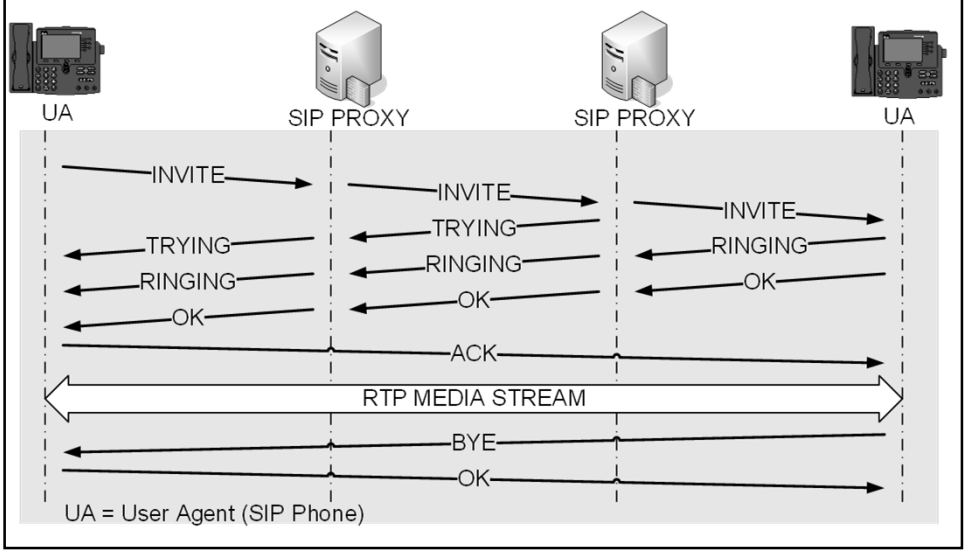
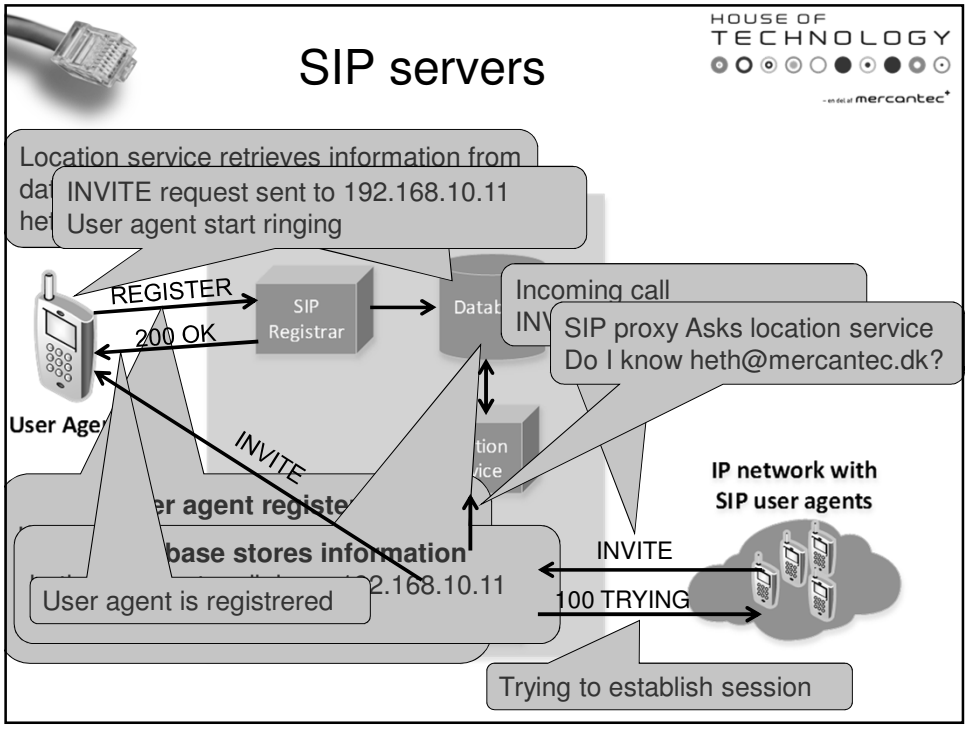
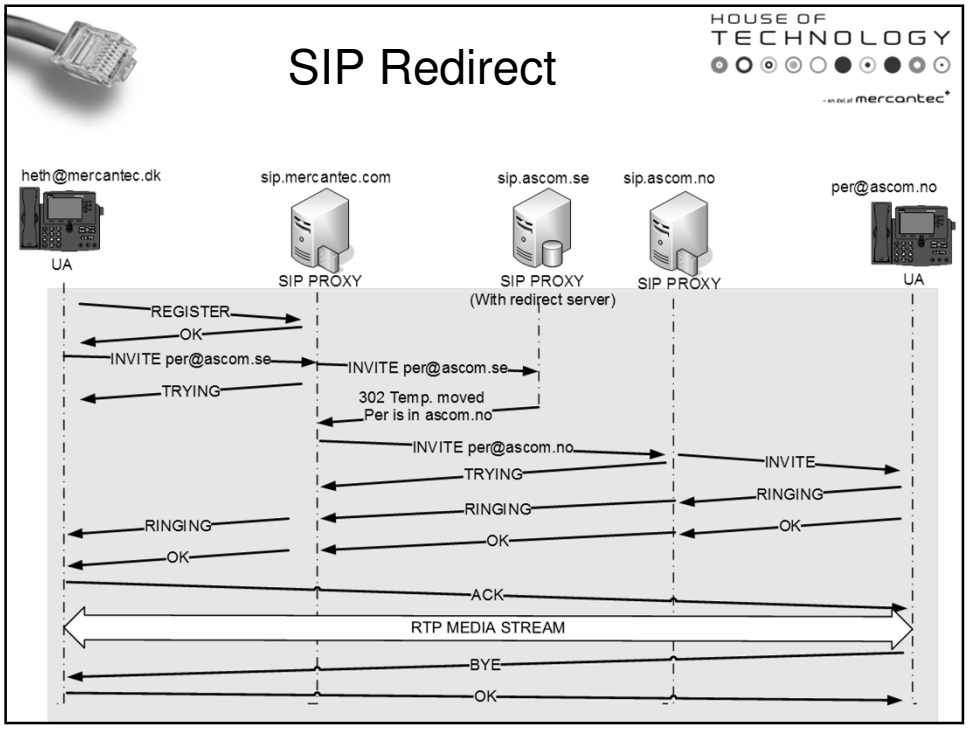
SIP and H.323

