TZ - Setting up a VoIP communication between a Raspberry Pi and an IP phone using an Asterisk IP PBX server

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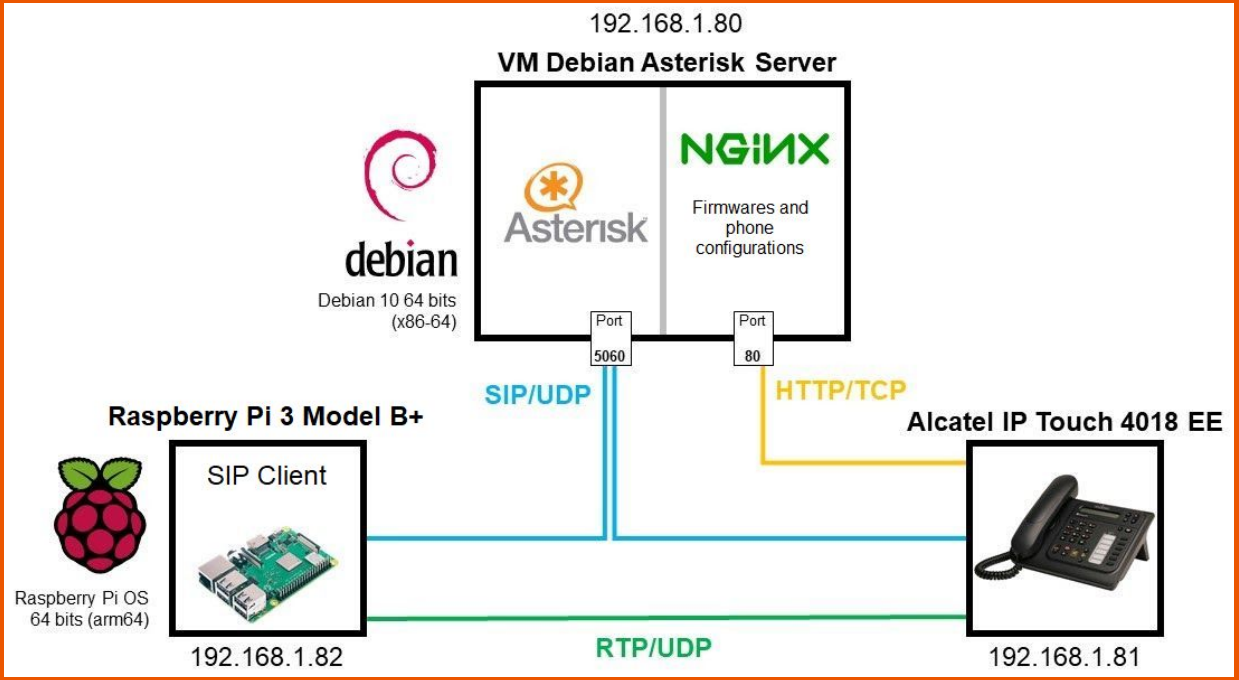
Aim of the project



1. SIP protocol and VoIP communication

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VoIP ?

SIP ?

RTP ?

1. SIP protocol and VoIP communication

Voice over Internet Protocol ?

SIP ?

RTP ?

1. SIP protocol and VoIP communication

Voice over Internet Protocol ?

Session Initiation Protocol ?

RTP ?

1. SIP protocol and VoIP communication

Voice over Internet Protocol ?

Session Initiation Protocol ?

Real-time Transport Protocol ?

