

INTRODUCTION TO TELEPHONY

ETI2506

Sunday, September 25, 2016

ETI2506 - SYLLABUS

ETI 2506 Telecommunication Systems

Prerequisites

ETI 2301 Computer Networks

Purpose

The aim of this course is to enable the student to;

1. understand evolution of telephony
2. understand structure of basic transmission systems and network topologies

Learning Outcomes

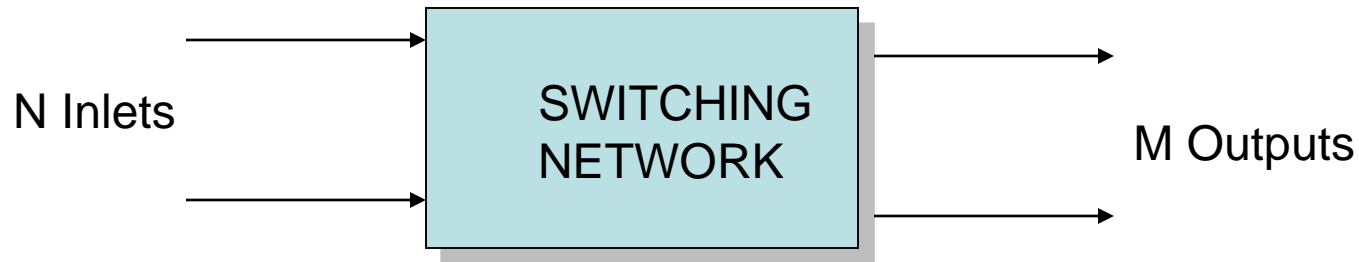
At the end of this course, the student should be able to;

1. apply knowledge of telephony in telecommunication systems

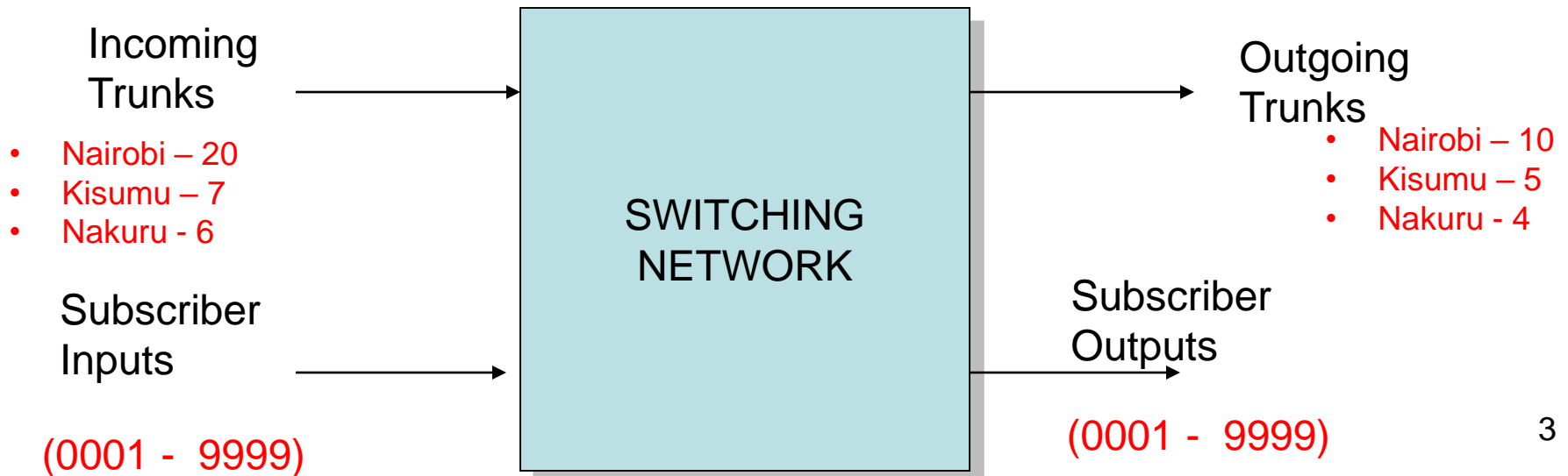
Course Description

Evolution of the fixed line telephony, analog to digital, relay switched to stored program controlled switching, manual PBX to private automatic branch exchange(PABX), analog to ISDN and DSL, non-cellular mobile phone systems, cordless phones (DECT). System structure: Basic transmission system. Types of switching: circuit switching, message switching and packet. Network topologies, exclusive and multiparty lines; signaling methods; signaling No. 7 protocol. Call types: local, trunk and international, automatic multi-exchange connection and inter-exchange signaling. Terminal Equipment: Telephone set (receiver and transmitter), telex, facsimile, computer. Traffic modeling and dimensioning: queuing theory, Erlang traffic theory. Use of traffic tables in capacity design of telephone network systems.

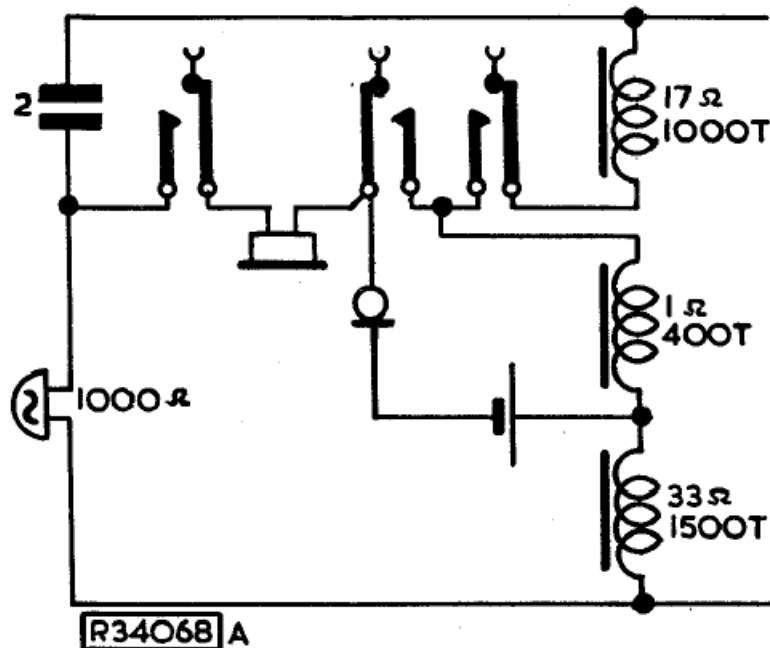
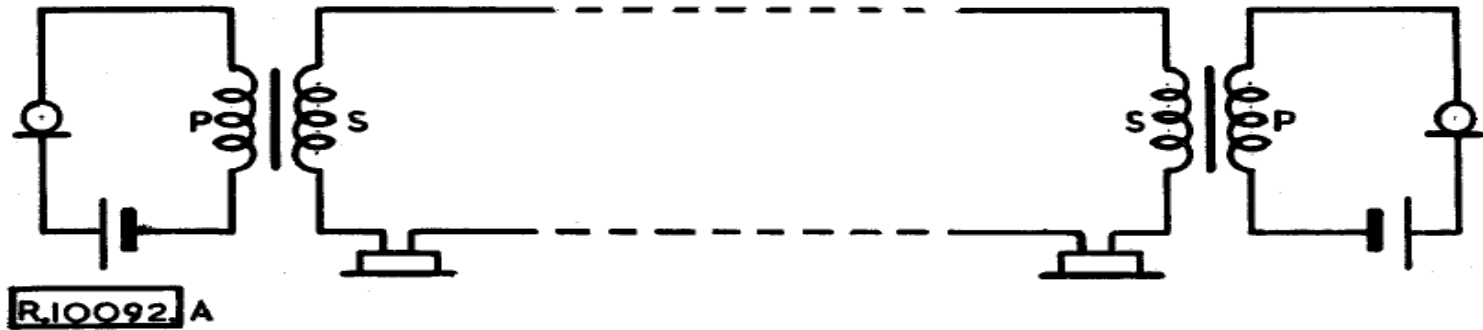
BASIC SWITCHING NETWORK



$M=N$: Symmetric Network



SIMPLE LOCAL BATTERY SYSTEM – OLD EXCHANGES



ELEMENTS OF A LOCAL BATTERY SYSTEM



Pair of Copper Wires



Contents:

1. Ear Piece
2. Mouth Piece
3. Ringer/Bell
4. Magneto Ringing current Generator

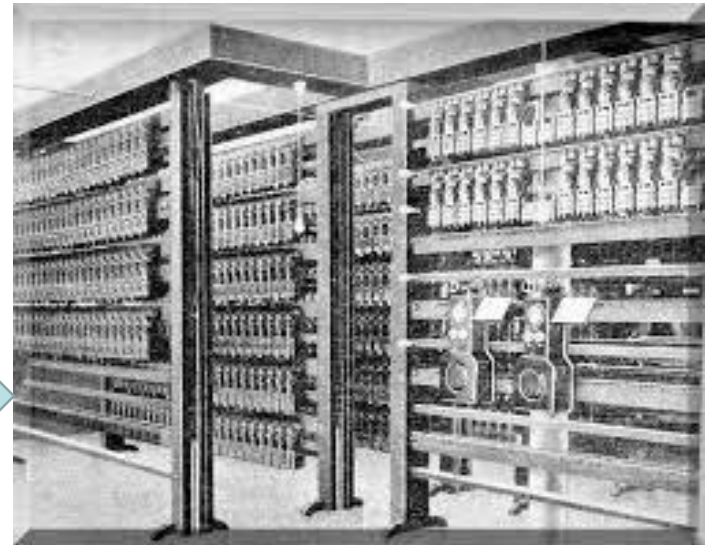
CENTRAL BATTERY SYSTEMS

Power Room

- Rectifiers
- Generator
- Battery Banks



Copper Bus-bars



Telephone Exchange Room



Dial Telephone

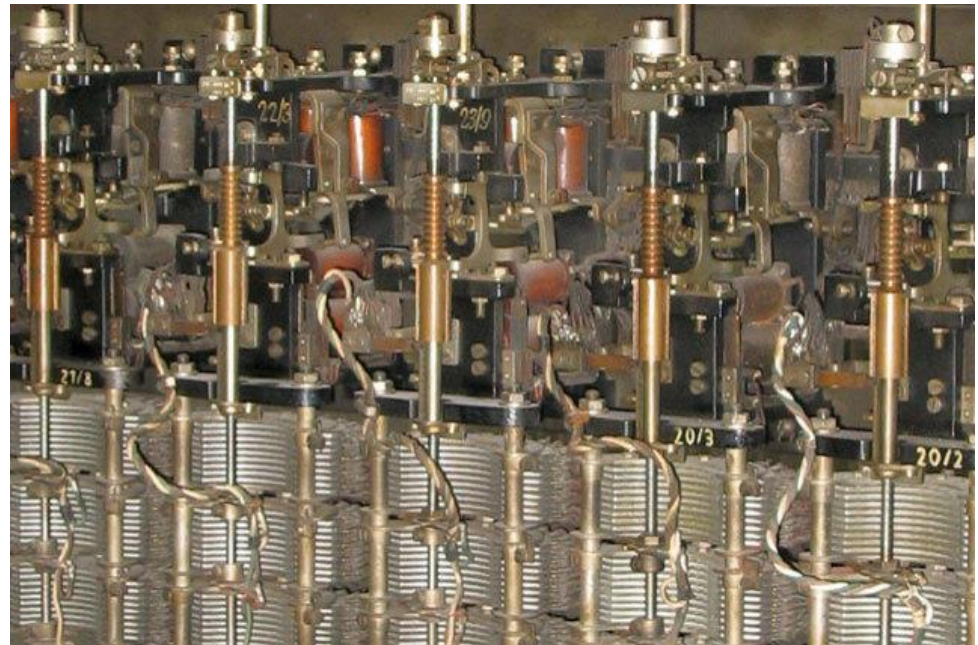
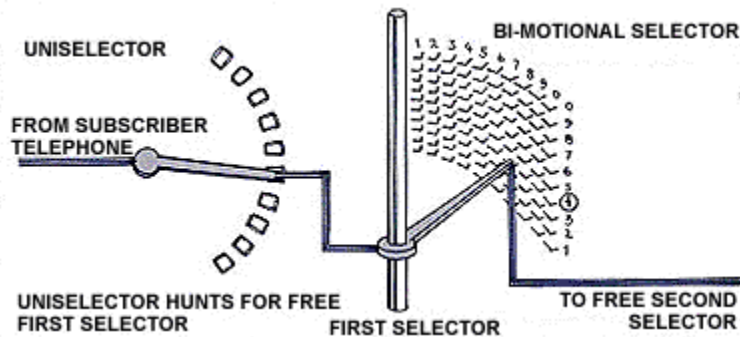
Pair of Copper Wires

STROWGER SWITCH

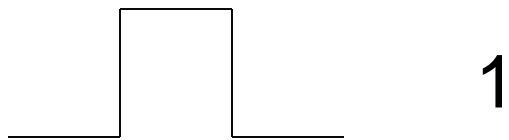
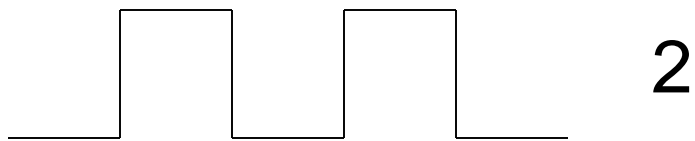
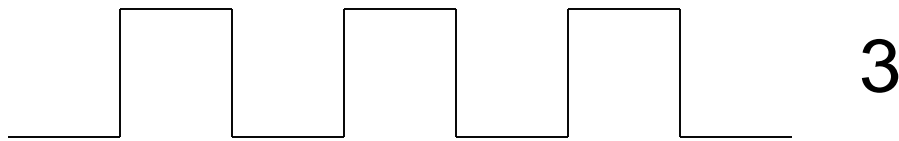
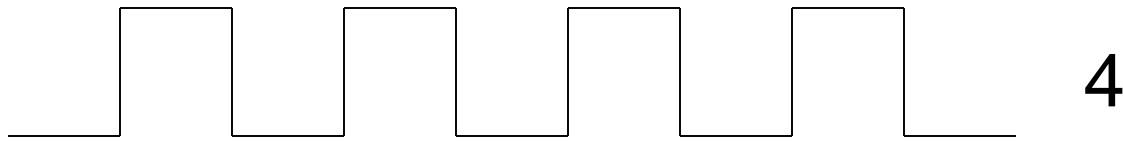
Rotary dialing [\[edit\]](#)

Main article: [Strowger switch](#)

Convinced that it should be subscribers, rather than the operator, who chose who was called - anecdotally, Strowger's undertaking business was losing clients to a competitor whose telephone-operator wife was intercepting and redirecting everyone who called Strowger - he first conceived his invention in 1888, and patented the [automatic telephone exchange](#) in 1891. It is reported that he initially constructed a model of his invention from a round collar box and some straight pins.

