDI	For more information on power value, refer to Appendix C: Model Names on page 36.
	Inventory - Hardware Revision	Specifies the hardware revision of IP phone.
	Inventory - Firmware Revision	Specifies the firmware revision of IP phone.
	Inventory - Software Revision	Specifies the software revision of IP phone.
	Inventory - Serial Number	Specifies the serial number of IP phone.
LLDP-MED TLVs	Inventory - Manufacturer Name	Manufacturer name of IP phone. The default value is "Yealink".

TLV Type	TLV Name	Description
	Inventory - Model Name	Specifies the model name of IP phone. For more information, refer to Appendix C: Model Names on page 36
	Asset ID	Specifies the asset identifier of IP phone.

Configuring LLDP Feature on Yealink IP Phones

LLDP is enabled on IP phones by default. You can configure LLDP via web user interface or using configuration files. You can also configure the sending frequency of LLDP packet. The default sending frequency is 60s.

Configuring LLDP via Web User Interface

The followings take configurations of a SIP-T46G IP phone running firmware version 81 as examples.

To configure LLDP feature via web user interface:

1. Log into the web user interface with the administrator credential.

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.

Yealink 1146g					Log Out English(English) 🗸
	Status Account	Network DSS	Key Features	Settings	Directory Security
Basic	LLDP 🕜				NOTE
PC Port		Active	Enabled -		VLAN
NAT	CDP 🕜	Packet Interval (1~3600s)	60		It is used to logically divide a physical network into several
	CDP 🕜	Active	Disabled -		broadcast domains. VLAN membership can be configured
Advanced		Packet Interval (1~3600s)	60		through software instead of physically relocating devices or
Wi-Fi	VLAN 🕜	r dekermentar († 56665)	00		connections.
	WAN Port	Active	Disabled -		The priority of VLAN assignment method (from highest to
		VID (1-4094)	1		lowest) :LLDP/CDP->manual configuration->DHCP VLAN
		Priority	0 -		NAT Traversal
	PC Port	Active	Disabled -		It is a general term for techniques that establish and
		VID (1-4094)	1		maintain IP connections traversing NAT gateways. STUN
		Priority	0 -		is one of the NAT traversal techniques.
	DHCP VLAN	Active	Enabled -		You can configure NAT traversal
		Option (1-255)	132		for the IP phone.

5. Click **Confirm** to accept the change.

The web user interface prompts the warning "Some settings you changed take effect when you restart your machine! Do you want to reboot now?".

6. Click **OK** to reboot the IP phone.

Configuring LLDP Using Configuration Files

The following IP phones use the new auto provisioning mechanism:

- SIP-T58V/T58A/T56A IP phones running firmware version 80 or later
- SIP-T54S/T52S/T48G/T48S/T46G/T46S/T42G/T42S/T41P/T41S/T40P/T40G/T29G/T27P/T2 7G/T23P/T23G/T21(P) E2/T19(P) E2, CP860, W52P and W56P IP phones running firmware version 81 or later

Other IP phones or the IP phones listed above running old firmware version use the old auto provisioning mechanism.

For Old Auto Provisioning Mechanism

To configure LLDP feature using configuration files:

1. Add/Edit LLDP parameters in the configuration file (e.g., y00000000028.cfg).

The following table shows the information of parameters:

Parameters	Permitted Values	Default				
network.lldp.enable	0 or 1	1				
Description:						
Enables or disables LLDP on the IP phone.						
0-Disabled						
1-Enabled						
network.lldp.packet_interval	Integer from 1 to 3600	60				
Description:						
Configures the interval (in seconds) for the IP ph	one to send the LLDP reque	est.				

The following shows an example of LLDP configuration in configuration files:

network.lldp.enable = 1

network.lldp.packet_interval = 60

2. Upload configuration files to the root directory of the provisioning server and trigger IP phones to perform an auto provisioning for configuration update.

For more information on auto provisioning, refer to *Yealink_SIP-T2 Series_T19(P) E2_T4_Series_CP860_W56P_IP_Phones_Auto_Provisioning_Guide*.

For New Auto Provisioning Mechanism

To configure LLDP feature using configuration files:

1. Add/Edit LLDP parameters in the configuration file (e.g., static.cfg).

The following table shows the information of parameters:

Parameters	Permitted Values	Default					
static.network.lldp.enable	0 or 1	1					
Description:							
Enables or disables LLDP on the IP phone.							
0-Disabled							
1-Enabled							
static.network.lldp.packet_interval	Integer from 1 to 3600	60					
Description:							
Configures the interval (in seconds) for the IP ph	one to send the LLDP reque	est.					
The following shows an example of LLDP configur	ation in configuration files:						

The following shows an example of LLDP configuration in configuration files:

static.network.lldp.enable = 1

static.network.lldp.packet_interval = 60

2. Reference the configuration file in the boot file (e.g., y00000000000.boot).

Example:

include:config "http://10.2.1.158/static.cfg"

- 3. Upload the boot file and configuration file to the root directory of the provisioning server.
- Trigger IP phones to perform an auto provisioning for configuration update.
 For more information on auto provisioning, refer to *Yealink_SIP-T2_Series_T19(P)* E2_T4_Series_T5_Series_W5_Series_CP860_IP_Phones_Auto_Provisioning_Guide_V81.

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 or WLAN port.
- Supports the MAC/PHY configuration (e.g., speed rate, duplex mode).
- Obtains VLAN info from the network policy, which takes precedence over manual settings.

The following figure shows the LLDP packet sent by the IP phone, the packet contains multiple TLVs (before obtaining VLAN ID).

<u>File</u>	<u>E</u> dit <u>V</u> iew	Go Capture Analyze St	atistics Telephony <u>T</u> oo	ls <u>I</u> nternals <u>H</u> elp							
		🕷 🖻 🖬 🗙 😂 🖴	Q, 🗢 🔿 7			2 🗃	M 🛃 :	* 🖬			
Filter:	lldp			Expression	Clear Appl						_
	Time	Source	Destination	·	nath Info						
		Source SO XiamenYe 41:46:dd	LLDP Multicast	LLDP		IS TO =	0.0.0	0 Port Id	= 0	0:15:65:41:46:dd TTL = 0	-
		0 xiamenYe 41:46:dd		LLDP						00:15:65:41:46:dd TTL = 180 System Name = SIP-T46G	
328	37.67624	30 xiamenYe_41:46:dd		LLDP	221 Chass	is Id =	0.0.0.	0 Port Id	= 0	0:15:65:41:46:dd TTL = 180 System Name = SIP-T46G	
		0 C1SC0_5d:42:98	LLDP_Multicast	LLDP						ort Id = Fal/0/22 TTL = 120 System Name = yealink-c	
		10 cisco_5d:42:98	LLDP_Multicast	LLDP						Port Id = Fa1/0/22 TTL = 120 System Name = yealink-c	
		LO C1SCO_5d:42:98	LLDP_Multicast	LLDP						Port Id = Fa1/0/22 TTL = 120 System Name = yealink-c	
		0 Cisco_5d:42:98	LLDP_Multicast	LLDP						Port Id = Fa1/0/22 TTL = 120 System Name = yealink-c	
4	93 47430	011 15rn 30-17-98	TTTD/ MITT TY AST	11102	Sas Chass		10.021	801-301-421	XII P	APT TH = CAT/0/22 TH = 120 SOSTEM NAME = OPATTHET	- F
H Er	amo 328.	221 bytes on wire (1	768 hits) 221 but	es cantured (1)	68 bits) (
		. Src: XiamenYe_41:4				st (01	:80:c2:	00:00:0e)			
		Discovery Protocol						,			
		ubtype - Network add	ress								
		ype = MAC address									
		ive = 180 sec									
		me = SIP-T46G									
	System De Capabilit	scription = 28.80.20	8.78								
		ription = WAN PORT									
		3 - MAC/PHY Configur	ation/Status								
		ia Capabilities	actory searchs								
		work Policy									
	1111 11	1 = TLV T	ype: Organization	Specific (127)							
		.0 0000 1000 = TLV L									
		ation Unique Code: T									
		ubtype: Network Poli									
		tion Type: Voice (1)									
		= Forre									
		00 0000 000. = VLAN									
		.0 00 = L2 Pr									
		00 = DSCP value: 0	-								

The following figure shows the LLDP packet received by the IP phone, the packet contains multiple TLVs (sent by the switch).

