



Telephony evolution at CERN

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About me

From Spain, living in Geneva

Joined CERN in 2013

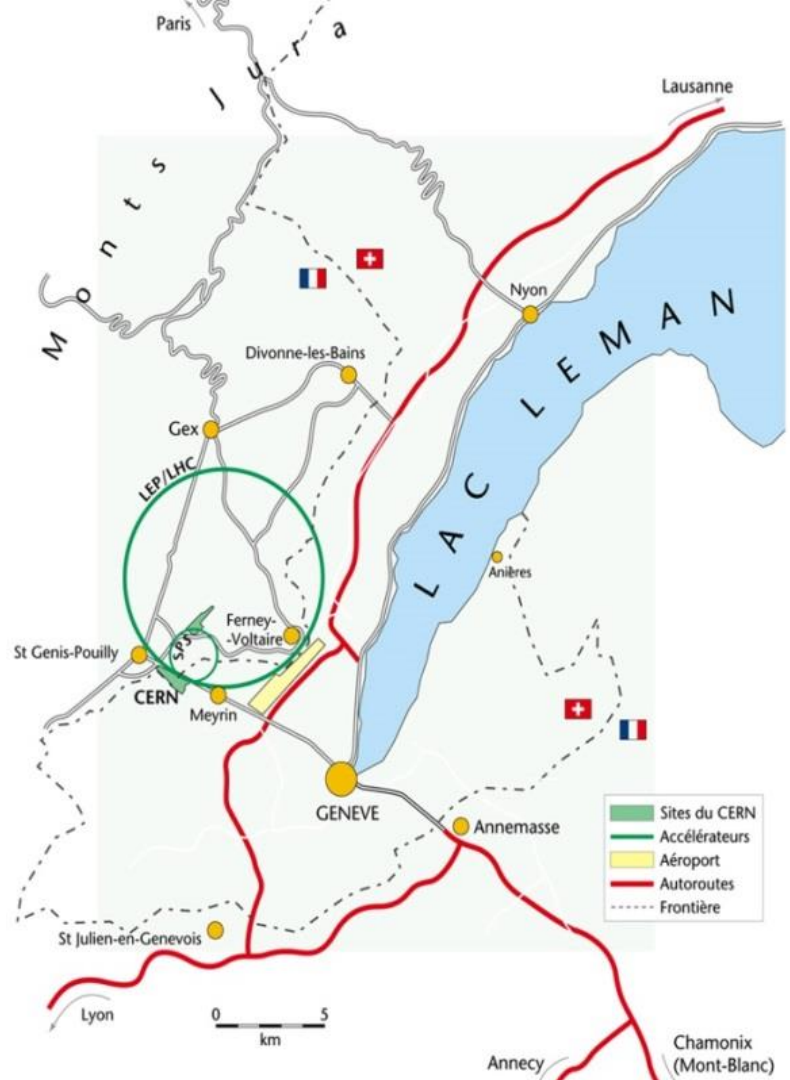
NGN/IMS core network roles previously

Telefónica Int. Wholesales, Huawei, Vodafone



CERN

- International organization
- Founded in 1954 by 12 countries
- 21 member states
- Amazing example of international collaboration
- Split between French and Swiss border
- Multiple sites in more than 60 Km²