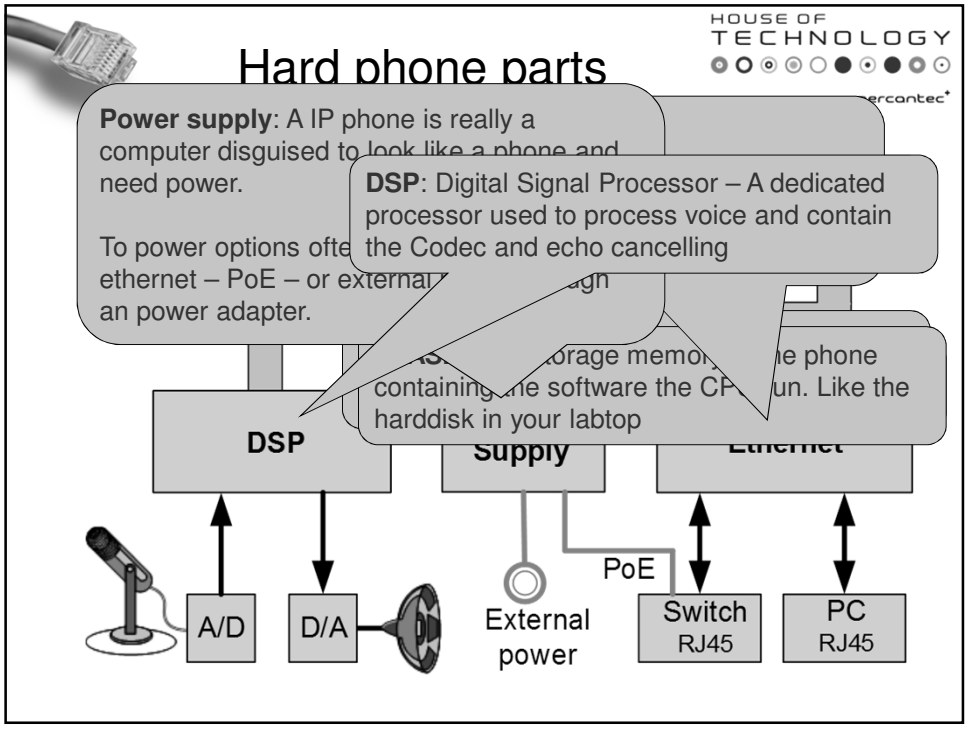
- H.323
  - Defined by ITU in 1996
    - International Telecommunication Union
  - Uses many technologies from PSTN
  - A suite of different protocols incl. voice/video
- SIP – Session Initiation Protocol
  - Defined by IETF in 1996
    - Internet Engineering Task Force
  - Uses many technologies from the Internet
  - Is a signalling protocol for voice/video