Ele	<u>E</u> dit <u>V</u> iew <u>Go</u> <u>C</u> apture <u>A</u> nalyze	Statistics Telephony Too	ls <u>I</u> nternals <u>I</u>	Heb	
8	¥ @4 @4 @4 E= 🖬 X 😂	🖴 🔍 🔶 🏟 🚳 📅	<u>↓</u> E [;	🗐 (Q, Q, (🗹)) 👪 🕺 🥵 % () 🧱	
Filter	: Ildp		- Expressi	ssion Clear Apply	
	Time Source	Destination	Protocol	Length Info	
568	63.4176990 cisco_5d:42:98	LLDP_Multicast	LLDP	545 Chassis Id = c0:62:6b:5d:42:80 Port Id = Fal/0/22 TTL = 120 System Name = yealink-ci:	sco
	93.4243020 cisco_5d:42:98	LLDP_Multicast	LLDP	545 Chassis Id = c0:62:6b:5d:42:80 Port Id = Fa1/0/22 TTL = 120 System Name = yealink-ci	
	97.4168990 X1amenYe_41:46:		LLDP	221 Chassis Id = 10.10.222.19 Port Id = 00:15:65:41:46:dd TTL = 180 System Name = SIP-T4	
1125	123.380655 cisco_5d:42:98	LLDP_Multicast	LLDP	545 chassis Id = c0:62:6b:5d:42:80 Port Id = Fa1/0/22 TTL = 120 System Name = yealink-ci	SCO
4				m	
	nk Layer Discovery Protoco				
	Chassis Subtype = MAC addr		42:80		
	Port Subtype = Interface n	ame, Id: Fa1/0/22			
	Time To Live = 120 sec				
	System Name = yealink-cisc			50 software (C3750-IPSERVICESK9-M), Version 12.2(55)SE6, RELEASE SOFTWARE (fc1)\nTechnical Sup	
	Port Description = FastEth		ware, 05/50	SU SULWARE (C3750-IPSERVICESK9-M), VERSION 12.2(33)566, RELEASE SUFTWARE (TCI)(INCONTCAL SUP	101
	Capabilities	er neci/0/22			
	Management Address				
	Management Address				
	TIA - Media Capabilities				
۲	TIA - Inventory - Hardware	Revision			
	TIA - Inventory - Software				
	TIA - Inventory - Manufact				
	TIA - Inventory - Model Na	me			
-	TIA - Network Policy				
	1111 111 = TL = TL		Specific ()	(127)	
	Organization Unique Code				
	Media Subtype: Network P				
	Application Type: Voice				
	0 Po				
	.1 = Ta				
	0 0001 1011 110. = VL				
	= L2				
	10 1110 = DSCP value:	46			

The following figure shows the LLDP packet sent by the IP phone, the packet contains multiple TLVs (after obtaining VLAN ID).

Ele	Edit View Go	<u>Capture</u> Analyze Statist	tics Telephon <u>y</u> <u>T</u> ools	Internals <u>H</u> elp											
	iii (iii (iii (iii (iii (iii (iii (iii	i 🖹 🔏 🗶 🛃 🗎	् 🗢 🛸 😜 🚡 🛓		କ୍ର୍ଦ୍ 🖭 i	¥ 🗹	8 % 🕱 👘								
Filter	r: Ildp		2	Expression	Clear Apply										
No.	Time	Source	Destination	Protocol	Length Info										
+ + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + + +	336 38.10030 339 39.1006 372 40.11375 556 63.4176 586 63.4176 586 53.4176 5978 53.42430 845 59.74168 455 59.74168 700 1000 1000 1111 1110 1111 1110 1114 - NetWeila 1114 - Net	= SIP-T46G ription = 28.80.208.7 s tion = WAN PORT - MAC/PHY Configurati Capabilities	bits), 221 bytes dd (00:15:65:41:46: 55 78 ion/Status a: organization Spe Th: 8 (0x0012bb) (0x02) Defined Yes : 222	:dd), Dst: I	545 chassi 545 chassi 545 chassi 545 chassi 545 chassi 221 chassi 221 chassi 70 100 Julio LLOP_Multicast	Id = c Id = c	0.0.0.0.0 Port 10 0:62:60:50:50:42: 0:62:60:50:50:42: 0:62:60:50:42:00 0:62:60:50:50:42: 0:62:60:50:50:42: 0:0:62:60:50:42: 10.10.222.19 Port c2:00:00:00:00)	0 Port 0 Port 0 Port 0 Port 0 Port	Id = Fal Id = Fal Id = Fal Id = Fal Id = Fal	/0/22 T /0/22 T /0/22 T /0/22 T /0/22 T	FL = 120 FL = 120 FL = 120 FL = 120 FL = 120 FL = 120) Syste) Syste) Syste) Syste) Syste) Syste	m Nam m Nam m Nam m Nam m Nam	e = ye e = ye e = ye e = ye e = ye	alink-o alink-o alink-o alink-o alink-o

CDP

Introduction

CDP (Cisco Discovery Protocol) allows IP phones to receive and/or transmit device-related information from/to directly connected devices on the network that are also using the protocol, and store the information about other devices.

CDP Feature on Yealink IP Phones

When CDP feature is enabled on IP phones, the IP phones periodically advertise their own information to the directly connected CDP-enabled switch. The IP phones can also receive CDP packets from the connected switch. 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 the IP phones to be plugged into any switch, obtain their VLAN IDs, and then start communications with the call control.

Configuring CDP Feature on Yealink IP Phones

CDP is disabled on IP phones by default. You can configure CDP via web user interface or using configuration files. You can also configure the sending frequency of CDP packet. The default sending frequency is 60s.

Configuring CDP via Web User Interface

The followings take configurations of a SIP-T46G IP phone running firmware version 81 as examples.

To configure CDP feature via web user interface:

1. Log into the web user interface with the administrator credential.

The default administrator user name and password are both "admin".

- 2. Click on Network->Advanced.
- 3. In the CDP 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.

Yealink 1466					Log Ou English(English)
	Status Accour	t Network DS	SKey Features	Settings	Directory Security
Basic	LLDP 🕜				NOTE
		Active	Enabled	•	
PC Port		Packet Interval (1~3600s)	60		VLAN It is used to logically divide a
NAT	CDP 🕜				physical network into several broadcast domains, VLAN
Advanced		Active	Enabled	•	membership can be configured through software instead of
Wi-Fi		Packet Interval (1~3600s)	60		physically relocating devices or connections.
	VLAN 🕜				The priority of VLAN assignmen
	WAN Port	Active	Disabled	•	method (from highest to
		VID (1-4094)	1		lowest) :LLDP/CDP->manual configuration->DHCP VLAN
		Priority	0	•	NAT Traversal
	PC Port	Active	Disabled	•	It is a general term for techniques that establish and
		VID (1-4094)	1		maintain IP connections traversing NAT gateways, STU
		Priority	0	•	is one of the NAT traversal techniques.
	DHCP VLAN	Active	Enabled	•	You can configure NAT travers
		Option (1-255)	132		for the IP phone.

5. Click **Confirm** to accept the change.

The web user interface prompts the warning "Some settings you changed take effect when you restart your machine! Do you want to reboot now?".

6. Click OK to reboot the IP phone.

Configuring CDP Using Configuration Files

The following IP phones use the new auto provisioning mechanism:

- SIP-T58V/T58A/T56A IP phones running firmware version 80 or later
- SIP-T54S/T52S/T48G/T48S/T46G/T46S/T42G/T42S/T41P/T41S/T40P/T40G/T29G/T27P/T2 7G/T23P/T23G/T21(P) E2/T19(P) E2, CP860, W52P and W56P IP phones running firmware version 81 or later

Other IP phones or the IP phones listed above running old firmware version use the old auto provisioning mechanism.