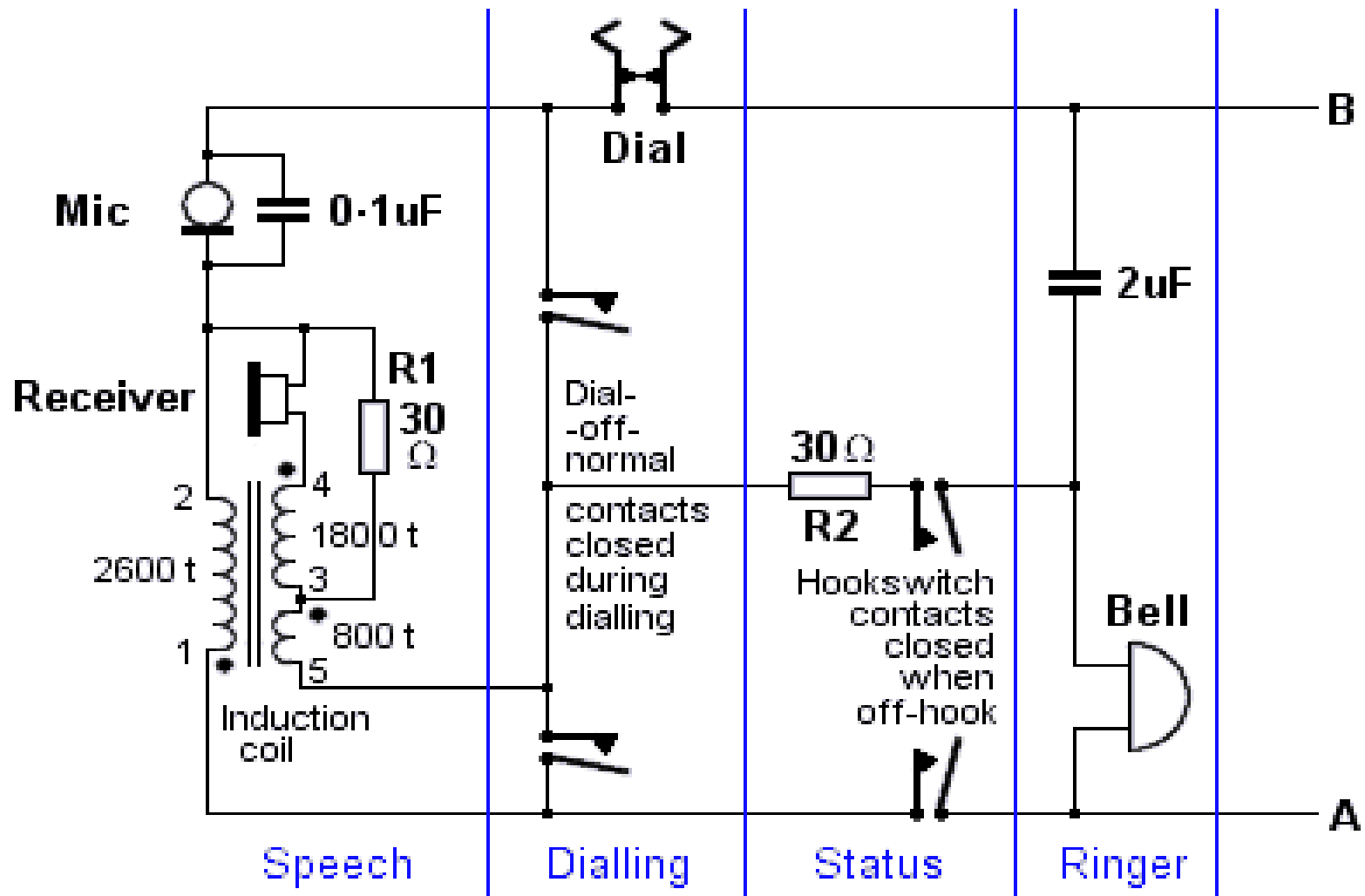


PULSE DAILING

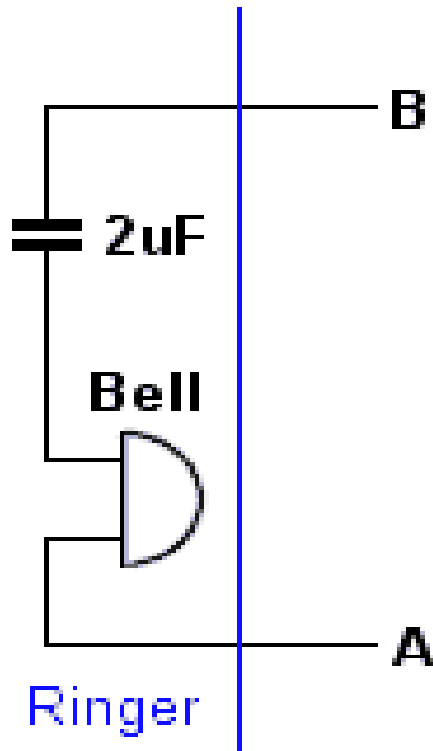


Probably, the earliest forms of digital communication.

PULSE TONE TELEPHONE CIRCUIT

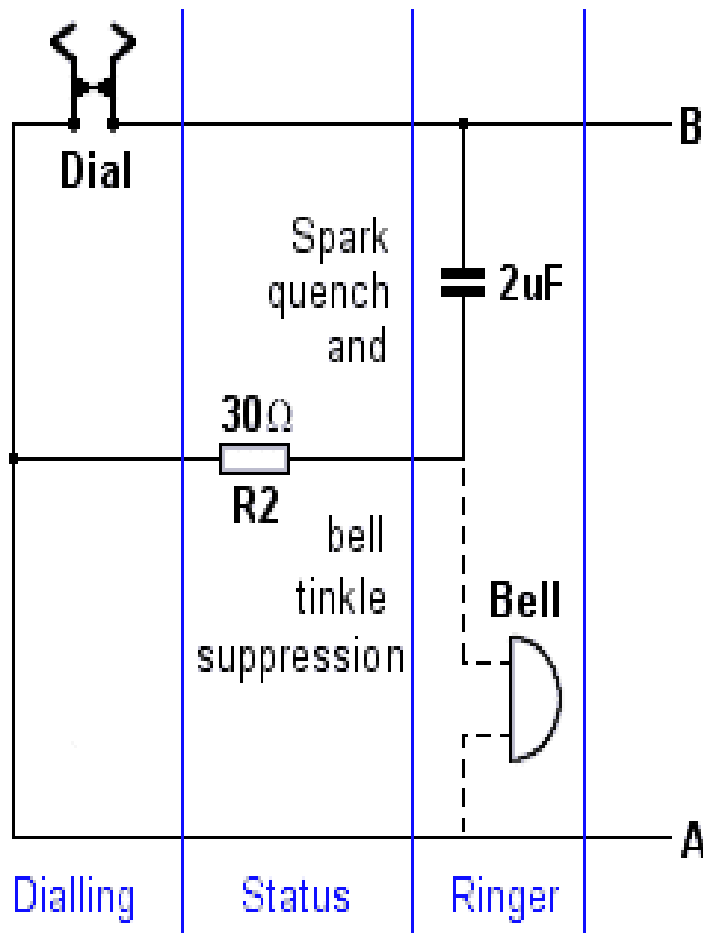


RINGER



1. **on-hook** the hook-switch contacts are open, and only the bell is connected across the line.
2. **en the telephone is** The 2 μ F capacitor blocks DC (48V)
3. Exchange sends 75v (rms) at 17 Hz to the line to ring the bell.

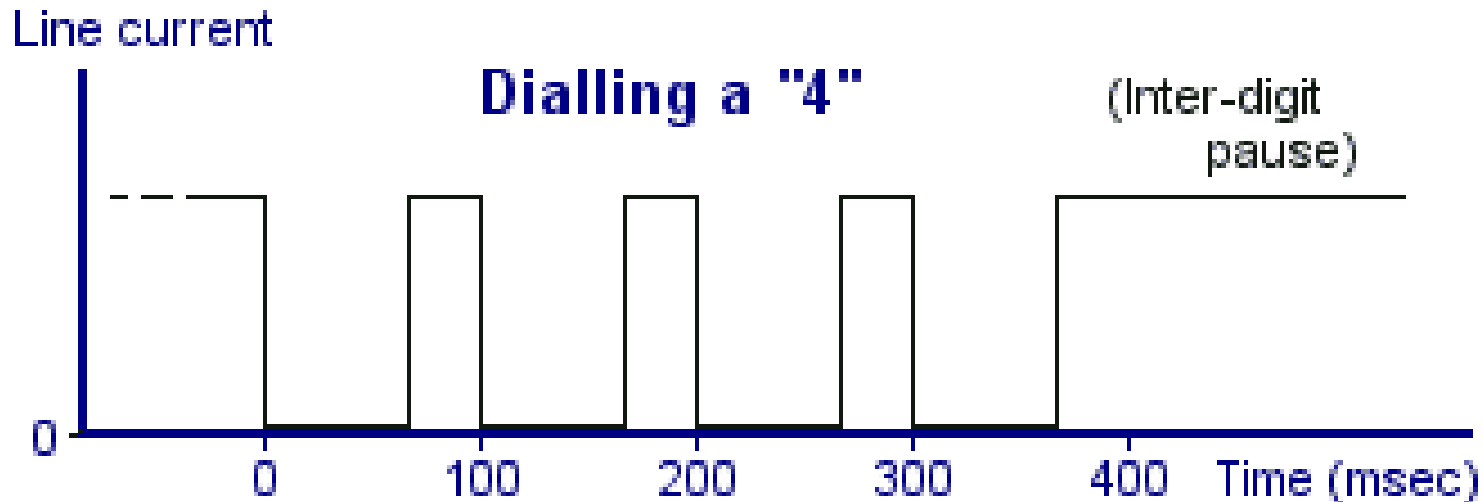
DIALING



1. **The rotary dial transmits** number to the exchange as a sequence of pulses by repeatedly making and breaking the line.
2. **The series RC network** connected across the impulse contacts **modifies the pulse shape, prevents arcing at the contacts and also mutes the bell.**