1. SIP protocol and VoIP communication

VoIP

SIP

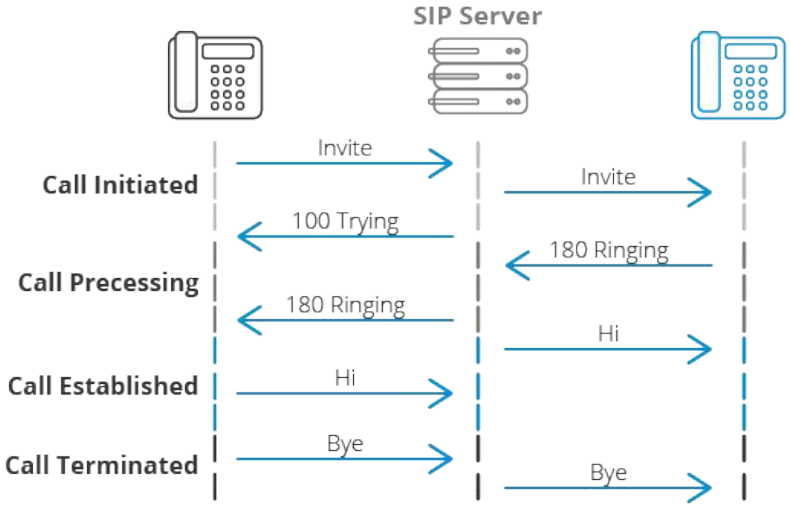
RTP

Application	SIP, HTTP, SMTP, FTP, RTP…
Presentation	
Session	
Transport	UDP/TCP
Network	IP
Data link	802.3 MAC, 802.11 MAC, EAP...
Physical	802.3 PHY, 802.11 PHY, copper, optical fibre...

(Internet protocol stack)

1. SIP protocol and VoIP communication

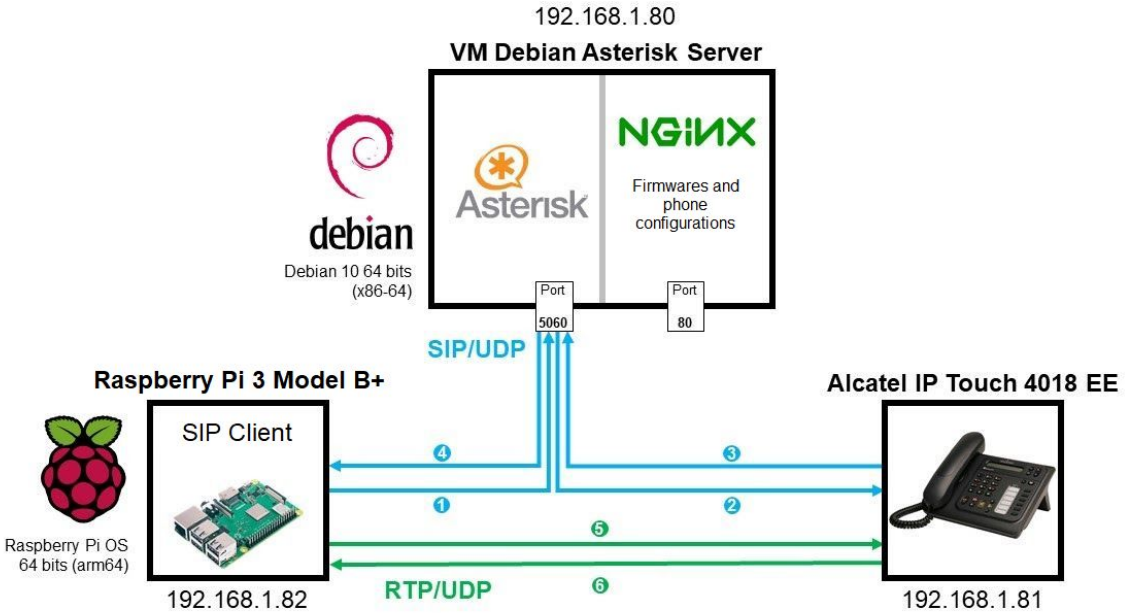
SIP



(Establishment and termination of a VoIP communication using SIP - attribution: 3cx.com)

1. SIP protocol and VoIP communication

(Establishing a phone call between the Raspberry Pi and the Alcatel IP Touch 4018 EE telephone)



2. Implementation of an Asterisk IP PBX server

2. Implementation of an Asterisk IP PBX server

Private Branch eXchange

Connecting telephone lines + additional services

PBX Matra MC6500 serie - Wikimedia Commons

2. Implementation of an Asterisk IP PBX server

Can we connect the Alcatel phone and the Raspberry Pi to this machine?

Analog

ISDN

Network	Q.931, X.25
Data link	Q.921 LAP-D...
Physical	I.430, I.431

IP

IP
802.3 MAC, 802.11 MAC, EAP...
802.3 PHY, 802.11 PHY, copper, optical fibre...