For Old Auto Provisioning Mechanism

To configure CDP feature using configuration files:

1. Add/Edit CDP parameters in the configuration file (e.g., y00000000028.cfg).

The following table shows the information of parameters:

Parameters	Permitted Values	Default
network.cdp.enable	0 or 1	0
Description:		
Enables or disables CDP on the IP phone.		
0 -Disabled		

Parameters	Permitted Values	Default					
1-Enabled							
network.cdp.packet_interval	Integer from 1 to 3600	60					
Description:							
Configures the interval (in seconds) for the IP phone to send the CDP request.							

The following shows an example of CDP configuration in configuration files:

network.cdp.enable = 1

network.cdp.packet_interval = 60

2. Upload configuration files to the root directory of the provisioning server and trigger IP phones to perform an auto provisioning for configuration update.

For more information on auto provisioning, refer to *Yealink_SIP-T2 Series_T19(P) E2_T4_Series_CP860_W56P_IP_Phones_Auto_Provisioning_Guide.*

For New Auto Provisioning Mechanism

To configure CDP feature using configuration files:

1. Add/Edit CDP parameters in the configuration file (e.g., static.cfg).

The following table shows the information of parameters:

Parameters	Permitted Values	Default						
static.network.cdp.enable	0 or 1	0						
Description:								
Enables or disables CDP on the IP phone.								
0-Disabled								
1-Enabled								
static.network.cdp.packet_interval Integer from 1 to 3600 60								
Description:								
Configures the interval (in seconds) for the IP phone to send the CDP request.								

The following shows an example of CDP configuration in configuration files:

static.network.cdp.enable = 1

static.network.cdp.packet_interval = 60

2. Reference the configuration file in the boot file (e.g., y000000000000.boot).

Example:

include:config "http://10.2.1.158/static.cfg"

3. Upload the boot file and configuration file to the root directory of the provisioning server.

4. Trigger IP phones to perform an auto provisioning for configuration update.

For more information on auto provisioning, refer to *Yealink_SIP-T2_Series_T19(P) E2_T4_Series_T5_Series_W5_Series_CP860_IP_Phones_Auto_Provisioning_Guide_V81*.

Verifying the Configuration

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

- Periodically advertises information (e.g., software revision, device ID, power consumption) of the IP phone to a multicast address on the network.
- Allows CDP packets to be received from the Internet (WAN) port or WLAN port.
- Obtains VLAN ID of connecting ports.

The following figure shows the CDP packet sent by the IP phone (before obtaining VLAN ID-with VLAN Query field).

File	Ec	tit View	60 C	apture <u>A</u> nalyze <u>S</u> t	atistic	s Telenhony Tu	nols 1	Internak Hel	n																		
						_							-	-													
				🖹 🔏 🗶 😂 🖴		् 🗢 🛸 🌍 र	F 2		€	Q	2 🖸	1	¥	8 %	i 🗓	Į.											
Filt	er:	cdp						Expression	C	lear A	pply																
No.		Time	S	ource		Destination		Protocol	l	Length	Info																_
				iamenYe_41:46:													Port										
				isco_5d:42:98		CDP/VTP/DTP/F											0.yeal): F	astEt	hern	et1/(0/22		
				iamenYe_41:46:													Port										
				iamenYe_41:46:													Port										
				isco_5d:42:98		CDP/VTP/DTP/F											0.yeal): F	astEt	hern	et1/(0/22		
				iamenYe_41:46:													Port										
				isco_5d:42:98		CDP/VTP/DTP/F											0.yeal): F	astEt	hern	et1/0	0/22		
				iamenYe_41:46: isco 5d:42:98		CDP/VTP/DTP/F CDP/VTP/DTP/F											Port D.veal						hone		0 /22		
	1/1	6 181.41	9248 C	15C0_50:42:98		CDP/VIP/DIP/F	AgP/	UDCDP		517		ce IL	o: ye	eaiink	-015	03/5	J. year	пк.со	m Por	rt ID): F	astet	nern	et1/0	0/22		
< []																											•
				oytes on wire (992	bits), 124 by	ytes	captured	(992	bits)																
		802.3																									
		ical-Lin																									
		co Disco ersion:		Protocol																							
		EL: 180		-																							
				15 11 [correct]																							
				0015654146DD																							
		dresses		01000414000																							
		ort ID:		DRT																							
B	e ca	apabilit	ies																								
	. So	oftware	versio	n																							
	e Pl	latform:	т46																								
		uplex: H																									
				ion: 8000 mw		_																					
E		DIP VLAN																									
				AN Query (0x00	0f)																						
		Length:	8																								
		Data																									
		voice v	LAN: S	512																							

The following figure shows the CDP packet received by the IP phone (with VLAN Reply field).

<u>File Edit View Go Capture Analyze Statistics Telephony</u> <u>Tools</u> Internals <u>Help</u>	
E E E E E E Z X 2 A Q + + + + 7 2 B E (원, 이, 예, 🖂 📓 🌉 🎉 🕌
Filter: cdp Expression	Clear Apply
No. Time Source Destination Protocol	Length Info
1052 102.491507 xiamenye 41:46:dd CDP/VTP/DTP/PAgP/UDCDP	116 Device ID: T460015654146DD Port ID: WAN PORT
1059 103.395614 Cisco_5d:42:98 CDP/VTP/DTP/PAgP/UDCDP	517 Device ID: yealink-cisco3750.yealink.com Port ID: FastEthernet1/0/22
1185 118.399333 xiamenYe_41:46:dd CDP/VTP/DTP/PAqP/UDCDP	124 Device ID: T460015654146DD Port ID: WAN PORT
1198 119. 396632 xiamenYe_41:46:dd CDP/VTP/DTP/PAgP/UDCDP	124 Device ID: T460015654146DD Port ID: WAN PORT
1199 119.409462 Cisco_5d:42:98 CDP/VTP/DTP/PAgP/UDCDP	517 Device ID: yealink-cisco3750.yealink.com Port ID: FastEthernet1/0/22
1210 120.40/969 x1amenYe_41:46:dd CDP/VIP/DIP/PAQP/UDCDP	124 DEVICE 1D: 14600156541460D PORT 1D: WAN PORT
<	III
H Logical-Link Control	
Cisco Discovery Protocol	
version: 2	
TTL: 180 seconds	
⊕ Checksum: 0x3706 [correct]	
Device ID: yealink-cisco3750.yealink.com	
Software Version	
Addresses	
Port ID: FastEthernet1/0/22	
Capabilities	
Protocol Hello: Cluster Management	
VTP Management Domain: yealink Native VLAN: 5	
Native vLAN: 5 Duplex: Half	
■ Duplex: Hall □ VoIP VLAN Reply: 222	
TVDE: VOIP VLAN REPTY: 222 TVDE: VOIP VLAN REPTY (0x000e)	
Length: 7	
Data	
Voice VLAN: 222	
Trust Bitmap: 0x00 Ox00 Ox00	
Untrusted port CoS: 0x00	
Management Addresses	
E Location: \003\002	
C Dowor Available: 0 mt 4204067205 mt	

The following figure shows the CDP packet sent by the IP phone (after obtaining VLAN ID-without VLAN Query field).

<u>File Edit View Go Capture Analyze Statisti</u>	s Telephony Iools Internals Help	
). 수 수 수 주 👱 🗐 🕞 이 이 이 연 🕾 🛛 🥵 🚿 🐹	
Filter: cdp	Expression Clear Apply	
No. Time Source	Destination Protocol Length Info	
1059 103. 395614 Cisco_5d:42:98	CDP/VTP/DTP/PADP/UDCDP 517 Device ID: yealink-cisco3750.vealink.com Port ID: FastEthernet1/0/22	
1185 118. 399333 xiamenYe_41:46:dd		
1198 119. 396632 xiamenYe_41:46:dd		
1199 119.409462 cisco_5d:42:98	CDP/VTP/DTP/PAgP/UDCDP 517 Device ID: yealink-cisco3750.yealink.com Port ID: FastEthernet1/0/22 CDP/VTP/DTP/PAgP/UDCDP 124 Device ID: T460015654146DD Port ID: WAN PORT	
1210 120.407969 xiamenye_41:46:dd 1225 121.414332 Cisco_5d:42:98	CDP/VTP/DTP/PAgP/UDCDP 124 Device ID: 14000150541400D POTT ID: WAN PORI CDP/VTP/DTP/PAgP/UDCDP 517 Device ID: yealink-cisco3750.yealink.com Port ID: FastEthernet1/0/22	
1706 181.067700 xjamenye 41:46:dd		
-		F
n Frame 1700: 116 bytes on wire (928 m Frame 1700: 116 bytes on wire (928 m Logical-Link Control Cisco Discowery Protocol Version: 2 TTL: 180: secfa3d [correct] m Device ID: 746001565414600 Addresses Type: Addresses (Dx0002) Length: 17 Number of addresses: 1 m Paddress: 10.10.222.19 m Port ID: WAN PORT m Capabilities m Software Version m Platform: T46 m Deplex: Malf m Power Consumption: 8000 mW	oncs), 116 bytes captured (928 bits)	

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 DHCP Server

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 DHCP Turbo.

