



# DT01 WiFi/3G VoIP PBX / ATA User Manual

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# 1 Introduction

# 1.1 What is DT01

The DT01 is an Open Source appliance designed for VoIP application. DT01 has built-in Asterisk software and have a FXS port to connect normal phone. DT01 has a friendly Web UI, user can configure the DT01 to work as a VoIP ATA or PBX through the web browser easily.

DT01 has two RJ45 port, a WiFi 802.11 b/g/n interface and a USB port host port to provide flexible network connection via LAN cable/ wifi or 3G/4G network.

DT01 is fully open source, user can modify the inside Linux system or compile a firmware for their customized applications.

The goal for DT01 is to fulfill VoIP requirement on dedicate application or installations.

# 1.2 Specifications

#### Hardware System:

- Processor: 400MHz, 24K MIPS
- ➢ 64MB RAM
- 16MB Flash
- DC Input: 9 ~ 12v or 5V

### Interface:

- > 1 x FXS port
- > 2 x RJ45 ports
- USB 2.0 Host port to connect 3G dongle or USB flash

#### WiFi Spec:

- ➢ IEEE 802.11b/g/n
- Frenquency Band: 2.4 ~ 2.462GHz
- Chip Antenna or External antenna

### 1.3 Features

- ✓ Open Source OpenWrt system
- ✓ Asterisk 1.8.10
- ✓ Support SIP / IAX2 server/client.
- ✓ Support multiply SIP / IAX2 entries
- ✓ Easy configure SIP/IAX2/dial-plan in Web UI
- ✓ Managed by Web GUI or SSH
- ✓ Firmware upgrade via Web

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- ✓ Support WiFi AP, Client or Ad-Hoc(Mesh) mode
- ✓ Optional external antenna for long distance connection
- ✓ Support USB dongle for 3G/4G dial up
- ✓ Support USB flash for extend storage



# 2 Access DT01

#### 2.1 Overview

DT01 has two separate RJ45 ports and a WiFi Interface. They have different IP addresses, user can use either of them to access the DT01 and configure it via Web or SSH.

# 2.2 Find the ip addresses

## Factory IP of WiFi port

当前连接到:	* <u>*</u> ^
Pragino-A84041136FFC Internet 访问	
<b>未识别的网络</b> 无网络访问	E
拨号和 VPN	^
宽带连接	<ul> <li>■</li> </ul>
USB-KEY DIAL	
WCDMA	
无线网络连接	^
Dragino-A84041136FFC 已连接	311
TP-LINK-edwin	- III.
打开网络和共享中心	
	20:58
100%] 🕞 🔺 📲 🗒	2014/7/2

At the first boot of Yun Shield, it will auto generate an secure WiFi network call *Dragino2-xxxxx*. The WiFi password is *dragino-dragino* by default

User can use their laptop to join this WiFi network. The laptop will get an IP 10.130.1.xxx and the DT01 has the default IP 10.130.1.1

### Fall Back IP

17%				
如果网络支持此功能,则可以紊 您需要从网络系统管理员处获得	获取自动指派的 导适当的 IP 设置	IP 设 to	置。否	Ŋ,
◎ 自动获得 IP 地址(0)				
● 使用下面的 IP 地址(S):				
IP 地址(I):	172 . 31	. 255	. 253	
子网摘码(U):	255 . 255	. 255	. 252	
默认网关 (0):	) 22	8	.8	
● 白动获得 NMS 服务哭他们	F (B)			
● 使用下面的 DMS 服务器地	<u>}址(E):</u>			
首选 DNS 服务器(P):	1 1	98) -	-	
备用 DNS 服务器(A):		81	64	
同辺中心に沿異ない			宣织 û	n

A fall back IP 172.31.255.254/255.255.255.252 is assigned to DT01's LAN port so user can always access DT01 with this ip if their laptop has the IP 172.31.255.253/255.255.255.252.



# 2.3 Configure Method

The DT01 runs Open Source Linux system. If user has a PC at the same network as DT01, user can access its system via either Web Interface or Secure Shell (SSH).

## 2.3.1 Access via browser

The recommended browsers to configure DT01 are **Firefox** and **Chrome**. Simply type the IP address into your browser and you will see the log in page of DT01.