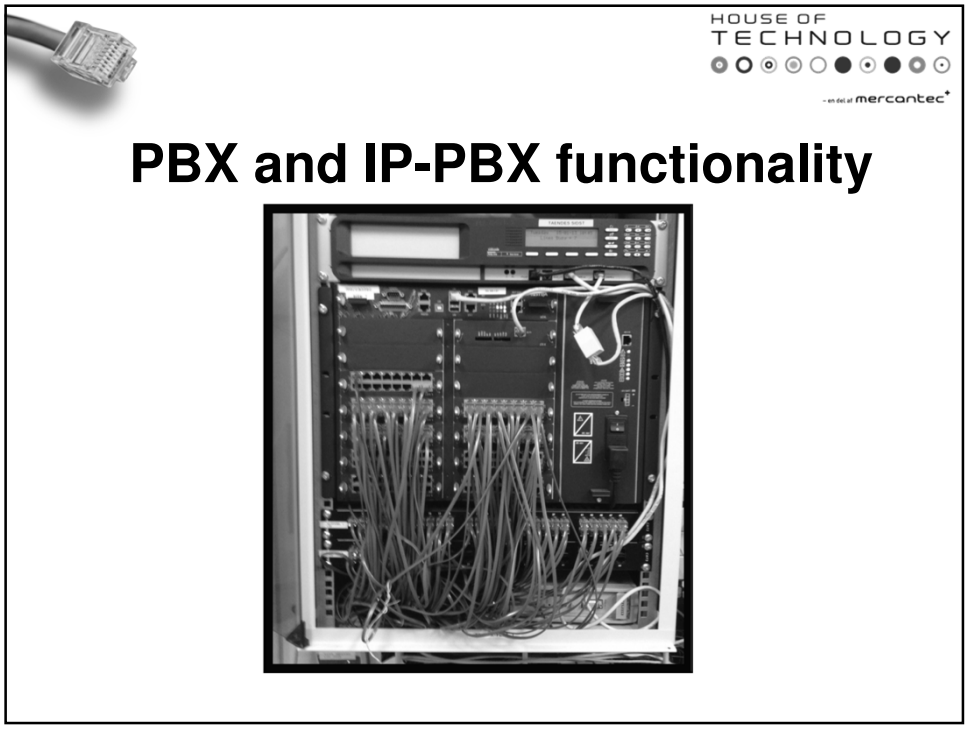
SIP call flow example




SIP servers
HOUSE OF TECHNOLOGY
mercantec
Location service retrieves information from
INVITE request sent to 192.168.10.11
User agent start ringing
REGISTER
200 OK
SIP Registrar
Incoming call
SIP proxy Asks location service
Do I know heth@mercantec.dk?
INVITE
IP network with SIP user agents
base stores information
User agent is registrered
INVITE
100 TRYING
Trying to establish session


SIP Redirect
HOUSE OF TECHNOLOGY
mercantec
heth@mercantec.dk
sip.mercantec.com
sip.ascom.se
sip.ascom.no
per@ascom.no
UA
SIP PROXY
SIP PROXY
(With redirect server)
SIP PROXY
UA
REGISTER
OK
INVITE per@ascom.se
INVITE per@ascom.se
TRYING
302 Temp. moved
Per is in ascom.no
INVITE per@ascom.no
INVITE
TRYING
RINGING
RINGING
OK
RINGING
OK
ACK
RTP MEDIA STREAM
BYE
OK

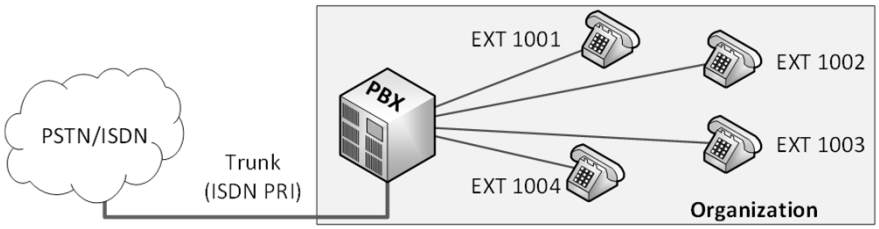

HOUSE OF TECHNOLOGY
Hard phone parts
Power supply: A IP phone is really a computer disguised to look like a phone and need power.
To power options ofte
ethernet – PoE – or external
an power adapter.
DSP: Digital Signal Processor – A dedicated processor used to process voice and contain the Codec and echo cancelling
containing the software the CP un. Like the harddisk in your labtop
DSP
Supply
Ethernet
A/D
D/A
External power
PoE
Switch RJ45
PC RJ45


HOUSE OF TECHNOLOGY
PBX and IP-PBX functionality

PBX functionality

Private Branch eXchange

- A PBX make connections among internal telephones of a private organization

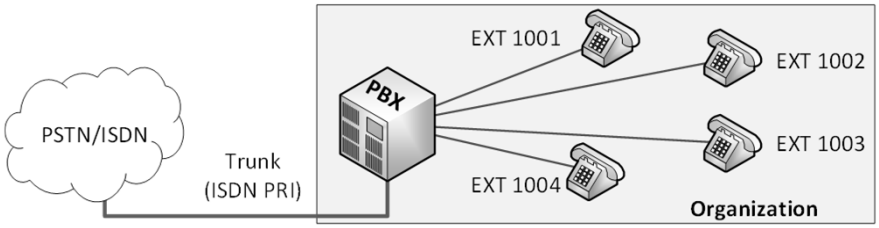


- A PBX connect internal phones to the PSTN
  - Typically when dialing 0 for a line out
- End-points (telephones) in a private organization are called extensions