To configure DHCP option on a DHCP server:

- **1.** Start the DHCP Turbo application.
- 2. Right click Option Types, and then select New Option Type.

🍇 DHCP Turbo on localhost (modified)			
<u>File Edit View Bindings Tools H</u> elp			
	* 🤊	♥	
Servers / Filter St	andard Option		
🗄 🔂 Scopes 🛛 🛛 Tag 🗸		Option	<u> </u>
Doption Types 🖅 New Option Type	Ctrl+V	SMTP servers POP3 servers	
Named Polici	Ctrl+Z	NNTP servers	
Database 🖉 Redo	Ctrl+Y	WWW servers	
Cut	Ctrl+X	Finger servers IRC servers	
	Ctrl+C	Streettalk servers	
Paste	Ctrl+V	Streettalk DA servers User class	
Delete	Del	User class Device FODN	
Select All	Ctrl+A	Relay Agent Information	
<u></u> ind	Ctrl+F	Subnet Selection SIP Server	
Properties	Ctrl+P	Cablelabs Client Configuration	
		Yealink Phone Test VLAN ID	•
Description			
/			
Create a new option type			//

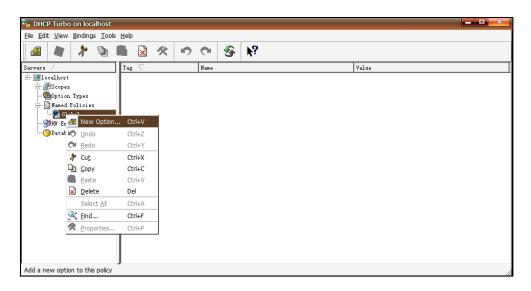
3. Enter the desired option in the Tag field.

The custom options range from 128 to 254.

- 4. Enter the desired name in the Name field.
- 5. Select string from the pull-down list of Type.

🖅 Option Prope	rties 🗾 🔀
Tag 132	A Y
Name Yealink Ph	none Test VLAN ID
Type string	▼
🔲 Signed	Arrayed
Description	
ŪK	Cancel

- 6. Click **OK** to finish setting the option properties.
- 7. Click 🔄 to accept the change.
- 8. Double click Named Policies.
- 9. Right click Global, and then select New Option.



/ Option Sel	ector		×
Filter	Standard Options	•	
Tag 🗸	Name		_
	Magic cookie		
	Home directory		
🖅 1	Boot file		
🚈 1	Subnet mask		
	Time offset		
	Gateways		
⁄ 🖅 4	Time servers		
	IEN116 name servers		
	Domain name servers		
/ 🖅 7	Log servers		
	Cookie/Quote servers		
	LPR servers		
/ 🖅 10	Impress servers		
🚈 11	RLP servers		
/ 🖅 12	Hostname		
/ 🖅 13	Boot file size		
/ 🖅 🖓 🕂	Merit dump file		
/ 🖅 🖅	Domain name		
/ 🖅 16	Swap servers		
/ 🖅 🖅	Root path		
/ 🖅 18	Extensions path		
/ 🖅 19	IP forwarding		▼
Description			S
Description			3°
,			Cancel

The Option Selector screen displays as below:

- **10.** Scroll down and double click the option created above.
- **11.** Fill the VLAN ID to be assigned in the input field.

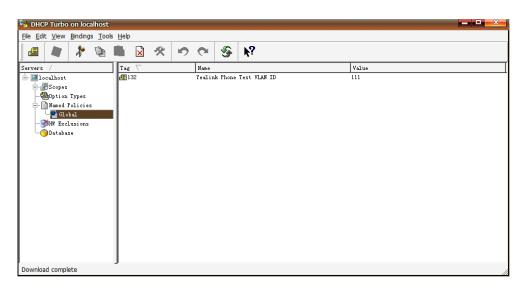
Three formats of valid values: VLAN-A= *VLANID*, *VLANID* and VID= *VLANID*. VLAN ID ranges from 1 to 4094.

🖅 Yealink Phone Test VLAN ID	
111	
<pre>Expression</pre>	Build
<u>OK</u> ancel	\underline{A} dvanced $>>$

12. Click OK to finish setting a custom option.

13. Click **a** to accept the change.

Then you can find the configured option under **Global** option.



Configuring DHCP Option on Yealink IP Phones

DHCP VLAN is enabled on IP phones by default. You can configure DHCP VLAN via web user interface or using configuration files. You can also configure the DHCP option. The default DHCP option is 132.

Configuring DHCP Option via Web User Interface

The followings take configurations of a SIP-T46G IP phone running firmware version 81 as examples.

To configure DHCP VLAN feature via web user interface:

1. Log into the web user interface with the administrator credential.

The default administrator user name and password are both "admin".

- 2. Click on Network->Advanced.
- 3. In the VLAN block, select the desired value from the pull-down list of DHCP VLAN Active.
- 4. Enter the desired value in the **Option** field.

You can specify 5 options at most and separate options by commas. The default value is 132.

Yealink 1466					Log Out English(English) 🗸
	Status	Network DSS	6Key Features	Settings	Directory Security
Basic	LLDP 🕜				NOTE
PC Port		Active Packet Interval (1~3600s)	Enabled 60	•	VLAN It is used to logically divide a
NAT	CDP 🕜				physical network into several broadcast domains. VLAN membership can be configured
Advanced Wi-Fi		Active Packet Interval (1~3600s)	Enabled 60	•	through software instead of physically relocating devices or connections.
WEIT	VLAN 🕜				The priority of VLAN assignment
	WAN Port	Active	Disabled	•	method (from highest to lowest) :LLDP/CDP->manual configuration->DHCP VLAN
		VID (1-4094) Priority	0	•	NAT Traversal
	PC Port	Active	Disabled	•	It is a general term for techniques that establish and maintain IP connections
		VID (1-4094)	1		traversing NAT gateways. STUN is one of the NAT traversal
	DHCP VLAN	Priority	0 Enabled	•	techniques.
	DHCP VLAN	Option (1-255)	132	•	You can configure NAT traversal for the IP phone.

5. Click **Confirm** to accept the change.

The web user interface prompts the warning "Some settings you changed take effect when you restart your machine! Do you want to reboot now?".

6. Click **OK** to reboot the IP phone.

Configuring CDP Using Configuration Files

The following IP phones use the new auto provisioning mechanism:

- SIP-T58V/T58A/T56A IP phones running firmware version 80 or later
- SIP-T54S/T52S/T48G/T48S/T46G/T46S/T42G/T42S/T41P/T41S/T40P/T40G/T29G/T27P/T2 7G/T23P/T23G/T21(P) E2/T19(P) E2, W52P and W56P IP phones running firmware version 81 or later

Other IP phones or the IP phones listed above running old firmware version use the old auto provisioning mechanism.

For Old Auto Provisioning Mechanism

To configure DHCP VLAN feature using configuration files:

1. Add/Edit DHCP VLAN parameters in the configuration file (e.g., y00000000028.cfg).

The following table shows the information of parameters:

Parameters	Permitted Values	Default
network.vlan.dhcp_enable	0 or 1	1
Description: Enables or disables DHCP VLAN discovery feature	e on the IP phone.	

Parameters	Permitted Values	Default			
0-Disabled					
1-Enabled					
network.vlan.dhcp_option Integer from 128 to 254 132					
Description:					
Specifies the DHCP option used to detect the VLAN ID.					
You can specify 5 options at most and separate o	options by commas.				

