Expanding Possibilities...

BUILDING YOUR OWN FREE HOME PHONE SYSTEM WITH MIKROTIK

By

Haytham Aboulabbas Mohamed

Senior IT/Telecommunications Engineer – Petroleum Pipelines Company (PPC)

MUM Egypt, Cairo, 29th January, 2019

OVERVIEW

1. Hardware & Software Used In This Presentation.
2. What Is MetaROUTER?
3. How To Install MetaROUTER In Mikrotik RouterBOARD?
4. How To Install Asterisk 1.8 With GUI?
5. Basic Asterisk Server Configuration:
    a. SIP Extension Configuration.
    b. Register Your PC / Android Mobile Phone With Asterisk.
    c. Register Analog Telephone Adapter (ATA) With Asterisk.
6. What Is Next?
    a. Send/Receive Calls Using Your Asterisk Server While You Are Anywhere Across The Globe!
    b. Connecting Two Asterisk Servers Together Via SIP Trunk.
    c. Does Your Mikrotik Need To Have A Static IP Address?
    d. Can We Use A Broadband USB Modem For Internet Connection?
    e. Why Not Integrate Your Asterisk Server With Your Existing Business Telecommunication Systems?!
    f. Can We Make Outbound Calls To PSTN Using Our Asterisk Server?

1. HARDWARE & SOFTWARE USED IN THIS PRESENTATION

RB951Ui-2HnD	
Architecture	MIPSBE
CPU	AR9344
CPU core count	1
CPU nominal frequency	600 MHz
Operating System	RouterOS (version = 6.43.2)
Size of RAM	128 MB
Storage size	128 MB
Storage type	NAND

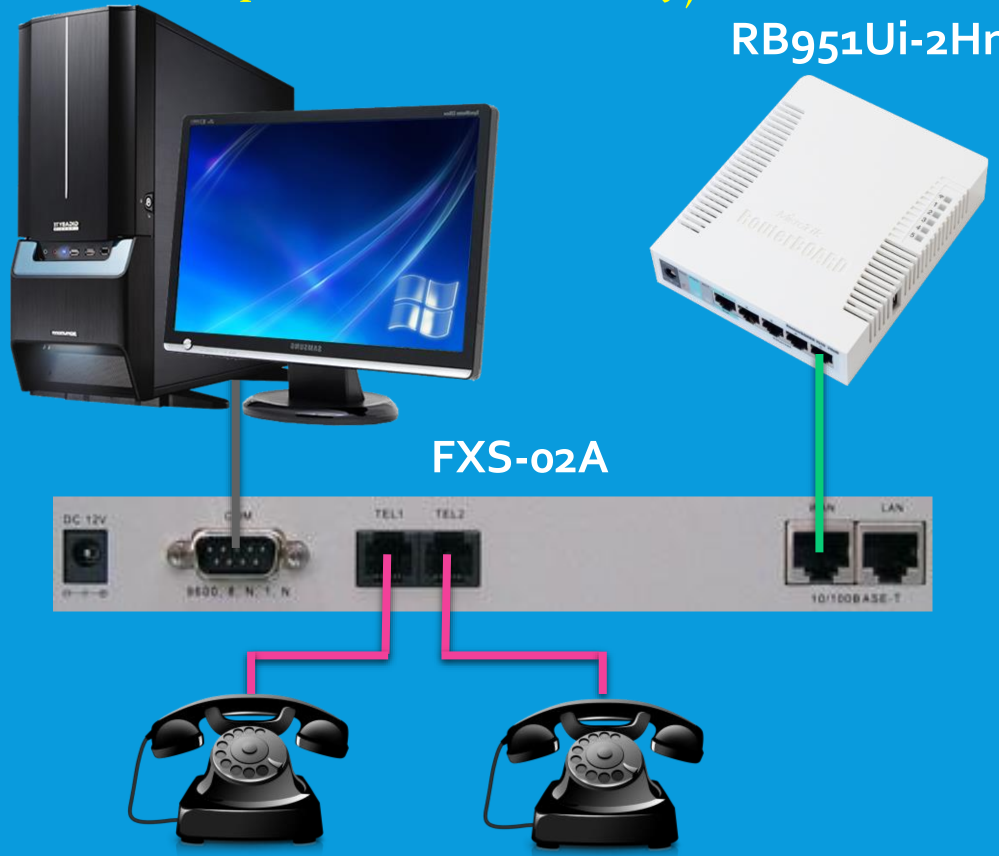
1. HARDWARE & SOFTWARE USED IN THIS PRESENTATION (CONTINUED...)

VoIP Gateways with 2 FXS ports (SIP)

PC
(for initial setup of FXS VoIP Gateway)

RB951Ui-2HnD

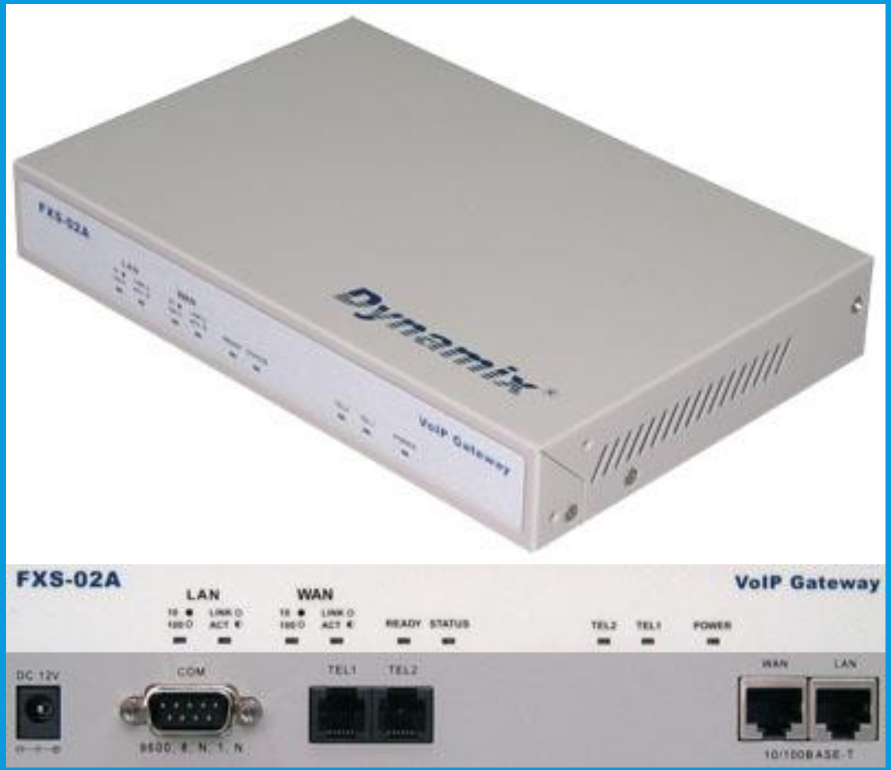
FXS-02A



Ethernet Cable

Telephone Cable

Serial Cable



1. HARDWARE & SOFTWARE USED IN THIS PRESENTATION (CONTINUED…)

Free VoIP SIP Softphone Application for PC

X-Lite

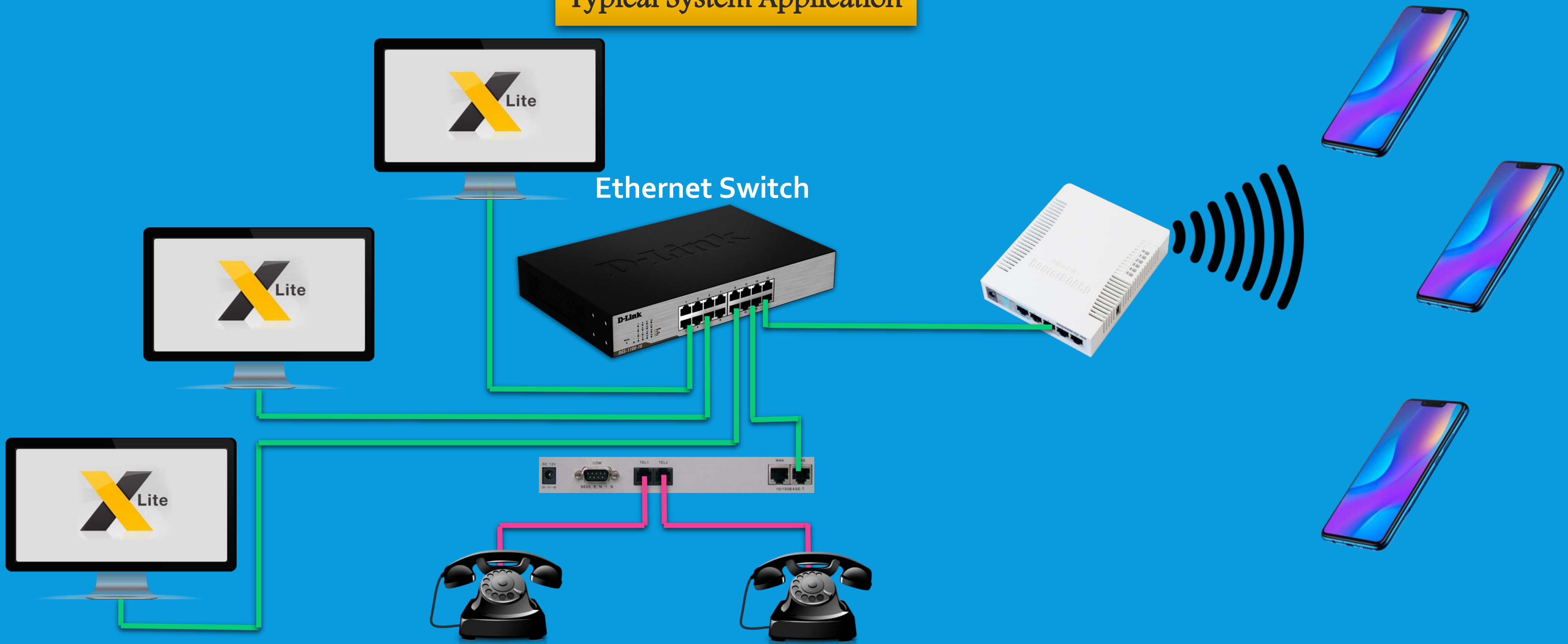
Download Link: https://www.counterpath.com/XLiteForWindows

Free VoIP SIP Softphone Application for Android

Download Link: https://play.google.com/store/apps/details?id=com.csipsimple

1. HARDWARE & SOFTWARE USED IN THIS PRESENTATION (CONTINUED…)

Typical System Application



2. WHAT IS METAROUTER?

- **MetaROUTER** is a way to have logical routers running on your existing **RouterBOARD.**
  - **Since v3.21 support for MetaROUTER on mipsbe platform,**
  - **Since v3.26 support for MetaROUTER on PPC (RB1000).**
- Virtual environment allows user to partition system into different administrative domains.
- Able to run either RouterOS or OpenWRT patched Linux.
- Each RouterOS instance requires **at least** 16MB Ram, 32MB Ram recommended.
- Commonly deployed for customer administered router (RouterOS) or running specific simple task without need of dedicated server (Squid proxy, **Asterisk PBX**, Apache webserver).
- Currently MetaROUTER can be used on:
  - **RB400, RB700 series** except models with SPI flash, **RB900 series** except models with SPI flash, **RB2011** boards.
  - Listed PPC boards: **RB1000, RB1100, RB1100AH** and **RB800.**

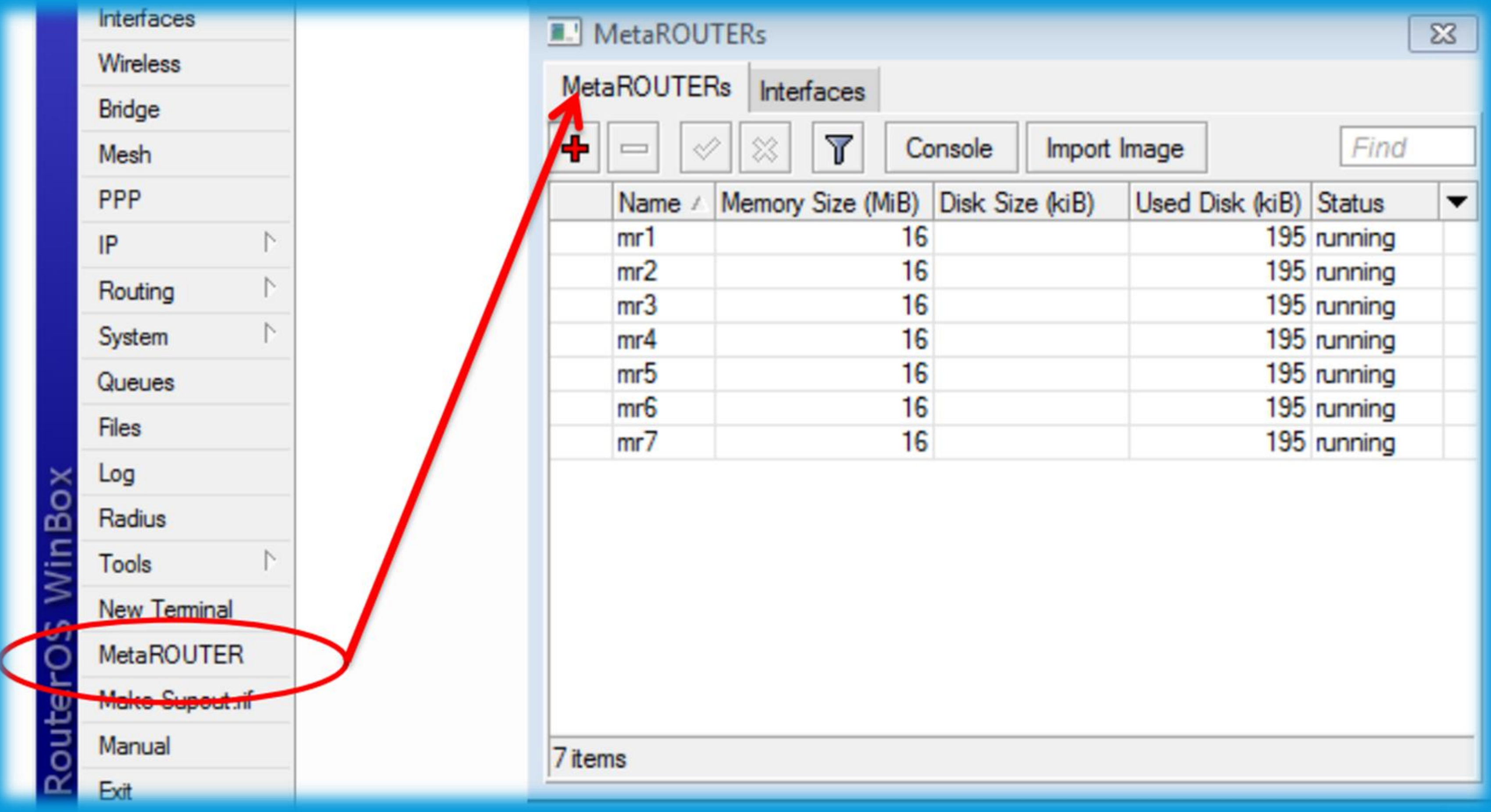
2. WHAT IS METAROUTER?

(CONTINUED…)

- <u>**MetaROUTER Limitations & Faults**</u>:
  - Only 8 instances per RouterBOARD.
  - No CF or microSD devices can be used for running images.
  - No ability to export running virtual image back into a file.
  - OpenWRT on MetaROUTER won't properly shutdown when RouterOS reboots.
  - Limited by available Ram (256MB 450G).
  - No ability to monitor running states with Dude Server.
  - Host Router on occasion reboots with watchdog timeout error (V3.28)