Dedicated PBX

Private Branch eXchange

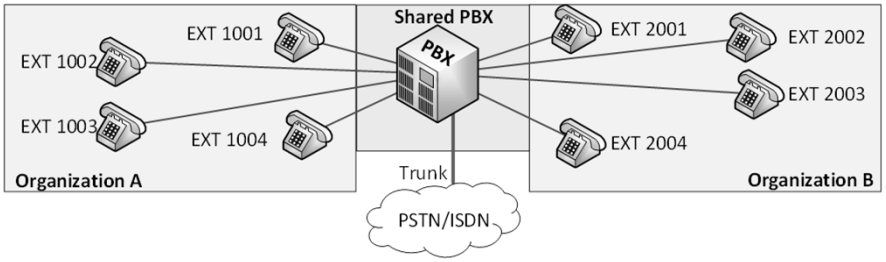
- A dedicated PBX is a PBX used by a single organization



Shared PBX

Private Branch eXchange

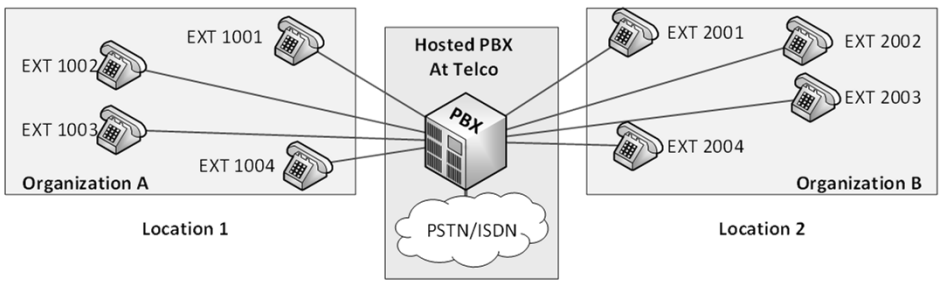
- A shared PBX is a PBX shared by more organizations typically in the same location
- Logically operates as two or more PBX's
- Often used in office rental buildings
- Share the same amount of outside lines



Hosted or Centrex PBX

Private Branch eXchange

- A hosted PBX is a PBX shared by more organizations typically at different locations
- A hosted PBX is typically located at the telco
  - Telco = Telephone company
- Telco provides access to the PSTN



Hosted PBX

Private Branch eXchange

HOUSE OF TECHNOLOGY

- Some hosted Scandinavian solutions

Provider	Country	Product	Mobile	Wired
Telia	Sweden	Centrex	Yes	Yes
Telia	Denmark	Mobiz link	Yes	Yes
Telenor	Norway	Mobilt bedriftsnett	Yes	No
TDC	Denmark	Scale	Yes	Yes

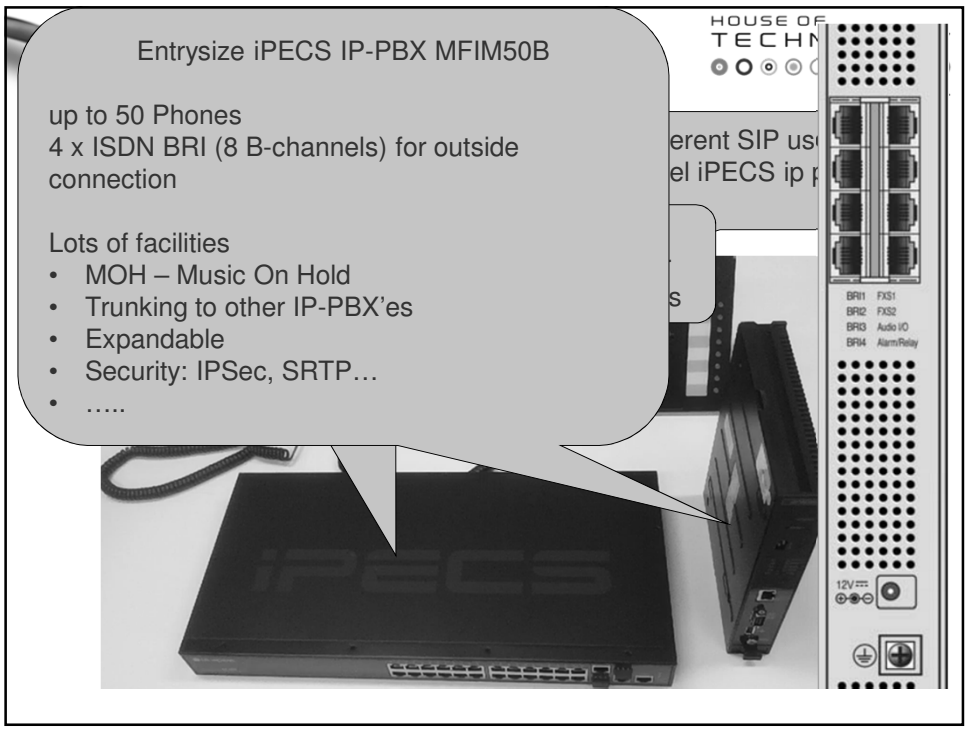
Telia

TDC

IP-PBX

HOUSE OF TECHNOLOGY

- A IP-PBX is an IP based PBX
  - Can be partially traditional PBX
- Can be running on dedicated hardware
  - Hardware designed specially for the IP-PBX
- Can be running on standard PC hardware
  - For example based on Windows or Linux

