





CERN Fixed Telephony Service Development

HEPiX Autumn 2019 Workshop – October 2019

A Bit of History

Legacy Phone Infrastructure

- Alcatel PABX
 - Running since 1990s
 - Monolithic design
 - Ageing hardware
 - Decaying cabled infrastructure
 - Growing license costs
 - Not designed for VoIP

Project Goals

- Avoid Vendor lock-in
- Reduce operational costs
- Increase flexibility to add new services
- Replace the PABX by a software-based solution
 - ... using Open-source components
 - ... that uses VoIP standard protocols (SIP)
 - ... built on top of IT's Agile Infrastructure
 - ... with minimum resources

A Joint Project: DialTone

- Between 2 CERN IT groups:



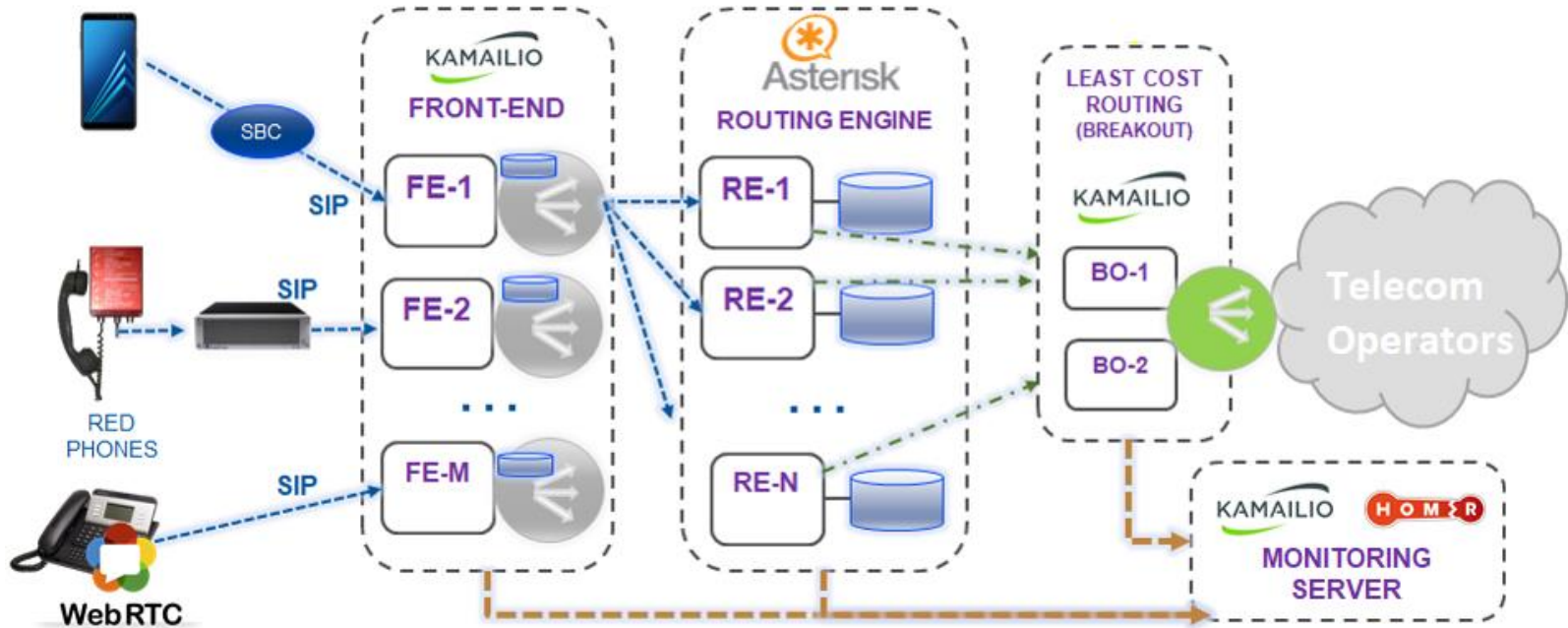
CS: Backend (PABX and SIP gateways)



CDA: Dial Clients (hardware and software)