3. HOW TO INSTALL METAROUTER IN MIKROTIK ROUTERBOARD?

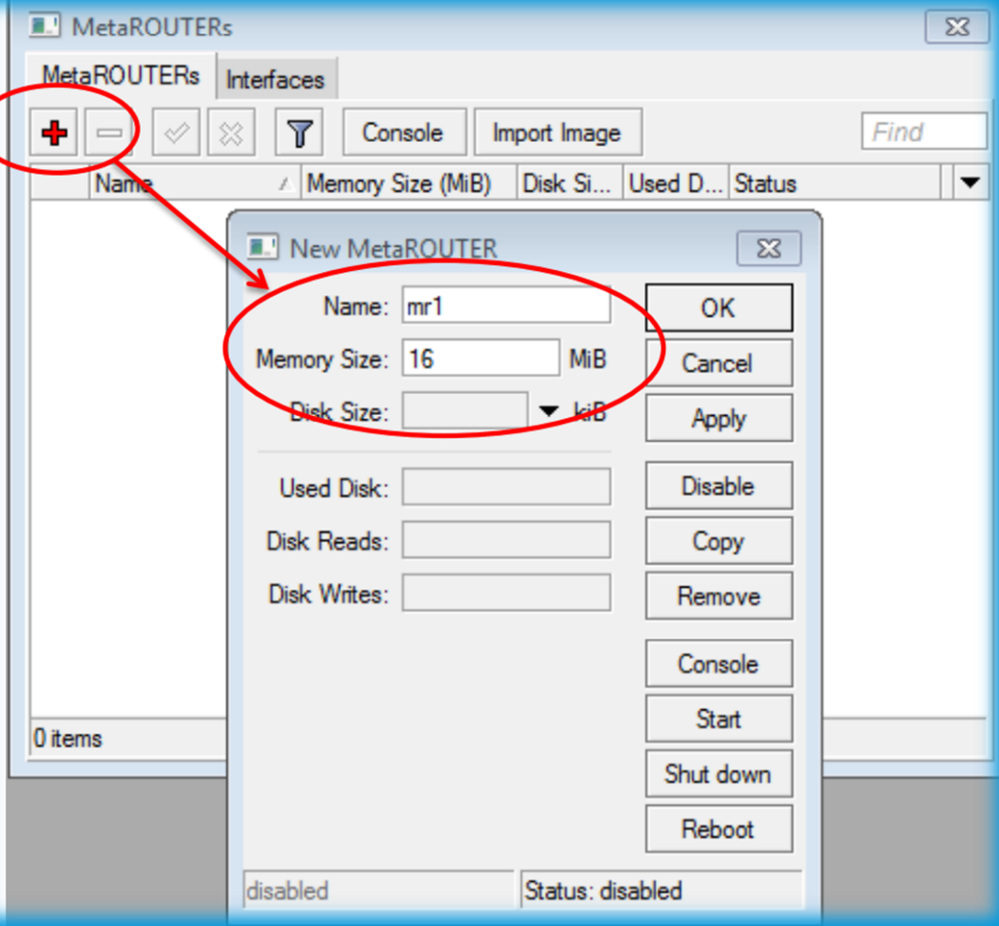
➢ The MetaROUTER Winbox Interface



3. HOW TO INSTALL METAROUTER IN MIKROTIK ROUTERBOARD?

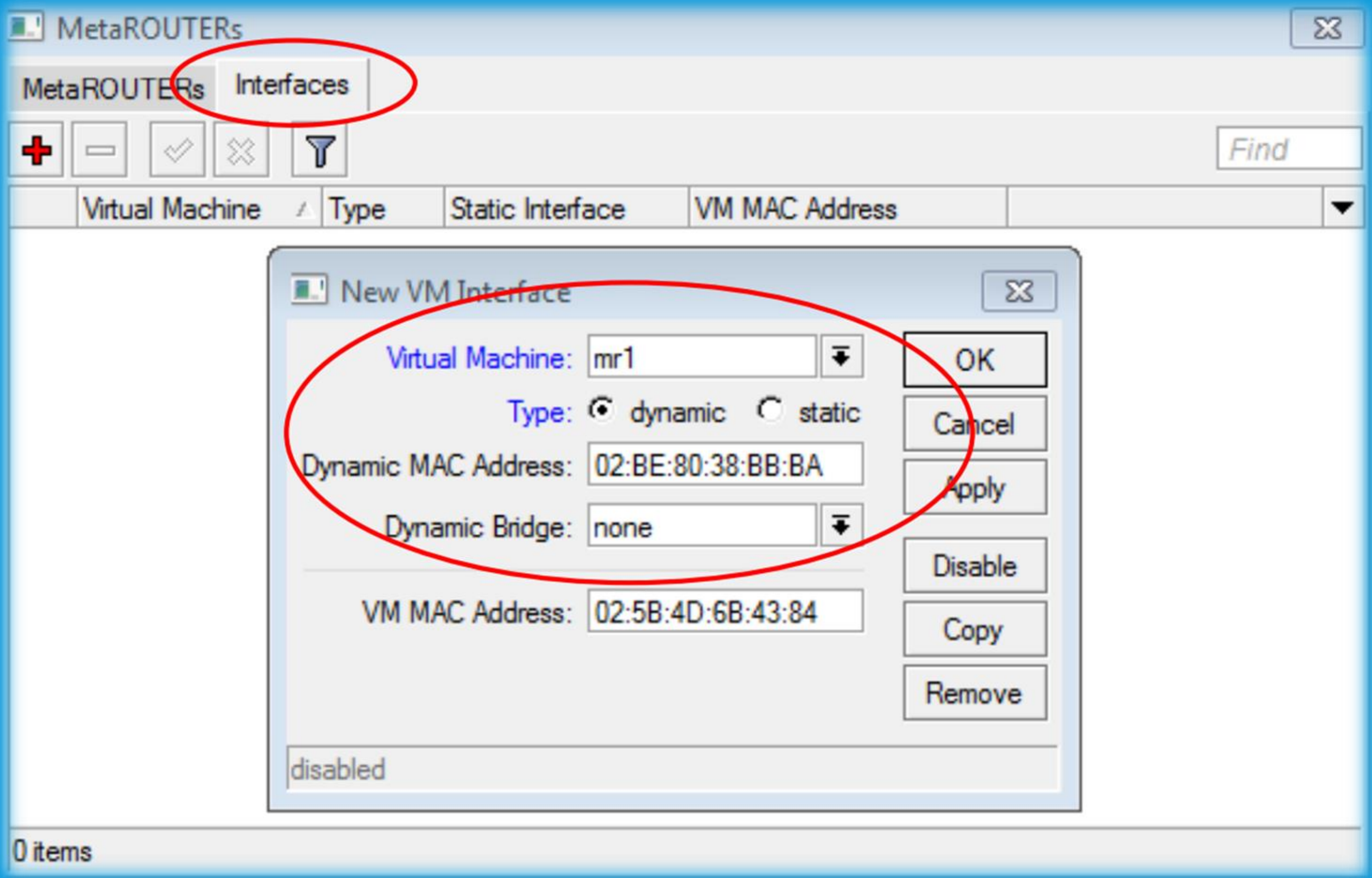
(CONTINUED…)

- **Creating a MetaROUTER**



3. HOW TO INSTALL METAROUTER IN MIKROTIK ROUTERBOARD? (CONTINUED…)

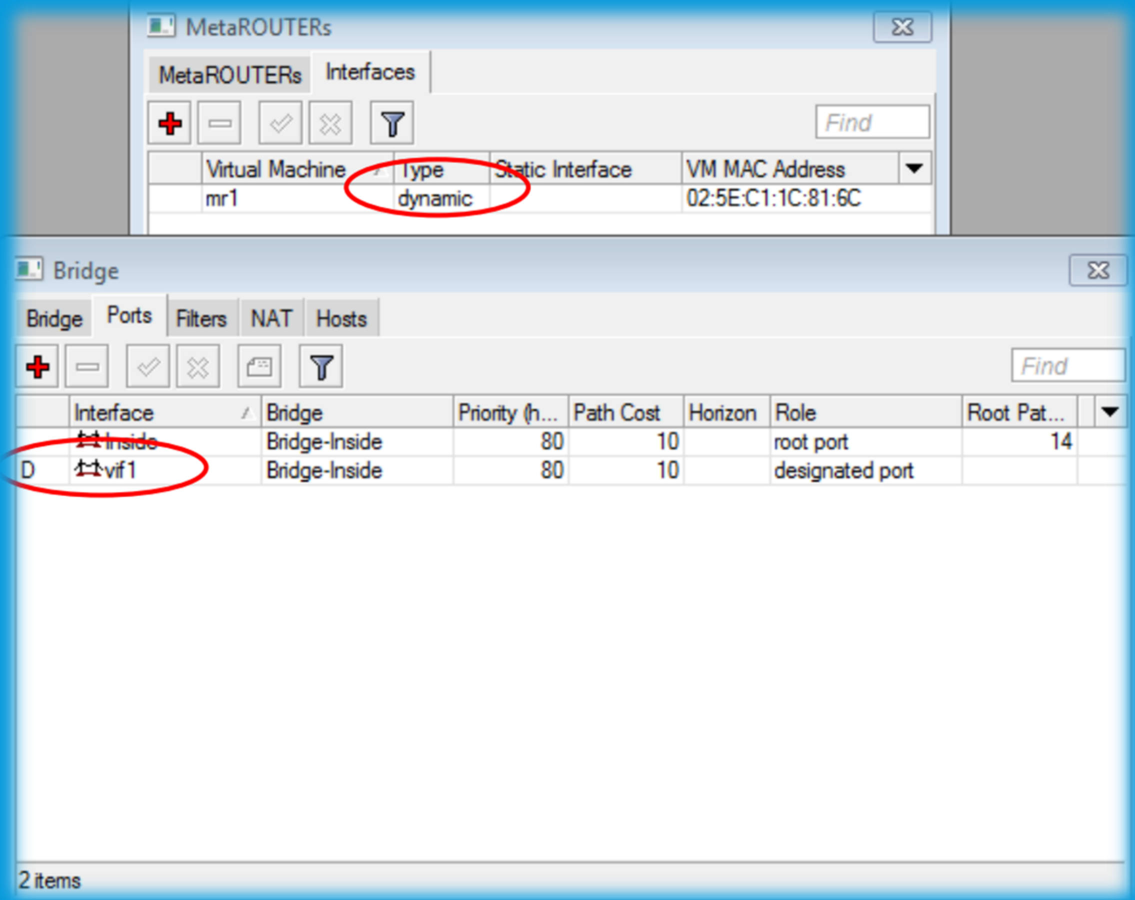
➢ Dynamic Interface Creation



3. HOW TO INSTALL METAROUTER IN MIKROTIK ROUTERBOARD?

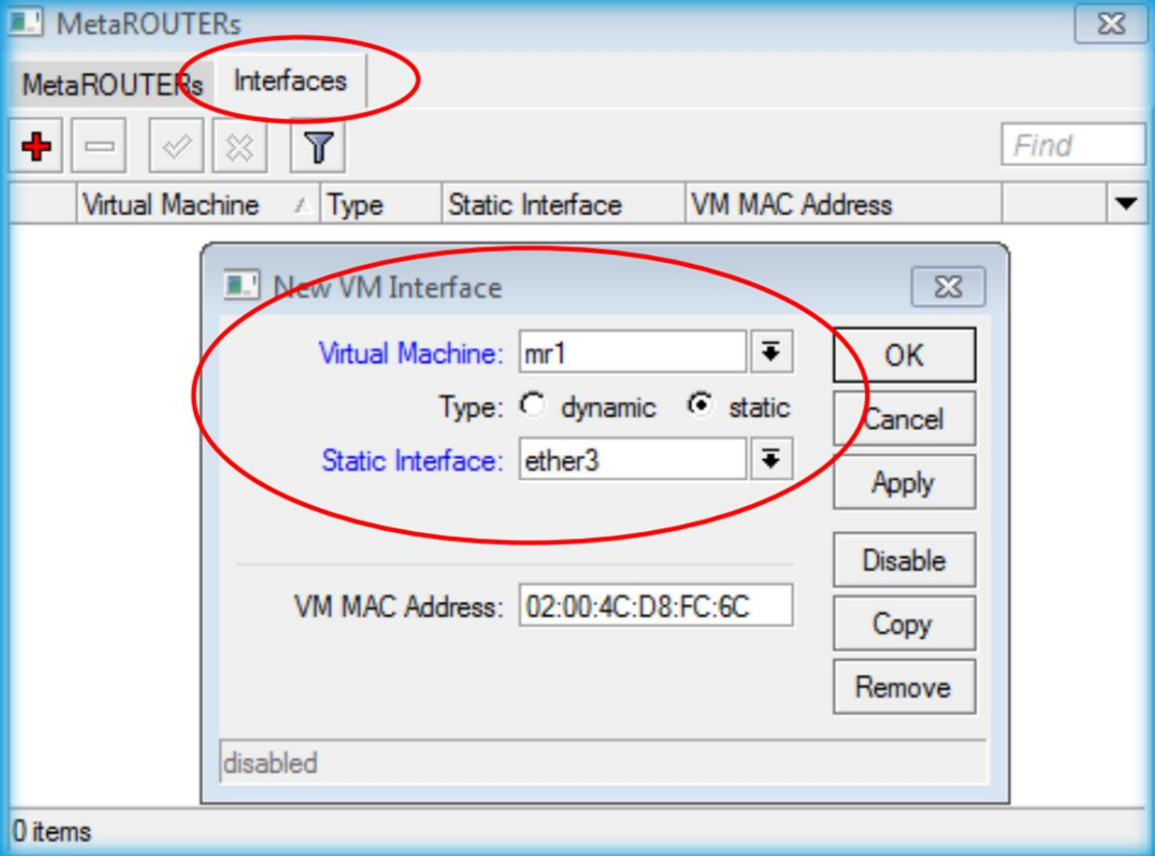
(CONTINUED…)

➢ Dynamic VIF Interface



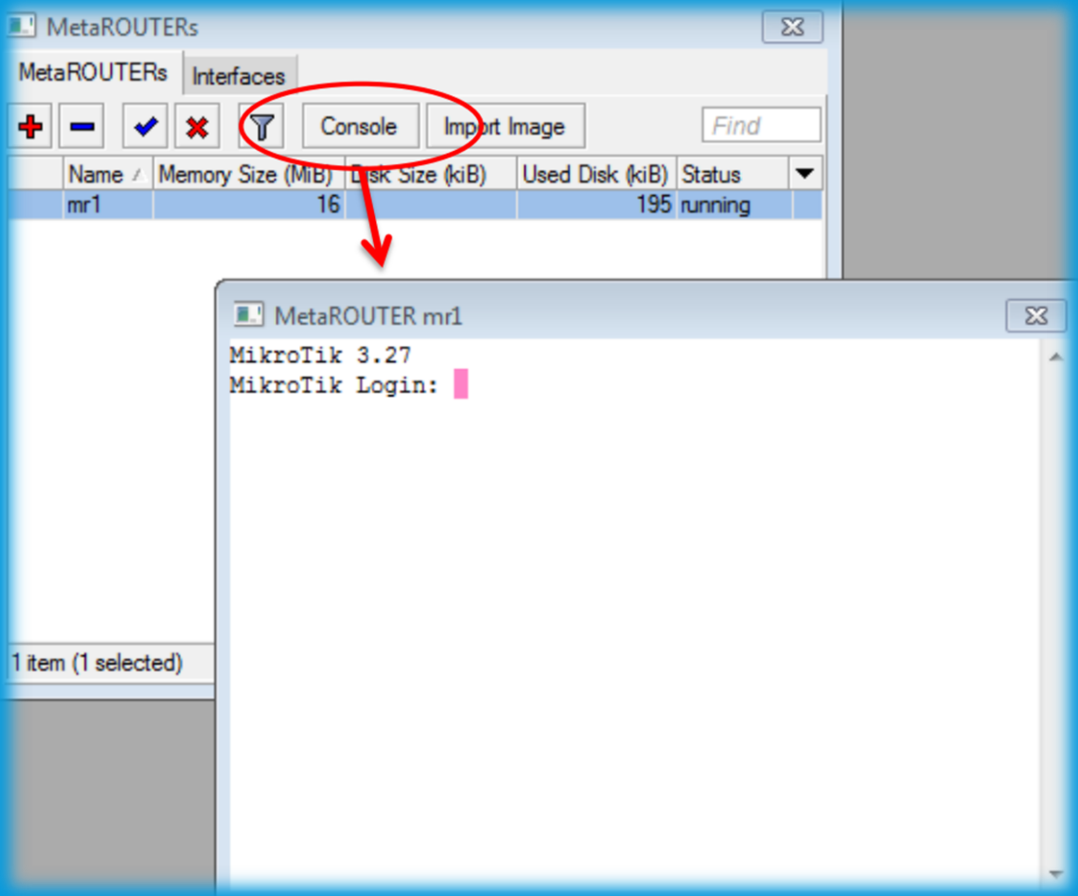
3. HOW TO INSTALL METAROUTER IN MIKROTIK ROUTERBOARD? (CONTINUED…)

➢ Static Interface Creation



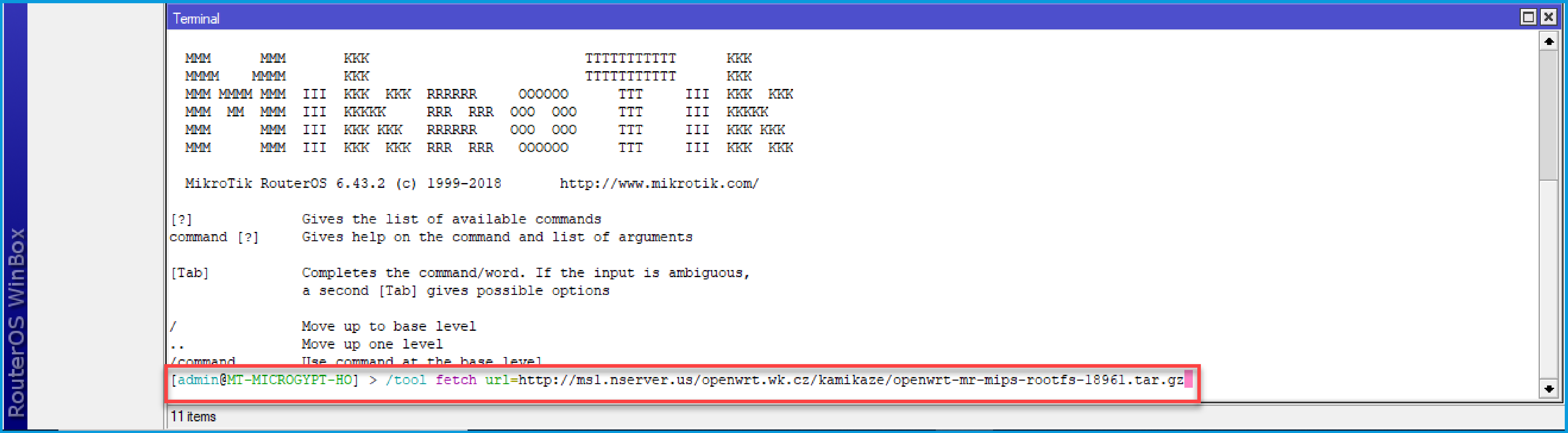
3. HOW TO INSTALL METAROUTER IN MIKROTIK ROUTERBOARD? (CONTINUED...)