The following shows an example of DHCP VLAN configuration in configuration files:

network.vlan.dhcp_enable = 1

network.vlan.dhcp_option = 132

2. Upload configuration files to the root directory of the provisioning server and trigger IP phones to perform an auto provisioning for configuration update.

For more information on auto provisioning, refer to *Yealink_SIP-T2 Series_T19(P) E2_T4_Series_CP860_W56P_IP_Phones_Auto_Provisioning_Guide*.

For New Auto Provisioning Mechanism

To configure DHCP VLAN feature using configuration files:

1. Add/Edit DHCP VLAN parameters in the configuration file (e.g., static.cfg).

The following table shows the information of parameters:

Parameters	Permitted Values	Default					
static.network.vlan.dhcp_enable 0 or 1 1							
Description:							
Enables or disables DHCP VLAN discovery feature on the IP phone.							
0 -Disabled							
1-Enabled							
static.network.vlan.dhcp_option	Integer from 128 to 254	132					
Description:							
Specifies the DHCP option used to detect the VL	AN ID.						
You can specify 5 options at most and separate of	options by commas.						

The following shows an example of DHCP VLAN configuration in configuration files:

```
static.network.vlan.dhcp_enable = 1
```

static.network.vlan.dhcp_option = 132

Reference the configuration file in the boot file (e.g., y0000000000000.boot).
 Example:

include:config "http://10.2.1.158/static.cfg"

- 6. Upload the boot file and configuration file to the root directory of the provisioning server.
- **7.** Trigger IP phones to perform an auto provisioning for configuration update. For more information on auto provisioning, refer to *Yealink_SIP-T2_Series_T19(P)*

E2_T4_Series_T5_Series_W5_Series_CP860_IP_Phones_Auto_Provisioning_Guide_V81.

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 obtaining the VLAN ID from DHCP server, the phone will release the leased IP address and start a new DHCP Discover cycle with the now known Voice VLAN ID tag.

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

The following figure shows the DHCP Discover message sent by the IP phone (before obtaining VLAN ID):

<u>Ele</u>	<u>E</u> dit <u>V</u> iew <u>G</u> o	<u>Capture</u> Analyze St	atistics Telephony Tools Int	ernals <u>H</u> elp					
2) 8		i 🖻 🛃 🗶 🛃 🖴	0, 4 🔿 🚳 🕢 🛃		1 🛯 🖬 🖻 🕵	% 🔀			
Filter:	bootp		•	Expression Clear Apply					
lo.	Time	Source	Destination	Protocol Length Inf	, ,				
	3 0.110993		255.255.255.255			Transaction I			
	4 0.115183		5.5.5.18			Intersection 1			
	5 0.150004		255.255.255.255			Transaction I			
	6 0.154213		5.5.5.18			Transaction I			
	7 0.200977		255.255.255.255			Transaction I			
	8 0.205328 9 10.068604		5.5.5.18 255.255.255.255	DHCP 342 DH DHCP 594 DH		 Transaction I Transaction I 			
		10.10.111.254	10.10.111.2			Transaction I			
	11 10.161676		255, 255, 255, 255			Transaction I			
		10.10.111.254	10.10.111.2			Transaction I			
_	12 10.1050/0	10.10.111.234	10.10.111.2	540 bit		in ansaccion 1	0 0000000000000000000000000000000000000		
S S Int Use Boo M H H H T S B C Y R C C	Source: Xlamw ype: IP (OxK cernet Proto er Datagram : Distarp Proto Tessage-type dardware type dardware add dops: 0 rransaction : sootp flags: lient IP add year Server telay agent : lient MAC ad	col version 4, sr Protocol, src Por col <u>Boot Request (1</u> <u>Es Ethernet</u> ress length: 6 ID: 0x83952d00 sed: 100 0x0000 (unicast) dress: 0.0.0.0 (0 IP address: 0.0.0 IP addres	(15:65:11:27:b1) c: 0.0.0.0 (0.0.0.0), It i: bootpc (68), Dst Por Click here to know mor (0.0.0) 0.0 (0.0.0.0) 0.0 (0.0.0.0)	rt: bootps (67) e information.	(255. 255. 255.	.255)			
	ff ff 00 44	00 43 02 2c b3	ea 01 01 06 00 83 95 00 00 00 00 00 00 00 11 27 b1 00 00 00 00	D.C.,					

		tistics Telephon <u>y T</u> ools Jr 🔍 🗢 💠 သ 🏹 坐		t c @ 🗉 📓 🕅	5 % 🛱			
lter: bootp		•		. Clear Apply				
o. Time	Source	Destination	Protocol	Length Info				
3 0.110993								
4 0.115183		5.5.5.18	DHCP	342 DHCP Offer	 Transaction 1 			
5 0.150004		255.255.255.255	DHCP		- Transaction 1			
6 0.154213		5.5.5.18	DHCP	342 DHCP ACK	- Transaction 1			
7 0.200977		255.255.255.255	DHCP		- Transaction 1			
8 0.205328		5.5.5.18	DHCP	342 DHCP ACK	- Transaction 1			
9 10.068604		255.255.255.255	DHCP		r - Transaction 1			
	10.10.111.254	10.10.111.2	DHCP	346 DHCP Offer	- Transaction 1			
11 10.16167		255.255.255.255	DHCP		- Transaction 1			
12 10.1636/0	10.10.111.254	10.10.111.2	DHCP	346 DHCP ACK	- Transaction 1	LD 0XC486620		
Client IP ac Your (client Next server Relay agent Client MAC a Client hardw Server host Boot file na Magic cooki ⊕ Option: (t=!	<pre>0x0000 (Unicast) (dress: 0.0.0.0 (0.)) IP address: 0.0.0. IP address: 0.0.0. IP address: 0.0.0. ddress: xiamenve_1 are address paddin name not given ame not given : DHCP 3,1=1) DHCP Messag 1,1=7) Client iden</pre>	0.0 (0.0.0) 0 (0.0.0) 0 (0.0.0) 1:27:b1 (00:15:65:11 g: 000000000000000000000000 t:Type = DHCP Discove tifier ss identifier = "udhe	2000 2r 2p 1.10.3"]				

The following figure shows the DHCP Offer message received by the IP phone (DHCP server sends a DHCP Offer message with the Option 132):

		🗎 🗃 🗶 🎜 🗄	수 수 ♀ 주 쏘		କ୍ର୍ଭ୍ 🖭	M 🗹	8 % 🕱			
Filter:	bootp		-	Expression	Clear Apply					
No.	Time	Source	Destination	Protocol	Length Info					
	3 0.110993	0.0.0.0	255.255.255.255	DHCP	590 DHCP	Discover	- Transaction			
	4 0.115183	5.5.5.2	5.5.5.18	DHCP	342 DHCP	offer	- Transaction	ID 0x83952d00		
	5 0.150004		255.255.255.255	DHCP			- Transaction			
	6 0.154213		5.5.5.18	DHCP	342 DHCP		- Transaction			
		0.0.0.0	255.255.255.255	DHCP			- Transaction			
	8 0.205328		5.5.5.18	DHCP	342 DHCP		- Transaction			
	9 10.068604		255.255.255.255	DHCP			- Transaction			
	LO 10.074079	10.10.111.254	10.10.111.2 255.255.255.255	DHCP	346 DHCP		- Transaction - Transaction			
		10.10.111.254	10.10.111.2	DHCP	346 DHCP		- Transaction			
- 1	12 10.1030/0	10.10.111.254	10.10.111.2	DHCP	346 DHCP	ACK	- mansaccion	1D 0XC48e620		
C S B M 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	lient hardwa erver host n oot file nam agic cookie: ption: (t=53 ption: (t=53 ption: (t=51 ption: (t=59 ption: (t=58 ption: (t=3.	re address padding ame: mid0507-dc2a3 e not given DHCP ,1=1) DHCP Message 1=4) subnet Mask = ,1=4) IP Address L ,1=4) Rebinding Ti ,1=4) Renewal Time 1=4) Router = 5.5.	Type = DHCP offer 255.255.255.0 ease Time = 6 hours me value = 5 hours, value = 3 hours	00 15 minutes	5					
€ 0 € 0 € 0 E	ption: (t=22 ption: (t=12	2,1=1) Unassigned 8,1=5) DOCSIS full	security server IP Identifier = 5.5.5.2	[торо]						
120 130	ff ff 00 33 04 00 00 2a	00 00 63 82 53 6	3 35 01 02 01 04 ff b 04 00 00 49 d4 3a 5 01 84 03 31 31 31	с.	şc5					