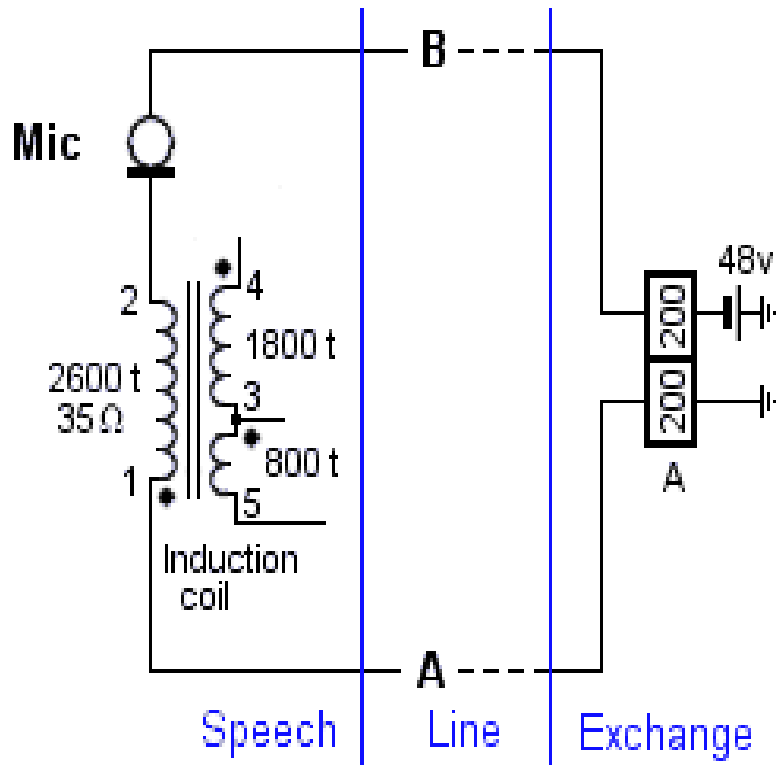
PULSE TIMING DIAGRAM

1. The dial is supposed to deliver 10 pulses per second (but the exchange equipment was designed to **accept anything between 7 and 12 pulses/sec**) at a make/break ratio of 1:2.



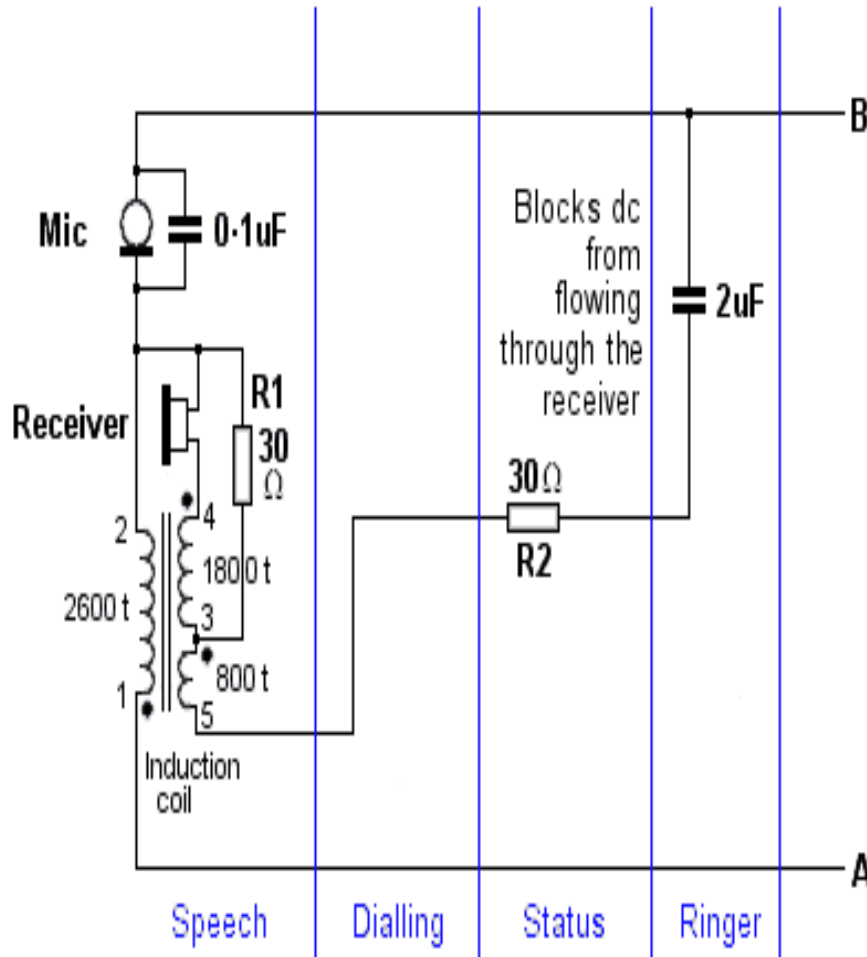
2. **The actual value of line current** flowing would **depend on the length of the line back to the exchange and the state of the exchange battery(35 to 140 mA)**.

HOLDING CIRCUIT



1. When the user picks up the handset, current begins to flow in the line. **The 'A' relay at the exchange operates.**
2. When the call ends, relay is released.

THE SPEECH CIRCUIT

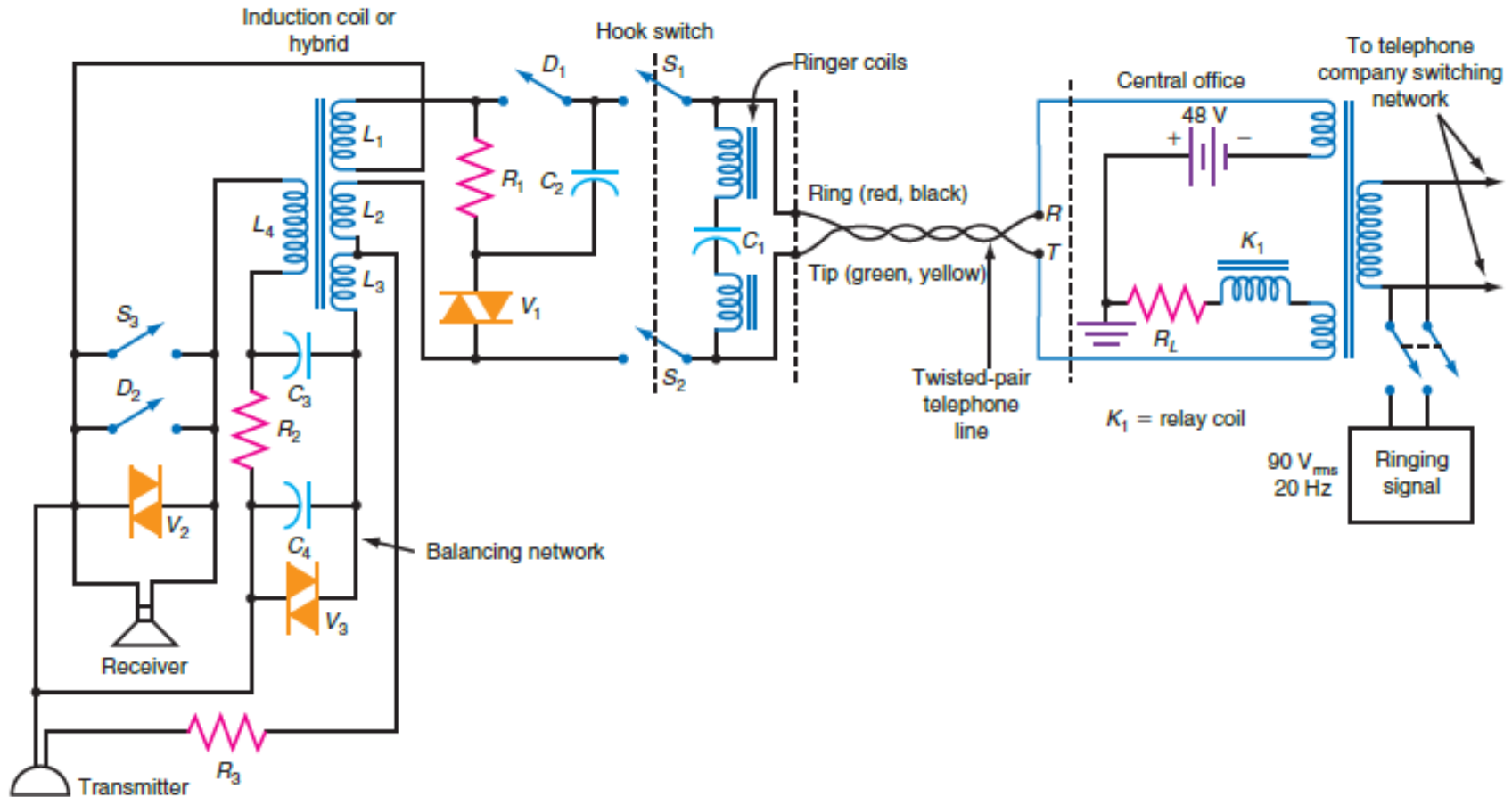


Functions:

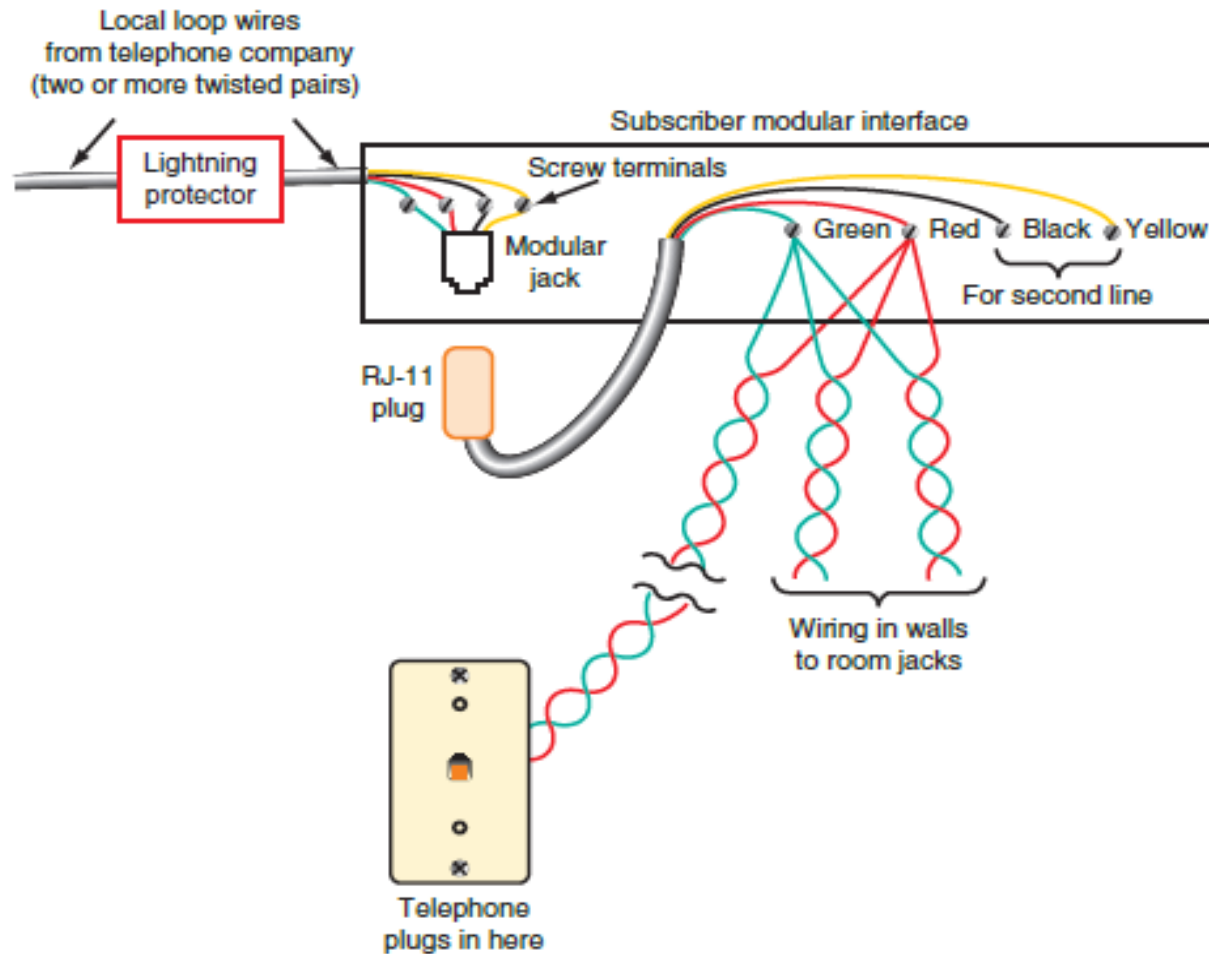
1. Move all the signal power generated in the microphone out to the line.
2. Move all the signal power delivered by the line into the receiver.
3. Prevents any power being generated by the microphone from reaching the receiver.

MODERN TELEPHONE CIRCUIT

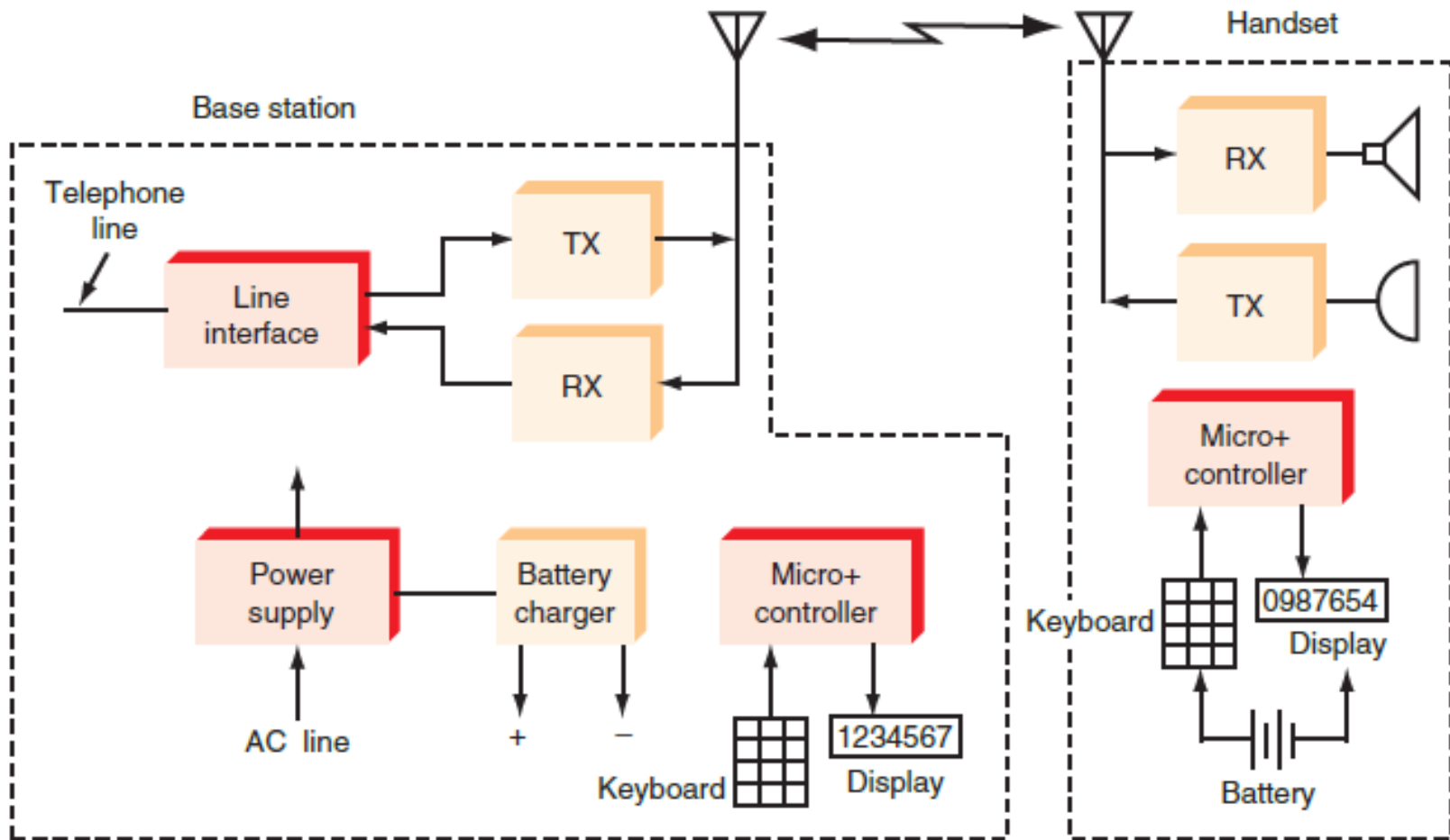
1. The central office applies a DC voltage over the twisted-pair line to the telephone.
2. The DC is approximately 48 V with respect to ground in the open-circuit condition.
3. When a subscriber picks up the telephone, the switch hook closes, connecting the circuitry to the telephone line.
4. The load represented by the telephone circuitry causes current to flow in the local loop and the voltage inside the telephone to drop to approximately 5 to 6 V.