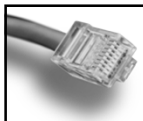


Popular IP-PBX products

- Aastra
- Cisco Call Manager
- Cisco Call Manager Express
- Ericsson
- LG Ericsson iPecs
- FreePBX – Based on asterisk
- Vendor specific configuration and functionality

HOUSE OF TECHNOLOGY

TELEPHONY SERVICES



HOUSE OF TECHNOLOGY

Telephony services

- Voicemail
  - Record messages when busy or absent
- Call waiting
  - Beep when a call is received in a conversation
- Conference call
  - Three or more participants in a conference
- Call forwarding
  - Redirecting a call to another phone

Telephony services

HOUSE OF TECHNOLOGY

- DND or Do not disturb
  - Telephone not ringing when receiving calls
  - Can be combined with call forwarding, when DND activated calls forwarded to other phone
- Call Park
  - Park one call to make another or respond to a call waiting signal
- MOH or Music on hold
  - Playing music for calls on hold

Telephony services

HOUSE OF TECHNOLOGY

- Follow-me
  - The exchange is configured with a list of numbers for a person.
  - When a call is received for that person, the exchange routes it to each number on the list in turn until either the call is answered or the list is exhausted

Telephony services

HOUSE OF TECHNOLOGY

- CLIP - Calling Line Identification Presentation
  - See the ID of incoming call in the display
    - Also called CID - Caller Identification
    - CID - Caller Identification
    - Calling Line Identification Presentation
- CLIR – Calling Line Identification Rejection
  - Hiding the identification of caller (anonymous)

Telephony services

HOUSE OF TECHNOLOGY

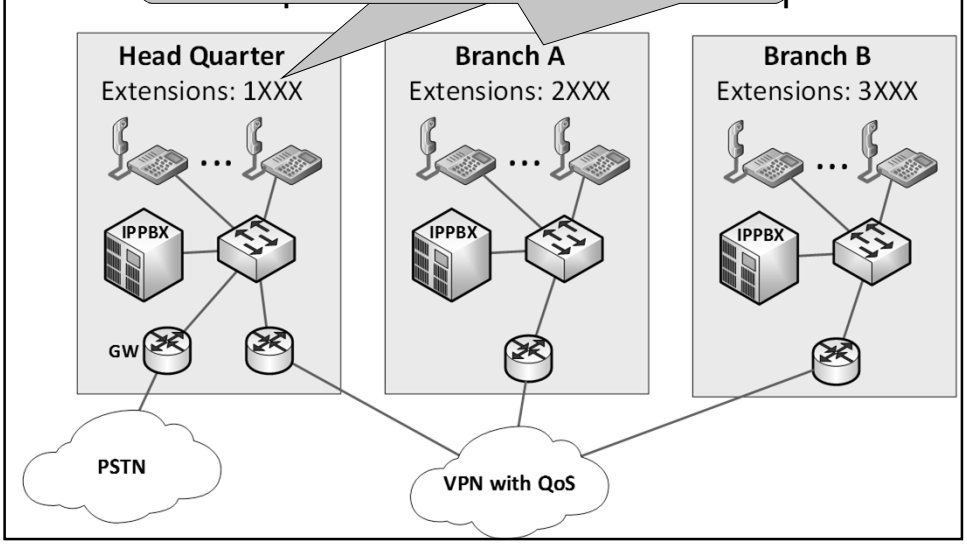
- CFU – Call Forwarding Unconditional
  - A call to a specific number is unconditionally forwarded to another number
- CFB – Call Forwarding Busy
  - A call to a specific number is forwarded to another number only if the phone is busy
- CFNR – Call Forwarding No Reply
  - A call to a specific number is forwarded to another number is the phone is unanswered

Services summary

Service	Brief explanation
Voicemail	Record messages when busy or absent
Call Waiting	Beep when a call is received in a conversation
Conference Call	Three or more participants in a conference
Call Forwarding	Redirecting a call to another phone
DND	Telephone not ringing when receiving calls
Call Park	Park one call to make another
MOH	Music on Hold - Playing music for calls on hold
Follow me	A list of numbers for a person, ringed in sequence.
CLIP	See the ID of incoming call in the display
CLIR	Hiding the identification of caller (anonymous)
CFU	Unconditionally forwarded to another number
CFB	Forwarded to another number only if the phone is busy
CFNR	Forwarded to another number is the phone is unanswered