Phone Backend

Backend Architecture

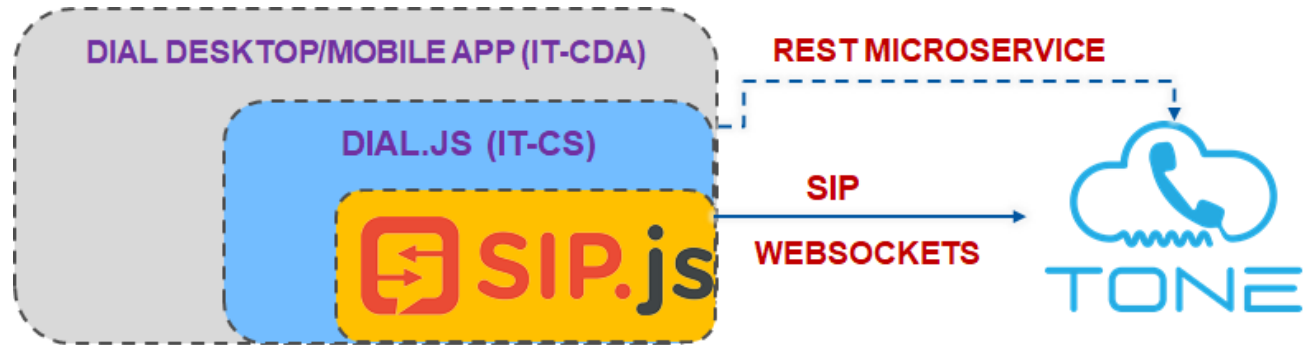


Ensuring a Critical Service

- Hybrid bare-metal and Openstack VMs (all puppet-managed)
- 2 new telephony hubs in Meyrin and Prévessin:
 - Dedicated subnet and routers
 - Direct fiber links to red phone sites
 - DNS-failure proof
 - Long-duration batteries
 - Connection to PSTN operators

Client Interface

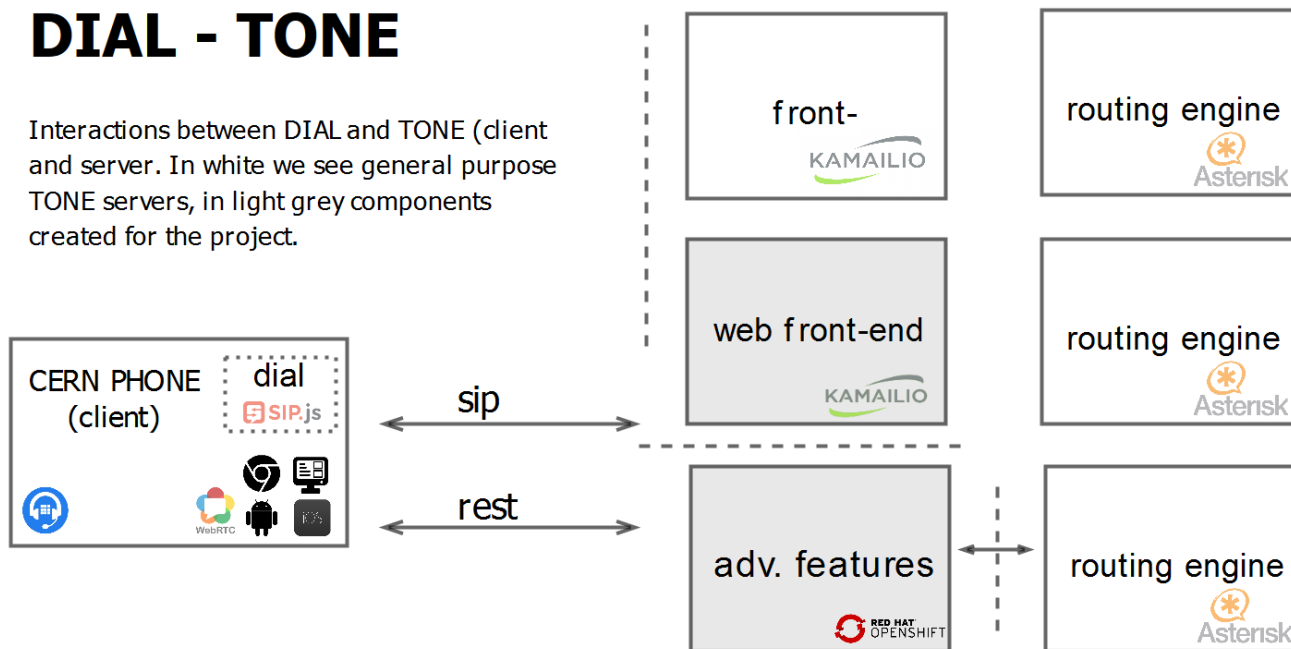
- Dial.js
 - Included in the webRTC client
 - Leverages TONE's built-in redundancy
 - Exposes a single JS API for desktop and mobile clients
 - A REST microservice provides additional features