🖉 dragino2-64bf28 - LuCI 🗙 📃	Conception of the Research Conception of the later
← → C 🗋 192.168.2.108/cgi-bin/luci/admin	
8 Google 搜索	
dragino2-64bf28	
Authorization Re Please enter your username and p	quired password.
Username	root default: root
Password	default: dragino
🖸 Login 🔞 Reset	
DRAGINO TECHNOLOGY CO., LI	IMITED

Default Web Login:

User name: root Password: dragino

### 2.3.2 Access via SSH

Via SSH access, user can access to the Linux system directly and customized the system to support more features and applications.





# 3 Typical Network Setup

User can configure DT01 to meet different network requirement. This chapter lists some typical network setup. Device are not limited to the network set up shows below, user can configure more advance network modes via the OpenWrt Linux system.

# 3.1 Connect Internet via WAN port

This is the default connection mode. System works like below:



# Set Up in Web UI:

- Internet Access
   Access Internet via WAN port
- LAN and DHCP:

Enable DHCP server in its LAN port

Access Point(optional)
 Enable WiFi AP
 Input SSID/ Encryption/ Passphrase

# ✓ Mesh Network

Disable WiFi Mesh Network



# 3.2 Connect Internet via WiFi Client mode



# Set Up in Web UI:

✓ Internet Access

Access Internet via WiFi Client

Way to Get IP: DHCP

Input correct SSID, Password and Encryption.

#### ✓ LAN and DHCP

Enable DHCP server in its LAN port

- Access Point
   Disable WiFi AP
- ✓ Mesh Network

Disable WiFi Mesh Network



# 3.3 Connect Internet via USB dongle, 3G/4G/GPRS



## Set Up in Web UI:

- Internet Access
   Access Internet via USB Modem
- LAN and DHCP:
   Enable DHCP server in its LAN port
- Access Point(optional)
   Enable WiFi AP
   Input SSID/ Encryption/ Passphrase
- Mesh Network
   Disable WiFi Mesh Network

Below are USB 3G modem set up example:



# Service 3G WCDMA

Provider: China Unicom

dragino2-3ccaef Ne	
USB Modem Setting	
USB Modem	Manufacturer:HUAWEI Technology, Vendor ID:12d1, Product ID:1436 Auto Detect USB Devices
Modern Status	inet addr:10.72.101.23 P-t-P:10.64.64.64 Mask:255.255.255.255 Connection Status
Available USB Port	/dev/ttyUSB1/dev/ttyUSB2/dev/ttyUSB3/dev/ttyUSB4 A modern is always detected to have several USB port for different features
USB Modem Service	UMTS 3G WCDMA
VID	12d1 Vendor ID as shown in USB info section
PID	1436 Product ID as shown in USB info section
Service APN	3gnet Service APN. 3gnet is for China Unicom
Dial String	*99# Dial String, Default *99#
Username	Leave blank if no provided by your provider
Password	Leave blank if no provided by your provider
PIN	Leave blank if no provided by your provider
USB Serial Port	ttyUSB1 The USB port of your dongle used for Dial Up.

# Service: 3G EV-DO Provider: China Telecom

dragino2-3ccaef st	atus ≠ System ≠ Sensor ≠ Network ≠ Logou	ıt
USB Modem Setting	3G EV-DO dial up example : Provider: China Telecom 3G USB Dongle: ZTE AC582	
USB Modem	Manufacturer:ZTE, Vendor ID:19d2, Product ID:0152	
Modem Status		
Available USB Port	/dev/ttyUSB0 /dev/ttyUSB1 /dev/ttyUSB2 /dev/ttyUSB	B3 /dev/ttyUSB4
USB Modem Service	EV-DO Ch	oose EV-DO
VID	19d2	USB dongle VID
PID	0152 Input	USB dongle PID
Service APN		
Dial String	#777 Dial Stri	ng for Chinatelecom
Username	ctnet@mycdma.cn	User Name
Password		Password
PIN		
USB Serial Port	ttyUSB0 Choose	USB Serial Port for 3G
		Save & Apply



## 3.4 Set up WiFi mesh network

**Brief**: in this network topology, user should choose the device to be a mesh gateway node or mesh client node

- Mesh Gateway: use WAN port or USB 3G to get internet access from uplink router. It also shares the internet to its Mesh Network for other Mesh Clients. The Mesh Gateway also acts as a DHCP router for its mesh network.
- Mesh Client: Connects to the Mesh Gateway via mesh WiFi, it also bridge internet via the LAN and WiFi AP interface.

