A call from your landline

Yatindra Nath Singh, Professor,
Electrical Engineering Department,
Indian Institute of Technology Kanpur, Uttar Pradesh India.

http://home.iitk.ac.in/~ynsingh
Telephone Instrument

- Electronic instrument – patent granted in 1876 to Alexander Graham Bell.
- Mechanism to sense voice, transfer it over pair of wires and reproducing it at other end.
- 48V DC supply from the exchange – gives power to equipment.
- Independent of home supply.

Image source: wikipedia.org
• Telephone – ringer unit – to indicate incoming call.

• Telephone need to be connected to telephone exchange (switch) – a telephone wire from your home to operator
Steps involved in a call

- You lift the handset
  - It has microphone and earphone, and you hold it with your hands.
- The wire from your phone connected to a electronic circuit in exchange (line interface card or line-card)

Image source: wikipedia.org
• Line card detects – handset lifted from cradle.

• Applies dial tone
  – you cannot dial a number before you get a dial tone.
  – Indicates that line card ready to receive digits from you.

• Dial digits
  – Pulses, cards counts the pulses and find the dialed digits.
  – DTMF (dual tone multi frequency), push button – sends two tones.
    • Card find the pushed digit based on combination of tones received.

• On receiving digits
  – line cards applies hunting tone to phone, indicating call setup in progress
  – The numbers are passed to exchange processor.
• Exchange processor
  – From the port id (where wire from home is attached), knows who you are?
  – It analyses if the call you want is permitted or not (based on your subscription)
  – It than looks at routing tables for how the call can be routed to destination.
    • Complete route is decided
    • Only the next exchange (switch) is decided. Next switch responsible for further onward routing.
• Each exchange runs software (intelligent entity) on its processor.

• Intelligent entities in all the exchanges (switches) can interact with each other – same way as PCs can interact over internet.

• A network is formed for message transfer between these entities – SS7 network.

• SS7 (signaling system no.7)
• Exchange processor send messages to all the intermediate exchanges, asking for resources (reservation of bandwidth for your call)
• Also ask the last exchange if the user is busy.
• All exchanges, blocks the resources – bandwidth
• Destination exchange confirm if the user is free.
• Source exchange ask everyone to setup the path.
• Asks destination exchange to apply ringing current to destination phone.
• Hunting tone is stopped.
• Destination current send ringing tone back to source phone.
• Once the person at other end, lifts the handset

• Destination exchange stops the ringing current and ringing tone both and path is finally made through.

• Destination exchange also sends message to source that call is through.

• Source exchange records the details
  – Call detail record (CDR)
  – Used for generating bill
• For a call two paths are used
  – One in each direction
  – Inefficient, as information – not transferred in both the direction all the time.
• DTMF – the tones in voice band are used.
  – Once a call is through
  – DTMF can be used to signal the equipment at the other end of the path