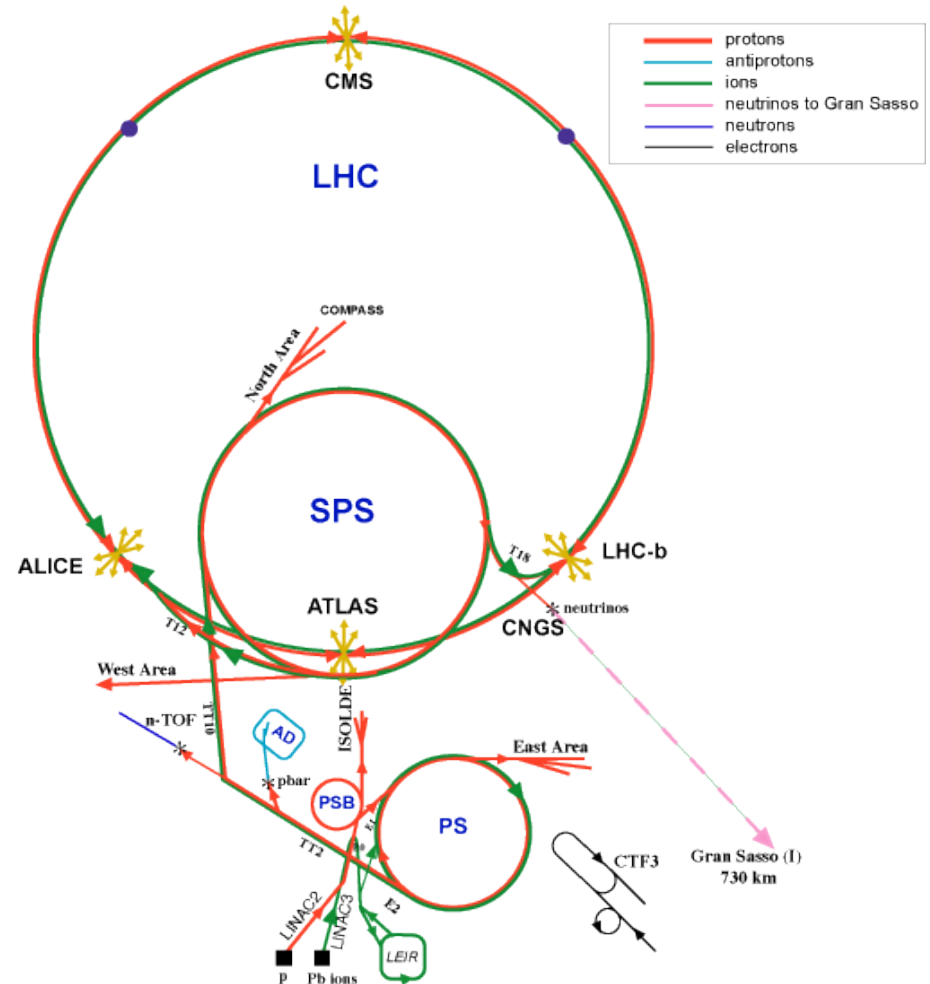
CERN

Goal :

Understand the universe: what is it made of and how it works

Instruments :