2. Implementation of an Asterisk IP PBX server

IPBX: Internet Protocol Branch eXchange

2. Implementation of an Asterisk IP PBX server

Debian 10 64 bits (x86-64)

Asterisk 18 LTS

IP: **192.168.1.80**

SIP server port: **5060**

2. Implementation of an Asterisk IP PBX server

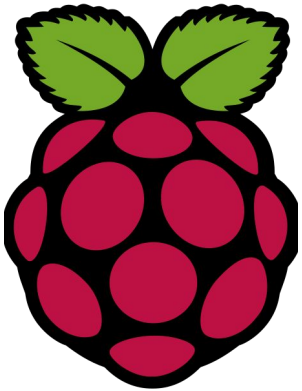
	Alcatel phone	Raspberry Pi	Test
Purpose	Dedicated account for the Alcatel IP Touch 4018 EE phone	Dedicated account for the Raspberry Pi	Dedicated account for testing
Nom d'affichage	Alcatel IP Touch	Raspberry Pi	Guillaume Nibert
Phone number	5001	5002	5003
Login	alcaltel	rpi	guillaume
Password	11111111	22222222	33333333

pjsip.conf

extensions.conf

3. Installation and configuration of a SIP client on the Raspberry Pi

3. Installation and configuration of a SIP client on the Raspberry Pi



Raspberry Pi OS Buster
64 bits (arm64)