Client/Server Architecture

DIAL - TONE

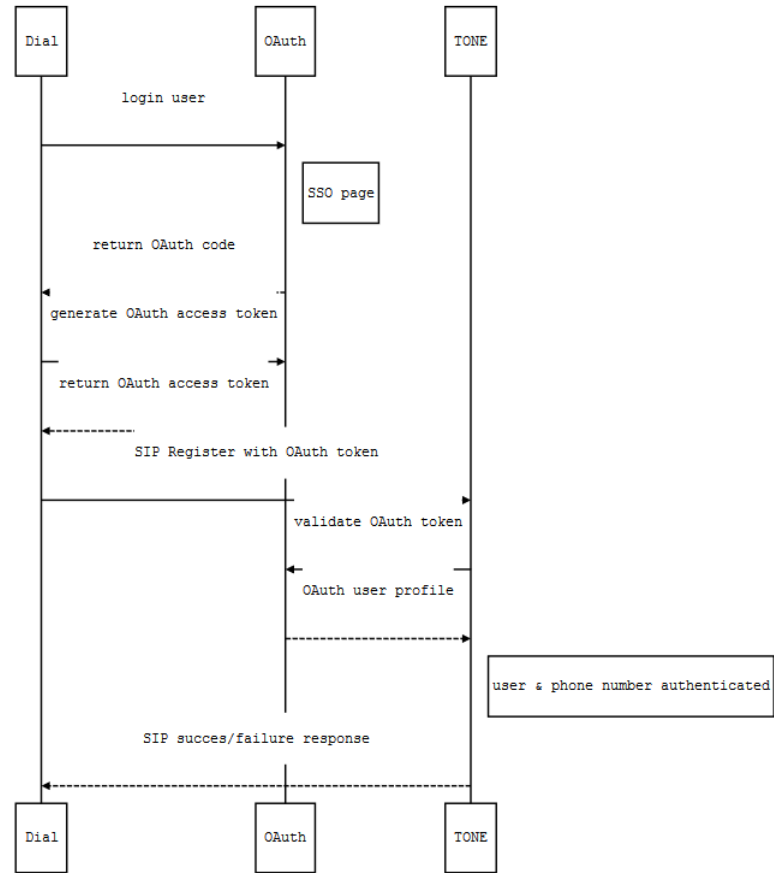
Interactions between DIAL and TONE (client and server). In white we see general purpose TONE servers, in light grey components created for the project.



Few Challenges

- Authentication
- Front-end server adaptation
- Advanced features server
- Mobile Application

Authentication



Front-end Server Adaptation

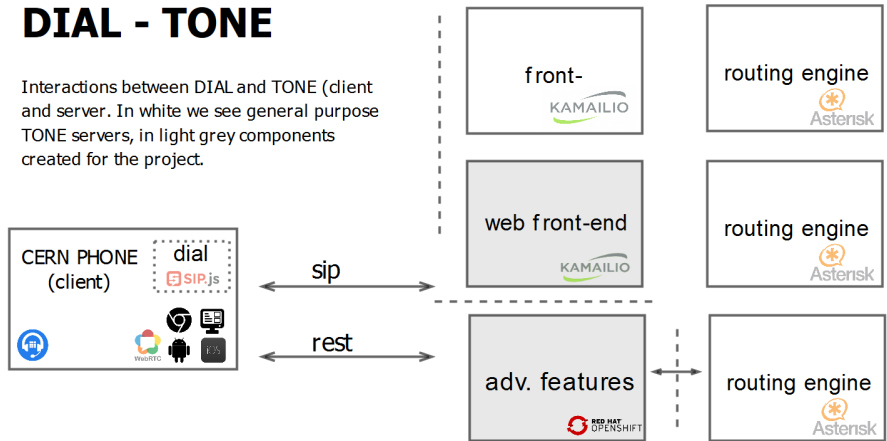
- Authentication
 - Custom SIP headers for authentication.
 - Module for OAuth communication.
 - Save and keep state.
- RTPengine
 - Calls from webRTC client to PSTN require extra component to handle media conversion and negotiation
- Websockets
 - SIP doesn't specify transport but usually plain TCP/UDP is used.

Advanced Features Server

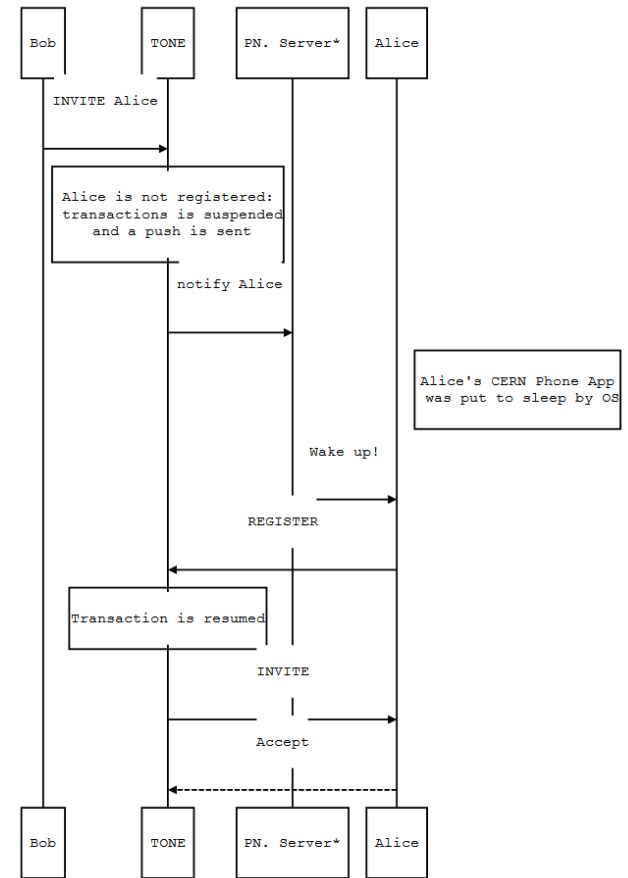
- REST API
- Server to enable/disable features directly related to telephony

