

Telecommunication Networks and Services

Switching

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2015



Content



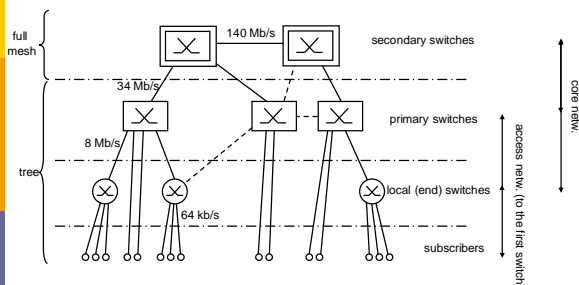
- 1. Introduction
 - Voice digitalisation
- 2. Access to IP networks through telecommunication and cableTV networks
- 3. **Switching** ←
- 4. Mobile networks
- 5. Signalling

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Topological overview of telecomm. networks

(repeated)

- Topology of Public Switched Telephony Network (Hungary)

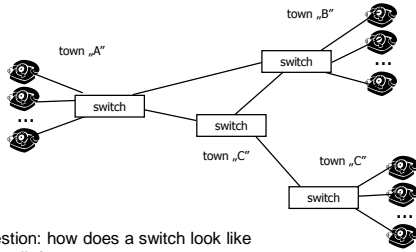


----- : alternative or direct connection:
goal: optimize routing, make the network more reliable (redundancy!)
Bit speeds are (typical) examples, other solutions are also possible

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Architecture of switches

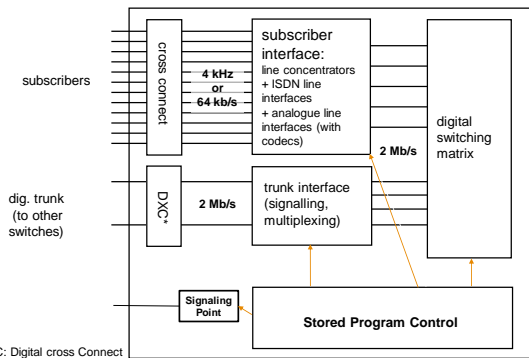
- A simplified model:



- Question: how does a switch look like internally?

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Internal structure of a SPC switch (block diagram)

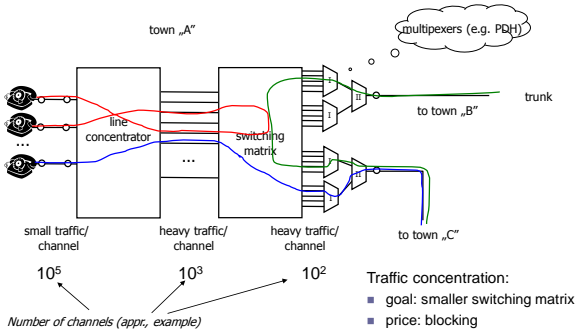


*DXC: Digital cross Connect

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Architecture of switches

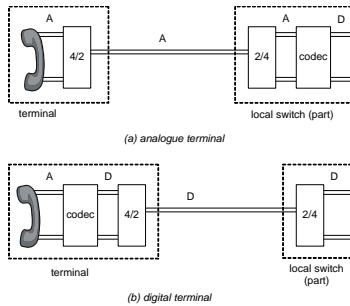
- Block diagram of a switch (model)



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2/4 wire systems

- 4-wire system:
 - 2 wire pairs
 - on a wire pair: unidirectional signal flow
- 2-wire system
 - 1 wire pair
 - on a wire pair: bidirectional signal flow
- Codec: always 4-wire (because of its internal structure)
- Handset: 4-wire (microphone + loudspeaker)
- Subscr. loop: 2-wire (cheaper ☺)
- Signal processing inside a switch: 4-wire (simpler)



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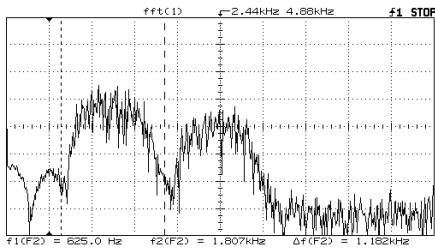
Implementation of the 2/4 wire conversion

- Goal of 4/2 wire conversion:
 - full duplex communication on **one** wire pair
- Possible solutions:
 - separation in frequency domain
 - separation in time domain

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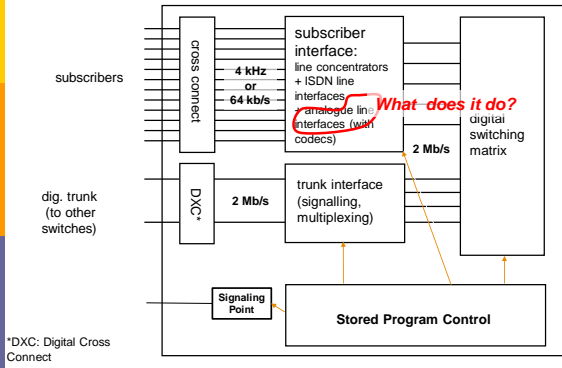
Implementation of the 2/4 wire conversion