The following figure shows the DHCP message received by the IP phone (DHCP server sent the ACK message to the phone):

<u>File Edit View Go</u>	Capture Analyze Statistics	Telephony Tools Int	ternals <u>H</u> elp			
	🕒 🖬 🗙 🎜 占 🔍	. 🗢 🛸 🥋 🚰		🗑 🗹 🍕 💥 🗮		
Filter: bootp		•	Expression Clear Apply			
No. Time	Source D	estination	Protocol Length Info			
		55.255.255.255		Discover - Transac		
4 0.115183		5.5.18	DHCP 342 DHCP		tion ID 0x83952d00	
5 0.150004		55.255.255.255		Request - Transac		
6 0.154213		.5.5.18	DHCP 342 DHCP		tion ID 0xbdaa1562	
7 0.200977 8 0.205328		55.255.255.255 5.5.5.18	DHCP 590 DHCP DHCP 342 DHCP		tion ID 0x83952d00 tion ID 0x83952d00	
9 10.068604		0. 0. 0. 18 00. 200. 200. 200		ACK - Transac		
		.0.10.111.2	DHCP 394 DHCP DHCP 346 DHCP		tion ID 0xc48e620	
11 10.161676		55.255.255.255		Request - Transac		
		0.10.111.2	DHCP 346 DHCP		tion ID 0xc48e620	
< [•
Next server 1 Relay agent 1 Client MAC ad Client MAC ad Server host n Boot file nam Magic cookie: B Option: (t=1, B Option: (t=2, B Option: (t=3, B O		5.5.5.2) .0.0.0) rb1 (00:15:65:11: 0000000000000000000000000000000000	15 minutes			

After obtaining the VLAN ID from DHCP server, IP phone will release the leased IP address (5.5.5.18) and start a new DHCP Discover message with the VLAN-tag 111.

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

File F	dit View Go	Canture Analyze Stat	tistics Telephony <u>T</u> ools I	nternals Heln						
			Q 🗢 🔶 🍄 🕇 🕹		Q Q 🖭		1 ale 1 15			
			<			S E (9 70 24			
Filter:	bootp			Expression	Clear Apply					
No.	Time	Source	Destination	Protocol	Length Info					
	3 0.110993	0.0.0.0	255.255.255.255	DHCP			- Transaction	ID 0x83952d00		
	4 0.115183		5.5.5.18	DHCP	342 DHCP			ID 0x83952d00		
	5 0.150004		255.255.255.255	DHCP				ID 0xbdaa1562		
	6 0.154213		5.5.5.18	DHCP	342 DHCP			1 ID Oxbdaa1562		
	7 0.200977		255.255.255.255	DHCP				ID 0x83952d00		
	8 0.205328		5.5.5.18	DHCP	342 DHCP			1 ID 0x83952d00		
	9 10.068604		255.255.255.255	DHCP				ID 0xc48e620		
		10.10.111.254	10.10.111.2	DHCP	346 DHCP			ID 0xc48e620		
	1 10.161676		255.255.255.255	DHCP				ID 0xc48e620	_	
1	2 10.163676	10.10.111.254	10.10.111.2	DHCP	346 DHCP	ACK	- Transaction	ID 0xc48e620		
<										Þ
🗏 Eth	ernet TT (VI	AN tagged), Src:	cisco_5d:42:c4 (c0:6	2:6b:5d:42:c	4). Dst: Xia	menye 11	27:b1 (00:15:	65:11:27:b1)		
			(00:15:65:11:27:b1)			_				
		5d:42:c4 (c0:62:								
ΞV	LAN tag: VLA	N=111, Priority=B	est Effort (default)							
		802.10 virtual L								
	000	= Priori	ty: Best Effort (def	ault) (0)						
		= CFI: C								
	0000 0	110 1111 = VLAN:	111							
	ype: IP (OxO	800)								
			: 10.10.111.254 (10.)			111.2 (10).10.111.2)			
			: bootps (67), Dst P	ort: bootpc	(68)					
	tstrap Proto									
		Boot Reply (2)								
	ardware type									
		ess length: 6								
	ops: 0									
		D: 0x0c48e620								
	econds_elaps									
		0x0000 (Unicast)								
		ress: 0.0.0.0 (0.								
Y	our (client)	IP address: 10.1	0.111.2 (10.10.111.2)						
0030	06 00 0c 48	e6 20 00 00 00	00 00 00 00 00 <mark>0a 0a</mark>	H						
0040	6f 02 00 00	00 00 00 00 00	00 00 15 65 11 27 b1	0.						

After this process, the phone has obtained an IP address (10.10.111.2) from the DHCP server in the VLAN 111.

Manual Configuration for VLAN

VLAN is disabled on IP phones by default. You can configure VLAN via web user interface or phone user interface or using configuration files. Before configuring VLAN on the IP phone, you need to obtain the VLAN ID from your network administrator. When you configure VLAN feature, the most important issue is to confirm the type of the connected port (access, trunk, and hybrid) on the switch. This ensures that the traffics (tagged/untagged) from the IP phones can be transmitted properly. VLAN feature could affect the ability of the IP phones to function in the network. Contact your network administrator for more information before configuration.

Configuring VLAN Feature in the Wired Network

You can enable or disable VLAN, and set specific VLAN IDs and priorities for the Internet (WAN) port and PC port respectively.

Configuring VLAN Feature in the Wired Network via Web User Interface

The followings take configurations of a SIP-T46G IP phone running firmware version 81 as examples.

To configure VLAN for Internet (WAN) port via web user interface:

1. Log into the web user interface with the administrator credential.

The default administrator user name and password are both "admin".

2. Click on Network->Advanced.

- 3. In the VLAN block, select the desired value from the pull-down list of WAN Port Active.
- 4. Enter the VLAN ID in the VID (1-4094) field.
- 5. Select the desired value (0-7) from the pull-down list of **Priority**.

7 is the highest priority.

Yealink 1466					Log Out English(English) -
	Status Accoun	t Network Ds	SKey Features	Settings	Directory Security
Basic	LLDP 🕜				NOTE
PC Port		Active Packet Interval (1~3600s)	Enabled 60	•	VLAN It is used to logically divide a
NAT Advanced	CDP 🕜	Active	Enabled	•	physical network into several broadcast domains. VLAN membership can be configured through software instead of
Wi-Fi	VLAN 🕜	Packet Interval (1~3600s)	60		physically relocating devices or connections.
	WAN Port	Active VID (1-4094)	Enabled	•	The priority of VLAN assignment method (from highest to lowest) :LLDP/CDP->manual configuration->DHCP VLAN
		Priority	5	•	NAT Traversal It is a general term for
	PC Port	Active	Disabled	•	t is a general term for techniques that establish and maintain IP connections
		VID (1-4094) Priority	0	•	traversing NAT gateways. STUN is one of the NAT traversal techniques.
	DHCP VLAN	Active Option (1-255)	Enabled	•	You can configure NAT traversal for the IP phone.

6. Click **Confirm** to accept the change.

The web user interface prompts the warning "Some settings you changed take effect when you restart your machine! Do you want to reboot now?".

7. Click **OK** to reboot the IP phone.

To configure VLAN for PC port via web user interface:

1. Log into the web user interface with the administrator credential.

The default administrator user name and password are both "admin".

- 2. Click on Network->Advanced.
- 3. In the VLAN block, select the desired value from the pull-down list of PC Port Active.
- 4. Enter the VLAN ID in the VID (1-4094) field.
- 5. Select the desired value (0-7) from the pull-down list of **Priority**.

7 is the highest priority.