linphone
open source VOIP project

linphonec SIP Client from Linphone

Raspberry Pi IP:
192.168.1.81

4. IP phone configuration

4. IP phone configuration

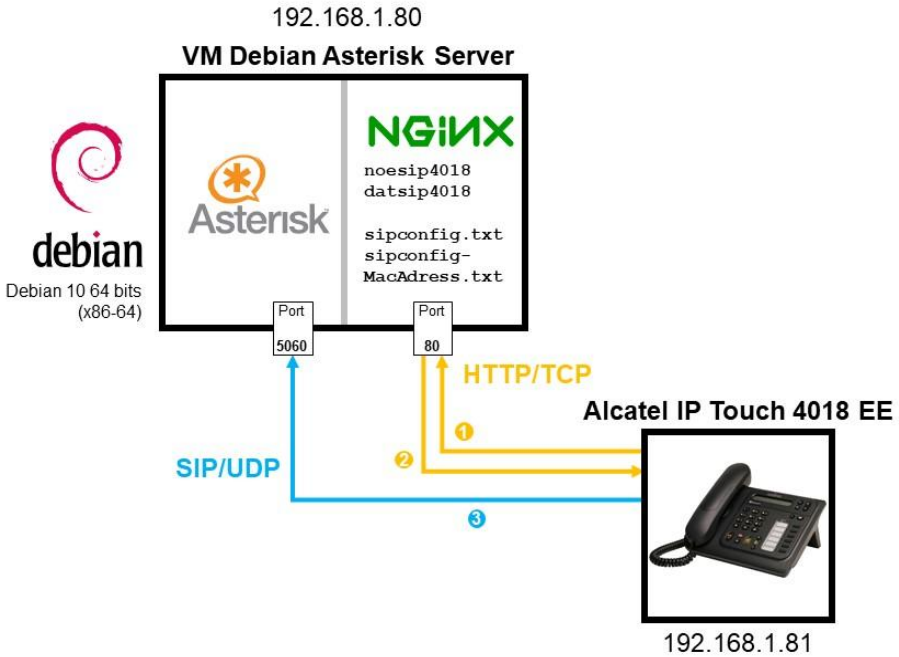
sipconfig.txt

sipconfig-MacAdress.txt

noesip4018

datsip4018

4. IP phone configuration



TFTP/UDP

HTTP/TCP

HTTPS/TCP

5. Demonstration

6. Preparation for the SIP client program in JavaScript

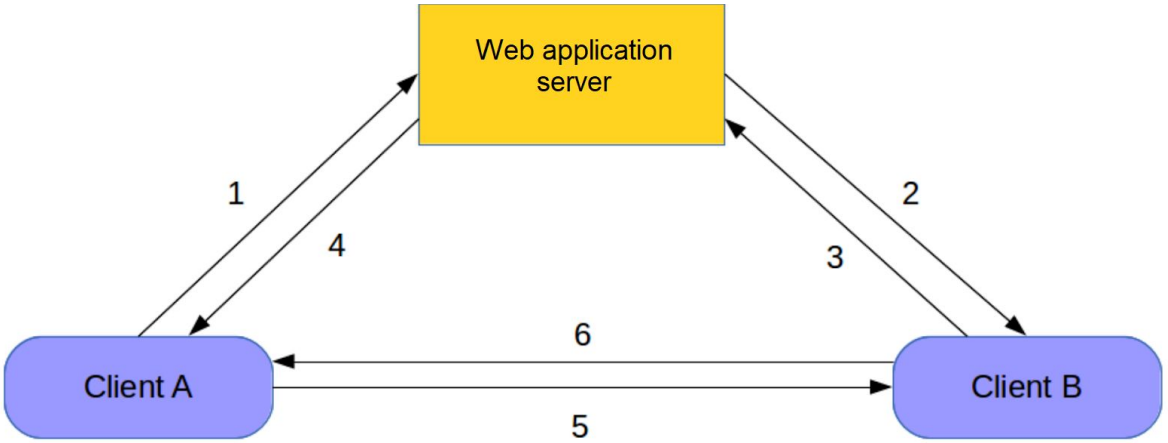
6. SIP client program in JavaScript

Challenge

SIP

WebRTC ?

6. Preparation for the SIP client program in JavaScript

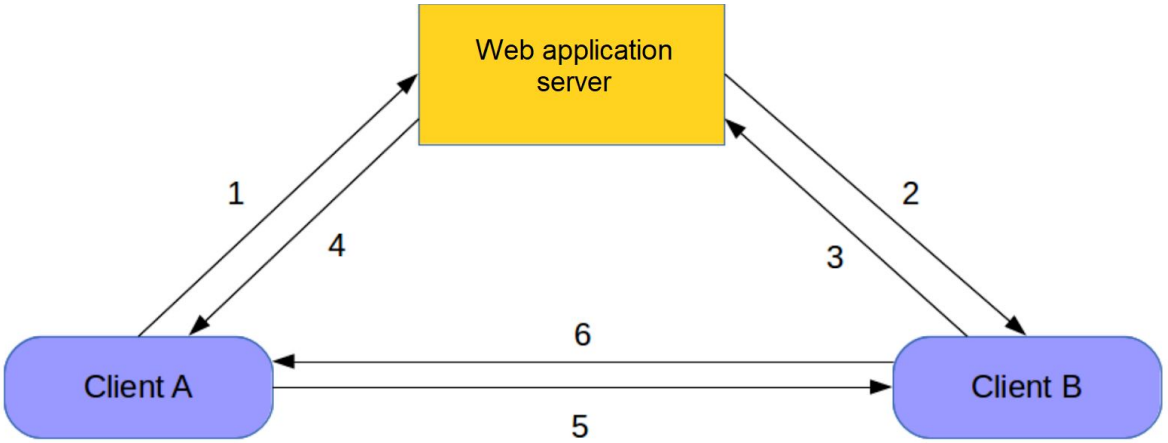


(Establishing a connection between two clients - Wikipédia)

WebRTC:

Web Real-Time Communication

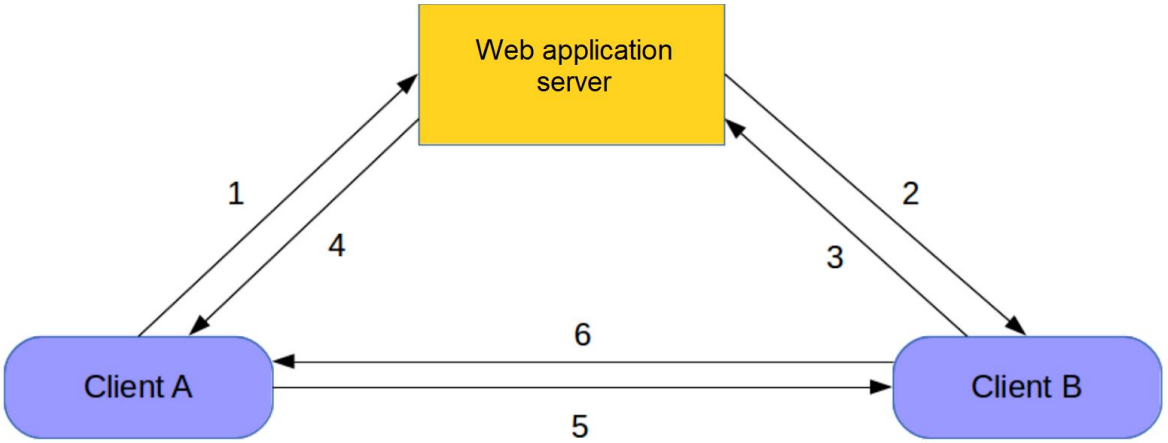
6. Preparation for the SIP client program in JavaScript



(Establishing a connection between two clients - Wikipédia)

What if client B does not support WebRTC?