DIAL - TONE

Interactions between DIAL and TONE (client and server). In white we see general purpose TONE servers, in light grey components created for the project.



Mobile App Workflow



Phone Clients

Technology

- webRTC
 - Client media management
 - Multiplatform
 - Existing in-house experience
- SIP
 - PABX connection
 - SIP.js

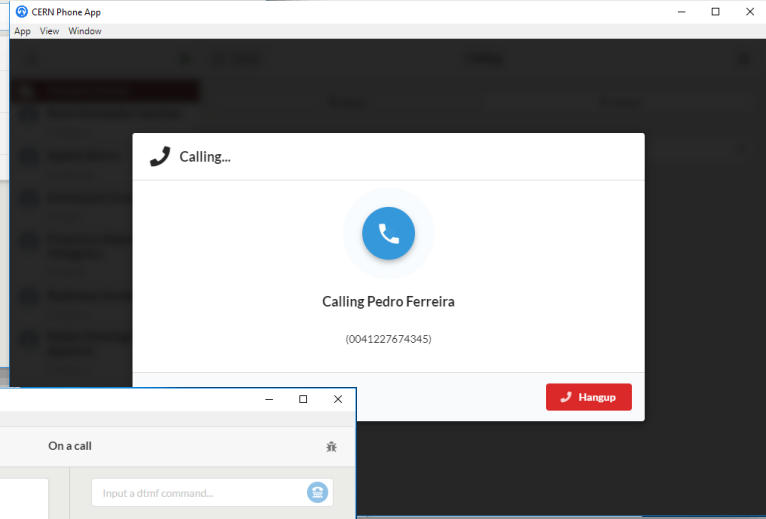
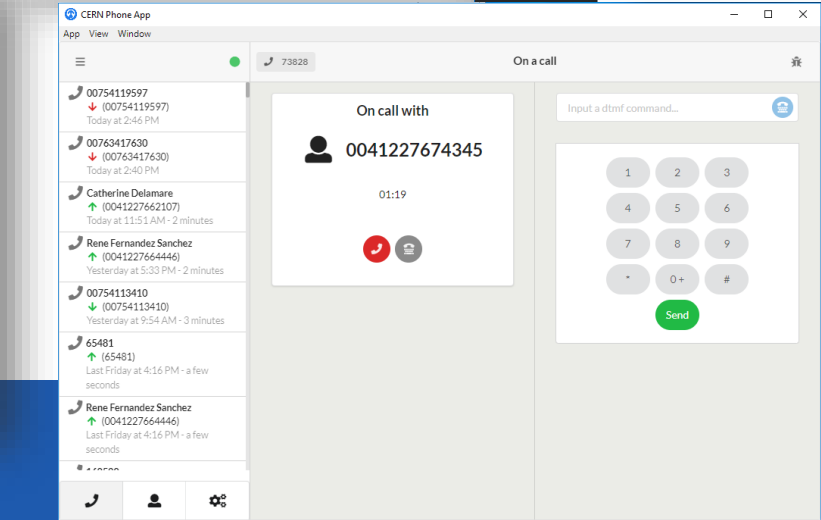
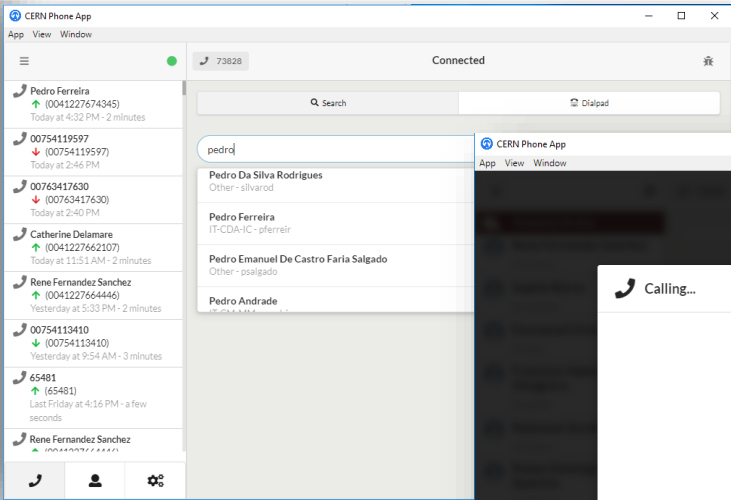
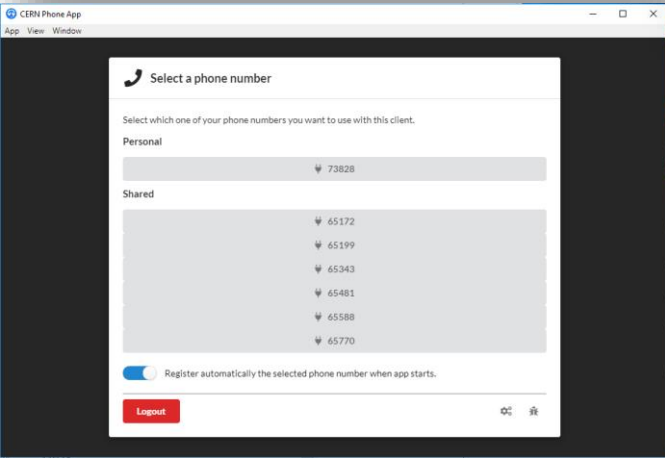
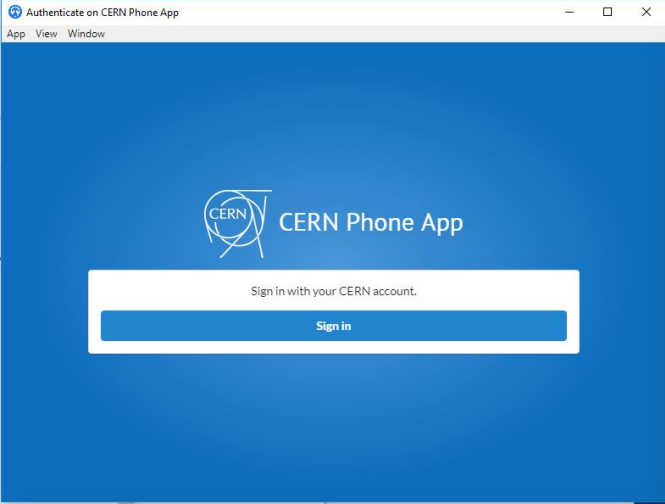
Technology