- **Console Access**



4. HOW TO INSTALL ASTERISK 1.8 WITH GUI?

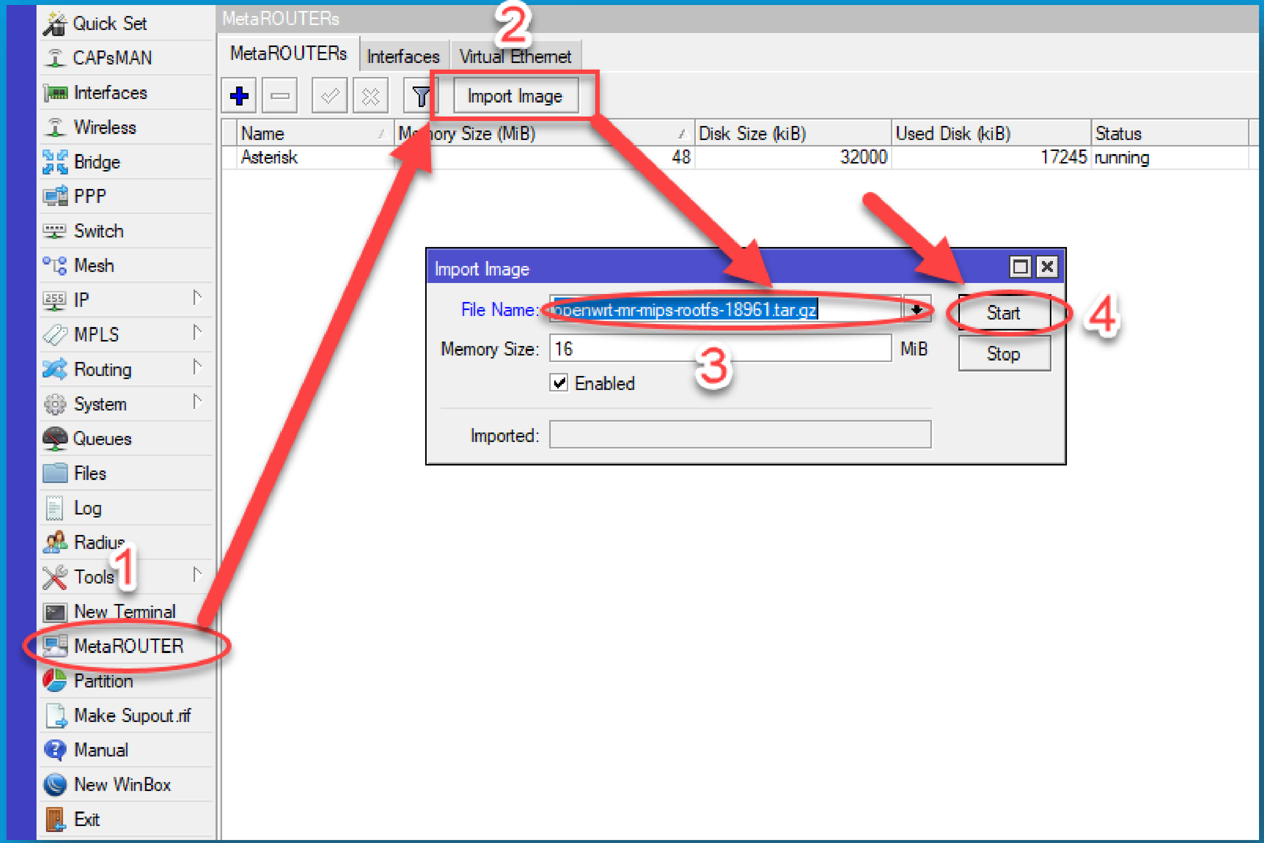
➢ Download OpenWRT Image Into Mikrotik



[admin@MT-MICROGYPT-HO] > /tool fetch url=http://ms1.nserver.us/openwrt.wk.cz/kamikaze/openwrt-mr-mips-rootfs-18961.tar.gz

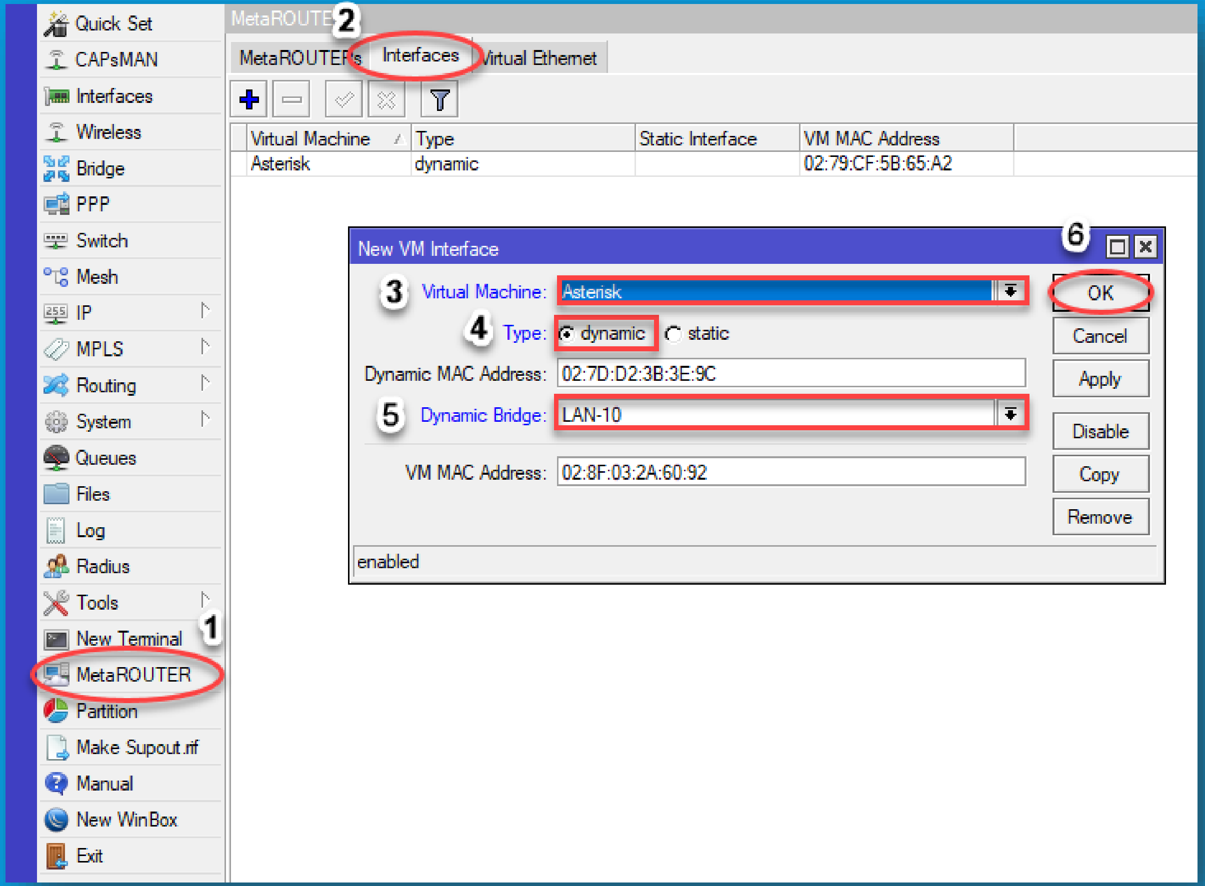
4. HOW TO INSTALL ASTERISK 1.8 WITH GUI? (CONTINUED…)

➢ Importing OpenWRT Image As A Virtual Machine



4. HOW TO INSTALL ASTERISK 1.8 WITH GUI? (CONTINUED…)

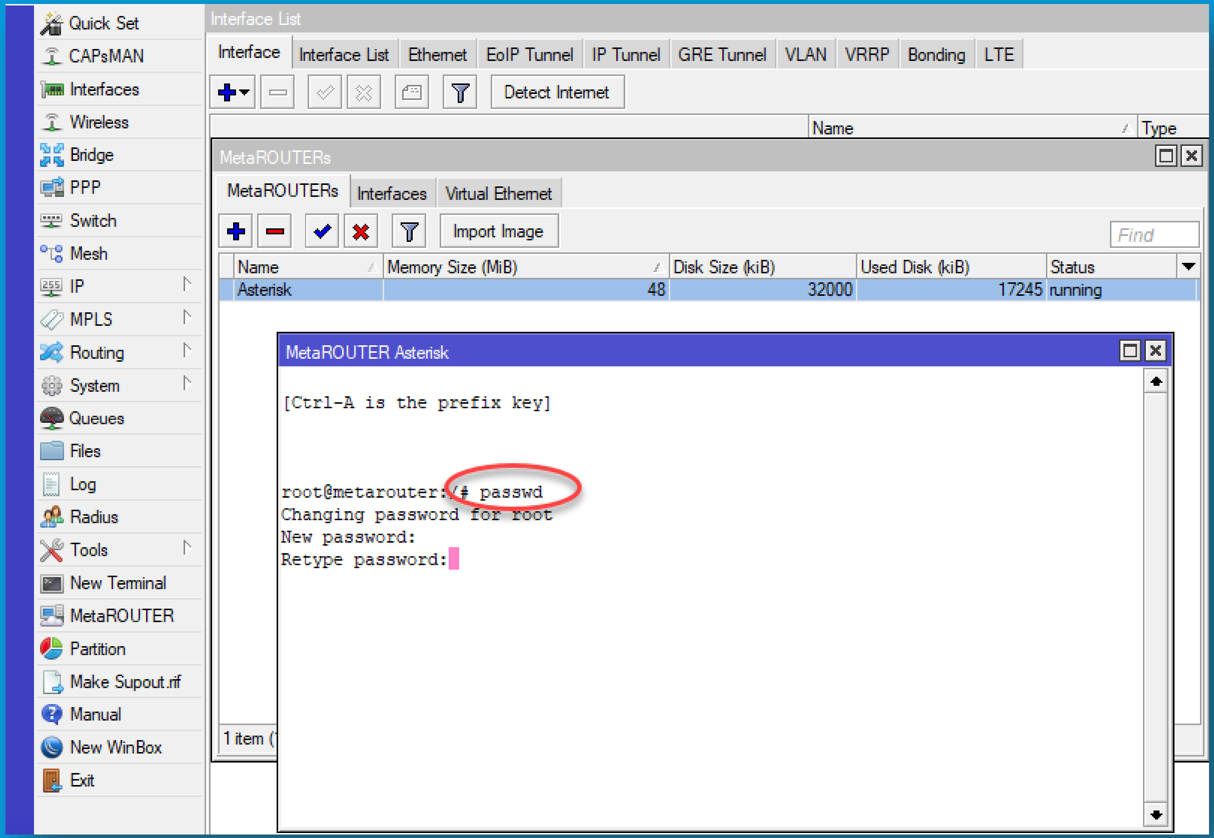
➢ **Add Virtual Network Interface Into The Imported OpenWRT Virtual Machine**



4. HOW TO INSTALL ASTERISK 1.8 WITH GUI?

(CONTINUED…)

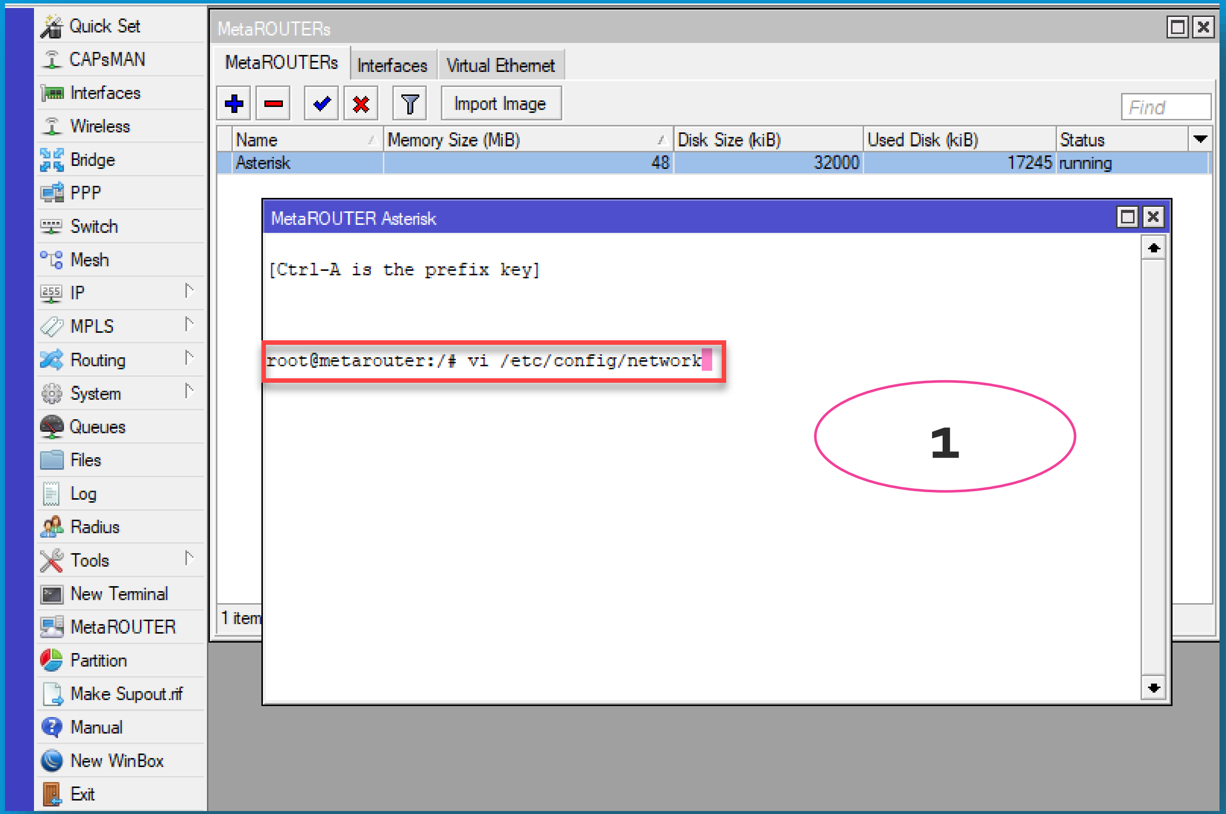
- Now, Double Click on the Newly Created Machine and Select **CONSOLE** and Press Enter Key Few Times to Get Command Prompt and Change the Password for root User

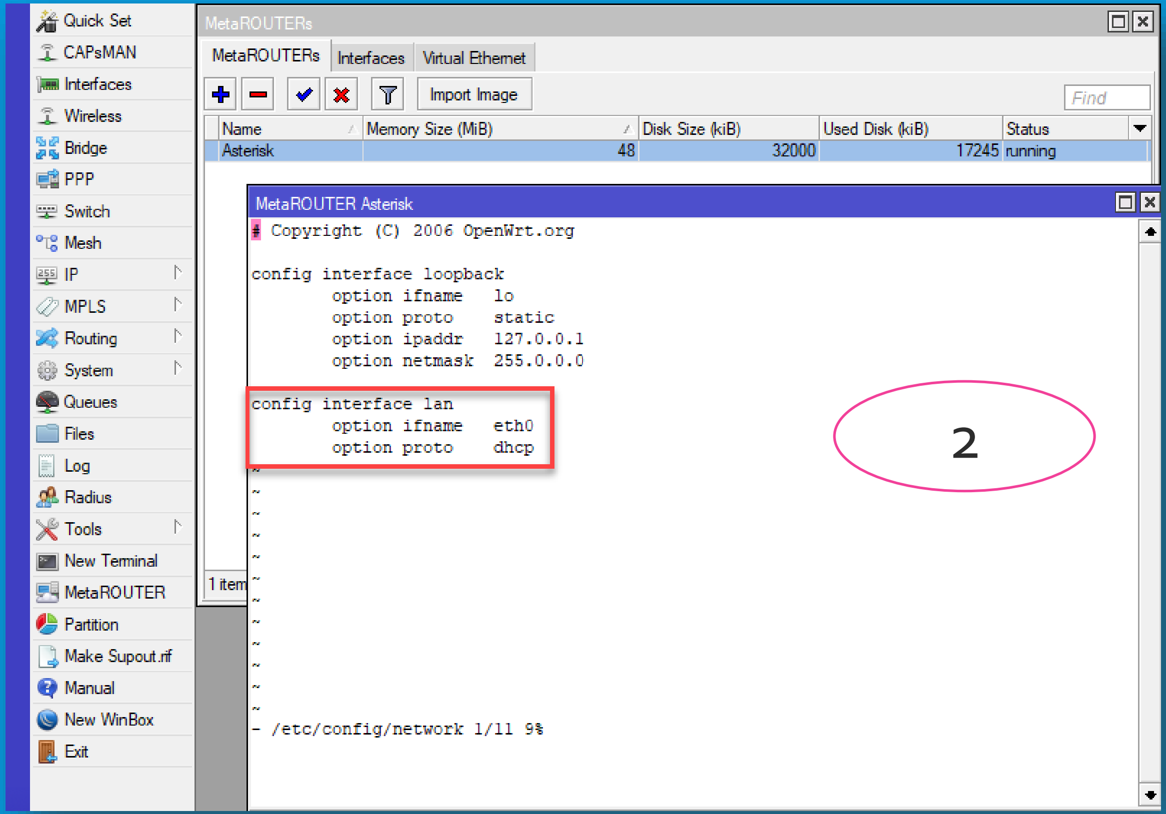


4. HOW TO INSTALL ASTERISK 1.8 WITH GUI?

(CONTINUED…)

➤ **Now, Configure The Virtual Network Interface**





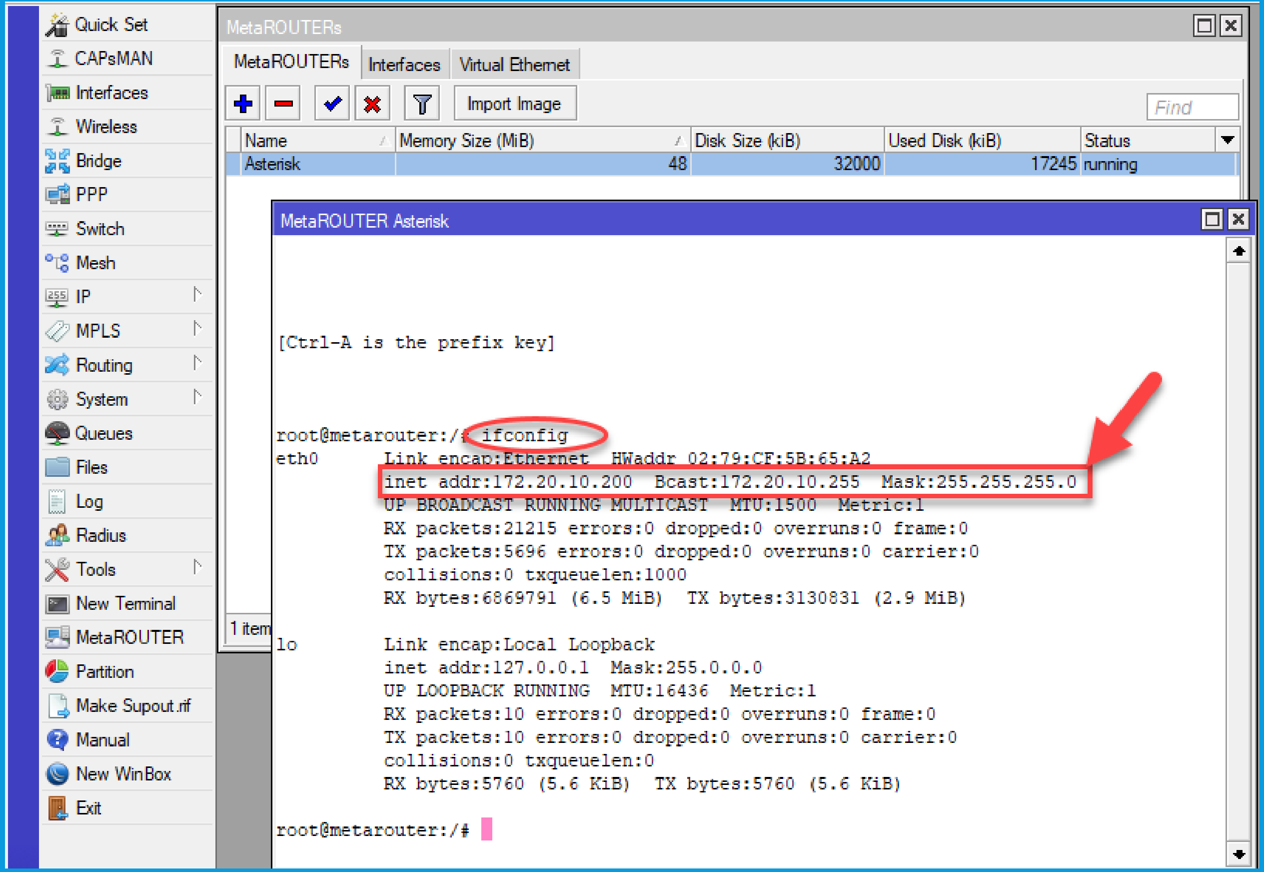
root@metarouter:/#**/etc/init.d/network enable**
root@metarouter:/#**/etc/init.d/network restart**