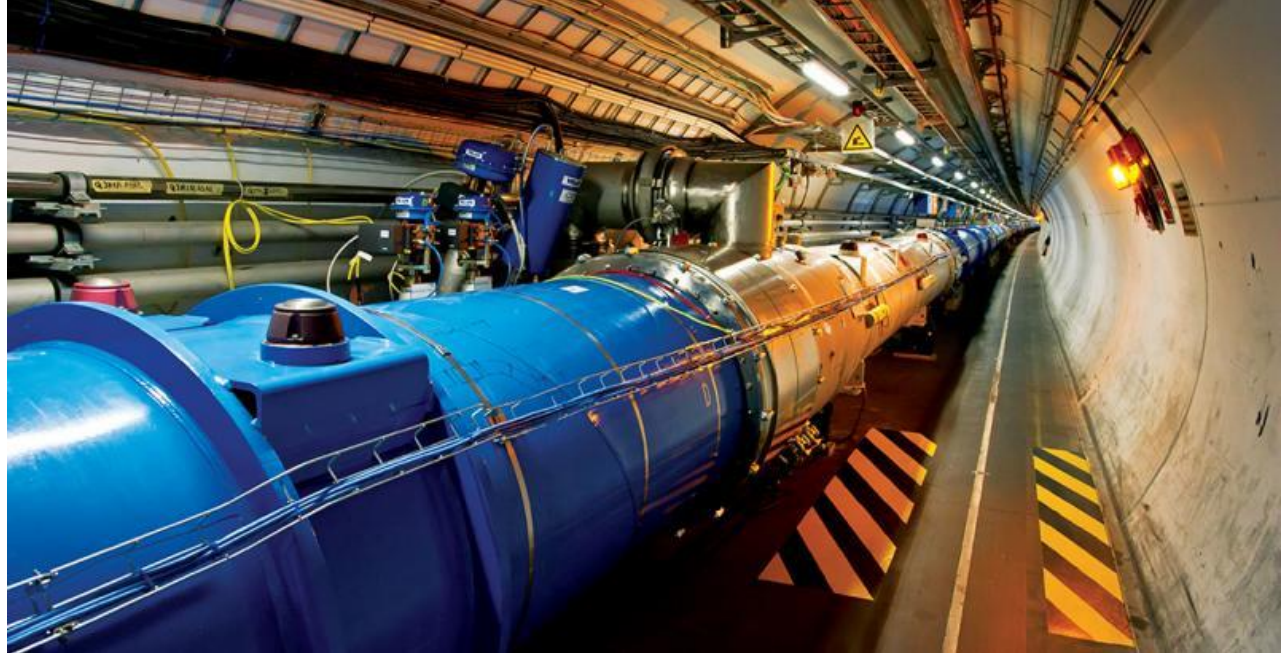
Accelerators and detectors



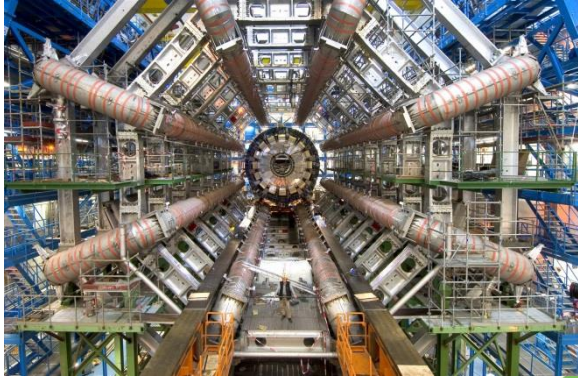
CERN

Large Hadron Collider

- 27 Km of circumference
- 50 to 175 m under ground
- Energy :13 TeV
- 1200 supraconductor magnets,
- 24 Km of cryogenic pipes at 1,9 °K
- A magnetic field 8 Tesla
- Upgrade finished on February 2015

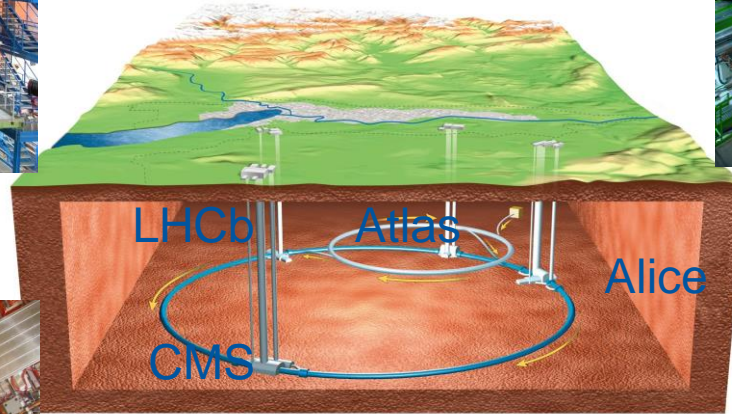
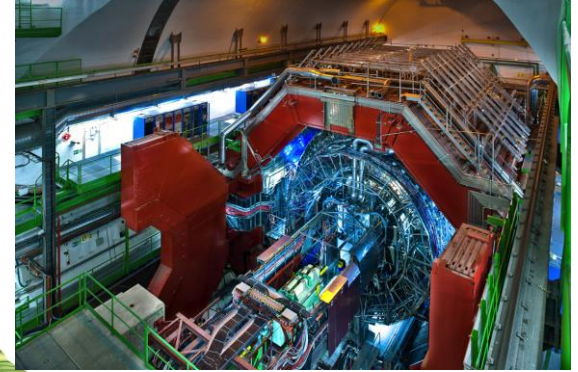


CERN

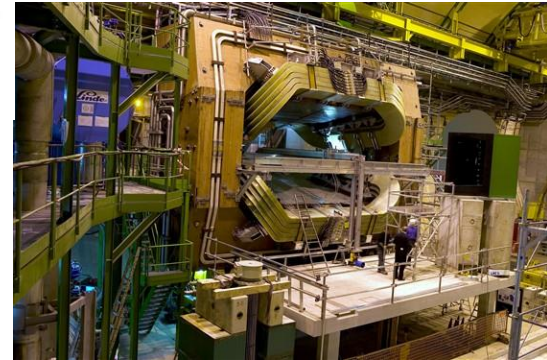


ATLAS

ALICE



CMS



LHCb

CERN

People

About 12,000 people at CERN

~2,400 CERN staff

~7000 Scientists from all over the world
Doctors, Fellows, Students, etc.