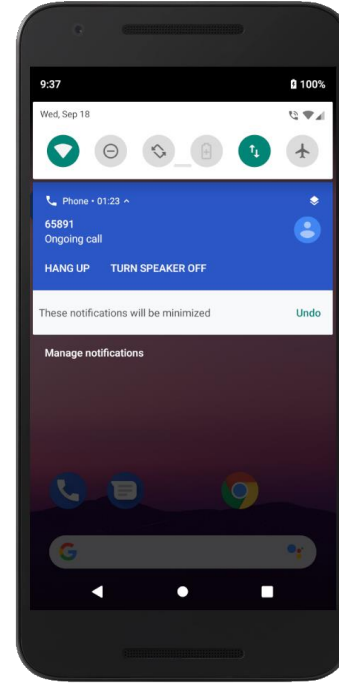
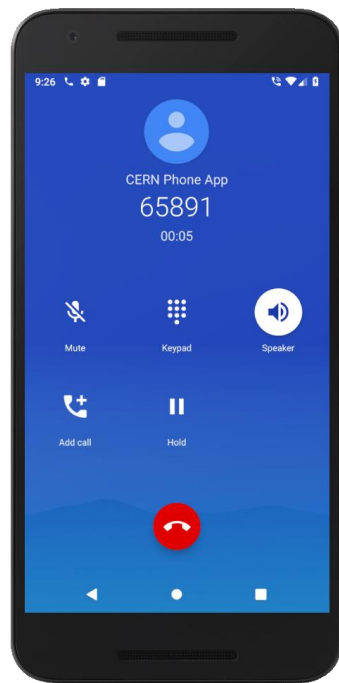
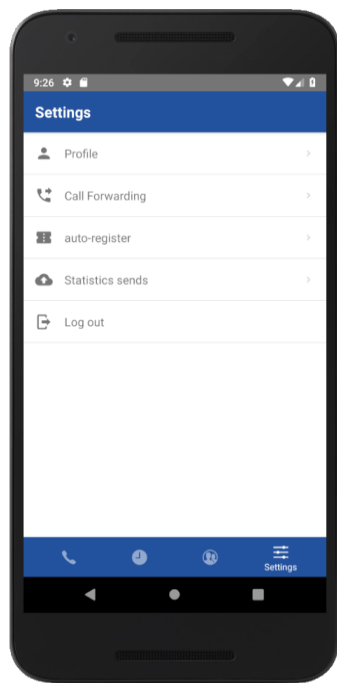
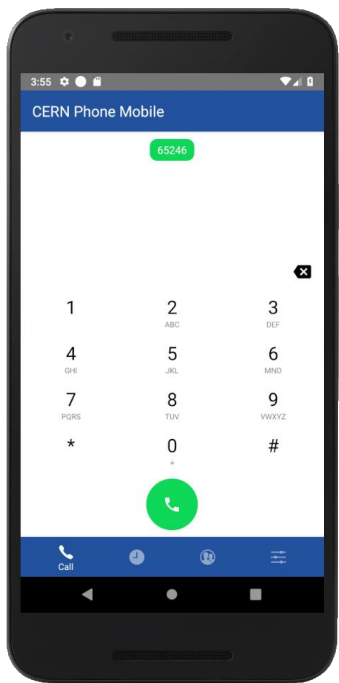
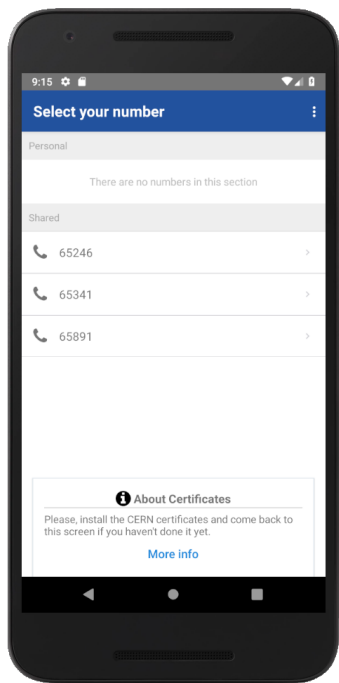
- Desktop clients