#### A mesh network with DT01.



#### 3.4.1 Mesh Gateway Set Up via Web UI

✓ Internet Access

Access Internet via WAN port or USB Modem

✓ LAN and DHCP

Enable DHCP server in its LAN port

- Access Point
   Enable WiFi AP
  - Mesh Network Enable WiFi Mesh Network Mesh Mode: SERVER



BSSID: 02:CA:FF:EE:BA:BB //Note: (1) BSSID should start with 02: ; (2) Mesh Device with different BSSID can't communicate with each other.

## 3.4.2 Mesh Client Set Up via Web UI

Internet Access
 Access Internet via Mesh WiFi

### ✓ LAN and DHCP

Disable DHCP server in its LAN port

### ✓ Access Point

Enable WiFi AP (can use same SSID or difference SSID with other mesh node)

### ✓ Mesh Network

Enable WiFi Mesh Network Mesh Mode: CLIENT BSSID: 02:CA:FF:EE:BA:BB //Note: (1) BSSID should start with 02:; (2) Mesh Device with different BSSID can't communicate with each other.

Note: Mesh set up need to reboot to take effect.



## 4 VoIP Settings

User can configure the VoIP settings in the Web UI or configure Asterisk advance settings via SSH access to the DT01.

### 4.1 Overview

This page shows the servers register status.



# 4.2 General Settings

Define the general info for Asterisk

🕼 dragino2-64bf28 - Gene 🗙 📃								
← → C 🗋 192.168.2.108/cgi-bin/luci/;stok=b56441f50972a09c0e0597d44a148393/admin/voip/general 🛱 😡 🗉								
<mark>8</mark> Google 搜索								
dragino2-64bf28 Sta	atus - System - VolP -	Network - Logout						
Voice Over IP								
General Settings								
Enable VolP	Image: Compare the service in the service is a service in the service in the service is a service in the service in the service is a service in the service in the service in the service is a service in the service in the service is a service in the se	Disable VoIP, Asterisk won't run						
Enable NAT	Image:	NAT infomation						
External IP	0.0.0.0							
Extension Prefix	8	Define the extension info while use						
Num of Extension Digits	4	the DT01 as a VolP server						
Audio Settings								
Codec 1	gsm	✓ Codec Settings						
Codec 2	ulaw	T						
Codec 3	alaw	•						



# 4.3 VoIP Server Settings

This page defines how DT01 connect to VoIP services.

Ø dragino2-64bf28 - Serv ×										
← → C 🗋 192.10	► → C 🗋 192.168.2.108/cgi-bin/luci/;stok=b56441f50972a09c0e0597d44a148393/admin/voip/servers 🎲 🖸 🗄									
Google 搜索										
dragino2-64bt	<b>128</b> Status <del>-</del> System <del>-</del>									
SIP / IAX2 Servers Configure SIP / IAX2	servers overviev	N								
Server	Register to Server	Host	User Name	Protocol						
voipbuster	Enabled	sip.voipbuster.com	dragino	sip	Z Edit	E Delete				
sip.51dyt.com	Enabled	sip.51dyt.com	15989561612	sip	Z Edit	× Delete				
Add	Add new provider inf	o		Edit current service	/ Save	Reset				

# Configure each SIP/IAX2 service entry.

G dragino2-64bf28 - LuCI ×			a provide contraction of them in	manual mark	
← → C  192.168 2 108/c	ai-bin/luci/:stok=b56441f50	972a09c0	e0597d44a148393/admin/voin/	servers/server/cfa0	5769c s^z 📵 🗉
8 Google 搜索	g. 511,140,750 K 000111100	0,2400000		server, ergo.	
dragino2-64bf28 Sta	itus <del>-</del> Svstem - VolP - Netv	vork – Lo	qout		
	-,				
Configure SIP / IAX2 S	Server				
Server Name	voipbuster	┥	local identify for this service, use in the dial rule setting		
	Ose for identical locally				
Enable Register	Image: Contract of the second seco		b101 won't send register into to the server if disable here.		
Protocol	SIP				
1100001					
Host	sip.voipbuster.com				
Register Port	5060				
Ŭ					
From Domain	sip.voipbuster.com		SIP or IAX2 server settings		
User Name	dragino				
		ן ר			
Password	•••••	2			
From User Name	dragino				
🖷 Ba	ack to Overview		Sav	ve & Apply Save	Reset



# 4.4 VoIP Clients

DT01 can act as a SIP/IAX2 server. This page defines the clients' info.