~2,000 Workers from external companies
Involved in maintenance activities

Two Nobel Prizes

In 1984, Carlo Rubbia and Simon Van der Meer

In 1992, Georges Charpak

Contribution to the Higgs discovery

2013 Nobel Prize, François Englert and Peter W. Higgs

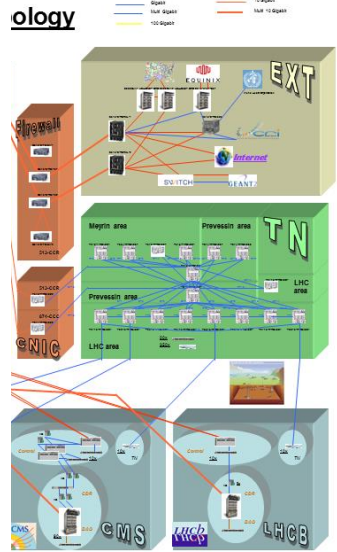
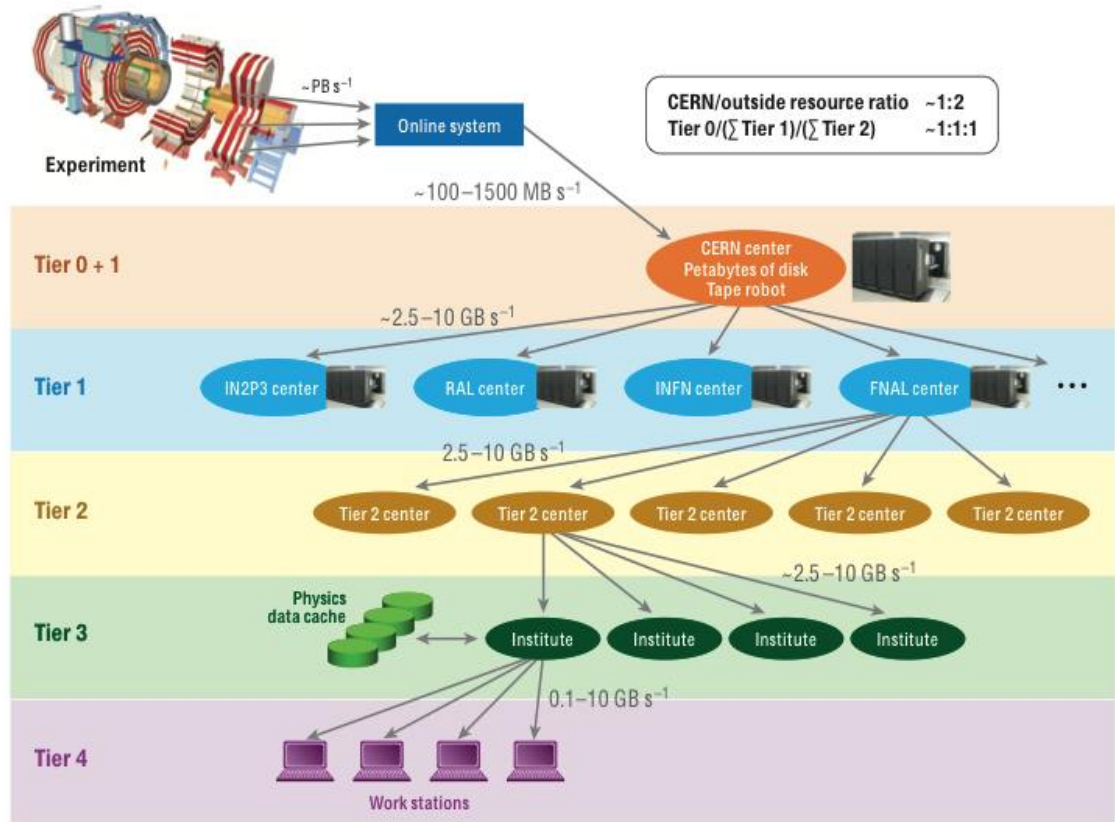
The place where the WWW was born