CONNECTING A TELEPHONE

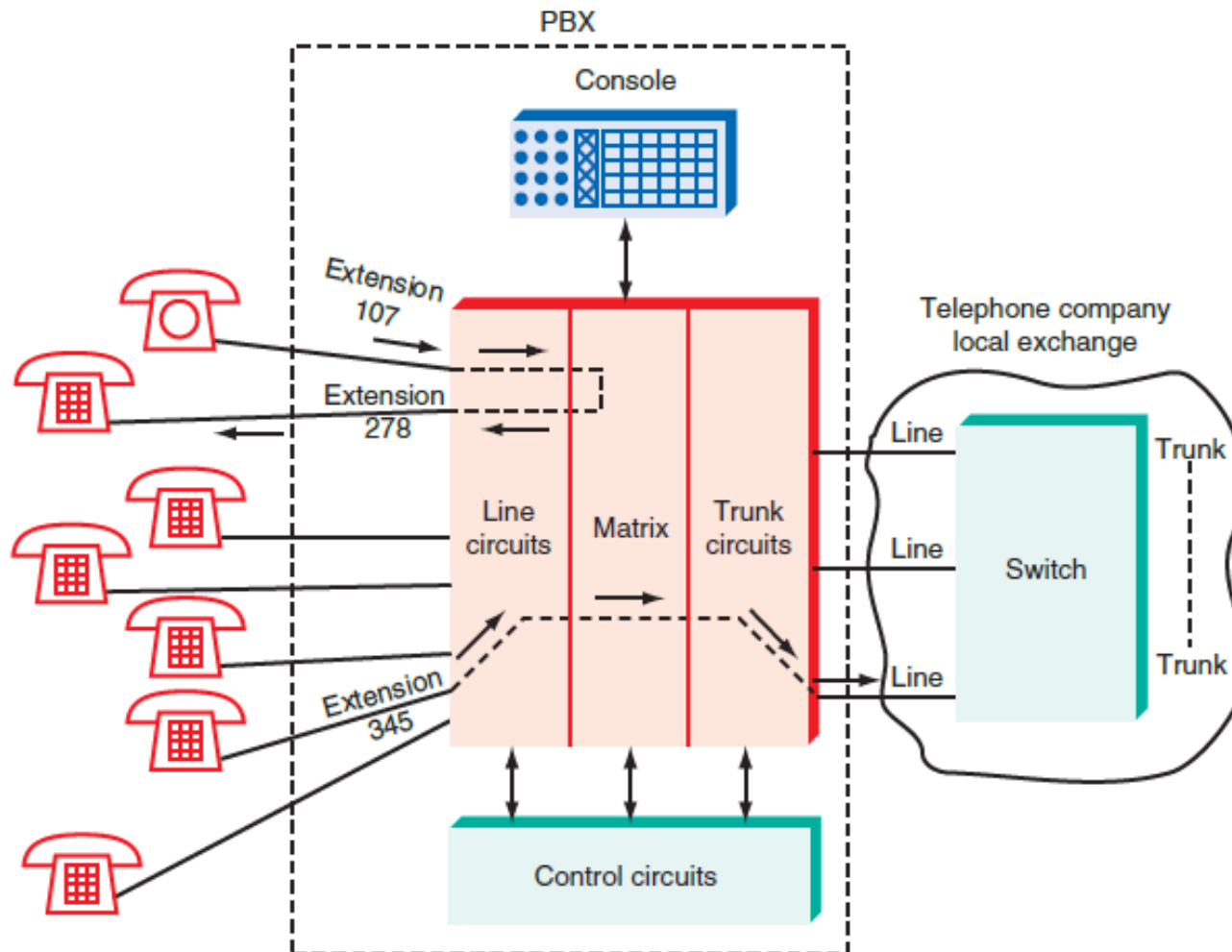


CORDLESS TELEPHONE



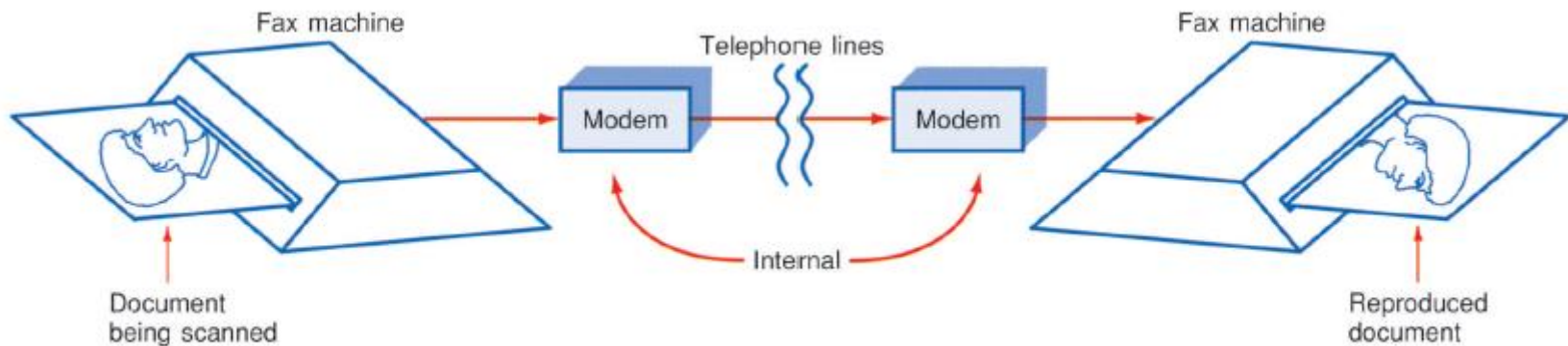
PRIVATE BRANCH EXCHANGE

A **private branch exchange (PBX)** is a private telephone system for larger organizations. PBXs can handle over 1,000 extensions.