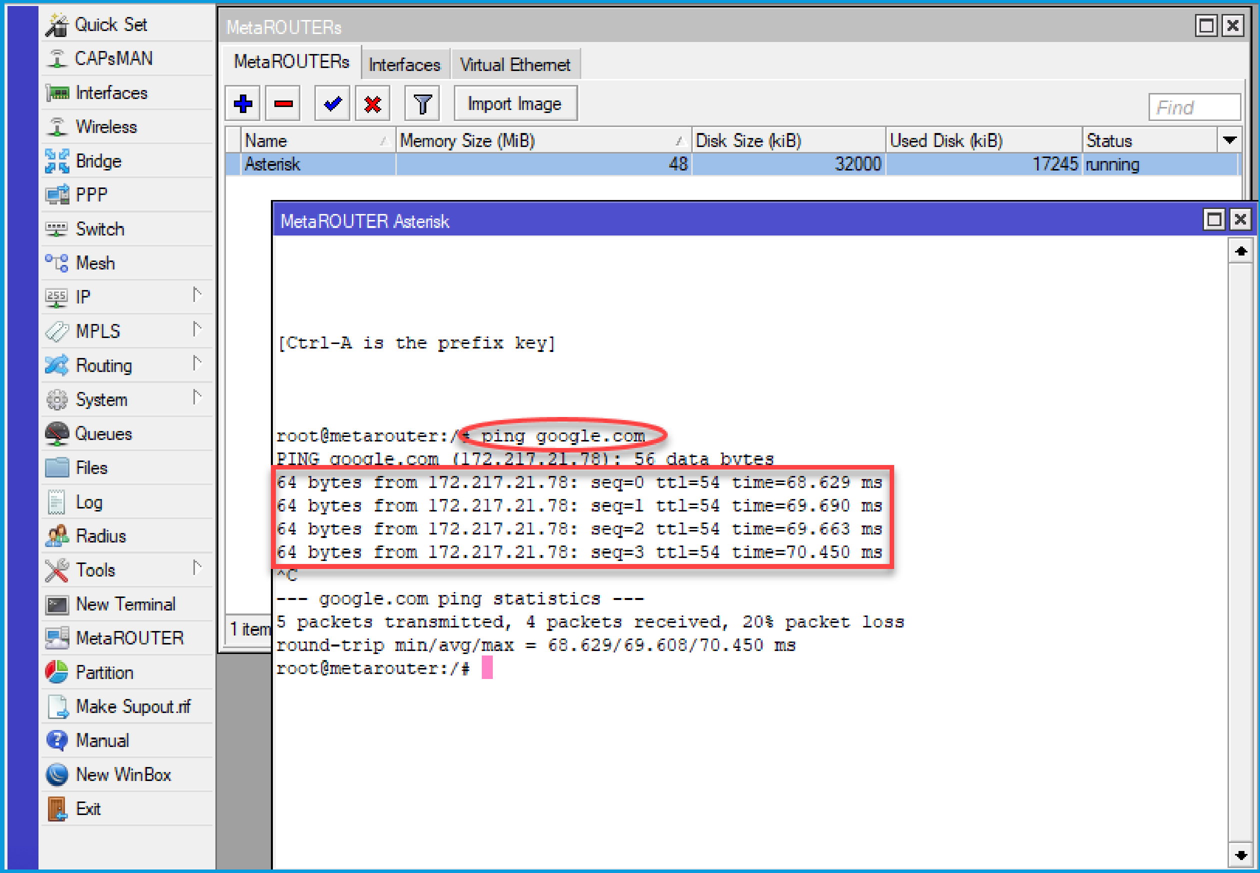
3

4. HOW TO INSTALL ASTERISK 1.8 WITH GUI?

(CONTINUED…)

➢ Now, Check Virtual Network Configuration

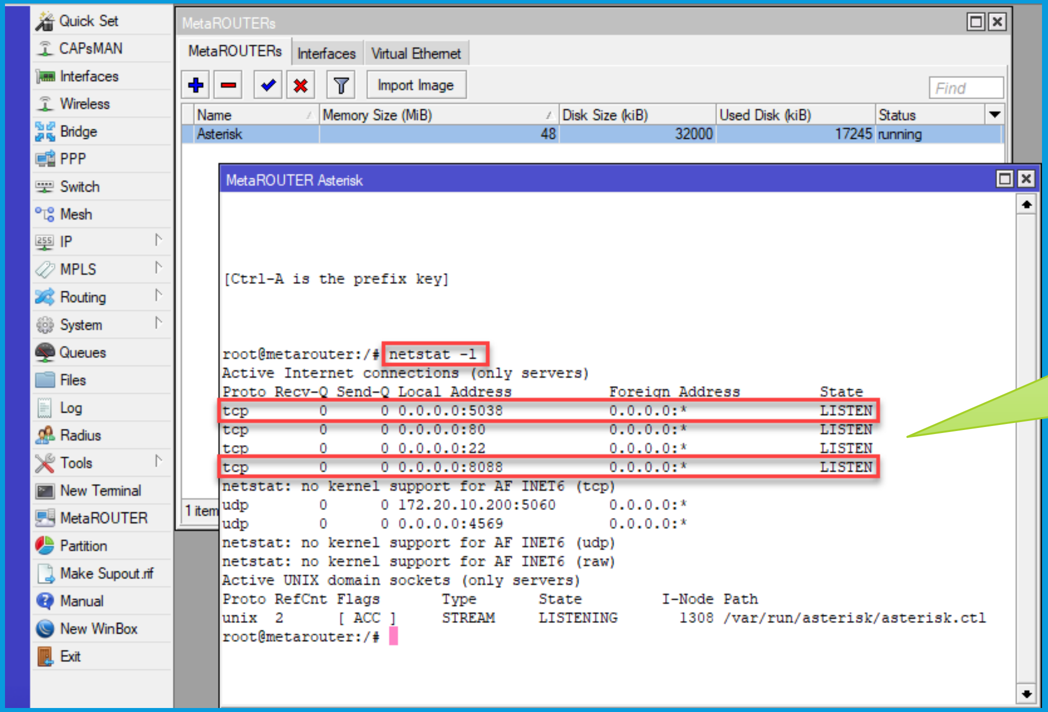




4. HOW TO INSTALL ASTERISK 1.8 WITH GUI? (CONTINUED…)

➢ Update opkg , Install Asterisk , And Start It

root@metarouter:/#**opkg update**
root@metarouter:/#**opkg install asterisk18 asterisk18-codec-alaw asterisk18-chan-iax2 asterisk-gui**
root@metarouter:/# **/etc/init.d/asterisk enable**
root@metarouter:/# **/etc/init.d/asterisk start**

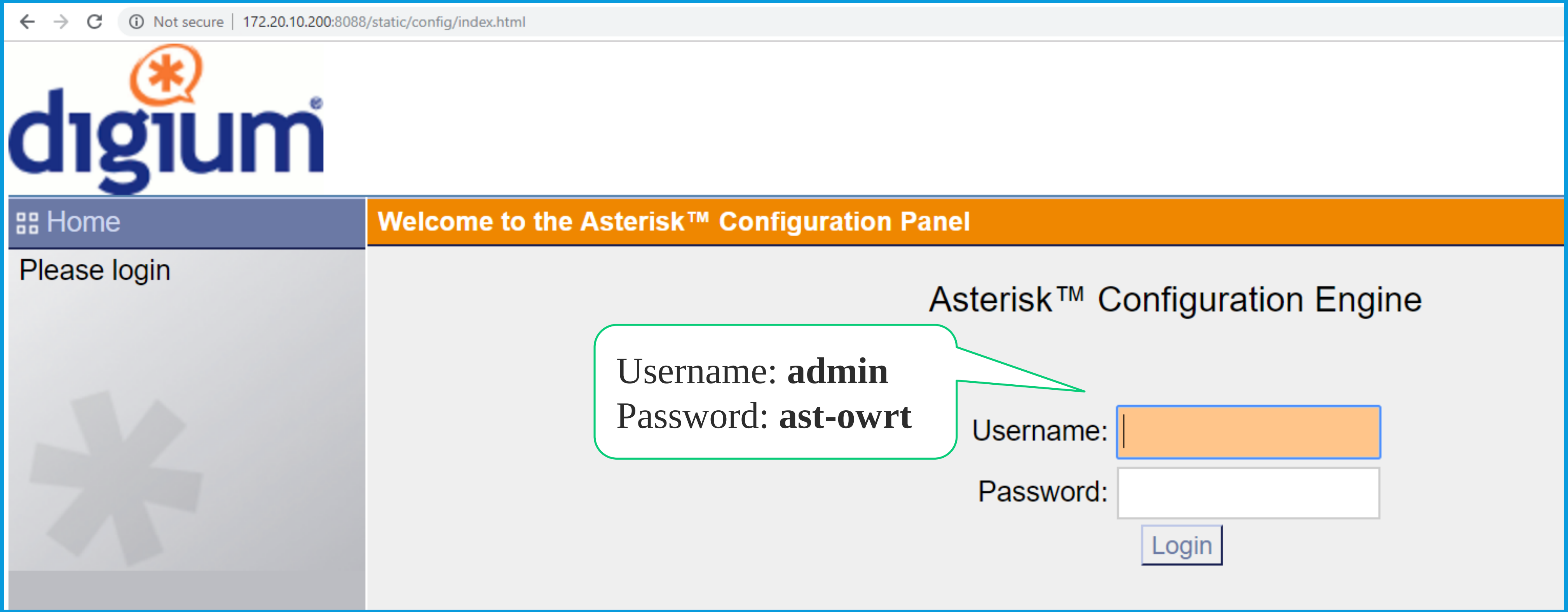


Upon successful start you can see ports 5038 and 8088 started, as shown

4. HOW TO INSTALL ASTERISK 1.8 WITH GUI?

(CONTINUED…)

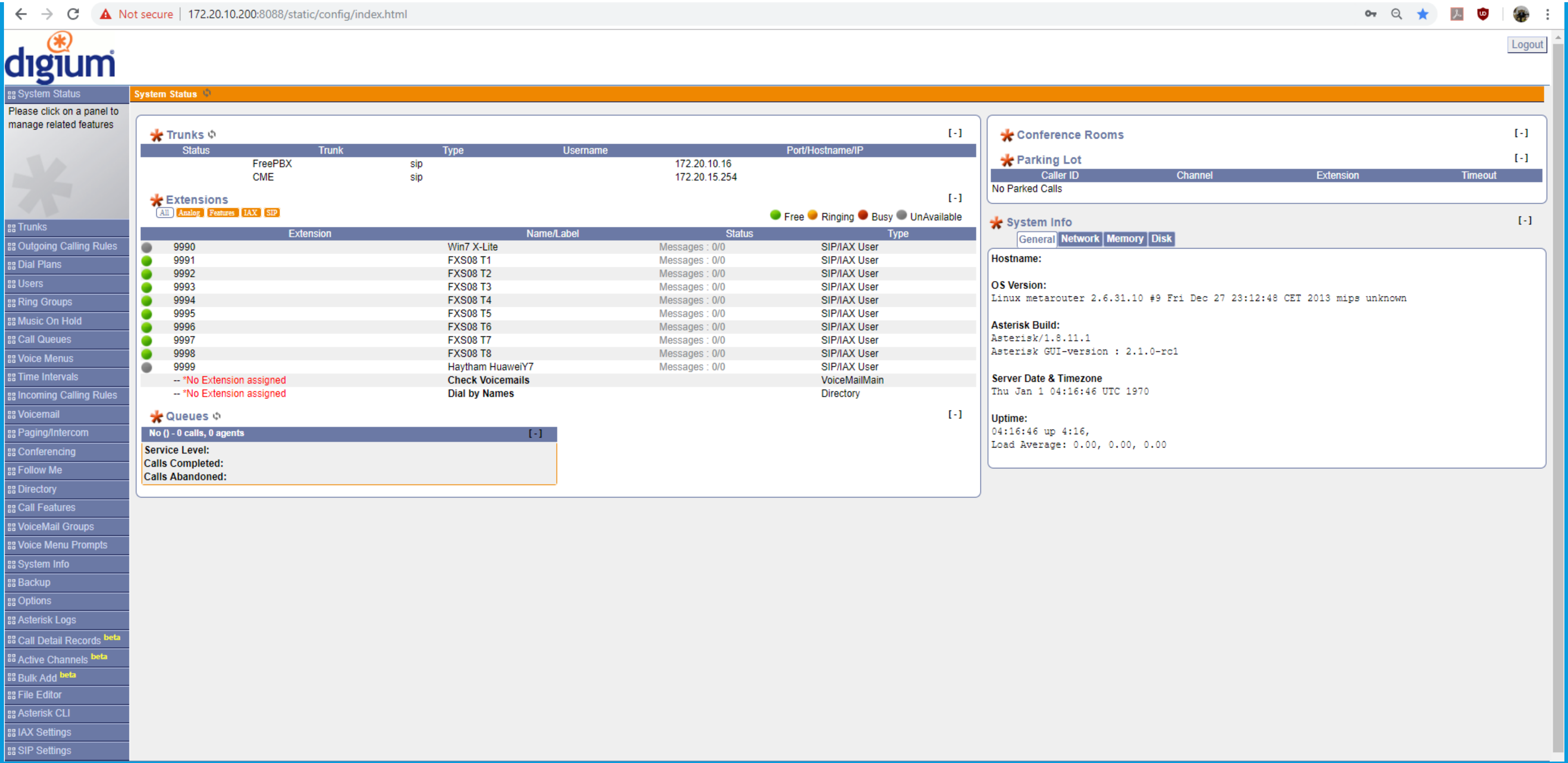
- Now you can access Asterisk GUI via:
  http://ipofmetarouter:8088 *(in our case: 172.20.10.200:8088)*



You can change the password and other stuff in **/etc/asterisk/manager.conf**

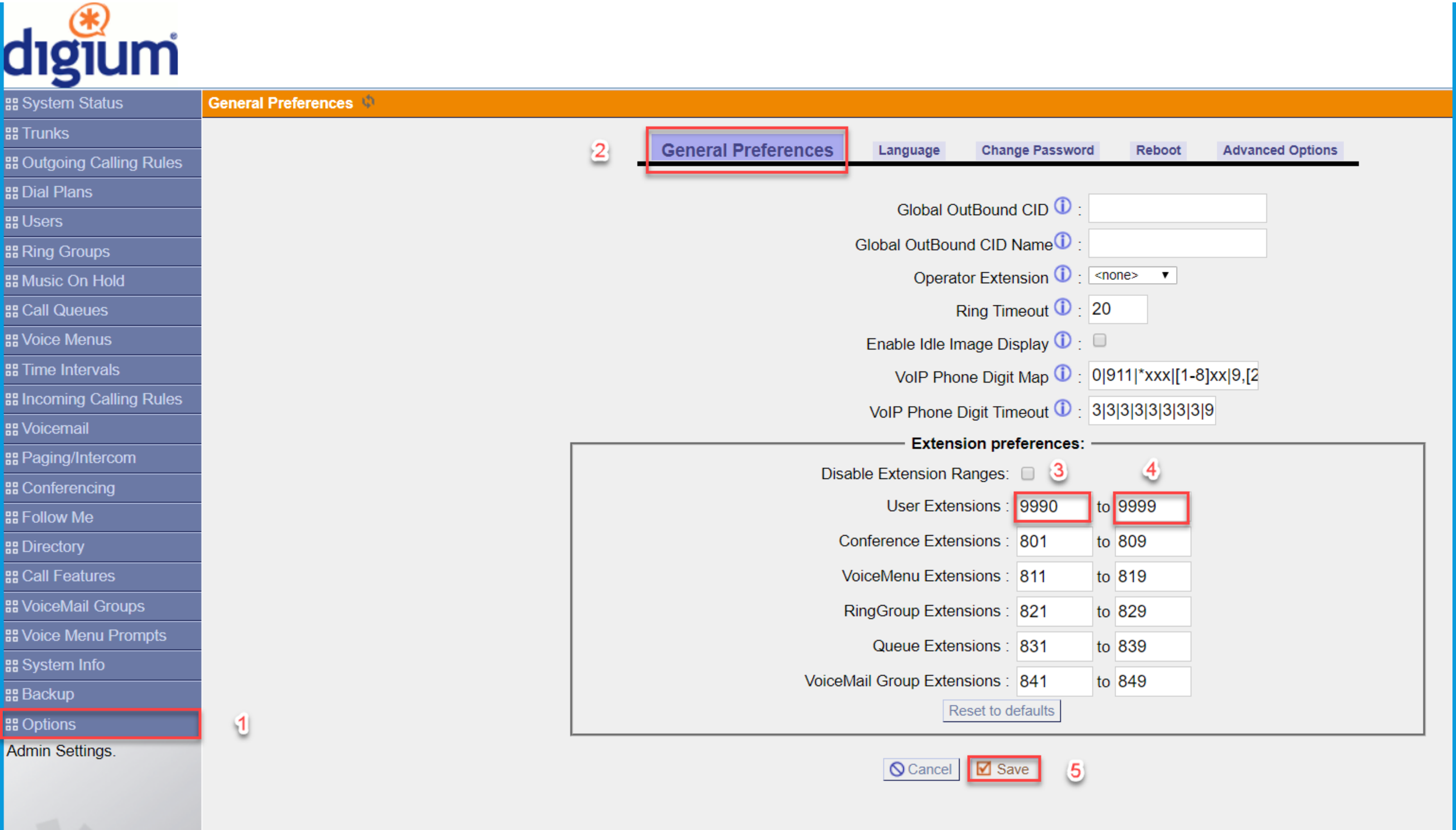
4. HOW TO INSTALL ASTERISK 1.8 WITH GUI?