The CERN's ATLAS, CMS, LHC and other experiments WWW

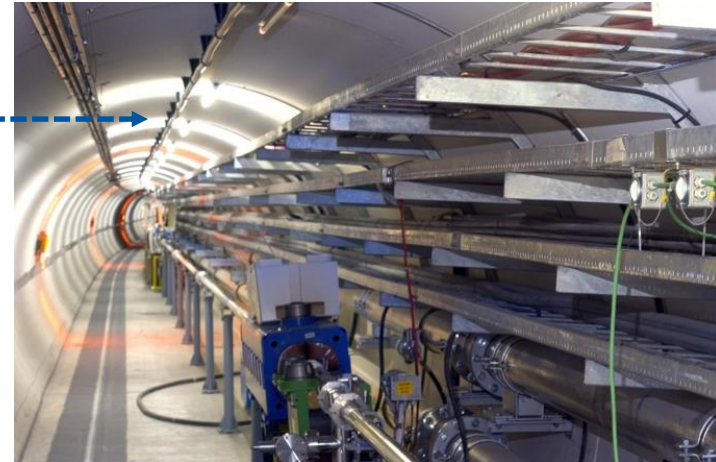
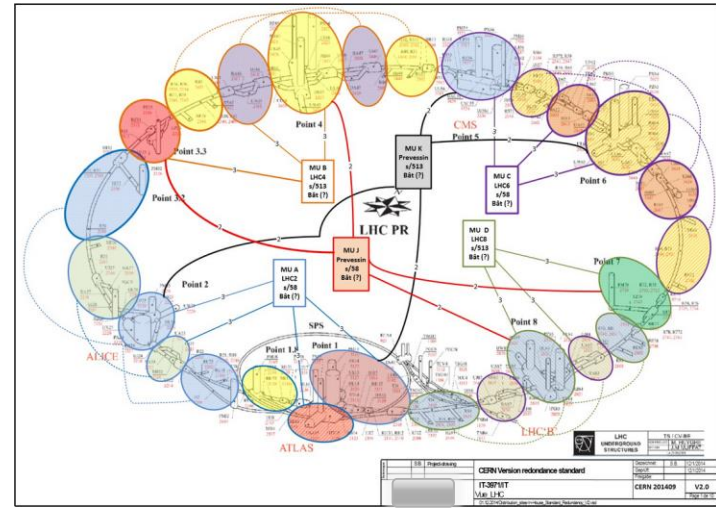
Network services

- Different administrative external tiers
- More than 100 external sites
- CERN International (CIXP) for external sites
- More than 100 external sites
- 75k active users



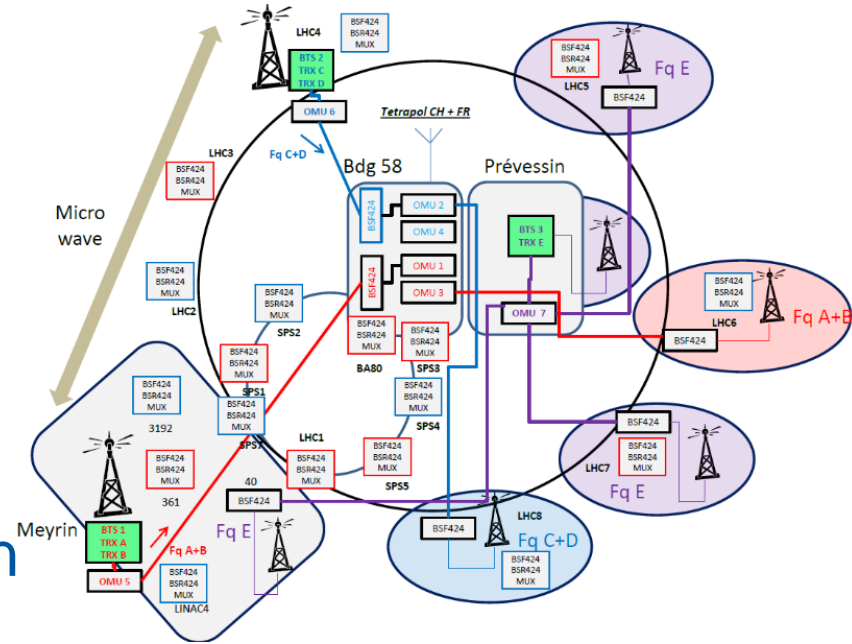
Telecom & radio services

- Mobile services (2G to 4G)
 - Single contract with a Swiss operator
 - Closed VPN for 6K users
 - 68 radio sites
 - >50 km of leaky feeder cable
 - Dedicated APN to connect to CERN intranet



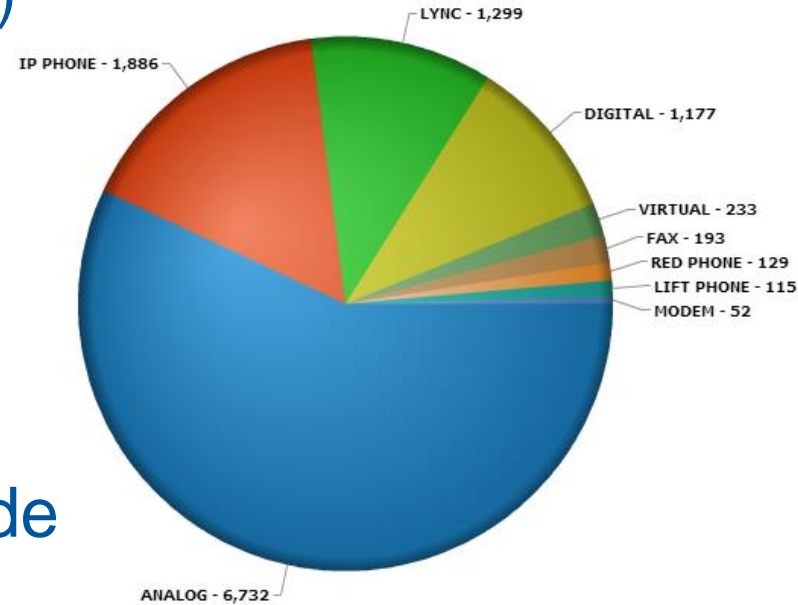
Telecom & radio services

- Radio safety service
 - 3 TETRA (Terrestrial Trunked Radio) Base Stations
 - Coverage on all tunnels and surface sites
 - Beacons for indoor localization