6. Preparation for the SIP client program in JavaScript

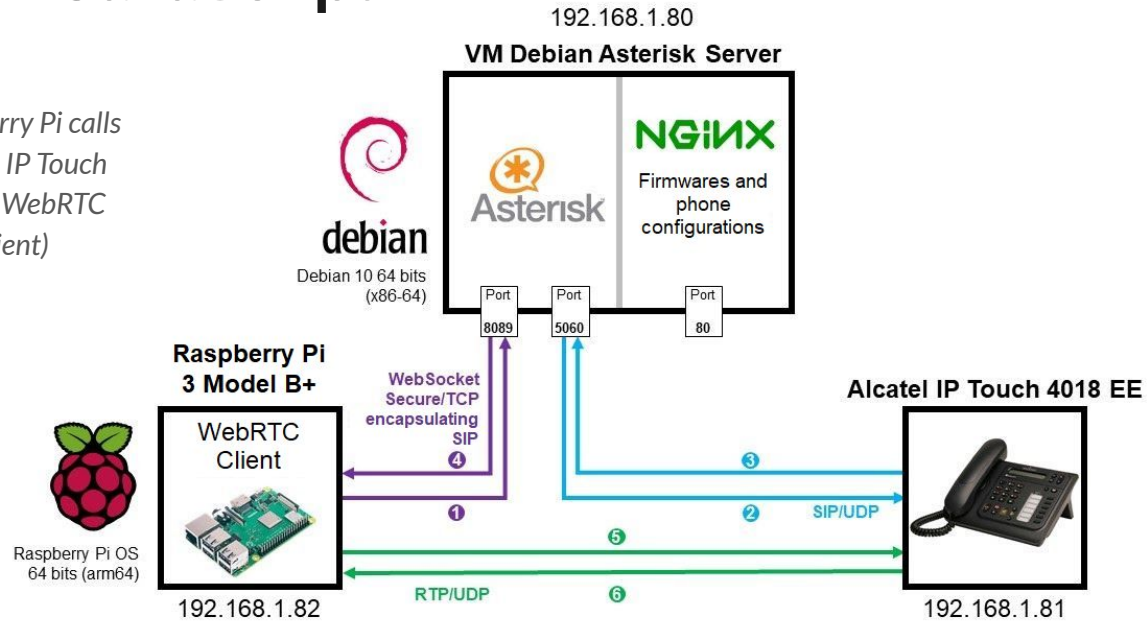


(Establishing a connection between two clients - Wikipédia)

It would be necessary to use SIP with WebRTC and to have an intermediate server managing both SIP and WebRTC...

6. Preparation for the SIP client program in JavaScript

(Raspberry Pi calls Alcatel IP Touch from a WebRTC client)



Using SIP with WebRTC = encapsulating SIP in a WebSocket

7. WebRTC/SIP Demonstration

8. SIP client program in JavaScript

8. SIP client program in JavaScript

SIP.js *JsSip* *sipML5*

Conclusion

Discovering new protocols and the world of telephony

Getting started with Asterisk

Encryption

Thank you for your attention.

Do you have any questions?

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Attributions

Figure 5 - PBX Matra MC6500 serie: the original uploader was After310 at French Wikipedia, *PABX Matra série MC6500*, CC BY-SA 3.0, via Wikimedia Commons, available at: https://commons.wikimedia.org/wiki/File:PABX_Matra6500.JPG.

Figure 17 - Establishing a connection between two clients: adapted from the original work of Feyd-Aran, *Etablissement d'une connexion par WebRTC*, CC BY-SA 3.0, via Wikimedia Commons, available at: https://commons.wikimedia.org/wiki/File:Etablissement_d'une_connexion_par_WebRTC.svg