	0.41.700				
Iragino2	-64bf28 Status -	System - VolP - Netwo	rk <del>~</del> Logout		
/oice (	Over IP				
/oIP Clie	ents				
onfigure SIF	P / IAX2 / Analog Clients				
User	Phone Number	Туре			
8000	8000	Analog Ph	Analog phone: u	ise FXS port	Z Edit 🗴 Delete
8001	8001	Soft Phon	e Soft Phone: SIP of	r IAX2 protocol	Edit Delete
📩 Add	ac	dd a new client		Edit the client entry	1
				Save & App	ly Save Reset
t Entr	<i>.</i> .				
nt Entry ino2-64b	<b>/:</b> bf28 Status <del>-</del> Svst	em ▼ VolP ▼ Network ▼	Logout		UNSAVED CHANGES: 1
nt Entry ino2-64k	/: bf28 Status → Syst	em + VolP + Network +	Logout		UNSAVED CHANGES: 1
nt Entry ino2-648 <b>ce Ove</b>	/: of28 Status - Syst er IP	em ▼ _ VolP ▼ _ Network ▼ _	Logout		UN SAVED CHANGES: 1
nt Entry ino2-64t <b>ce Ove</b> igure Cli	/: of28 Status - Syst er IP ients	em ▼ VolP ▼ Network ▼	Logout		UNSAVED CHANGES: 1
nt Entry ino2-64 ce Ove igure Cli	/: of28 Status - Syst er IP ients User Name 8002	em + VolP + Network +	Logout		UNSAVED CHANGES: 1
nt Entry ino2-648 <b>ce Ove</b> igure Cli	/: of28 Status - Syst er IP ients User Name 8002 Password 8002	em ≠ VolP ▼ Network ▼	Logout		UNSAVED CHANGES: 1
nt Entry ino2-64 ce Ove	/: of28 Status - Syst er IP ients User Name 8002 Password 8002 000 8002	em - VolP - Network -	Logout		UNSAVED CHANGES: 1
nt Entry ino2-64 ce Ove igure Cli Ph	/: of28 Status - Syst er IP ients User Name 8002 Password 8002 ione Number 8002	em • VolP • Network •	Logout		UNSAVED CHANGES: 1
nt Entry ino2-64 ce Ove igure Cli Ph Ext	/: of28 Status - Syst er IP ients User Name 8002 Password 8002 one Number 8002 iension Type Soft Phone	em • VoIP • Network • / IP Phone •	Logout		UNSAVED CHANGES: 1



# 4.5 Dial Plan

Here configure how to make calls via the service provide.

dragino2-64bf28 - Dial 🗙 🛴					
→ C 192.168.2.10	8/cgi-bin/luci/;stok=b	56441f50972a09c0e	0597d44a14	8393/admin/voip/dial_r	ules ☆ G
oogle 搜索					
dragino2-64bf28					
Dial Plan					
Dial Rules Modify outgoing number befo	re sending to trunk				
Pattern Prefix	Sub-num Offset	Sub-num Length	Suffix	Use Trunk	
_9. 86				voipbuster	Edit Delete
Add add	a new dial rule			Edit current dial rule	
				Save & Ap	pply Save Reset
🕼 dragino2-64bf28 - LuCI >		_	-		
← → C 🗋 192.168.2	2.108/cgi-bin/luci/;stok	=b56441f50972a09c	0e0597d44a1	.48393/admin/voip/dial_	_rules/dial_rule/cfg02:숬 G
8 Google 搜索					
P Do you want Google	e Chrome to save your p	bassword? Save pas	sword	er for this site	
dragino2-64bf28					
Configure Dial R	ule				
Match F	_9.		number match	this pattern will use this dia	al rule
Add	Prefix 86 Ø Add a prefix to the	he dial string	add a pi	efix on the final dial string	
Sub-number	Offset Ø position start fro	m 0 .	capture part string. The sub	of the dial number as the o	dial
Sub-number	Length			and length.	
Ado	Suffix 🕜 Add a suffix to ti	he dial string	add a	suffix on the final string	
Use	Trunk voipbuster	•		dial via this trunk	
VolP P	rotocol	T	VolP p	rotocol for the used trunk	
	Back to Overview			Save & A	Apply Save Reset