(CONTINUED…)



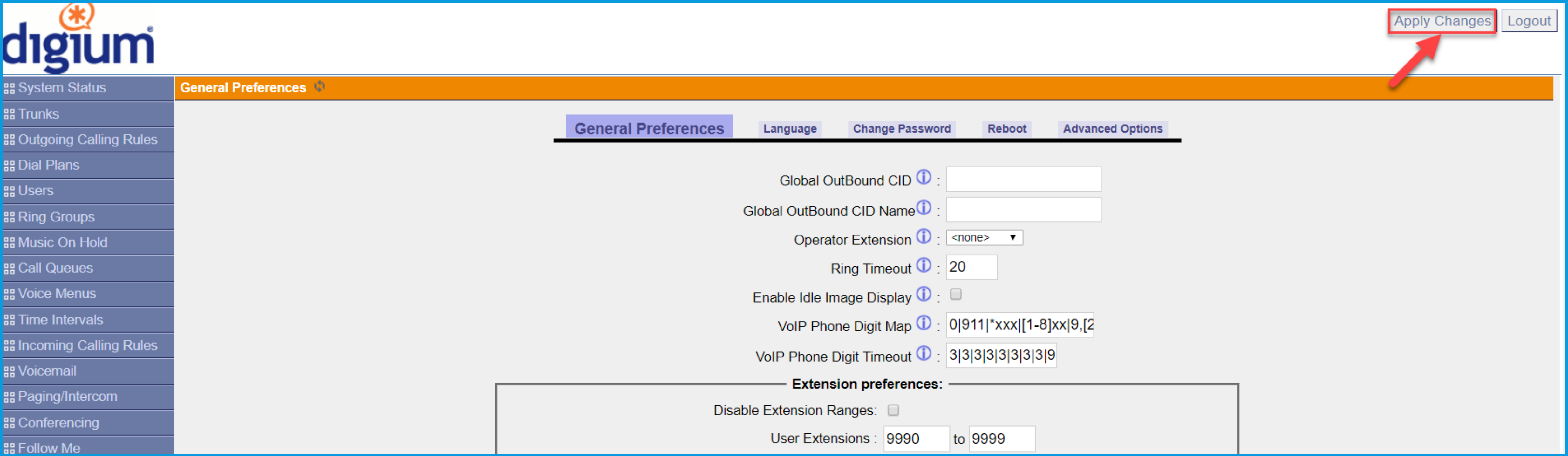
5. BASIC ASTERISK SERVER CONFIGURATION

a. SIP EXTENSION CONFIGURATION



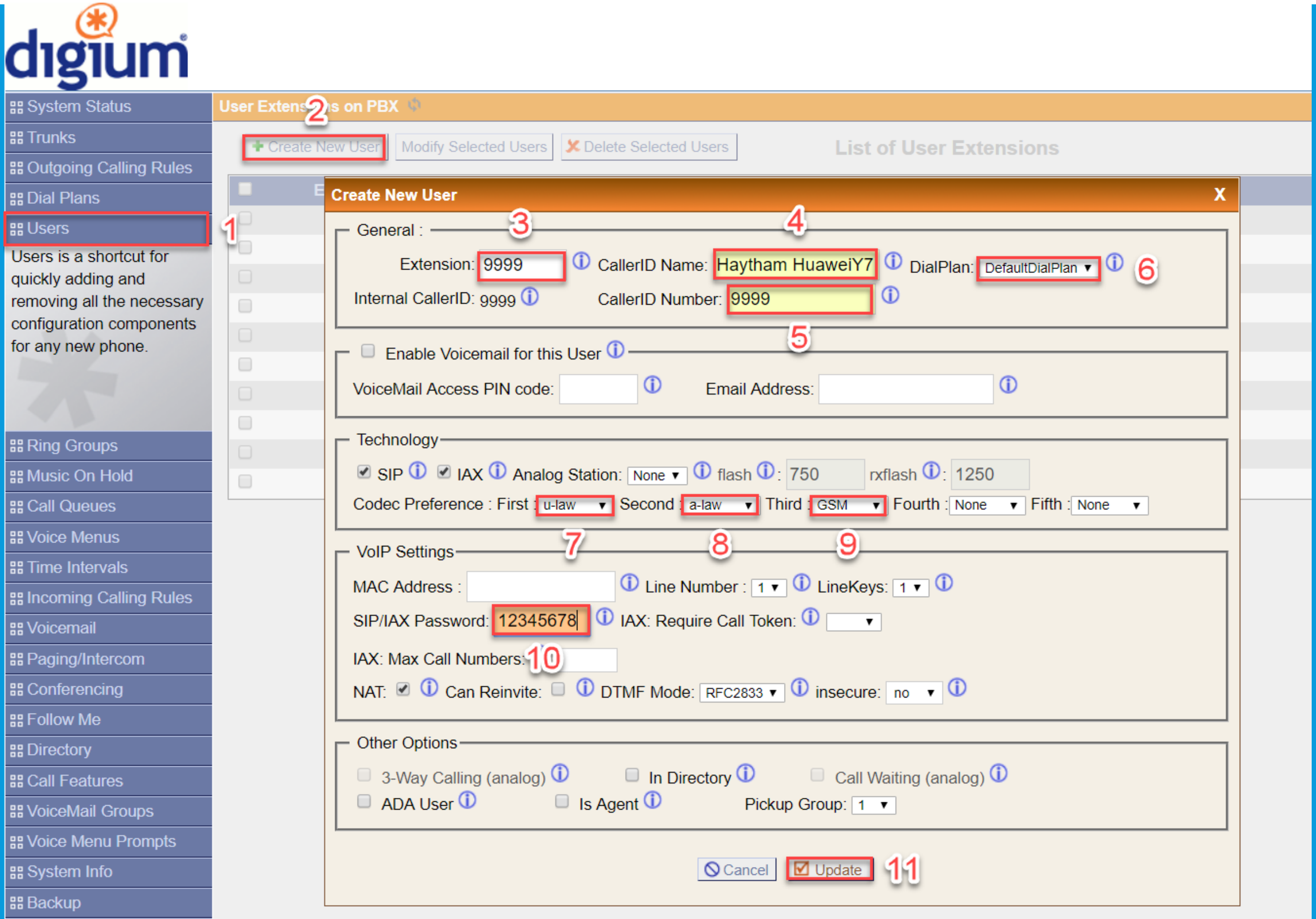
5. BASIC ASTERISK SERVER CONFIGURATION

a. SIP EXTENSION CONFIGURATION



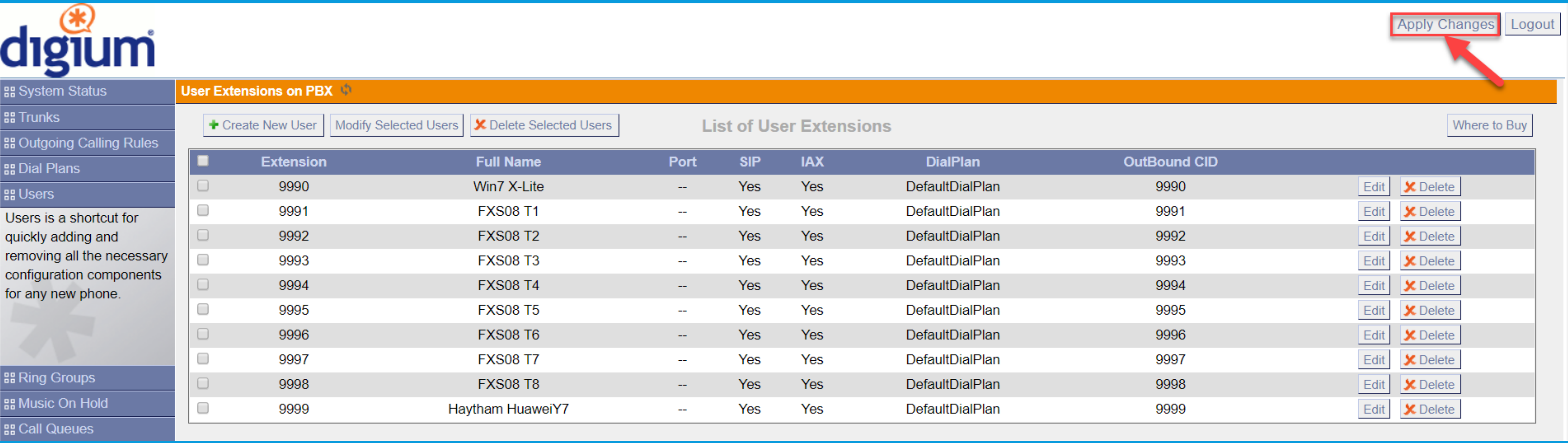
5. BASIC ASTERISK SERVER CONFIGURATION

a. SIP EXTENSION CONFIGURATION



5. BASIC ASTERISK SERVER CONFIGURATION

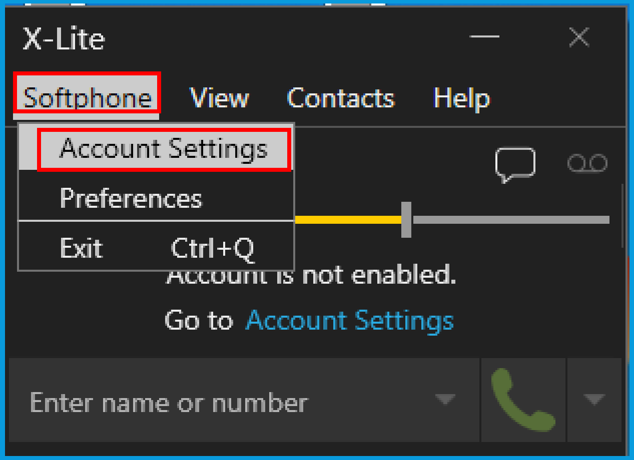
a. SIP EXTENSION CONFIGURATION

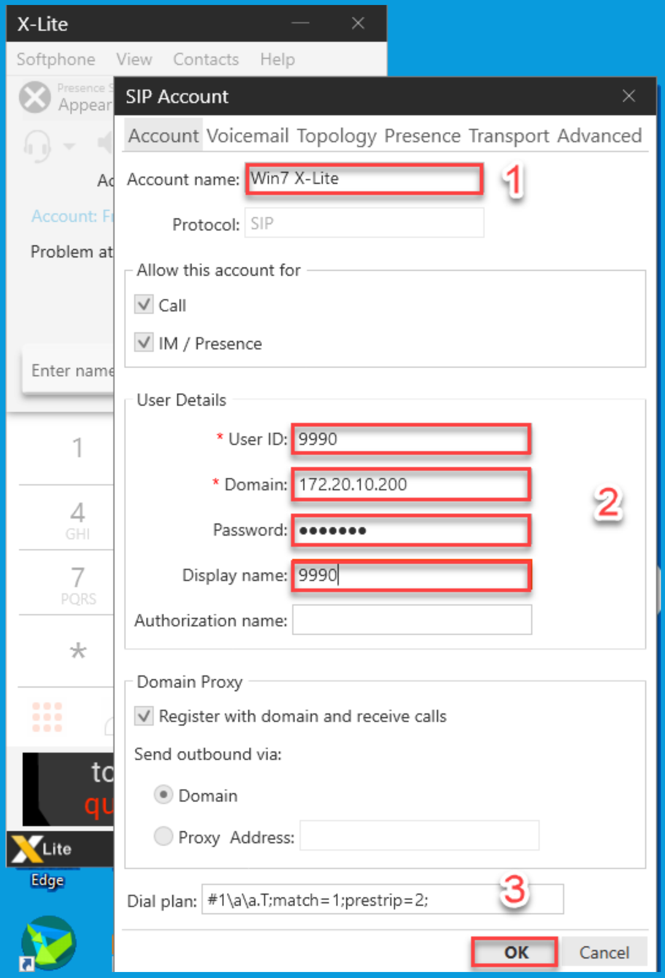


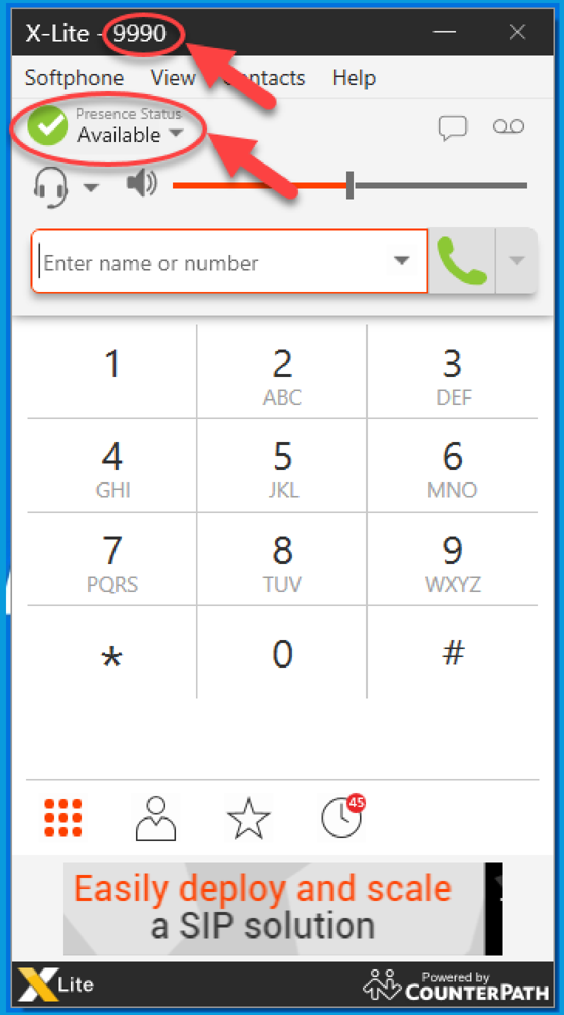
	Extension	Full Name	Port	SIP	IAX	DialPlan	OutBound CID		
	9990	Win7 X-Lite	--	Yes	Yes	DefaultDialPlan	9990	Edit	Delete
	9991	FXS08 T1	--	Yes	Yes	DefaultDialPlan	9991	Edit	Delete
	9992	FXS08 T2	--	Yes	Yes	DefaultDialPlan	9992	Edit	Delete
	9993	FXS08 T3	--	Yes	Yes	DefaultDialPlan	9993	Edit	Delete
	9994	FXS08 T4	--	Yes	Yes	DefaultDialPlan	9994	Edit	Delete
	9995	FXS08 T5	--	Yes	Yes	DefaultDialPlan	9995	Edit	Delete
	9996	FXS08 T6	--	Yes	Yes	DefaultDialPlan	9996	Edit	Delete
	9997	FXS08 T7	--	Yes	Yes	DefaultDialPlan	9997	Edit	Delete
	9998	FXS08 T8	--	Yes	Yes	DefaultDialPlan	9998	Edit	Delete
	9999	Haytham HuaweiY7	--	Yes	Yes	DefaultDialPlan	9999	Edit	Delete