Yealink 1466					Log Out English(English) ▼
	Status Accourt	t Network D	SSKey Features	Settings	Directory Security
Basic	LLDP 🕜				NOTE
PC Port		Active	Enabled	٣	VIAN
FOFUIL		Packet Interval (1~3600s)	60		It is used to logically divide a physical network into several
NAT	CDP 🕜				broadcast domains. VLAN membership can be configured
Advanced		Active	Disabled	٣	through software instead of physically relocating devices or
Wi-Fi		Packet Interval (1~3600s)	60		connections.
	VLAN 🕜				The priority of VLAN assignment method (from highest to
	WAN Port	Active	Disabled	Y	lowest) :LLDP/CDP->manual configuration->DHCP VLAN
		VID (1-4094)	1		NAT Traversal
		Priority	0	¥	It is a general term for techniques that establish and maintain IP connections
	PC Port	Active	Enabled	•	traversing NAT gateways. STUN is one of the NAT traversal
		VID (1-4094)	76		techniques.
		Priority	3	•	You can configure NAT traversal for the IP phone.
	DHCP VLAN	Active	Enabled	•	Quality of Service (QoS)
		Option (1-255)	132		It is the ability to provide different priorities for different

6. Click **Confirm** to accept the change.

The web user interface prompts the warning "Some settings you changed take effect when you restart your machine! Do you want to reboot now?".

7. Click **OK** to reboot the IP phone.

To configure VLAN for Internet (WAN) port via phone user interface:

- 1. Press Menu->Advanced (password: admin) ->Network->VLAN->WAN Port.
- **2.** Press () or (), or the **Switch** soft key to select the desired value from **VLAN Status** field.
- 3. Enter the VLAN ID (1-4094) in the VID Number field.
- 4. Enter the desired value (0 to 7) in the **Priority** field.

7 is the highest priority.

WAN Port							
1. VLAN Statu	JS:	Enabled	$\triangleleft \triangleright$				
2. VID Numb	er:	77					
3. Priority:		5					
Back	123	Delete	Save				

5. Press the Save soft key to accept the change.

The IP phone reboots automatically to make settings effective after a period of time.

To configure VLAN for PC port via phone user interface:

- 1. Press Menu->Advanced (password: admin) ->Network->VLAN->PC Port.
- 2. Press (\cdot) or (\cdot) , or the **Switch** soft key to select the desired value from **VLAN Status**

field.

- 3. Enter the VLAN ID (1-4094) in the VID Number field.
- 4. Enter the desired value (0 to 7) in the **Priority** field.

	PC	Port	
1. VLAN Status:		Enabled	$\triangleleft \triangleright$
2. VID Number:		76	
3. Priority:		3	
Back	123	Delete	Save

7 is the highest priority.

5. Press the Save soft key to accept the change.

The IP phone reboots automatically to make settings effective after a period of time.

Configuring VLAN Feature in the Wired Network Using Configuration Files

The following IP phones use the new auto provisioning mechanism:

- SIP-T58V/T58A/T56A IP phones running firmware version 80 or later
- SIP-T54S/T52S/T48G/T48S/T46G/T46S/T42G/T42S/T41P/T41S/T40P/T40G/T29G/T27P/T2 7G/T23P/T23G/T21(P) E2/T19(P) E2 IP, CP860, W52P and W56P phones running firmware version 81 or later

Other IP phones or the IP phones listed above running old firmware version use the old auto provisioning mechanism.

For Old Auto Provisioning Mechanism

To configure VLAN for Internet (WAN) port and PC port using configuration file:

 Add/Edit VLAN for Internet (WAN) port and PC port parameters in the configuration file (e.g., y00000000028.cfg).

The following table shows the information of parameters:

Parameters	Permitted Values	Default				
network.vlan.internet_port_enable	0 or 1	0				
Description:						
Enables or disables the IP phone to tag VLAN ID (WAN) port.	in packets sent from the In	ternet				

Parameters	Permitted Values	Default						
0-Disabled								
1-Enabled								
network.vlan.internet_port_vid	Integer from 1 to 4094	1						
Description:								
Configures the VLAN ID that associates with the	particular VLAN.							
network.vlan.internet_port_priority	Integer from 0 to 7	0						
Description:								
Specifies the priority used for transmitting VLAN packets.								
network.vlan.pc_port_enable	0 or 1	0						
Description:								
Enables or disables the IP phone to tag VLAN ID	in packets sent from the PC	C port.						
0 -Disabled								
1-Enabled								
network.vlan.pc_port_vid Integer from 1 to 4094								
Description:								
Configures the VLAN ID that associates with the	particular VLAN.							
network.vlan.pc_port_priority Integer from 0 to 7								
Description:								
Specifies the priority used for transmitting VLAN	packets.							

The following shows an example of VLAN configuration in configuration files:

network.vlan.internet_port_enable = 1

network.vlan.internet_port_vid = 77

network.vlan.internet_port_priority = 5

network.vlan.pc_port_enable = 1

network.vlan.pc_port_vid = 76

network.vlan.pc_port_priority = 3

2. Upload configuration files to the root directory of the provisioning server and trigger IP phones to perform an auto provisioning for configuration update.

For more information on auto provisioning, refer to Yealink_SIP-T2 Series_T19(P)

E2_T4_Series_CP860_W56P_IP_Phones_Auto_Provisioning_Guide.

For New Auto Provisioning Mechanism

To configure VLAN for Internet (WAN) port and PC port using configuration file:

1. Add/Edit VLAN for Internet (WAN) port and PC port parameters in the configuration file (e.g., static.cfg).

The following table shows the information of parameters:

Parameters	Permitted Values	Default						
static.network.vlan.internet_port_enable	0 or 1	0						
Description:								
Enables or disables the IP phone to tag VLAN ID in packets sent from the Internet (WAN) port.								
0-Disabled								
1-Enabled								
static.network.vlan.internet_port_vid Integer from 1 to 4094 1								
Description:								
Configures the VLAN ID that associates with the particular VLAN.								
static.network.vlan.internet_port_priority Integer from 0 to 7 0								
Description:								
Specifies the priority used for transmitting VLAN packets.								
static.network.vlan.pc_port_enable 0 or 1 0								
Description:								
Enables or disables the IP phone to tag VLAN ID	in packets sent from the PC	C port.						
0-Disabled								
1 -Enabled								
static.network.vlan.pc_port_vid Integer from 1 to 4094 1								
Description:								
Configures the VLAN ID that associates with the	particular VLAN.							
static.network.vlan.pc_port_priority								

Parameters	Permitted Values	Default			
Description:					
Specifies the priority used for transmitting VLAN packets.					

The following shows an example of VLAN configuration in configuration files:

static.network.vlan.internet_port_enable = 1

static.network.vlan.internet_port_vid = 77

static.network.vlan.internet_port_priority = 5

static.network.vlan.pc_port_enable = 1

static.network.vlan.pc_port_vid = 76

static.network.vlan.pc_port_priority = 3

2. Reference the configuration file in the boot file (e.g., y000000000000.boot).

Example:

include:config "http://10.2.1.158/static.cfg"

- 3. Upload the boot file and configuration file to the root directory of the provisioning server.
- Trigger IP phones to perform an auto provisioning for configuration update.
 For more information on auto provisioning, refer to *Yealink_SIP-T2_Series_T19(P)* E2_T4_Series_T5_Series_W5_Series_CP860_IP_Phones_Auto_Provisioning_Guide_V81.

Configuring VLAN Feature in the Wireless Network

You can enable or disable VLAN, and set specific VLAN IDs and priorities for the wireless network. It is only applicable to SIP VP-T49G IP phones. VLAN feature in the wireless network can be configured using the configuration files only.

To configure VLAN feature in the wireless network using configuration file:

1. Add/Edit VLAN for wireless network parameters in the configuration file (e.g., y00000000051.cfg).

The following table shows the information of parameters:

Parameters	Permitted Values	Default				
wifi.vlan_enable	0 or 1	0				
Description:						
Enables or disables VLAN discovery feature in the wireless network for the IP phone.						
0 -Disabled						
1-Enabled						

Parameters	Permitted Values	Default					
network.vlan.wifi_enable	0 or 1	0					
Description:							
Enables or disables manual configuration of VLAN feature in the wireless network for the							
IP phone.							
0-Disabled							
1-Enabled							
network.vlan.wifi_vid	Integer from 1 to 4094	1					
Description:							
Configures VLAN ID in the wireless network for t	he IP phone.						
network.vlan.wifi_priority Integer from 0 to 7 0							
Description:							
Configures VLAN priority in the wireless network for the IP phone.							