## **Definition of dial rule entry:**

Match Pattern: Define what number will use this dial rule. Same the extension pattern defined in Asterisk, it can be a complete number or a pattern.

If extension name starts with '\_', it is consider as pattern.

When use the pattern, some characters have special meaning:

- X any digit from 0-9
- Z any digit from 1-9
- N any digit from 2-9
- [12679] any digit in the brakets (in the example: 1,2,6,7,9)
- -.- (dot) wildcard, matches everything remaining

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( \_1234. - matches anything starting with 1234 excluding 1234 itself).

Note: Do not use '\_.', because it will match everything even the predefined extensions!!! Example:

\_359ZXXXXXX - This will match all dialed numbers that start with 359, and are 10 digits long( including 359)

\_0XXX. - This will match all dialed numbers that begin with 0 and are minimum 5 digits long (including 0)

## > Sub Number Offset, Sub Number Length

These two setting is used to get a sub-number from the dialed number and use this sub-number as the number dial to the VoIP provider.

The **offset** tells the position to get the sub-number and the **length** tells the length of this sub-number. If **Length** is blank, the sub-number will be the number from the offset to the end of dialed number.

Example:

If the dialed number is 9123456, while:

Offset is 0, length is 4.  $\rightarrow$  the real outgoing number 9123 Offset is 1, length is blank  $\rightarrow$  the real outgoing number is 123456

## Add Prefix, Suffix

Add prefix or suffix to the real outgoing number.

### > Use trunk

Select the VoIP service provider to send the outgoing call.

### > VoIP Protocol

The dial out voip protocol , SIP or IAX2.



#### 5 VoIP Set up example:

# 5.1 Configure as SIP ATA

This is the most normal configuration for DT01, the structure is as below:



Below is the configure example for Voipbuster service:

### Step 1: Input Service Provider info

dragino2-64bf28 St			UNSAVED CHANGES: 2
Configure Server	r		
Configure SIP / IAX2 S	Server		
Server Name	sip.voipbuster.com  Use for identical locally		
Enable Register	🗵 🍘 Enable Register to Server		
Protocol	SIP		
Host	sip.voipbuster.com		
Register Port	5060		
From Domain	sip.voipbuster.com		
User Name	dragino		
Password		8	
From User Name	dragino		
e Ba	ack to Overview		Save & Apply Save Reset

# Step 2: Configure Dial Plan

Dial Rule Entry		
Configure Dial Rule		
Match Pattern	_9.	All number start with 9 will use this rule
Add Prefix		
Sub-number Offset	Add a prefix to the dial string     1     position start from 0	The first digit (9) will be cut off, rest digits will be sent out as the dial
Sub-number Length		
Add Suffix	Add a suffix to the dial string	
Use Trunk	sip.voipbuster.com	Dial via voipbuster and use SIP
VoIP Protocol	SIP	protocol.

After above configure, user will be able to use the normal phone to dial out via VoIP Buster.



## 5.2 Configure as SIP server

In this application, DT01 connect to SIP provider like section 5.1. Besides that, DT01 also acts as a SIP server. So softphones or IP phones can register to DT01 and make outbound calls via DT01's trunks.

Structure is as below:



User can add clients via the VoIP  $\rightarrow$  Clients page. VoIP client uses the type <u>soft phone</u> while create.

dragino2-6	4bf28 Status -	System -	VolP • Network •	Logout			
Voice Ov	ver IP						
VoIP Client	S IAX2 / Analog Clients						
User	Phone Number		Туре				
6000	6000		Analog Phone			Z Edit	× Delete
6001	6001		Soft Phone			Z Edit	× Delete
6002	6002		Soft Phone			Z Edit	E Delete
Mdd 🔝							
					Save & A	oply Save	Reset



# 5.3 Link two DT01s via IAX2 protocol.

Two DT01 can link to each other so extension behind them looks like in the same office and calls between all extensions are free.