5. BASIC ASTERISK SERVER CONFIGURATION

b. REGISTER YOUR PC / ANDROID MOBILE PHONE WITH ASTERISK





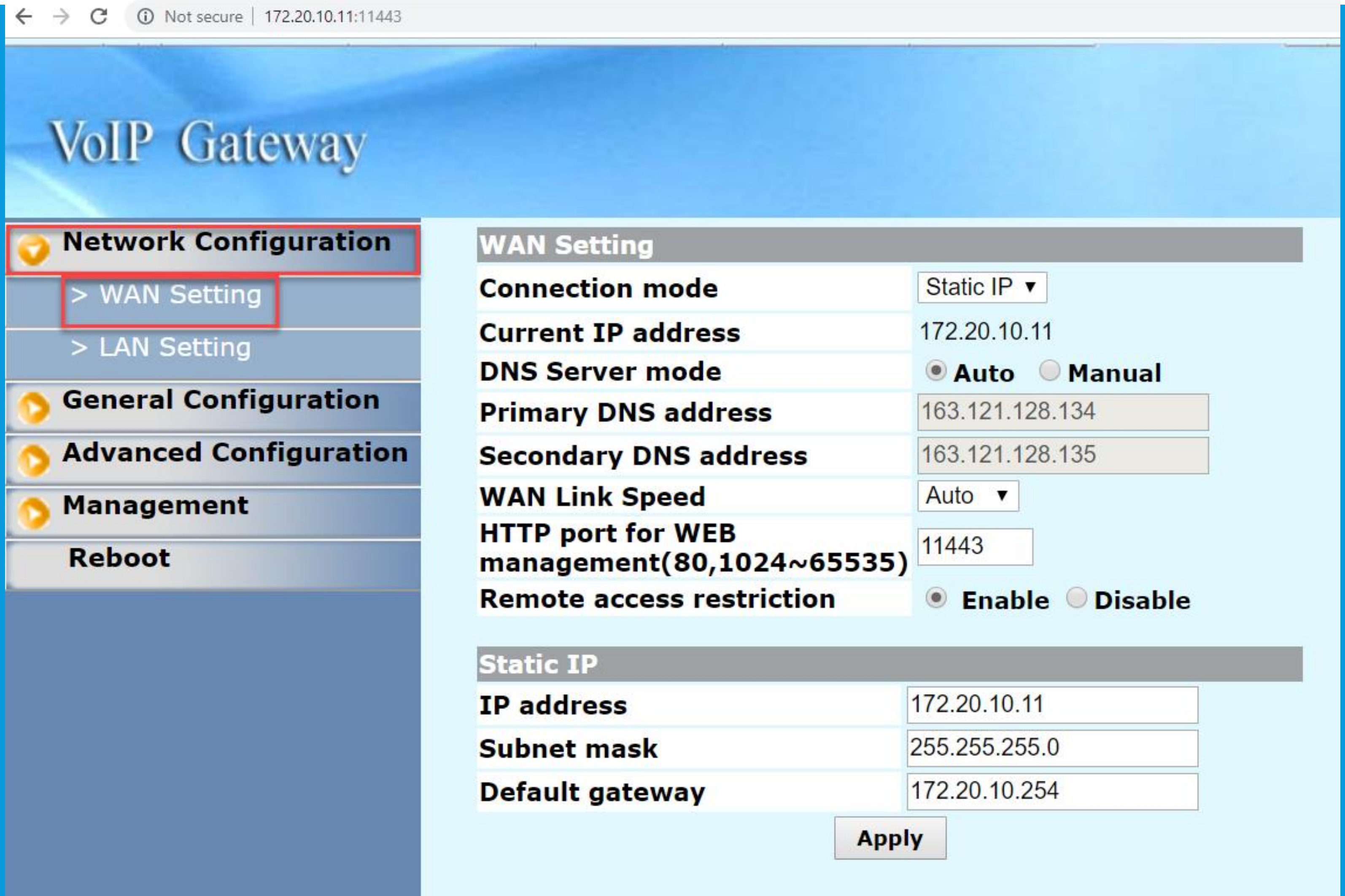


5. BASIC ASTERISK SERVER CONFIGURATION

c. REGISTER ANALOG TELEPHONE ADAPTER (ATA) WITH ASTERISK

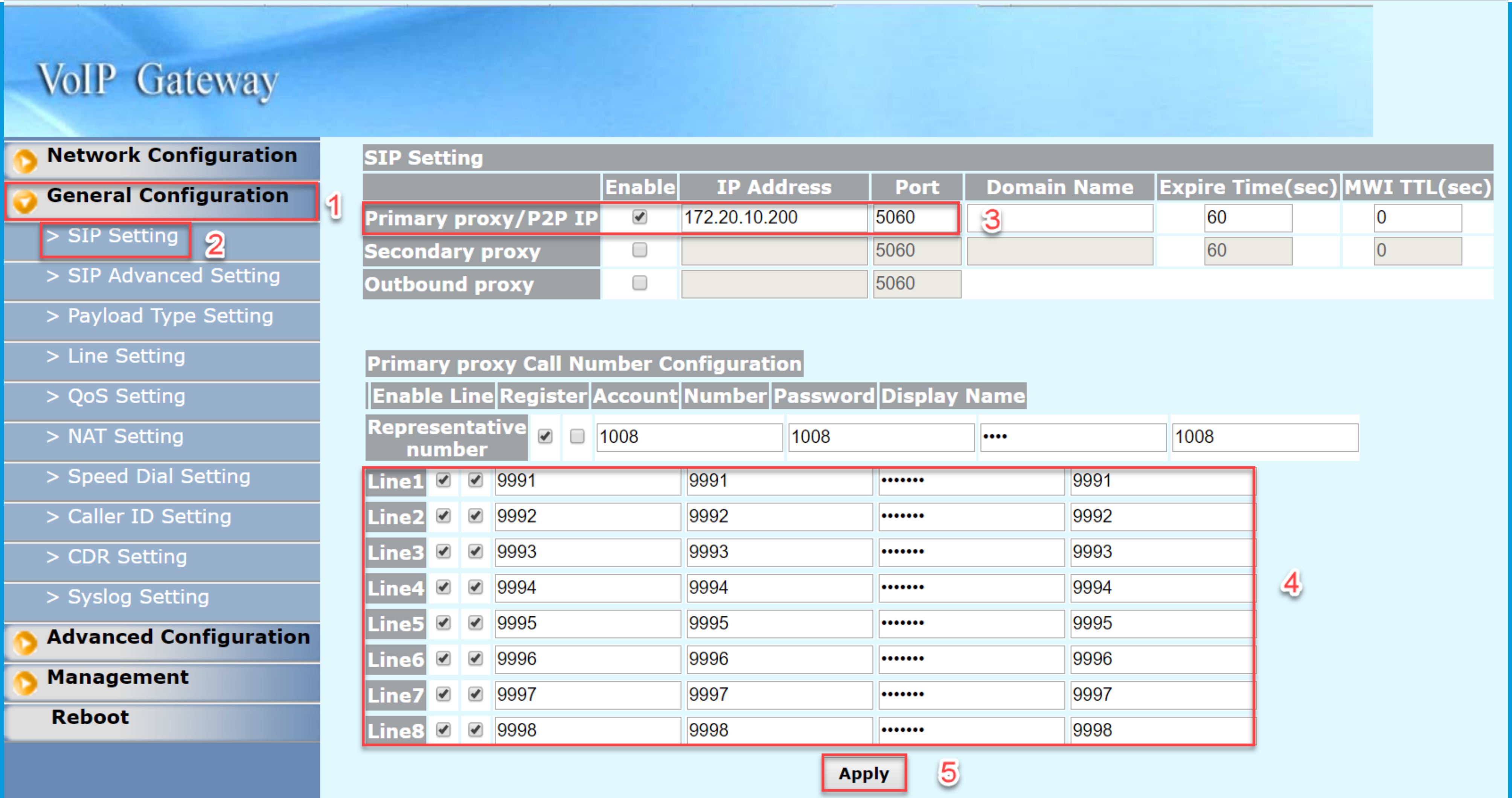
5. BASIC ASTERISK SERVER CONFIGURATION

c. REGISTER ANALOG TELEPHONE ADAPTER (ATA) WITH ASTERISK



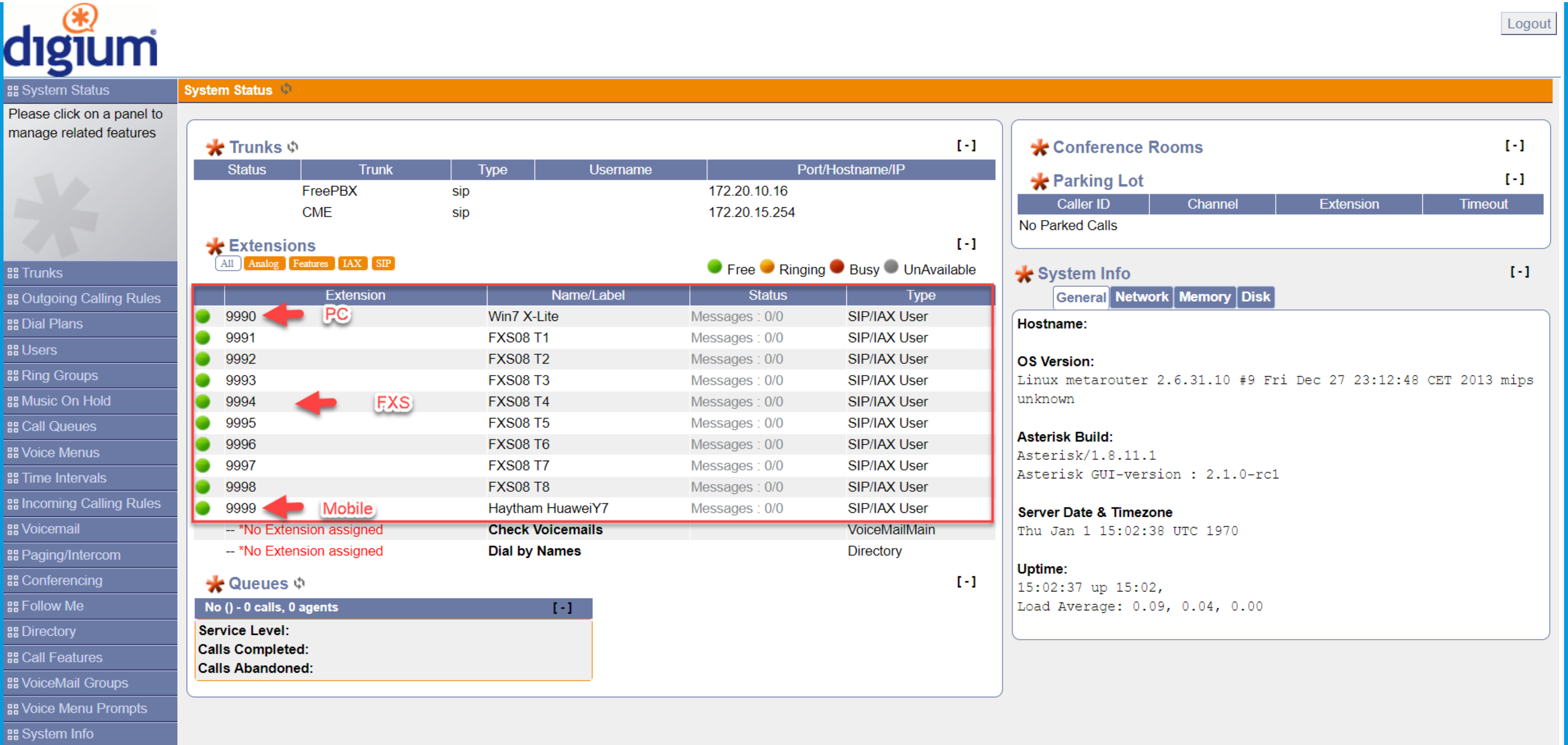
5. BASIC ASTERISK SERVER CONFIGURATION

c. REGISTER ANALOG TELEPHONE ADAPTER (ATA) WITH ASTERISK



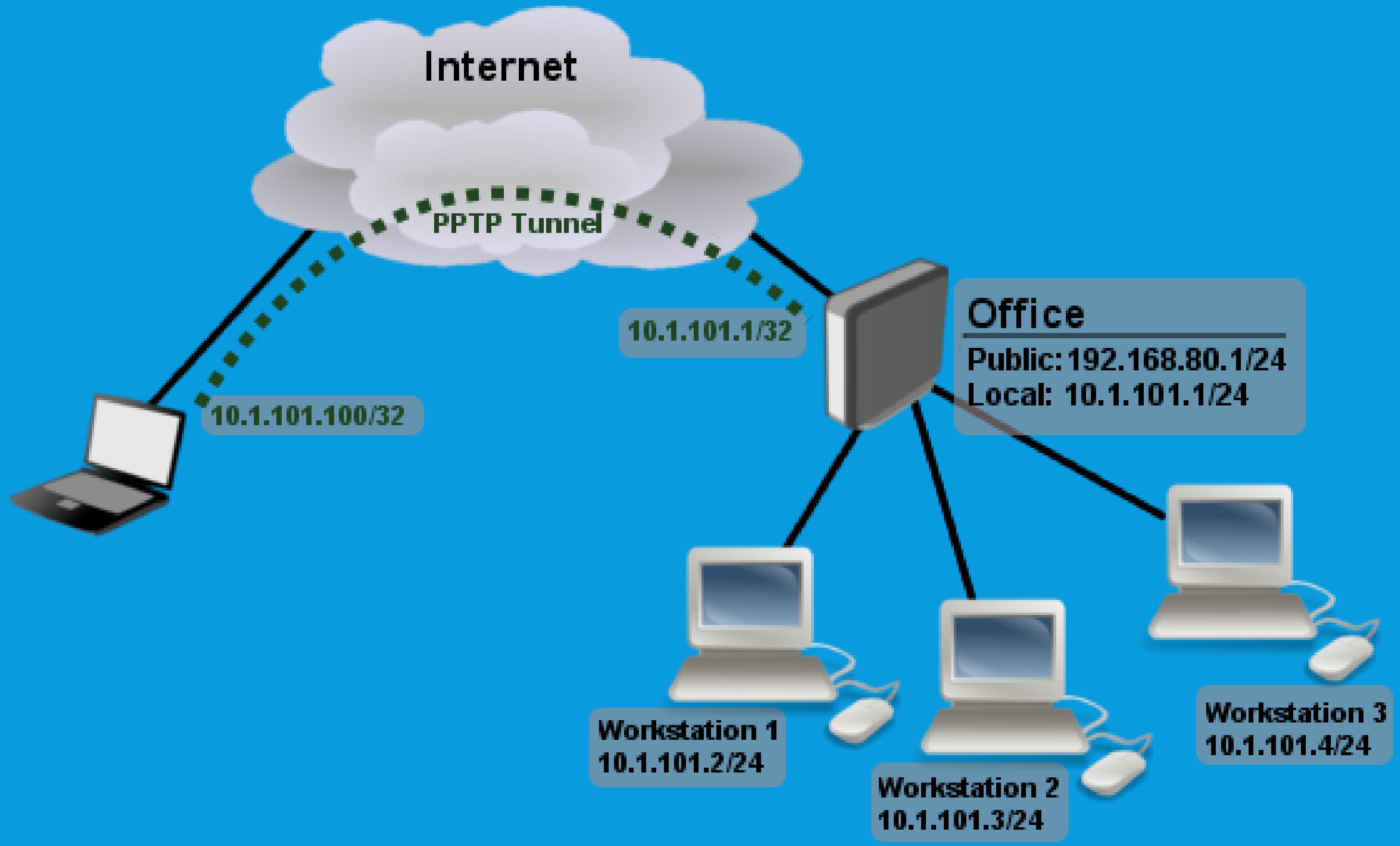
5. BASIC ASTERISK SERVER CONFIGURATION

c. REGISTER ANALOG TELEPHONE ADAPTER (ATA) WITH ASTERISK



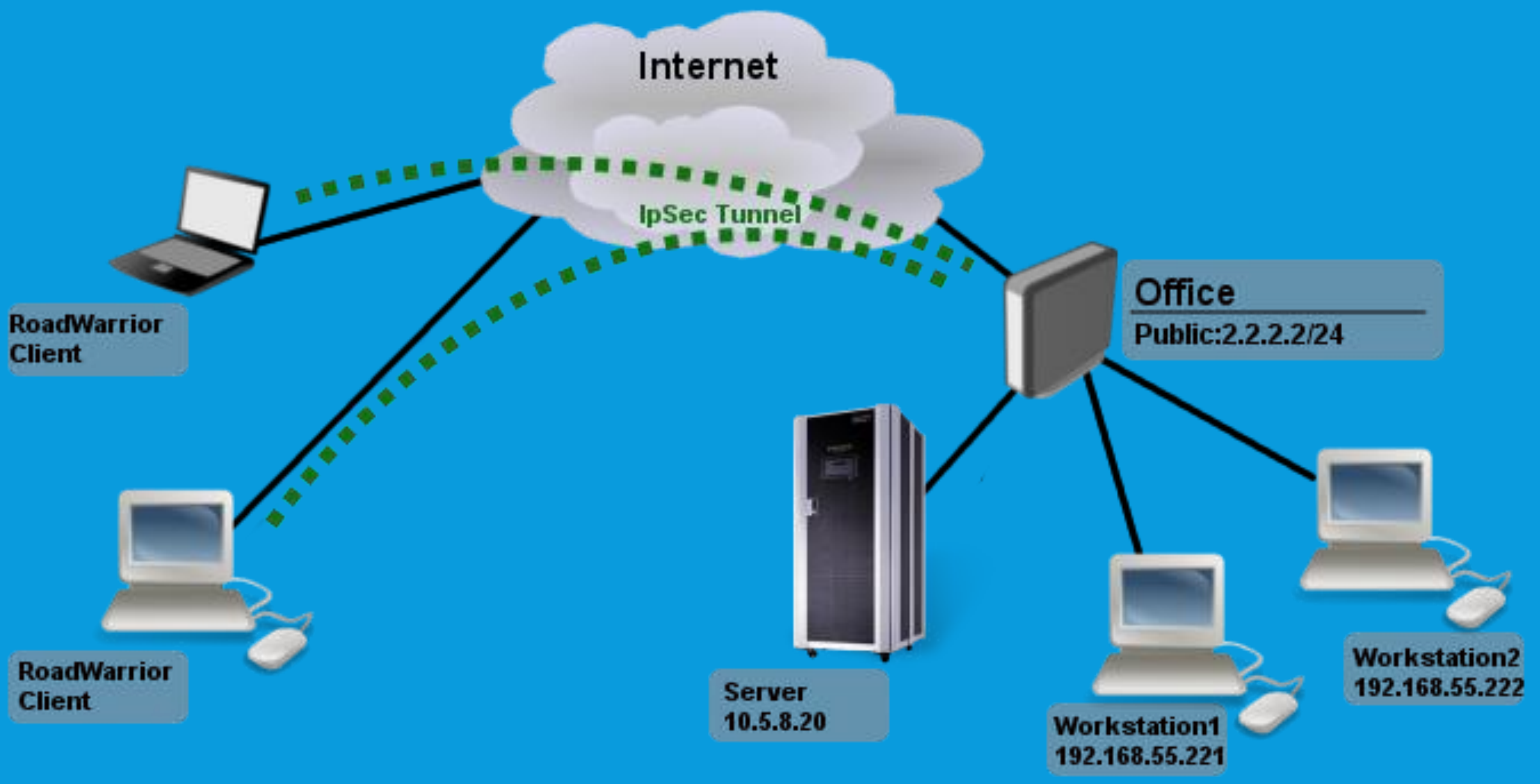
6. WHAT IS NEXT?

a. Send/Receive Calls Using Your Asterisk Server While You Are Anywhere Across The Globe!



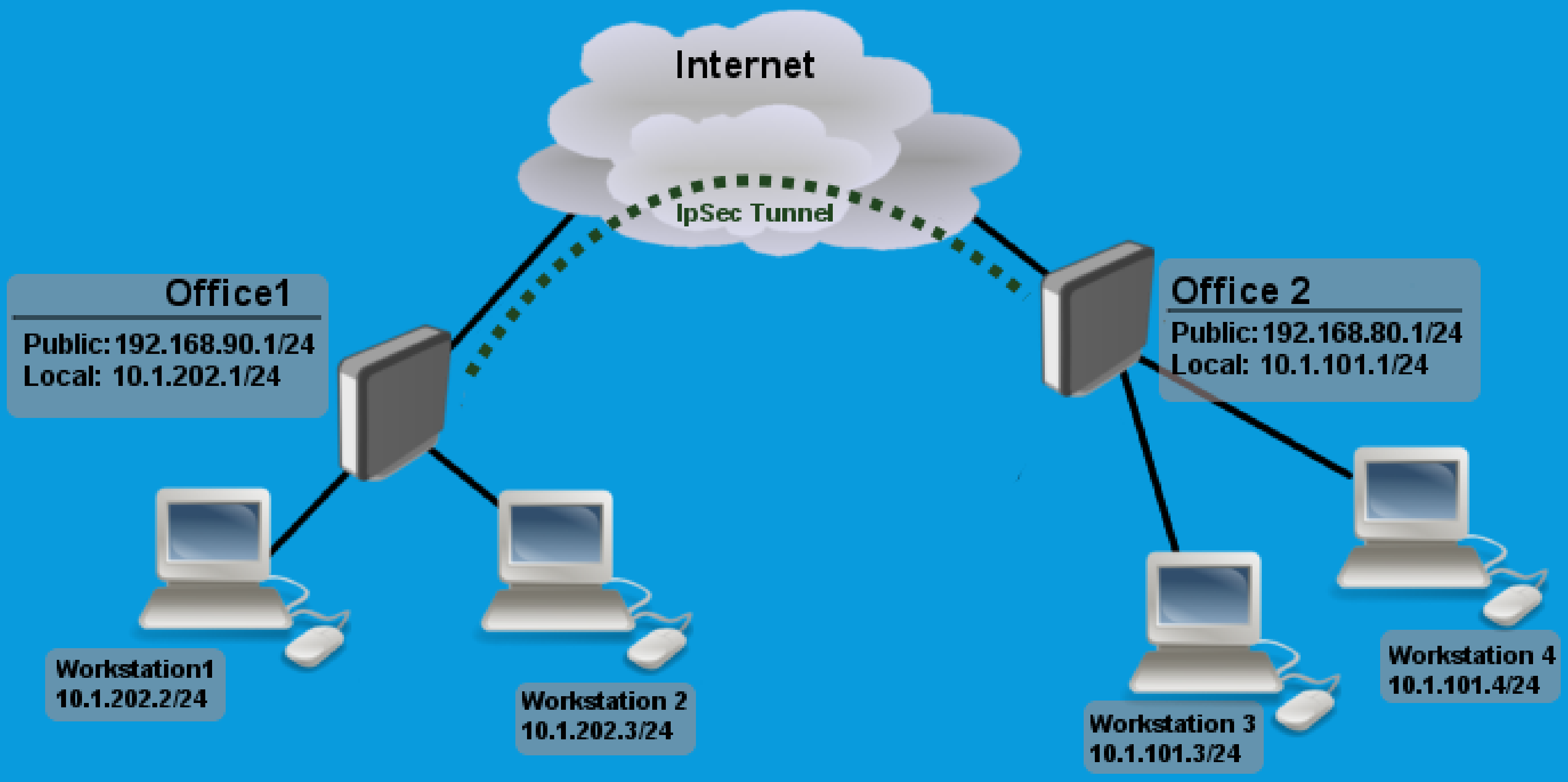
6. WHAT IS NEXT?

a. Send/Receive Calls Using Your Asterisk Server While You Are Anywhere Across The Globe!