The following shows an example of VLAN configuration in configuration files:

wifi.vlan_enable = 1

network.vlan.wifi_enable = 1

network.vlan.wifi_vid = 77

network.vlan.wifi_priority = 3

2. Upload configuration files to the root directory of the provisioning server and trigger IP phones to perform an auto provisioning for configuration update.

For more information on auto provisioning, refer to *Yealink_SIP-T2 Series_T19(P) E2_T4_Series_CP860_W56P_IP_Phones_Auto_Provisioning_Guide*.

Verifying the Configuration

The IP phone reboots after VLAN feature has been enabled. After starting up, the IP phone will be assigned with a subnet address defined for VLAN 77.

The following figure shows the VLAN ID sent and received by the IP phone:

File	E	dit Vi	ew G	o Capture	e Analyze	Statistics	Telephony	Tools H	ielp													
							0 4			⊉			€ (0, E	9 6	¥ 🗹	1	6	Ħ		
Filter	r:	sip							•	Express	ion	Clear	Apply									
No.	1	lime		Source		Destinati	ion	Protoco	l Inf													
1	1 3	2.449	322	10.2.	11.216	10.2.3	1.199	SIP/S						201@	10.2	.1.19	9, wi	th ses	ssio	n des«	cripti	on
1	2 2	2.451	191	10.2.	1.199	10.2.3	11.216	SIP	St	atus:	100	Tryi	ing									
		2.452		10.2.		10.2.		SIP/S						2010	10.2	.8.21	6:506	2, wit	th s	essio	n desk	ription
		2.489		10.2.		10.2.3	1.199	SIP		atus:												
		3.649		10.2.		10.2.3		SIP		atus:												
		3.651		10.2.			11.216	SIP		atus:												
		4.411		10.2.			1.199										ripti					
		4.415		10.2.			11.216										ripti	on				
		4.496		10.2.			8.216	SIP		quest												
2	34	4.496	749	10.2.	11.216	10.2.	8.216	SIP	Re	quest	: ACI	< sip	0:2010	910.	2.8.	216:5	062					
4																						
+ F	ra	me 11	.: 90	8 bytes	on wir	e (7264	bits), 9	08 byt	es ca	pture	d (7)	264 k	oits)									
+ E	th	ernet	: II,	Src: >	(iamen¥e	_12:22:f	9 (00:15	:65:12	:22:f	9), D	st: (5_40:c	da:5	5 (6	c:50:	4d:40	:da:5!	5)			
- 8	02	.1Q \	/irtu	ial LAN,	PRI: 3	, CFI: (), ID: 77															
	011 = Priority: Excellent Effort (3)																					
	0 = CFI: Canonical (0)																					
		(0000	0100 11	.01 = ID	: 77																
				(0×0800)																		
							L6 (10.2.								199)							
							na-local	ise (5	062),	Dst	Port	: sip	o (50€	60)								
÷S	es	sion	Init	iation	Protoco	1																

Appendix

Appendix A: Glossary

IEEE (Institute of Electrical and Electronics Engineers) –a professional association headquartered in New York City that is dedicated to advancing technological innovation and excellence.

TIA (Telecommunications Industry Association) –accredited by the American National Standards Institute (ANSI) to develop voluntary, consensus-based industry standards for a wide variety of ICT products.

IEEE 802.3 –a working group and a collection of IEEE standards produced by the working group defining the physical layer and data link layer's media access control (MAC) of wired Ethernet.

Port-based VLAN –a port-based VLAN is a group of ports on a Gigabit Ethernet Switch that form a logical Ethernet segment. Each port of a port-based VLAN can belong to only one VLAN at a time.

Port and Protocol-based VLAN –initially defined in IEEE 802.1v (currently amended as part of 802.1Q-2003) enables data frame classification and assignment to unique VLANs based on the received data frame type and the protocol information in its payload.

TPID (tag protocol identifier) –a 16-bit field set to a value of 0x8100 in order to identify the frame as an IEEE 802.1Q-tagged frame. It is used to distinguish the frame from untagged frames.

PCP (Priority Code Point) –a 3-bit field which refers to the IEEE 802.1p priority. It indicates the frame priority level. Values are from 0 (best effort) to 7 (highest); 1 represents the lowest priority.

CFI (Canonical Format Indicator) –used for compatibility reason between Ethernet type network and Token Ring type network. It is always set to zero for Ethernet switches. If a frame received at an Ethernet port has a CFI set to 1, then that frame should not be forwarded as it is to an untagged port.

Appendix B: System Names

The following table outlines the Yealink phone models and their system names:

Model	System Name
CP860	CP860
W52P/W56P	W52P
SIP-T58V/A	SIP-T58
SIP-T56A	SIP-T56A
SIP VP-T49G	SIP VP-T49G
SIP-T54S	SIP-T54S
SIP-T52S	SIP-T52S
SIP-T48G	SIP-T48G
SIP-T48S	SIP-T48S
SIP-T46G	SIP-T46G
SIP-T46S	SIP-T46S
SIP-T42G	SIP-T42G
SIP-T42S	SIP-T42S
SIP-T41P	SIP-T41P
SIP-T41S	SIP-T41S
SIP-T40P	SIP-T40P
SIP-T40G	SIP-T40G
SIP-T29G	SIP-T29G
SIP-T27P	SIP-T27P
SIP-T27G	SIP-T27G
SIP-T23P	SIP-T23P
SIP-T23G	SIP-T23G
SIP-T21(P) E2	SIP-T21P_E2
SIP-T19(P) E2	SIP-T19P_E2

Appendix C: Model Names

The following table outlines the Yealink phone models and their model names:

Model	Model Name
CP860	CP860
W52P/W56P	W52P
SIP-T58V/A	SIP-T58
SIP-T56A	SIP-T56A
SIP VP-T49G	T49
SIP-T54S	T54S
SIP-T52S	T52S
SIP-T48G	T48
SIP-T48S	T48S
SIP-T46G	T46
SIP-T46S	T46S
SIP-T42G	T42
SIP-T42S	T42S
SIP-T41P	T41
SIP-T41S	T41S
SIP-T40P	T40
SIP-T40G	T40G
SIP-T29G	Т29
SIP-T27P/G	T27
SIP-T23P/G	Т23
SIP-T21(P) E2	T21P_E2
SIP-T19(P) E2	T19P_E2

Appendix D: Power Values

The following table outlines the power value sent in LLDP-MED:

Model	Power Value
CP860	8100mW
W52P/W56P	1500mW
SIP-T58V/A	11400mW
SIP-T56A	8800mW
SIP-T54S	9500mW
SIP-T52S	9700mW
SIP-T48G	10600mW
SIP-T48S	10800mW
SIP-T46G	8000mW
SIP-T46S	7600mW
SIP-T42G	5900mW
SIP-T42S	6800mW
SIP-T41P	3200mW
SIP-T41S	12500mW
SIP-T40P	5300mW
SIP-T40G	6000mW
SIP-T29G	8100mW
SIP-T27P	6000mW
SIP-T27G	7100mW
SIP-T23P	6500mW
SIP-T23G	8200mW
SIP-T21P E2	6500mW
SIP-T19P E2	5000mW

Appendix E: Normative References

LLDP and LLDP-MED: http://en.wikipedia.org/wiki/Link_Layer_Discovery_Protocol

CDP: http://en.wikipedia.org/wiki/Cisco_Discovery_Protocol

IEEE 802.3: http://www.ieee802.org/3/

VLAN: http://en.wikipedia.org/wiki/Virtual_LAN

IEEE 802.1q: http://en.wikipedia.org/wiki/802.1Q

LLDP on Cisco Switch:

http://www.cisco.com/en/US/docs/switches/lan/catalyst3750/software/release/12.2_55_se/configuration/guide/swlldp.html

CDP on Cisco Switch:

http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3750/software/release/12-2_55_se/ configuration/guide/scg3750/swcdp.html

Customer Feedback

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