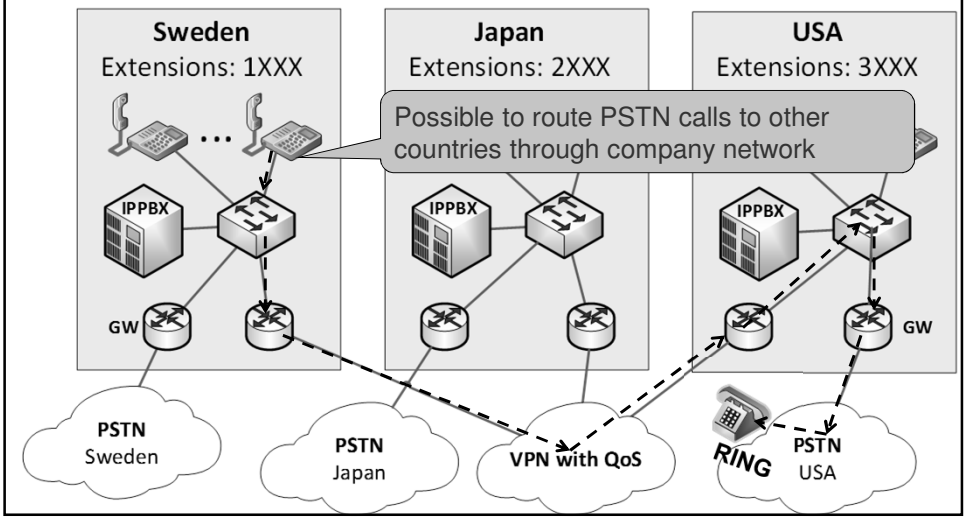
Dial plan example

In Branch A all extensions are in the 2000 range.
From 2000 to 2999



Dial plan example

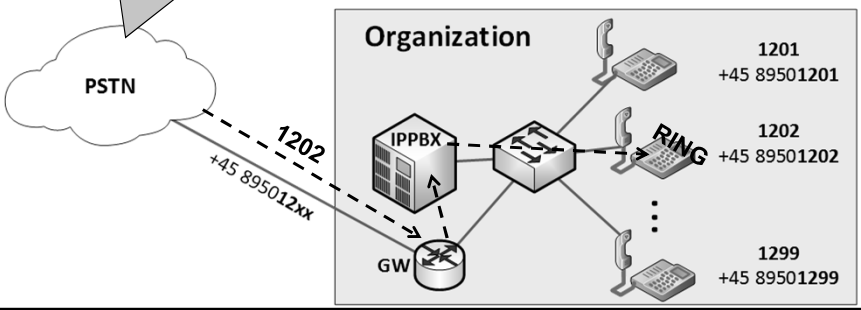
- Avoiding long distance calls



Dial plan example

- DiD or Direct inward Dialing
  - Calling an internal phone directly
- Often [illegible] number series xx = 00 to 99
  - This [illegible]00 series

Calling +45 89501202 from the PSTN, the telephone company will transmit 1202 to the IPPBX. 1202 is also the internal extension number



Assignment

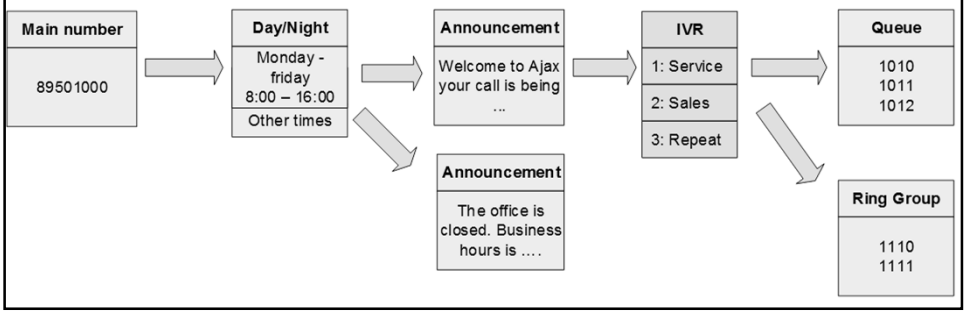
- Configure all Extensions with Voice Mail
  - User should receive an email on new VM
  - Voicemail activated after 10 seconds.
- Enable Call Waiting
- Create a Conference Number
  - New users need to get information about number af partisipants
  - Users need to know when new participants arrive and leave the conference

CALL FLOWS

Making things work

Call flows

- A call flow is preprogrammed behavior in a PBX to direct calls
  - Customers are directed to correct destination
- Call flows are build using advanced services