Current telephony network

- PABX in the core (TDM-IP hybrid)
 - Multi-node (4) and multi-site (17)
 - Double power supply (UPS)
- 12K fixed extensions
- 6K mobile subscriptions
- 3 levels of access rights:
CERN, local area, worldwide
- Automated self-service:
11K changes last-year



Current telephony network

- Services
 - S4B & video conference integration
 - LCR with 4 operators (PRI)
 - Switchboard and Service Desk call center.
 - Critical and safety:
 - Fire-Brigade call center / Red Phones
 - Tetra interconnection



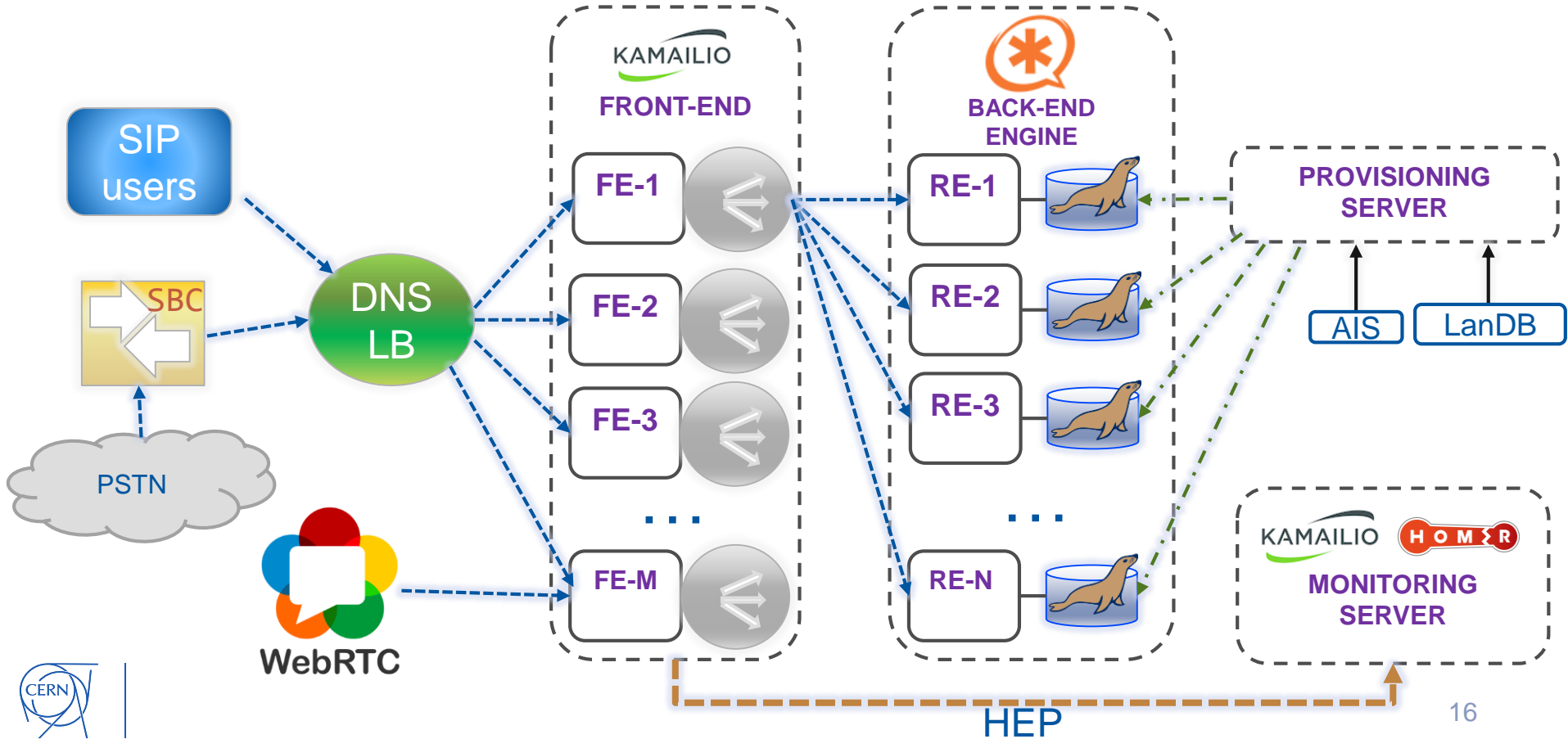
The TONE project

Telephony **O**pen-source **N**etwork **E**volution

Goals:

- Replace the PABX by a software-based solution
 - Reduce hardware/license costs
 - Avoid vendor lock-in
 - Increase network agility
- Be able to support new WebRTC / SIP clients and remove all traditional phones.

Architecture



The TONE project

Roles: Front-end

- Dispatches to Asterisk servers based on availability zone.
- Protects the core: ACLs, topology hiding, White/blacklists, Fail2Ban, htable.
- TLS and WebSocket termination

The TONE project

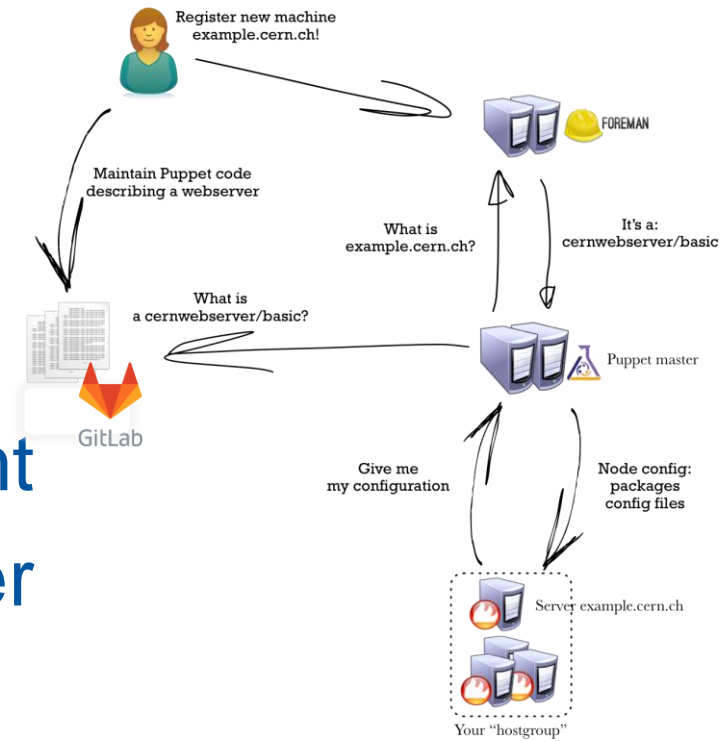
Roles: Back-End

- Identifies calling user rights (context matching)
- Resolve called user location and find cheapest (LCR) destination for external numbers
- Realtime switch with MariaDB populated from provisioning server.
- IVR service for Mobile VPN

The TONE project

CERN's Agile infrastructure

- OpenStack as IaaS solution
- Puppet for configuration mgmt
- Foreman as lifecycle manager
- GitLab for repos and CI
- JIRA for issue tracking



Puppet recipe

```
class kamilio(  
    $asterisk_ip      = '0.0.0.0/0',  
    $kamilio_dns_name = 'default',  
    $asterisk_dns_name = 'default',  
    $homer_dns_name   = 'default',  
    $node_type        = 'default',  
) {  
  
    # notify { "Hello Puppet on module kamilio": }  
  
    $pkg_list=['gcc', 'flex', 'bison', 'mysql++-devel', 'zlib-devel', 'zlib-static', 'openssl-devel']  
    ensure_packages($pkg_list)  
  
    teigi::secret{ 'kamilio_password':  
        path => '/root/.kamilio_password',  
    }  
}
```