Set up example:

#### Step 1:

- Create a softphone client 8003 in DT01 #1,
- create a softphone client 6003 in DT01 #2

### Step 2: In DT01 #1:

- ▶ In VoIP → Servers, set up an IAX2 account to register to **DT01 #2's** account 6003.
- ▶ In VoIP → Dial Plan, create a dial rule with below info:
  - ♦ Match Pattern: \_6.
  - ♦ Use Trunk: Select DT01 #2 trunk
  - ♦ Protocl: IAX2

### Step 3: In DT01 #2:

- ▶ In VoIP → Servers, set up an IAX2 account to register to **DT01 #1's** account 8003.
- > In VoIP  $\rightarrow$  Dial Plan, create a dial rule with below info:
  - ♦ Match Pattern: \_8.
  - ♦ Use Trunk: Select DT01 #1 trunk
  - ♦ Protocl: IAX2

After above configure, all the extensions in DT01 #1 (8xxx) is able to reach the DT01 #2 extensions (6xxx) by simple dial the number 6xxx. Inverse for 6xxx to call to 8xxx.



## 6 Upgrade Firmware

User can upgrade the firmware of DT01 for new features or bugs fix. Below are the method to upgrade via Web UI, there are more other upgrade methods can refer: <u>Upgrade DT01 firmware</u>

#### Upgrade via Web UI:

Goto Web UI  $\rightarrow$  System  $\rightarrow$  Flash Firmware: Choose the xxx--squashfs-sysupgrade.bin image and process update:

dragino2-b56fe7 st	
Backup / Restore	
Click "Generate archive" to down squashfs images).	load a tar archive of the current configuration files. To reset the firmware to its initial state, click "Perform reset" (only possible
Download backup:	I Generate archive
Reset to defaults:	Perform reset
To restore configuration files, you	r can upload a previously generated backup archive here.
Restore backup:	jjg.··· 未选择文件。 III Upload archive
Flash new firmware in	nage
Upload a sysupgrade-compatible compatible firmware image).	image here to replace the running firmware. Check "Keep settings" to retain the current configuration (requires an OpenWrt
Keep settings:	



# 7 FAQ

# 7.1 How to get long distance WiFi range?

The DT01 are equipped with chip antenna by default this antenna is mainly for indoor use and have a range 20~50 meters depends on the real environment. It is possible to change the DT01 to use a high gain (15dB etc) external antenna to reach a long distance range in WiFi.

The change can be done via the instruction from this link: <u>Change the resistor to use external antenna</u>.

# 7.2 How to reset DT01 to factory default?

User can go to the configure page: system  $\rightarrow$  flash firmware to reset the device to factory default.

## 7.3 How to recover DT01 if firmware crash?

In case the device is power off during a firmware upgrade which causes it can't boot or access. User is still able to recover the device by the web failsafe mode, by below procedures:

#### **Recover Procedure:**

- Use a RJ45 cable to connect the PC to DT01's Ethernet port directly.
- Set the PC to ip 192.168.255.x, netmask 255.255.255.0
- Pressing the toggle button and power on the DT01
- > All LEDs of the DT01 will start blink, release the toggle button after four blinking.
- Then all LEDs will blink very fast, this means device detect a network connection and DT01 is in the web-failsafe mode. Your PC should be able to ping 192.168.255.1 after device enter this mode.
- Open 192.168.255.1 in web browser.
- Select a squashfs-sysupgrade type firmware and update firmware.



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# 8 Reference

- ♦ DT01 firmware link: <u>http://www.dragino.com/downloads/downloads/DT01/Firmware/</u>
- ♦ MS14 (mother board for DT01) Official wiki
   <u>http://wiki.dragino.com/index.php?title=IoT\_Mesh\_Firmware\_User\_Manual</u>
- OpenWrt official website: <u>http://www.openwrt.org/</u>
- ♦ Asterisk official site <u>http://www.asterisk.org/</u>
- ☆ Things about Asterisk. <u>http://www.voip-info.org/wiki/view/Asterisk</u>