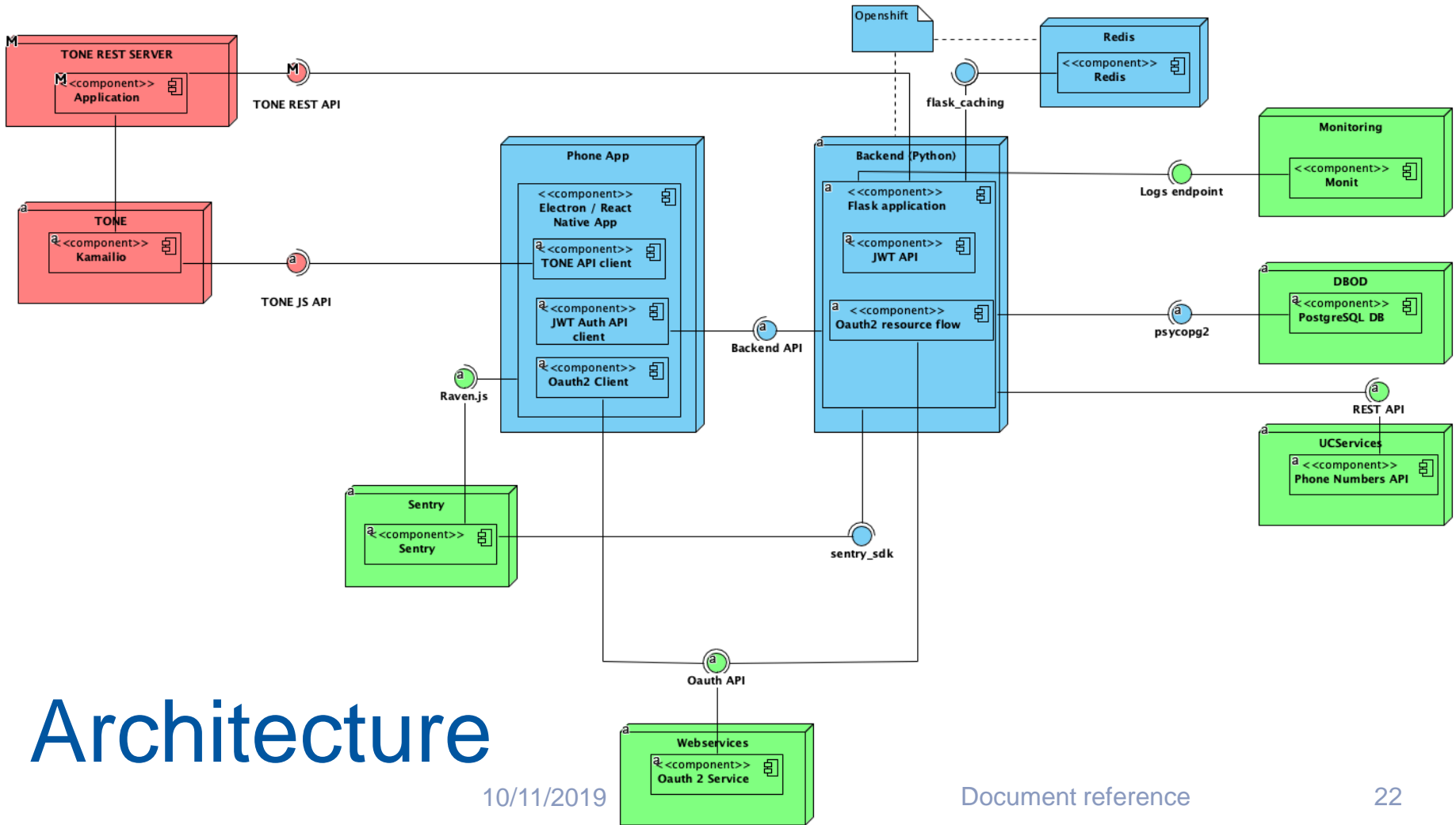
- Platform
 - React
 - Electron
- Libs
 - Redux
 - Semantic-ui-react
 - Tone-js-api
 - Electron-updater
- OS
 - Windows
 - Mac
 - Ubuntu 18
 - CentOS 7