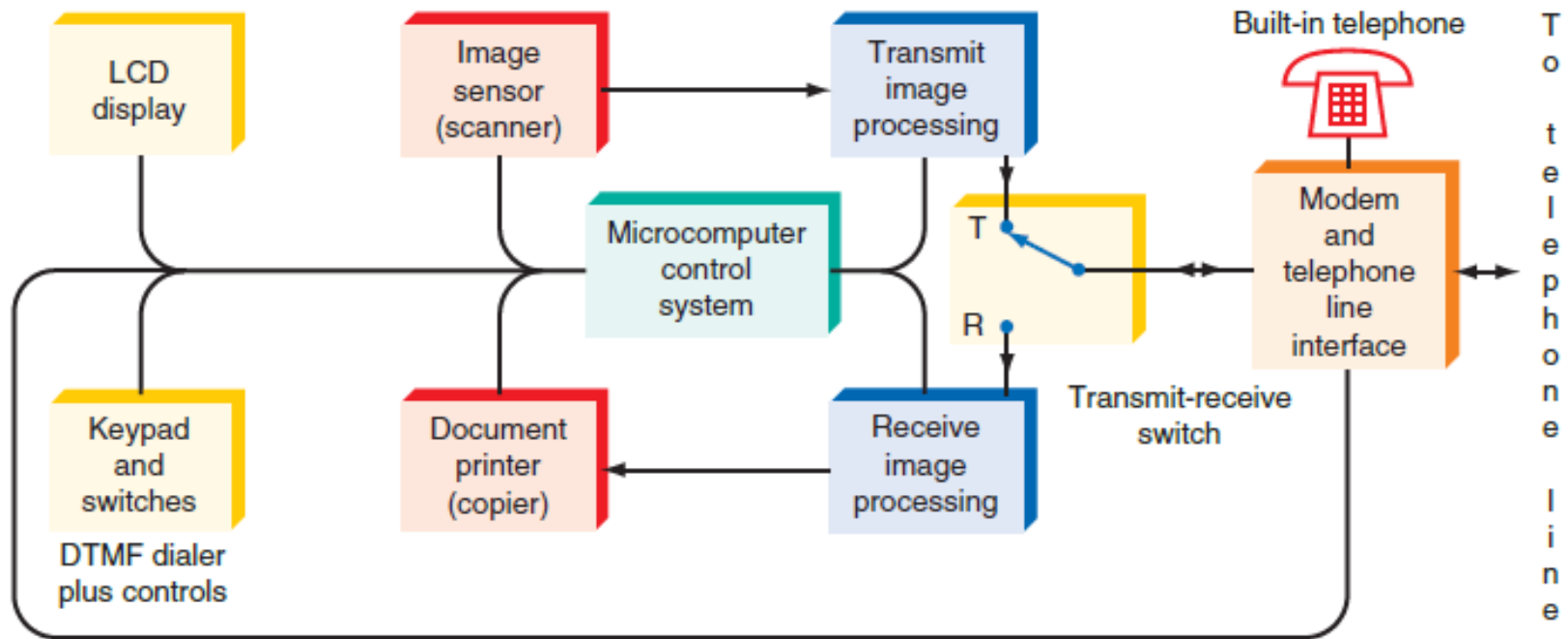


FACSIMILE

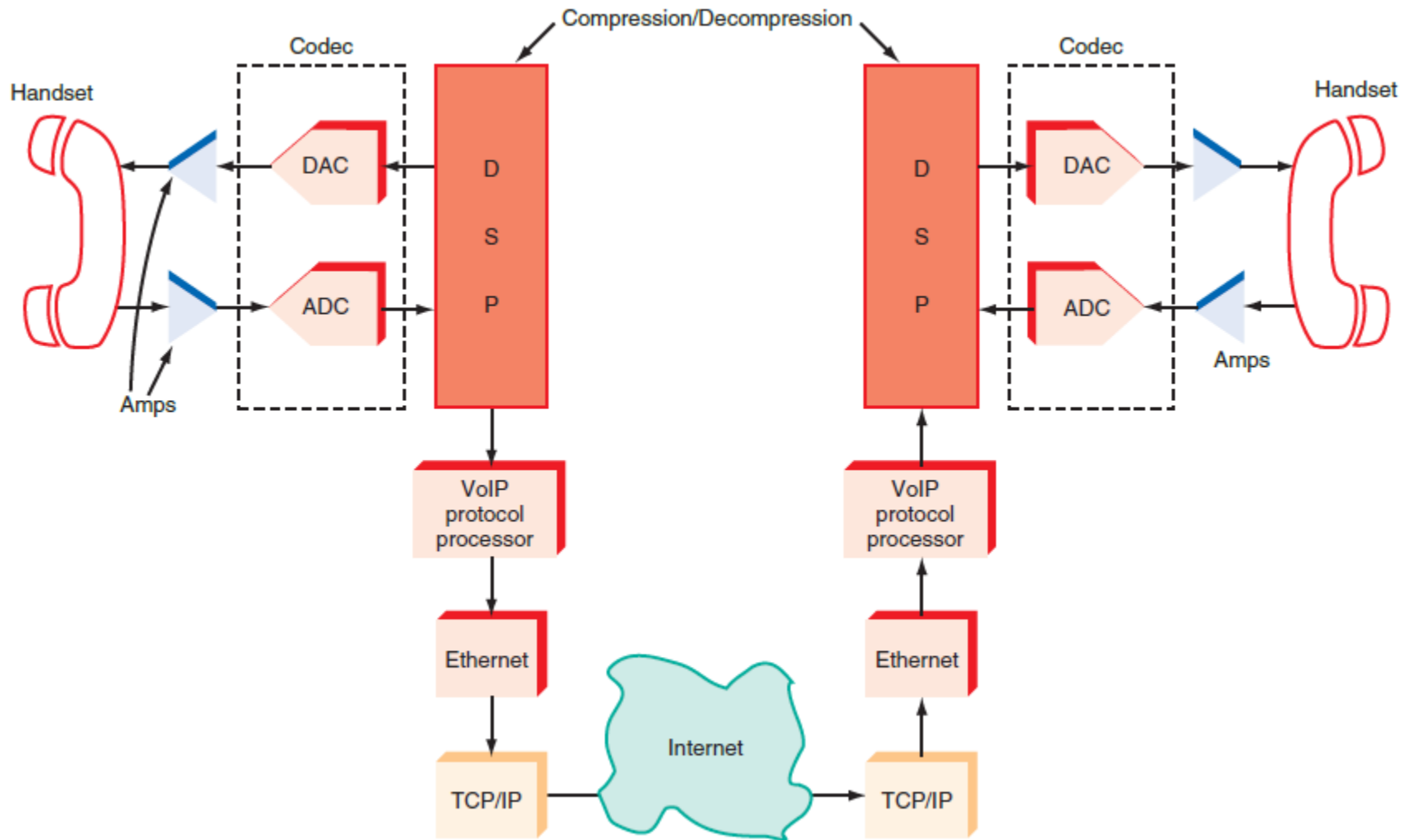
1. Facsimile, or fax, is an electronic system for transmitting graphic information by wire or radio.
2. Facsimile is used to send printed material by scanning it and converting it to electronic signals that modulate a carrier to be transmitted over the telephone lines.



BLOCK DIAGRAM OF A FAX



VOICE OVER IP (VoIP)