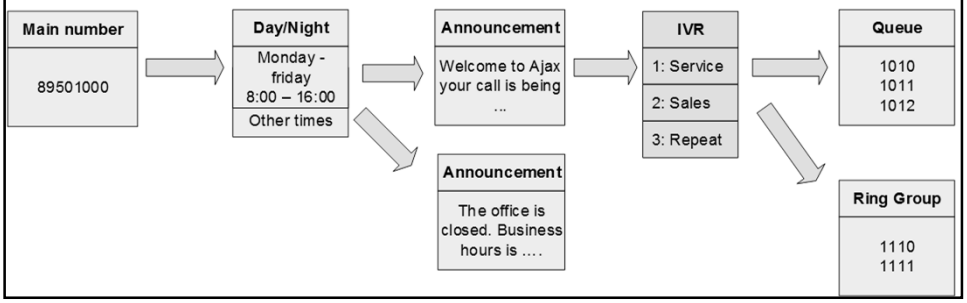


ADVANCED SERVICES

IVR, queues, ring groups …

Advanced services

- Advanced IP-PBX functionality are build with services
  - Time groups for example day/night
  - Announcements
  - IVR – Interactive Voice Response



Announcement

- An announcement is a voice recording
  - Welcome to Ascom Norway
  - You have called out of business hours ….
  - Press 1 for Service 2 for sales ….
- The voice can be recorded in different ways
  - From a telephone dialing a special number
  - From a microphone and processed by a professional sound studio
  - Ordered from companies specializing in voice recordings. Perfect telephone voice

Announcement

- Audacity – a free and full functional audio editor
  - Removing for example background noise

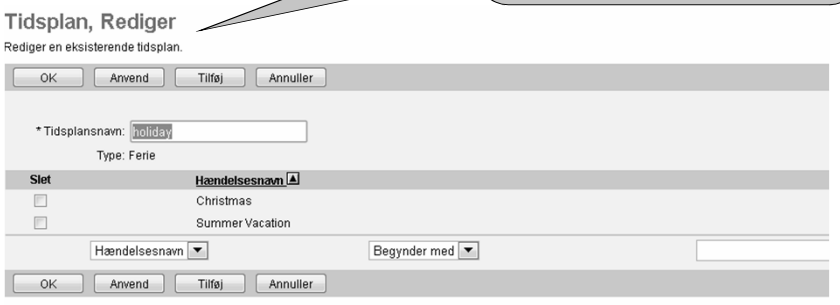
For example

- Westany a company specialized in making voice recordings.
- Westany has employees in many countries.
  - Offering localized language recordings

Time conditions

- Time conditions can have different names and implementations on different platforms
  - Time plans
  - Time groups

Danish to English translation
Tidsplan = Time plan
Rediger = edit
Ferie = Holiday
Slet = delete



Time conditions

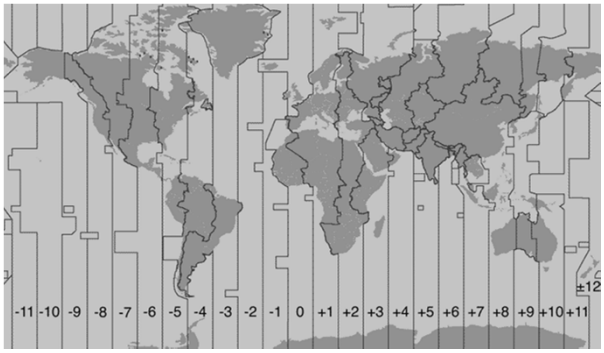
HOUSE OF TECHNOLOGY

- A time condition is a time interval
- A time group is one or more time conditions
  - If the current time is within the one of the time conditions do one thing if not do other thing
  - Time condition 1 is
    - Monday to Thursday from 08:00 to 16:30
  - Time condition 2 is
    - Friday is 08:00 to 14:00
  - Time group “Office Hours” is
    - Time condition 1 and time condition 2

Time conditions

HOUSE OF TECHNOLOGY

- In international companies with call centers a follow-the-sun model can be used
  - Instead of a three shift call center
  - Three or more call centers in different time zones



IVR

Interactive Voice Response

- Sometimes called an automated attendant
- Press “1” for sales “2” for bookkeeping …
- Plays an announcement and receives DTMF tones from caller
- Routes call to other service depending on DTMF tone

Ring groups

- A ring group is a virtual extensions that rings a group a of extensions/phones
- If all phones busy there is no queue
  - Calls are rejected or sent back to for example IVR after announcement “All lines are busy”
- Different ring strategies
  - Dependent on implementation

Strategy	Action
Ringall	Ring all available phones until one answer
Hunt	Take turns ringing each phone
Share load	Start ringing the phone used least first

Ring groups

- Possible to enter and leave ring groups
  - Implementation specific
- Using feature codes or preprogrammed buttons on the phone
  - The feature codes shown below are an example

Feature code	Action
*301 + **Group**	Leave ring group with virtual extension **Group**
*300 + **Group**	Enter ring group with virtual extension **Group**
*301	Leave all groups this extension is a member off
*300	Enter all groups this extension is a member off

