PBX EVOLUTION

Analog Voice PBX  →  Digital PBX

- Lower cost of digital integrated circuits
- Move to stored program control with added features in PBXs
- Evolution toward digital transmission
PBX APPROACH TO VOICE

Circuit Paths

Port Interfaces

A

B

C

D

E

J

K

L

M
CHARACTERISTICS OF DIGITAL VOICE

Continuous Bit Stream: 64 Kbps (8000 * 8 bits)
Low Call Duration: Minutes
Connected Busy Time: 8% to 16% per hour
CHARACTERISTICS OF DIGITAL TERMINAL DATA

Bursty Blocks: < 1000 bps average
High Call Duration: hours
Connected (Busy) time: approaches 100% per hour
DIGITAL VOICE/DATA PBX CAPACITY

Heavily depends on:
- Total port capacity or switch (two ports per conversion)
- Connectivity of external ports to switch internal ports
Vendors specify the characteristics of the switch in terms of "Blocking".

PBX architectures and the vendors define blocking in many ways advantageous to their products.

Alternate Definitions:

- Blocking - call request rejected because **Switch** has no more capacity for call circuit connections.
- Blocking - call request rejected because **Multiplexing Paths** have no more capacity.
- Blocking - call request rejected because **Expected Duty Cycle** or usage level specified by vendor **is Exceeded**.
BLOCKING vs. NON-BLOCKING

**Blocking**
- When the network is unable to connect two stations because all possible paths between them are already in use.

**Non-Blocking**
- Permits all stations to be connected (in pairs) at once and grants all possible requests as long as the called party is free.
EXAMPLE OF BLOCKING IN A THREE STAGE SWITCH
Space Division is

- Paths between pairs of devices are divided in space.
- Each connection requires a physical path through the switch.

Blocking Example

- Input line 9 cannot be connected to output line 4 or 6, yet both 4 and 6 are free.
NON-BLOCKING THREE STAGE SWITCH

Available

N-1 Busy

Available

N-1 Busy
ALTERNATIVE SOLUTIONS TO DATA

- Voice occupies two full 64 Kbps channels.

- Terminals require significantly less - to increase PBX data capacity to handle more terminals, vendors use different techniques:
  - Have enough switch capacity to "waste" bandwidth.
  - "Sub-Multiplex" - divide a 64 Kbps channel into many equal capacity subchannels - e.g., 1-64 Kbps to 8 - Kbps.
  - "Packet-Switch" a 64 Kbps channel dynamically among many terminals.
SUBMULTIPLEXING\ PACKET SWITCHING

a. Slotted Bus: 64 Kbps Stream

b. Wasted: 64 Kbps Stream
# SUBMULTIPLEXING PACKET SWITCHING

c. Submultiplexing-Static: 64 Kbps Stream

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d. Packet Switching-Dynamic: 64 Kbps Stream

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