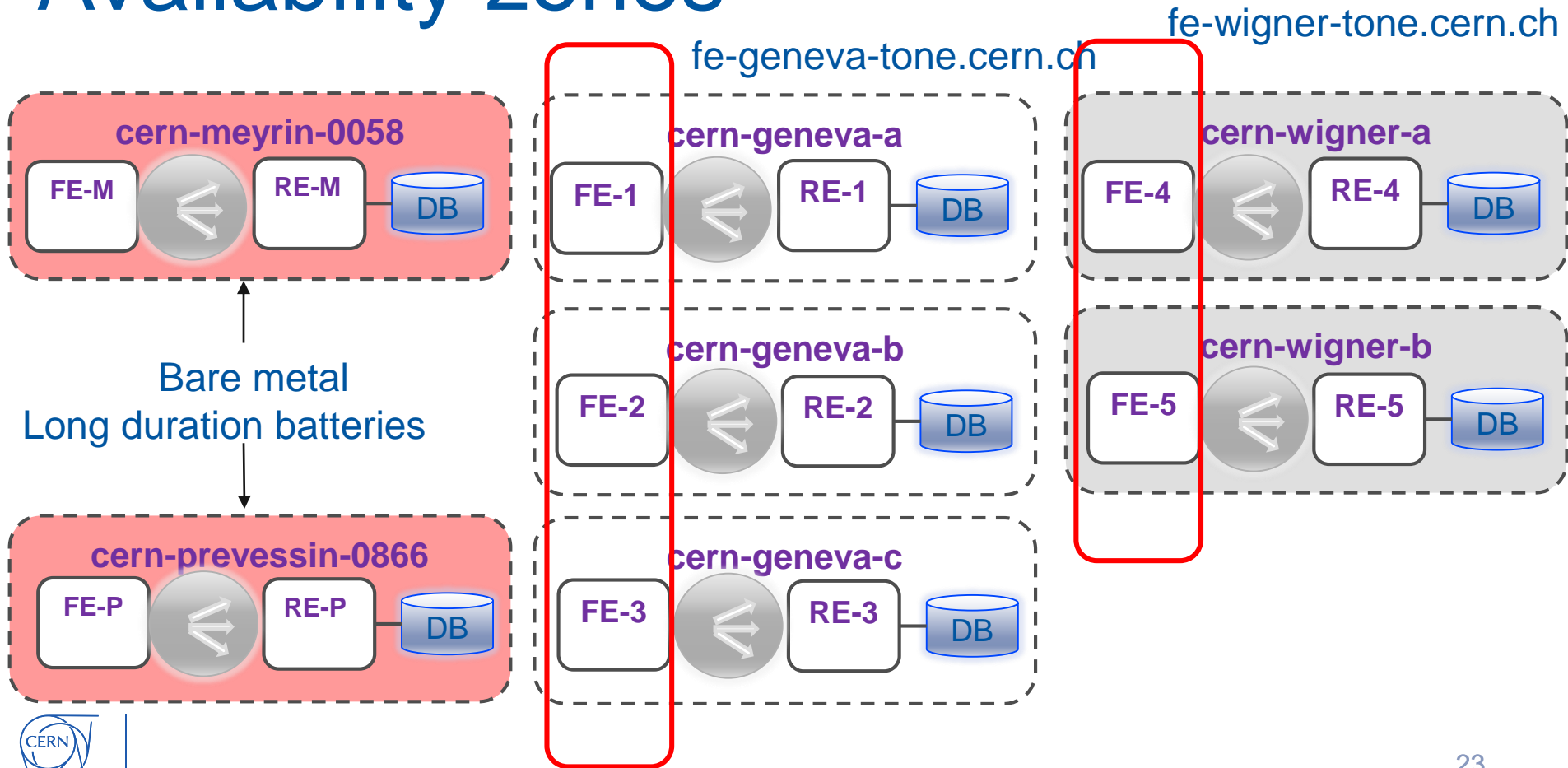
Puppet recipe

```
exec { 'kamailio-sources':
  command => '/usr/bin/wget http://www.kamailio.org/pub/kamailio/4.4.1/src/kamailio-.4.1_src.tar.gz',
  cwd     => '/usr/src',
  creates => '/usr/src/kamailio-4.4.1_src.tar.gz',
  require => Package['wget'],
} ->
exec { 'unpack-kamailio':
  . . . . .
} ->
exec { 'install-kamailio':
  provider => shell,
  command  => "make cfg && echo 'include_modules= db_mysql sipcapture pv textops rtimer xlog
sqlops htable sl siputils tls snmpstats' >> modules.lst && make all && make install && touch
/etc/.kamailio_installed",
  cwd      => '/usr/src/kamailio-4.4.1',
  creates  => '/etc/.kamailio_installed',
  timeout  => 0,
  require  => Package[$pkg_list],
} ->
```

Datacenter extension



Availability zones



The TONE project

- Status
 - First service: IVR for Mobile VPN in July 2016
 - Next: external SIP connectivity & massive user migration
- Challenges
 - SIP vs WebRTC clients ?
 - Integrate call center into the new architecture while keeping the same redundancy and criticality

Thank you!

Questions?