- Mobile clients

- Platform
 - React Native
- Libs
 - React-native-callkeep
 - React-native-webrtc
 - React-native-firebase
 - Tone-js-api
- OS
 - Android
 - iOS







Architecture

Features (1/2)

Desktop	Mobile
✓ Make/Receive Calls	
✓ Register a phone number	
✓ LDAP Search for people	
✓ Authentication using CERN OAuth	
✓ Call Forwarding	
✓ Contacts Management	

Features (2/2)

Desktop	Mobile
✓ Store sensitive data in the OS Keychain (Win, Mac, Linux)	✓ Integration with iOS Callkit and Android Connection Service
✓ Check for updates	✓ Integration with push notifications
✓ Do not disturb mode	Receive calls when app is in background/ not running
✓ Select input and output devices	

Roadmap

- Nov. 2019
 - Simple mobile client
 - Chat
- Dec. 2019
 - Call transfers
 - Managers e-group
- Jan. 2020
 - Simultaneous calls
- Feb. 2020
 - Team Members
 - Missed calls
- Mar. 2020
 - Ad-hoc conference
- Apr. 2020
 - Complete mobile client
 - Voice Messages
- Sep. 2020
 - Advanced Call Logs
- Dec. 2020
 - Voice Recording

Provisioning

CERN Resources Portal

CERN Resources Portal

Manage your CERN Resources, lifecycle, settings, etc.

[Home](#) [List Services](#) [Pending Actions](#) [Select Account](#) [Service Desk](#) [Help](#) [Support](#)

Service Information

Fixed Telephony

Enhanced IP telephony

Subscriptions

PILOT Service

Beware: This is a pilot service. Please see more information about the pilot, as well as known limitations on this page.

IP Phones

Your personal number [?]

Number In Phonebook

73828

[Remove from Phonebook](#)

[Turn to shared number](#)

[Delete](#)

Your shared numbers [?]

You have 5 shared phone number(s).

Number Description

Managers Egroup [?]

65199 Test room codecs

[Change description](#)

[Change owner](#)

[Delete](#)

[phone-mngr-65199](#)

65343 Test Polycom VVX 201

[Change description](#)

[Change owner](#)

[Delete](#)

[phone-mngr-65343](#)

65481 Test Polycom VVX 150

[Change description](#)

[Change owner](#)

[Delete](#)

[phone-mngr-65481](#)

65588 Indico service number

[Change description](#)

[Change owner](#)

[Delete](#)

[Create](#)

65770 Test Polycom VVX 411

[Change description](#)

[Change owner](#)

[Delete](#)

[Create](#)

Enter here the new shared number description

Description for the new number

[Get a new shared number](#)

Migrate existing numbers from legacy services

Number Type of number

62922 Alcatel IP Service

[Migrate as shared number](#)

65655 Skype for Business (common area)

[Migrate as shared number](#)

65773 Skype for Business (common area)

[Migrate as shared number](#)

70811 Legacy (analogue number)

[Migrate as shared number](#)

By clicking "Migrate" you start process of migrating one of your legacy phone numbers to this service. You will become responsible for this number. Beware you can have only **ONE PERSONAL** phone number. Some numbers cannot be migrated as your personal number, in general that's because several other people appear under this number in the phonebook.