DIAL/TOUCH-TONE PHONE

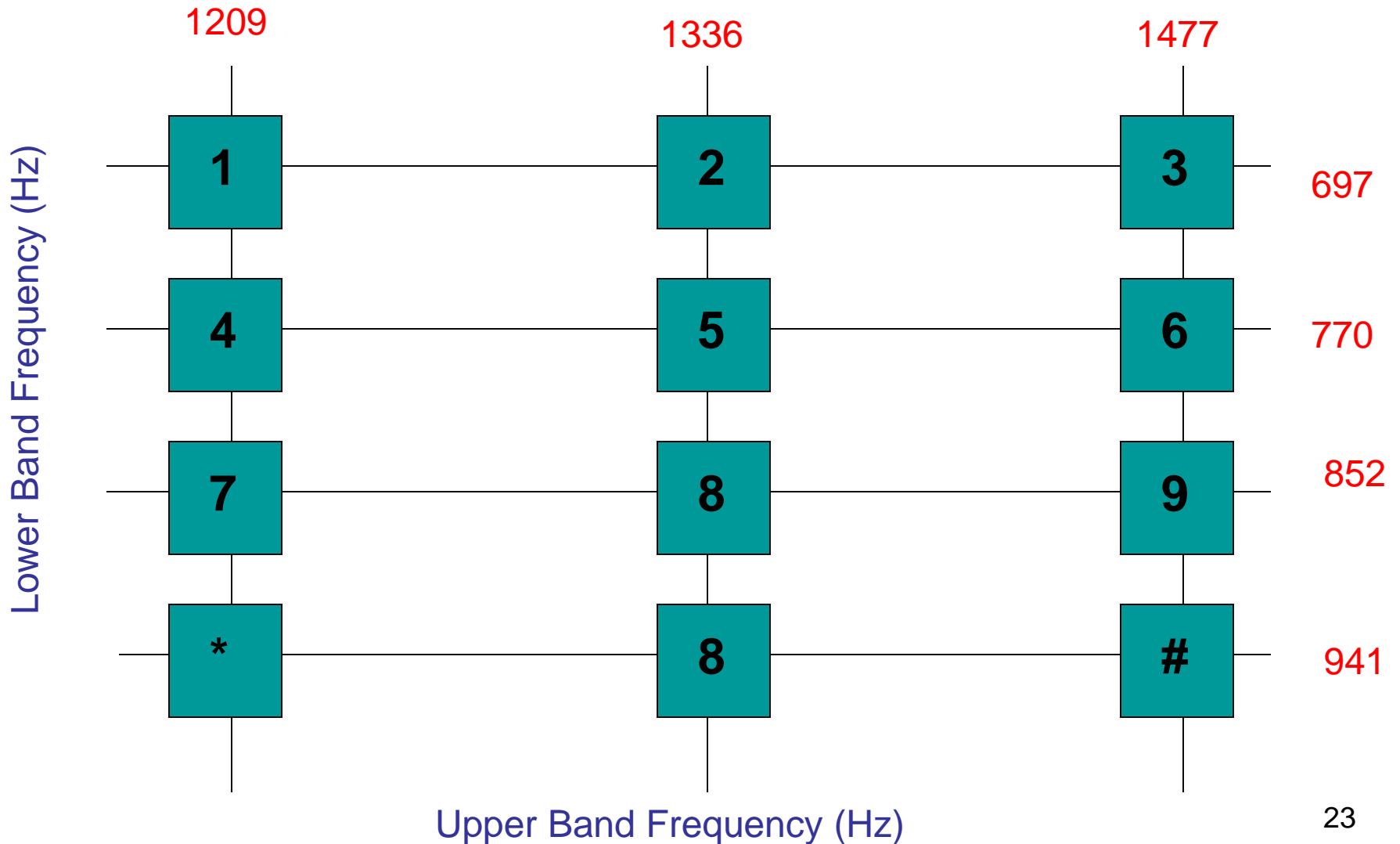


Dial-Pulse Phone



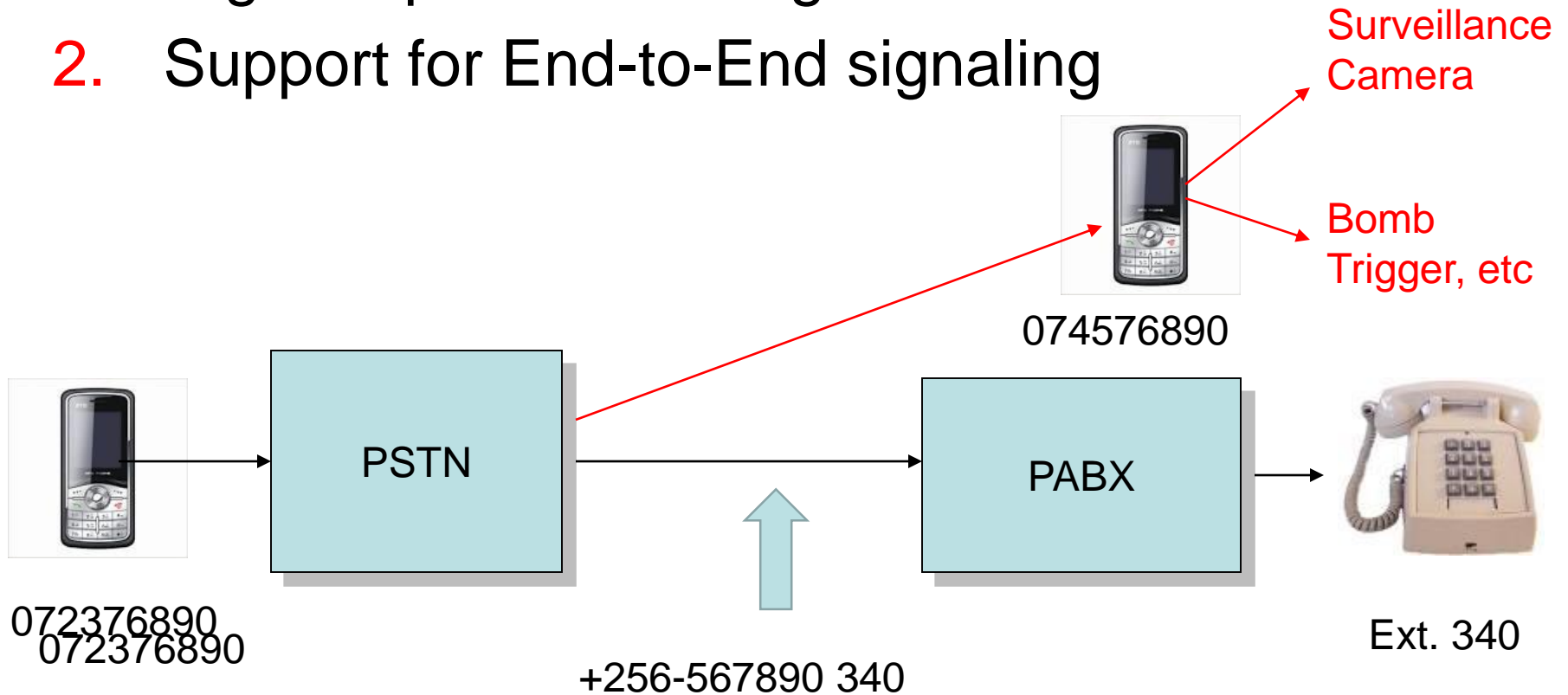
Touch Tone Phone

TOUCH TONE TELEPHONE



ADVANTAGES OF TOUCH-TONE

1. Higher speed of dialing
2. Support for End-to-End signaling



DUAL TONE MULTIFREQUENCY (DTMF) TELEPHONE

1. Advantages of DTMF dialing:
 - a) Shorter time taken to dial compared with pulse dialing which take 12 sec to dial a 7-digit number.
 - b) Equipment in common control switching systems are not tied up for the whole duration of the call.
 - c) End to end signaling is possible since the touch-tone-dialing works in the voice frequency band.
 - d) Using push button instead of a dial is more convenient to the user.
 - e) By using a combination of two sets of frequencies, touch tone can support a wider number range and more characters.

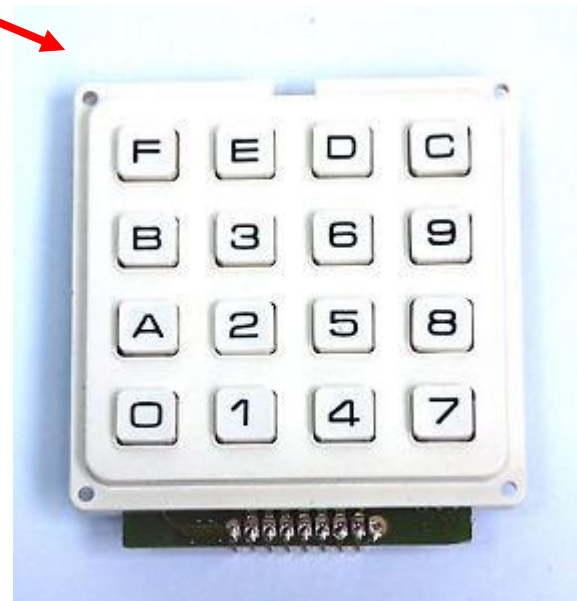
TOUCH TONE CAN SUPPORT A WIDER NUMBER RANGE AND MORE CHARACTERS



Supports only
10 characters,
i.e 0,1,2,..9



Introduces
Harsh, Star, and
even numbers in
some special
phones



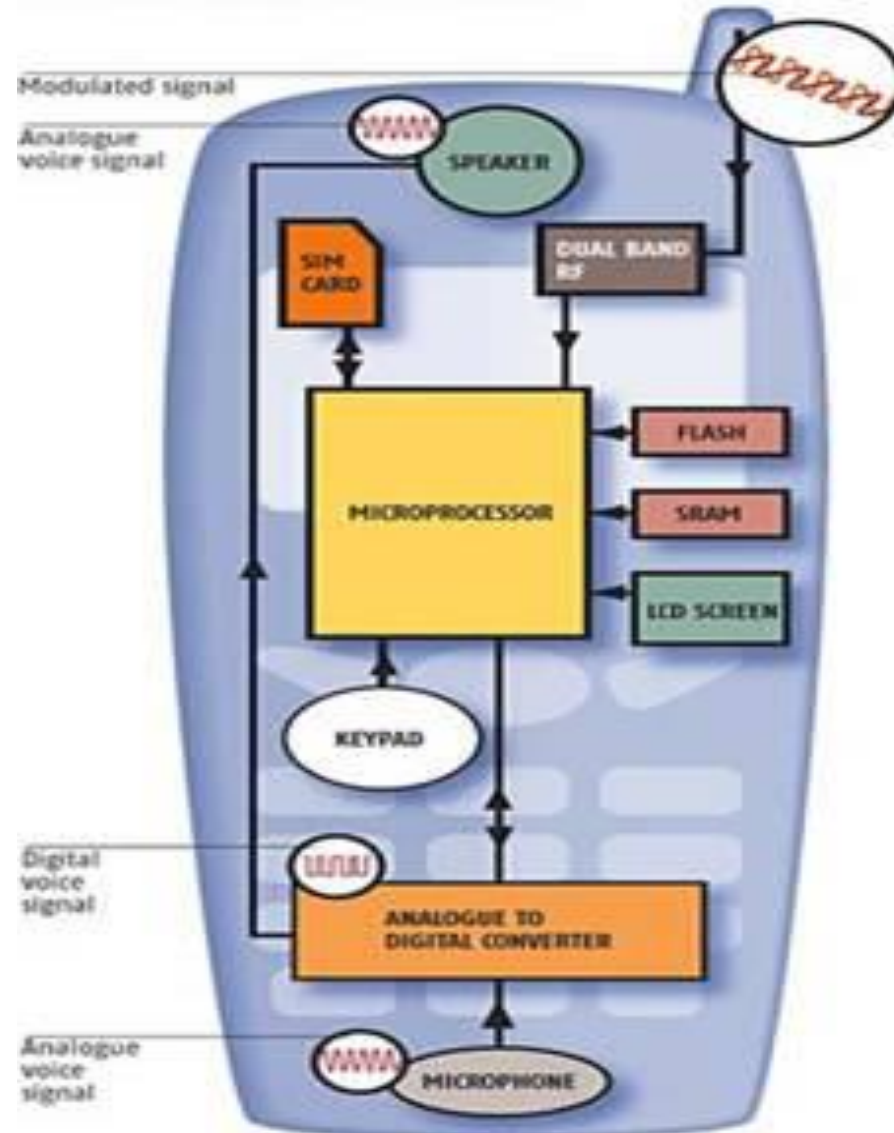
OUR MOBILE PHONE IS A MODIFIED MF PHONE



INSIDE THE MOBILE PHONE

BEHIND THE FACADE

Electronic components of a mobile phone



MOBILE STATION/PHONE

- Mobile Station consists of two parts:
 1. Subscriber Identity Module contains:
 - Subscriber related information
 - PIN and PUK codes.
 - Network access information

SIM card can be updated over the air.
 2. Mobile Equipment containing the phone hardware and firmware.