Ring queues or queues

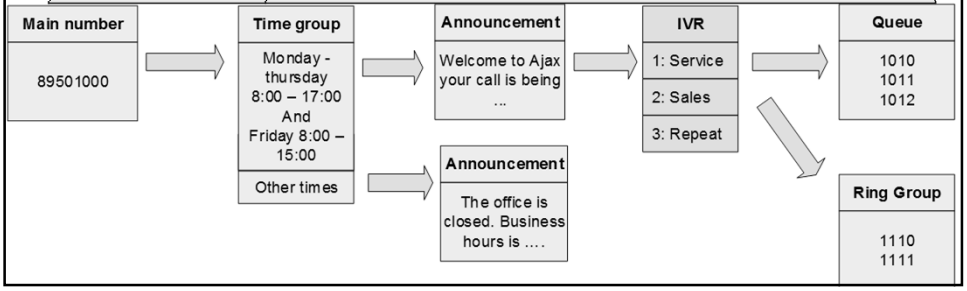
- Advanced ring groups with a queue
  - “You are number 17 in the queue”
- Often very advanced with many features
  - Music on hold
  - Periodic announcement of queue length and/or expected waiting time
- Can be used as call centers

Call center

- A call center is an advanced Ring queue
- Desktop combined with phone
  - Find customer in database based on dialing telephone number

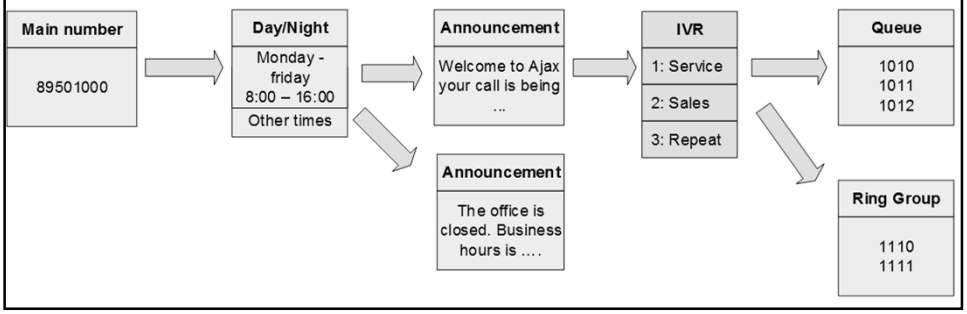
Advanced services

Service	Explanation
Announcement	voice recording
Time condition	Time/date interval
Time group	Action based on one or more time conditions
IVR	Interactive Voice Response. Action based on DTMF tones
Ring group	A virtual extension enabling a group of phones to ring
Ring queue	An advanced ring group with a queue
Call center	An advanced ring queue



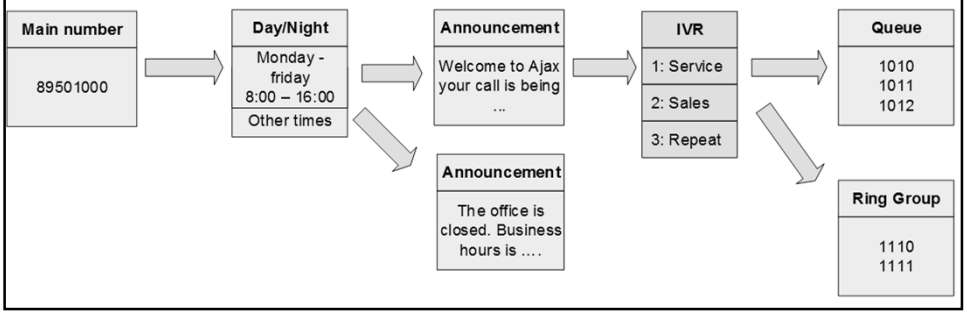
Call flow design

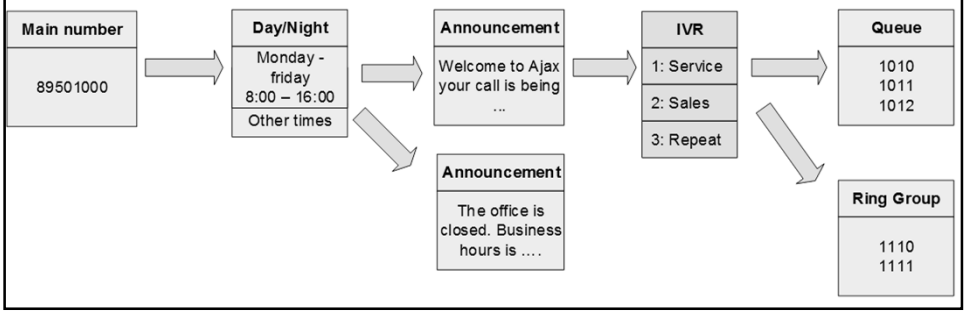
- Planning the call flow in a organization
  - Plan from left to right
  - Follow the call when planning.
    - What should happen when a customer calls?



Call flow configuration

- Configure from right to left
  - (Opposite direction)
- The Queue must exist before the IVR can route calls to it…



Assignment

- Configure this simple Call Flow
  - Remember to configure from Right to Left