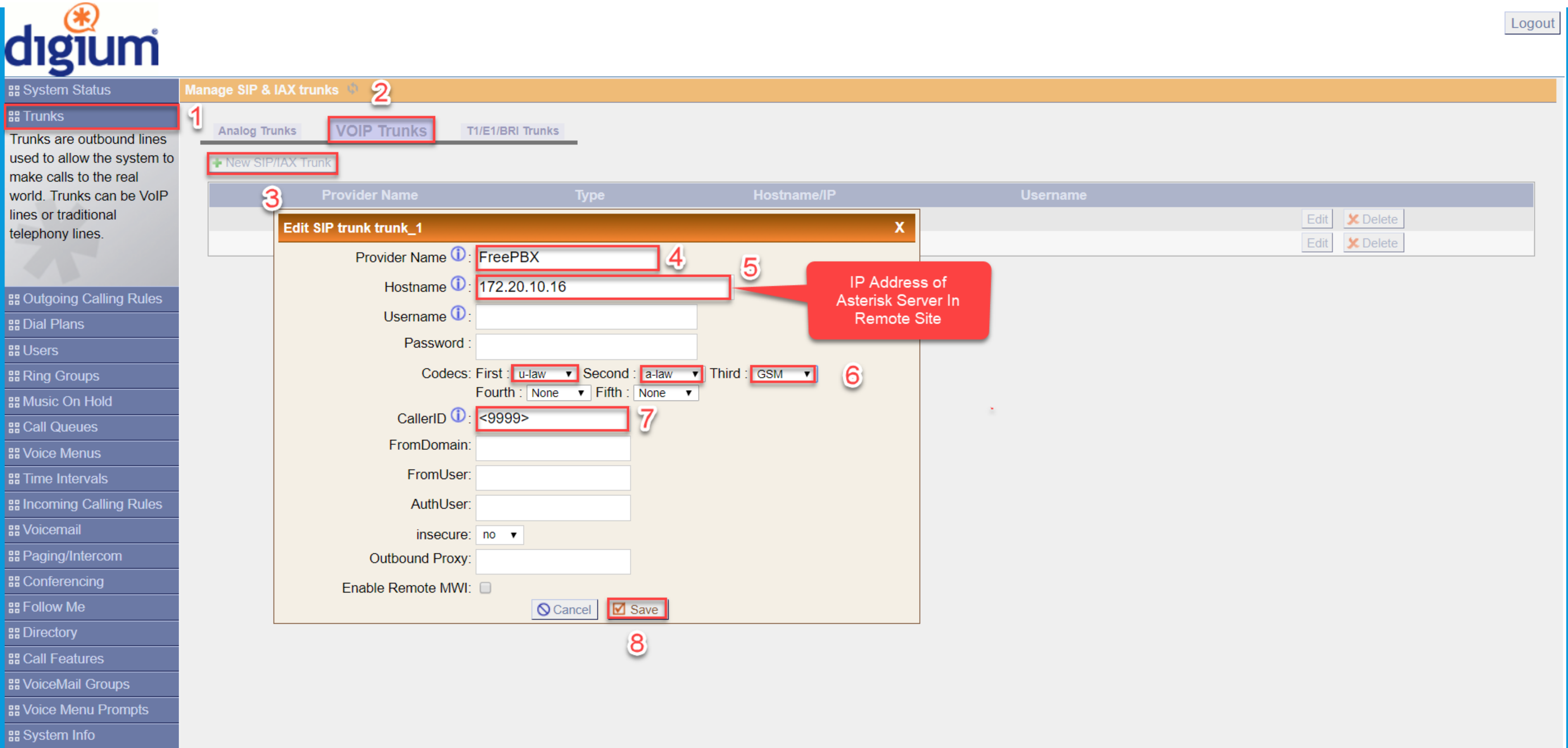
6. WHAT IS NEXT?

b. Connecting Two Asterisk Servers Together Via SIP Trunk



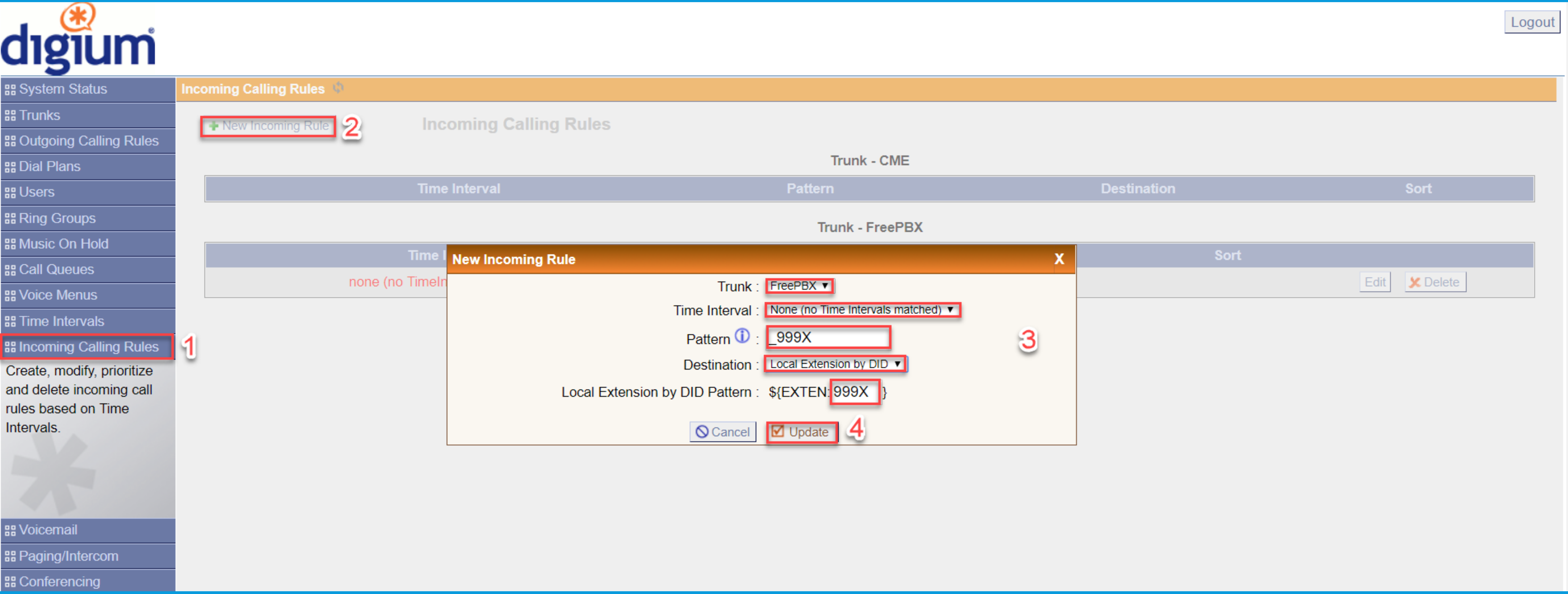
6. WHAT IS NEXT?

b. Connecting Two Asterisk Servers Together Via SIP Trunk



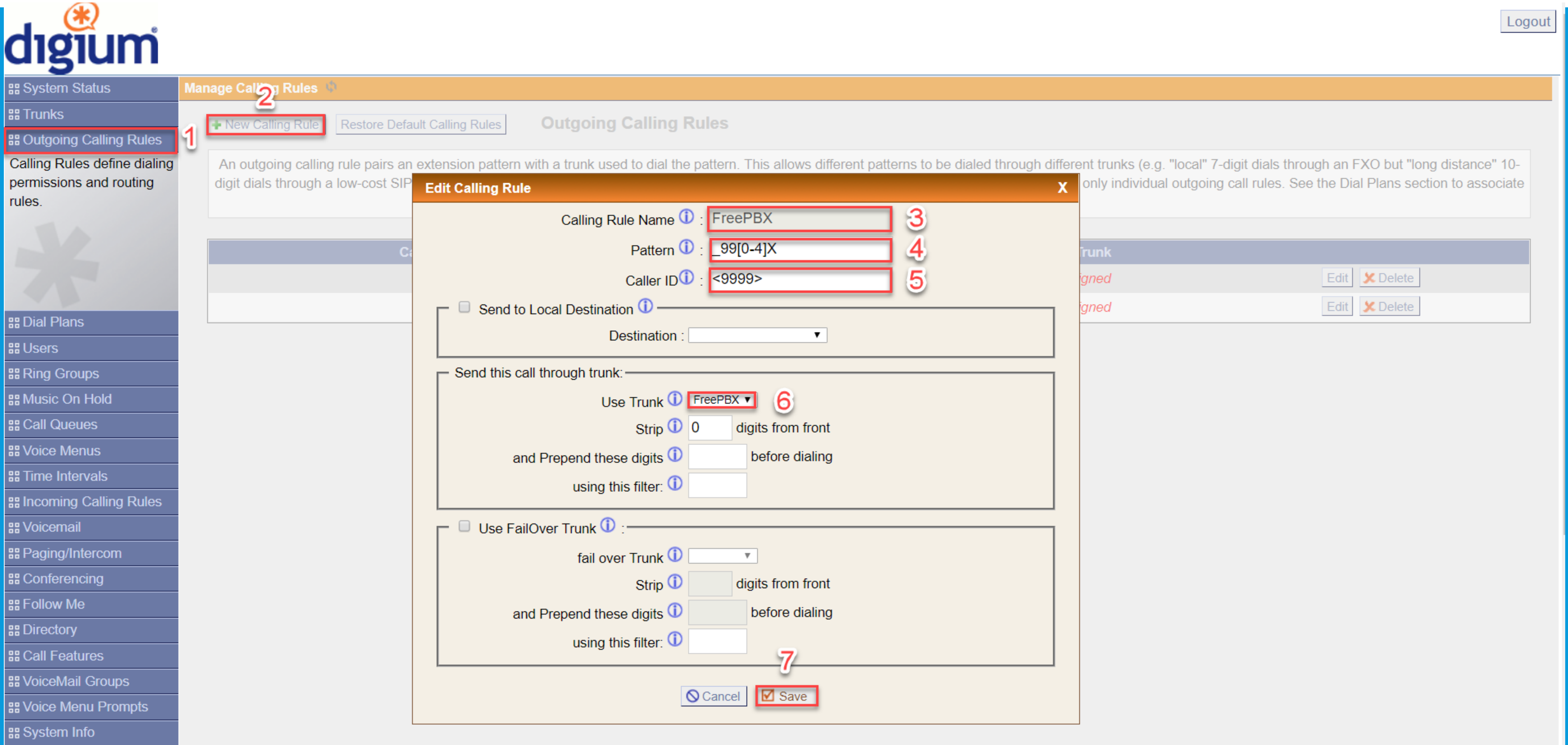
6. WHAT IS NEXT?

b. Connecting Two Asterisk Servers Together Via SIP Trunk



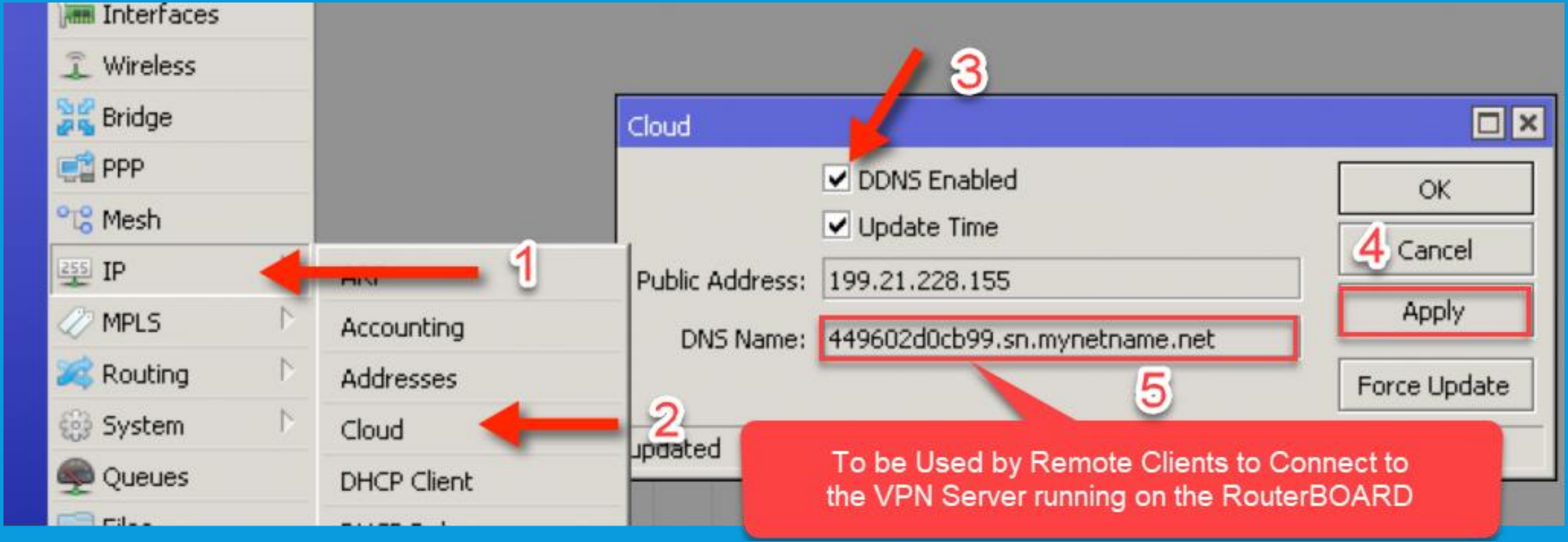
6. WHAT IS NEXT?

b. Connecting Two Asterisk Servers Together Via SIP Trunk



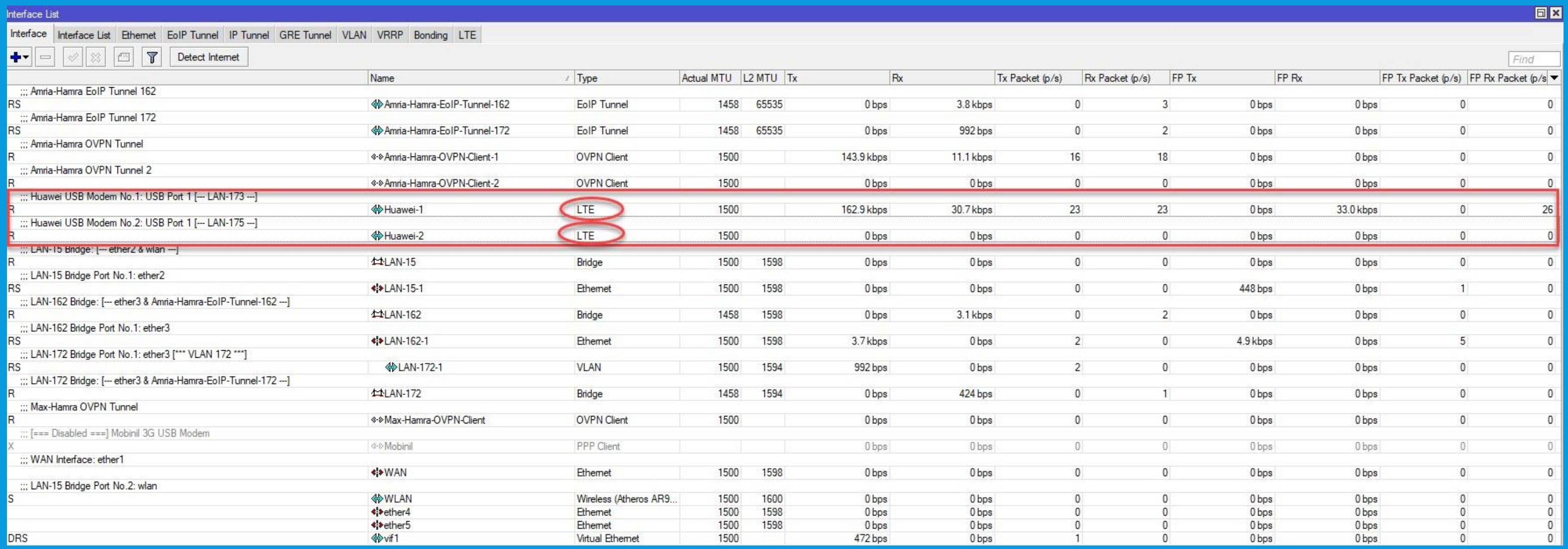
6. WHAT IS NEXT?

c. Does Your Mikrotik Need To Have A Static IP Address?



6. WHAT IS NEXT?

d. Can We Use A Broadband USB Modem For Internet Connection?