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IP Phones

Registered IP Phones for account tbaron

Name	Number ¹	Model	MAC Address	Compatible Model	Activation	
D60-TEST		POLYCOM D60	64-16-7F-04-13-6C	No		Unregister Phone
TELEPHONE-62922	62922	ALCATEL IP TOUCH 4028	00-80-9F-A8-8E-27	Soon		Unregister Phone
TELEPHONE-65343	65343	POLYCOM VVX 201	64-16-7F-89-C9-4D	Yes	Activated	Unregister Phone
TELEPHONE-65481	65481	POLYCOM VVX 150	64-16-7F-55-A2-0E	Yes	Activated	Unregister Phone
TELEPHONE-65770	65770	POLYCOM VVX 411	64-16-7F-2D-13-7D	Yes	Activated	Unregister Phone

[1]: Phone numbers are extracted from the network name of the registered IP Phone. Well-formatted network names should follow this schema: TELEPHONE-XXXXXX (where XXXXX is the phone number)

Register a new IP Phone

Model:

Phone Number:

Only numbers that you own and are not yet associated with an IP phone will appear here.

MAC Address:

The MAC address can be found on the sticker located under the IP Phone device.

Office: 28 1-022

[Register](#)

Related sites

- [Account Management](#)
- [Service Portal \(Get Help\)](#)



IP Phones Provisioning

- New auto-provisioning server for Polycom IP phones
- Automated redirection from old (SfB) server
- Still missing
 - Authentication of phones



Documentation

Fixed Telephony Service Public Site (DRAFT) Search

Fixed Telephony Service Public Site (DRAFT)

Service Description
Service Features
Getting Started
Use Cases
Phone App User Guide
IP Phones
Peripherals
FAQ

Welcome to the Fixed Telephony Service web site

Warning

This site is a **draft version** of the public web site of the new telephony service that will be deployed at CERN after Q3 2019. Information contained in this web site is likely to change although it is considered quite stable as of now

What is the Fixed Telephony Service ?

The fixed telephony service is provided by the IT department (IT-CDA and IT-CS) and is responsible for the installation, configuration, operation and maintenance of the fixed telephone infrastructure, as well as of the related telephony clients (software and hardware phones).

Contact

Call 77777, open a ticket on [ServiceNow](#), or send an email to fixedtelephony-support@cern.ch.

Scope of the service

Service Hours

This service is meant to operate 24/7/365.

Technical support is provided from **8:30 to 17:30** on week days.

Authorized Users

All CERN classes of personnel are authorized users of the service except EXMP (ex-member of personnel), PART (Participant to an experiment), RETP (retired participating in an experiment), RETR (Retired) and EXTN (external with CERN guarantor) which code is not HONO (honorary member of personnel), ILOF (Industrial Liaison Officer), SCIE (Scientific activities of pensioners of institutes), STAG (Trainee outside CERN official programs). Authorized users can use the service by requesting and using phone numbers.

Table of contents

- What is the Fixed Telephony Service ?
- Contact
- Scope of the service
- Service Hours
- Authorized Users
- Types of Phone Numbers
 - Personal Phone Numbers
 - Lifecycle
 - Usage
- Shared Phone Numbers
 - Owner
 - Managers e-group
 - Lifecycle
 - Usage
- Telephony Client Options
 - Desktop Phone App
 - Distribution
 - Limitation
 - Mobile Phone App
 - IP Phones
 - Calling Rights

Fixed Telephony Service Administration Site Search

Fixed telephony service provisioning

Background

Architecture

```
graph TD
    User --> RP[Resources Portal]
    RP --> FIM
    FIM --> UCRest
    UCRest --> UCServices
    Dial --> UCServices
    UCServices --> Foundation
    UCServices --> Phonebook
    UCServices --> LANDB
    UCServices --> IP_PPS[IP Phones Provisioning Server]
    UCServices --> DHCP
    IP_PPS --> IP_Phones[IP Phones]
    DHCP --> IP_Phones
    IP_Phones --> TONE
    Foundation --> TONE
    Phonebook --> TONE
```

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- Component details
 - Resources Portal
 - FIM
 - UCRest
 - UCServices
 - Controller for Dialtone numbers
 - Endpoint to list phone numbers for Dialtone interfaces
 - Deactivation of Skype for Business numbers
 - Foundation
 - Phonebook
 - TONE
 - Dial
- Provisioning workflows
 - New personal number
 - New shared number
 - Migration of personal phone from Skype for Business
 - Migration of shared phone from Skype for Business
 - Migration of personal phone from analogue service
 - Migration of shared phone from analogue service
 - Registration of new IP phone
 - Unregistration of IP phone
- IP Phones
 - D60 Pairing

Components general description

- Resources Portal
 - This is the web portal (<https://resources.web.cern.ch>) where users perform all actions regarding phone numbers (request, migrate, update, delete, re-assign) and IP phones lifecycle.



Pilot just started!



Thank you!

<https://fixed-telephony-service.docs.cern.ch/>
<https://github.com/cern-phone-apps>

IT-CS

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Francisco Valentin Vinagrero
Joao Garrett Paixao Florencio

IT-CDA

René Fernandez Sanchez
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Thomas Baron