- Separation in frequency domain
 - separation by low pass / high pass filter pairs (splitter)
 - e.g. V.22 modem standard (for data transmission)



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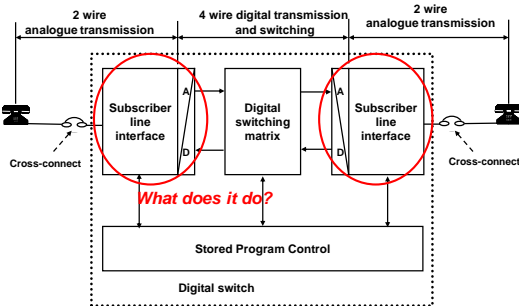
Internal structure of a SPC switch (block diagram)



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Subscriber line interface

- In ISDN: ET



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BORSCHT

- **B**attery feeding
- **O**vervoltage protection
- **R**inging
- **S**upervision/signalling: (monitor if the loop is closed – when receiver is picked up)
- **C**oding, decoding: A/D, D/A conversion (PCM)
- **H**ybridizing: 2/4 wire conversion
- **T**esting (of the local loop)

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Evolution of switches

- Manual switches
- Electro-mechanical
 - Rotary
 - Crossbar
- Digital
 - **Stored Program Control (SPC)**
 - e.g.: pathfinding

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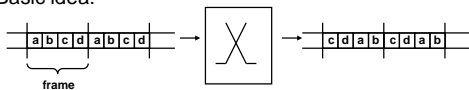
Types of switching matrices

- Space division
- Time division

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Time Division Switching, „T”

- Basic idea:

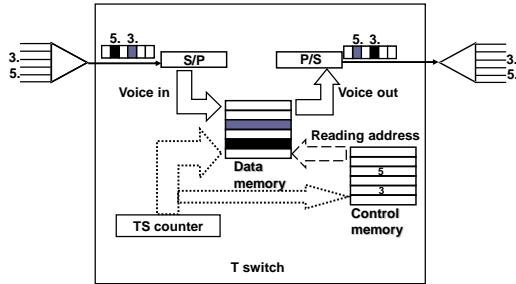


- Implementation: memory (cheap)
 - serial input, random output
 - random input, serial output
- 1 frame delay

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Time Division Switching, „T”

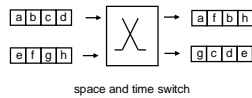
- Internal structure of a T switch



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Time Division Switching, „T”

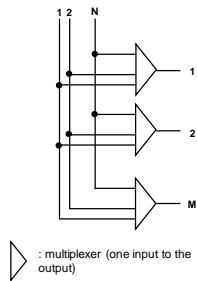
- The speed of the memory is finite: only several hundred or thousand time slots can be handled in a 125 μ s long frame
 - What to do if there are more subscribers?
- Solution: space **and** time switch



space and time switch

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Digital implementation of space switching



Control: Matrix memory
 Rows ~ multiplexers (outgoing trunks)
 Columns ~ Time Slots

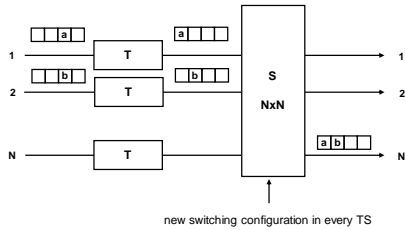
: multiplexer (one input to the output)

- Price is proportional to the number of pins of the ICs

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Space and time switching

- Implementation e.g.: TS switch

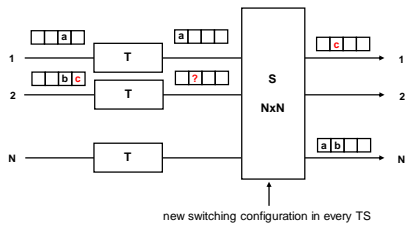


- T module: Changes TS, but does not change trunk
- S module: changes trunk, but does not change TS

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Space and time switching

- But TS is not the best (though it is simple) :

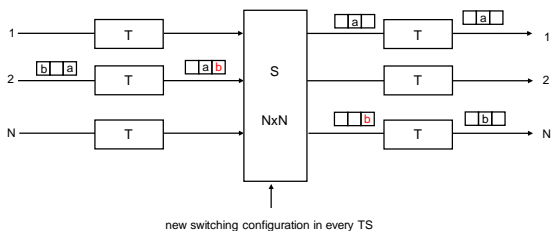


- internal blocking even in a so simple situation

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Space and time switching

- TST is better than TS



- it can handle the previous blocking situation

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