Interface List

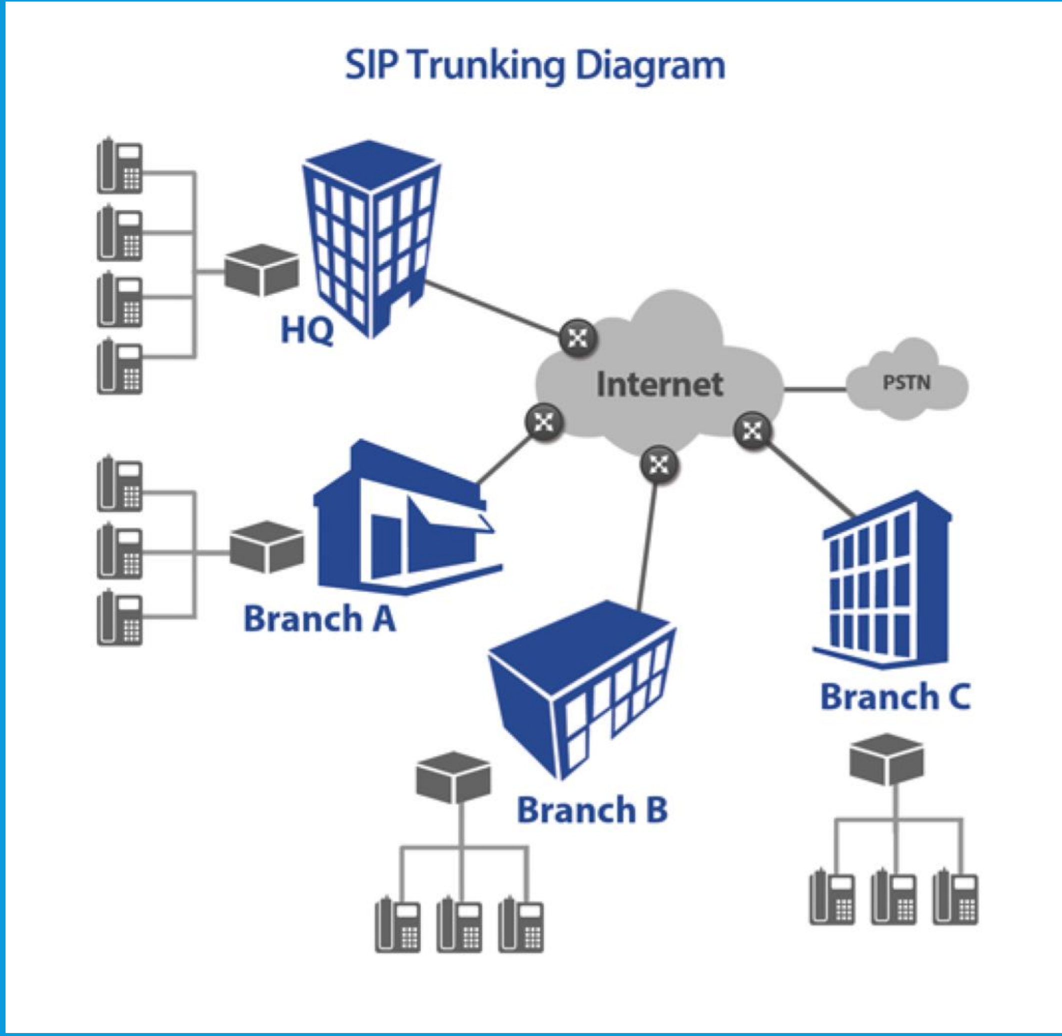
Interface | Interface List | Ethernet | EoIP Tunnel | IP Tunnel | GRE Tunnel | VLAN | VRRP | Bonding | LTE

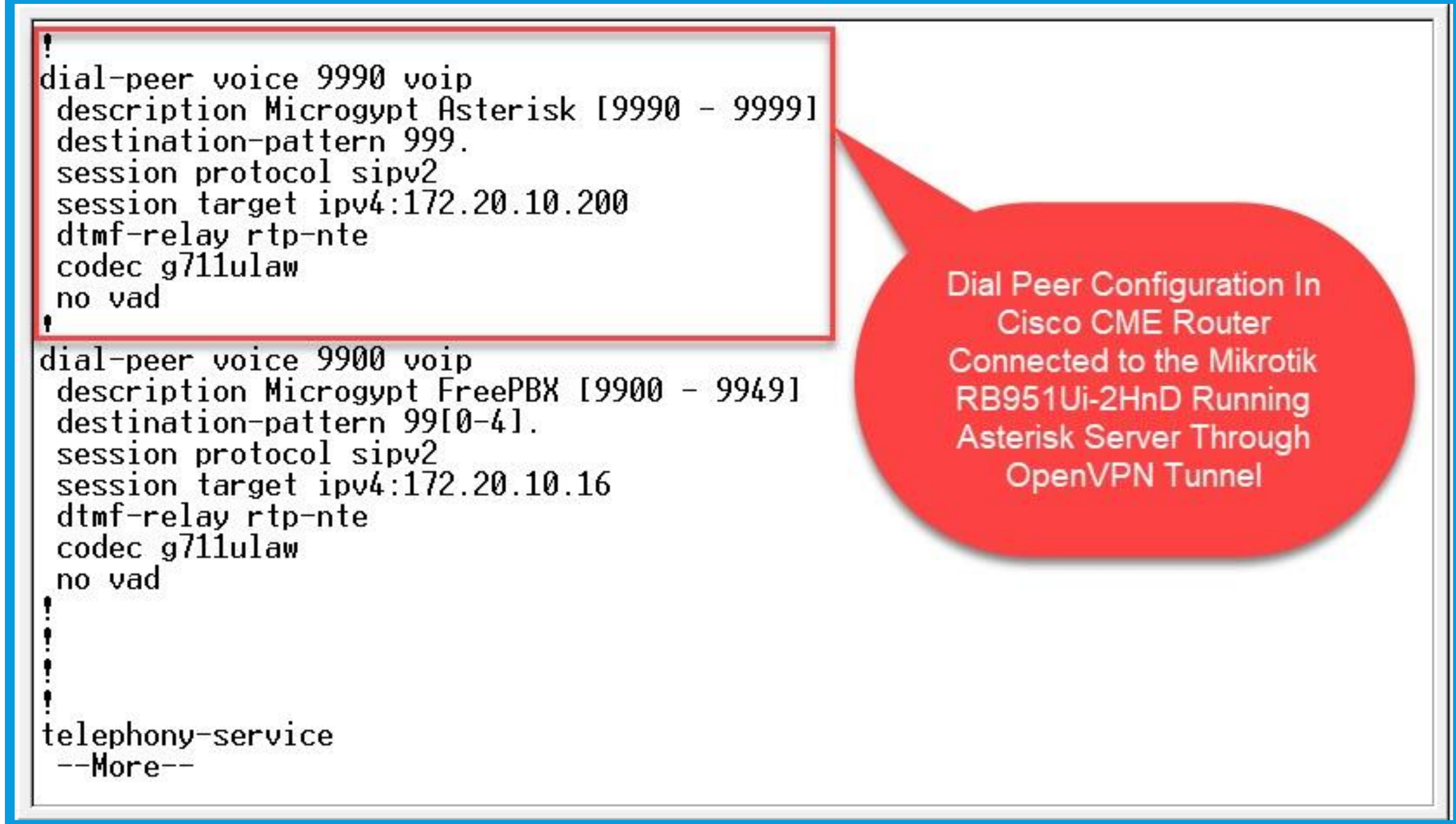
Detect Internet

	Name	Type	Actual MTU	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP Tx	FP Rx	FP Tx Packet (p/s)	FP Rx Packet (p/s)
;;; Amria-Hamra EoIP Tunnel 162												
RS	Amria-Hamra-EoIP-Tunnel-162	EoIP Tunnel	1458	65535	0 bps	3.8 kbps	0	3	0 bps	0 bps	0	0
;;; Amria-Hamra EoIP Tunnel 172												
RS	Amria-Hamra-EoIP-Tunnel-172	EoIP Tunnel	1458	65535	0 bps	992 bps	0	2	0 bps	0 bps	0	0
;;; Amria-Hamra OVPN Tunnel												
R	Amria-Hamra-OVPN-Client-1	OVPN Client	1500		143.9 kbps	11.1 kbps	16	18	0 bps	0 bps	0	0
;;; Amria-Hamra OVPN Tunnel 2												
R	Amria-Hamra-OVPN-Client-2	OVPN Client	1500		0 bps	0 bps	0	0	0 bps	0 bps	0	0
;;; Huawei USB Modem No.1: USB Port 1 [--- LAN-173 ---]												
R	Huawei-1	LTE	1500		162.9 kbps	30.7 kbps	23	23	0 bps	33.0 kbps	0	26
;;; Huawei USB Modem No.2: USB Port 1 [--- LAN-175 ---]												
R	Huawei-2	LTE	1500		0 bps	0 bps	0	0	0 bps	0 bps	0	0
;;; LAN-15 Bridge: [--- ether2 & wlan ---]												
R	LAN-15	Bridge	1500	1598	0 bps	0 bps	0	0	0 bps	0 bps	0	0
;;; LAN-15 Bridge Port No.1: ether2												
RS	LAN-15-1	Ethernet	1500	1598	0 bps	0 bps	0	0	448 bps	0 bps	1	0
;;; LAN-162 Bridge: [--- ether3 & Amria-Hamra-EoIP-Tunnel-162 ---]												
R	LAN-162	Bridge	1458	1598	0 bps	3.1 kbps	0	2	0 bps	0 bps	0	0
;;; LAN-162 Bridge Port No.1: ether3												
RS	LAN-162-1	Ethernet	1500	1598	3.7 kbps	0 bps	2	0	4.9 kbps	0 bps	5	0
;;; LAN-172 Bridge Port No.1: ether3 [*** VLAN 172 ***]												
RS	LAN-172-1	VLAN	1500	1594	992 bps	0 bps	2	0	0 bps	0 bps	0	0
;;; LAN-172 Bridge: [--- ether3 & Amria-Hamra-EoIP-Tunnel-172 ---]												
R	LAN-172	Bridge	1458	1594	0 bps	424 bps	0	1	0 bps	0 bps	0	0
;;; Max-Hamra OVPN Tunnel												
R	Max-Hamra-OVPN-Client	OVPN Client	1500		0 bps	0 bps	0	0	0 bps	0 bps	0	0
;;; [=== Disabled ===] Mobinil 3G USB Modem												
X	Mobinil	PPP Client			0 bps	0 bps	0	0	0 bps	0 bps	0	0
;;; WAN Interface: ether1												
	WAN	Ethernet	1500	1598	0 bps	0 bps	0	0	0 bps	0 bps	0	0
;;; LAN-15 Bridge Port No.2: wlan												
S	WLAN	Wireless (Atheros AR9...	1500	1600	0 bps	0 bps	0	0	0 bps	0 bps	0	0
	ether4	Ethernet	1500	1598	0 bps	0 bps	0	0	0 bps	0 bps	0	0
	ether5	Ethernet	1500	1598	0 bps	0 bps	0	0	0 bps	0 bps	0	0
DRS	vif1	Virtual Ethernet	1500		472 bps	0 bps	1	0	0 bps	0 bps	0	0

6. WHAT IS NEXT?

e. Why Not Integrate Your Asterisk Server With Your Existing Business Telecommunication Systems?!



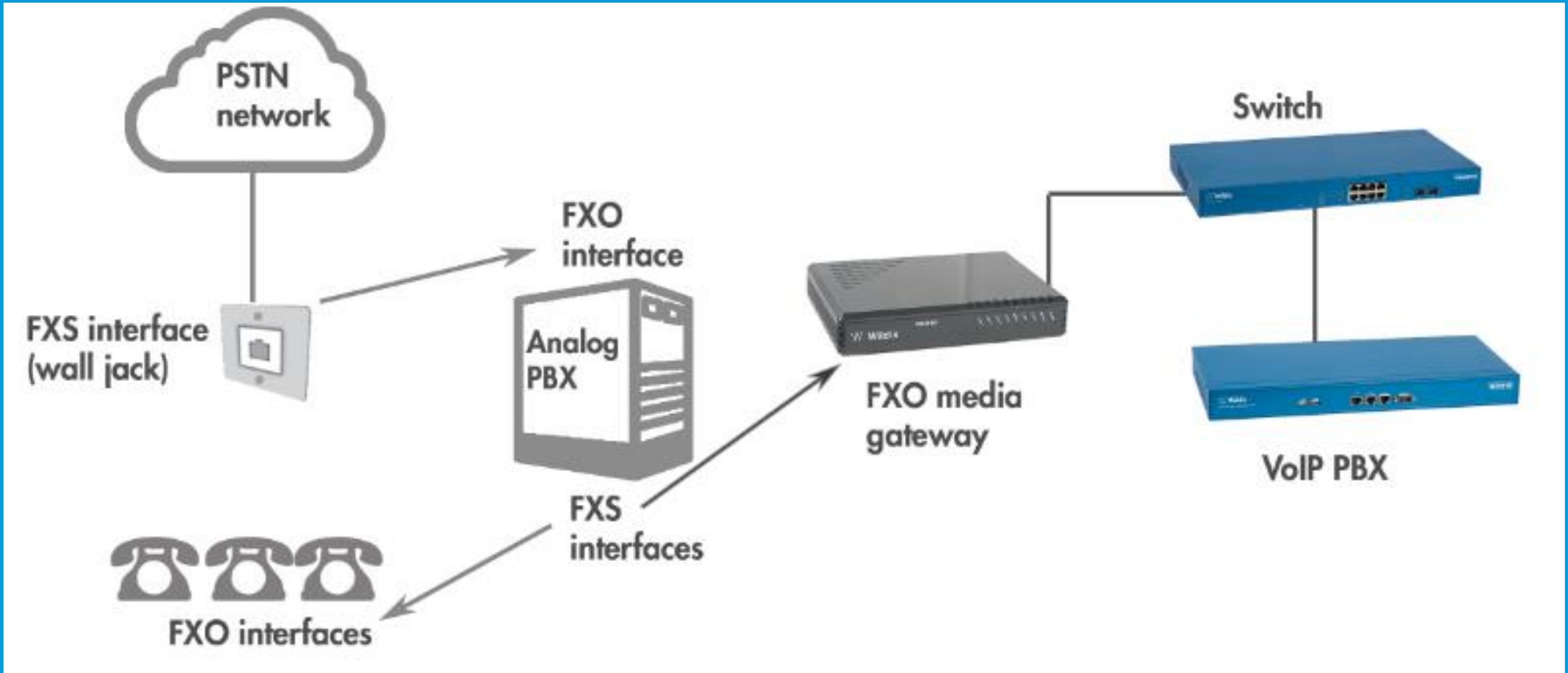


```
!
dial-peer voice 9990 voip
 description Microgypt Asterisk [9990 - 9999]
 destination-pattern 999.
 session protocol sipv2
 session target ipv4:172.20.10.200
 dtmf-relay rtp-nte
 codec g711ulaw
 no vad
!
dial-peer voice 9900 voip
 description Microgypt FreePBX [9900 - 9949]
 destination-pattern 99[0-4].
 session protocol sipv2
 session target ipv4:172.20.10.16
 dtmf-relay rtp-nte
 codec g711ulaw
 no vad
!
!
!
!
telephony-service
 --More--
```

6. WHAT IS NEXT?

f. Can We Make Outbound Calls to PSTN Using our Asterisk Server?

❖ Using FXO Media Gateway

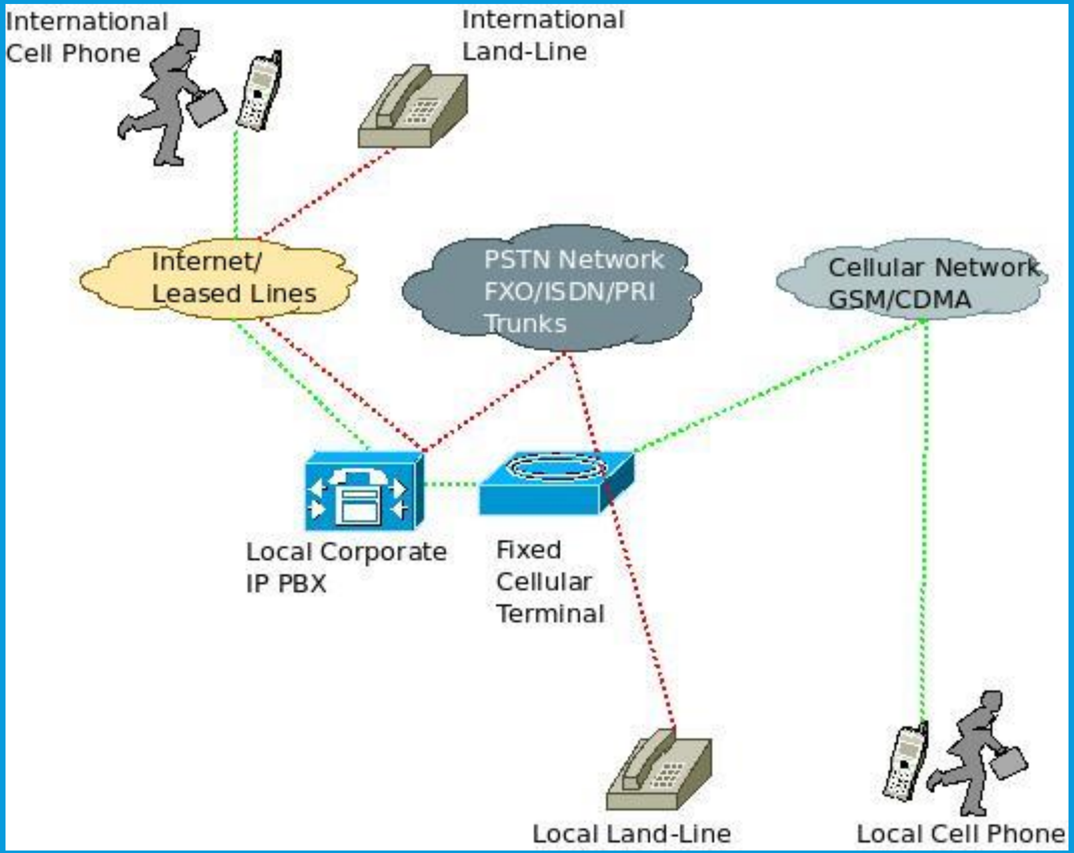


6. WHAT IS NEXT?

f. Can We Make Outbound Calls to PSTN Using our Asterisk Server?

❖ Using DISA

DISA (Direct Inward System Access) allows someone calling in from outside the telephone switch (PBX) to obtain an “internal” system dial tone and dial calls as if from one of the extensions attached to the telephone switch.



Thanks for your Attention

If later, feel free to contact me:

haythamaboulabbas@gmail.com

https://www.facebook.com/haythamaboulabbas

https://www.linkedin.com/in/haytham-aboulabbas-192485111/

(+20) 1227318847