Qualified Partner Programme QPP

ISDN Integrated Services Digital Network Theory

xDSL Digital Subscriber Line Theory

Felice Guarna

R&M

Convincing cabling solutions

New WAN Technologies

Development of new technologies driven by bandwidth demand

Bandwidth demand results from consumer services

- Types
- Quantity
- Frequency of usage
- Type of usage
  - Business
  - Entertainment
  - Security

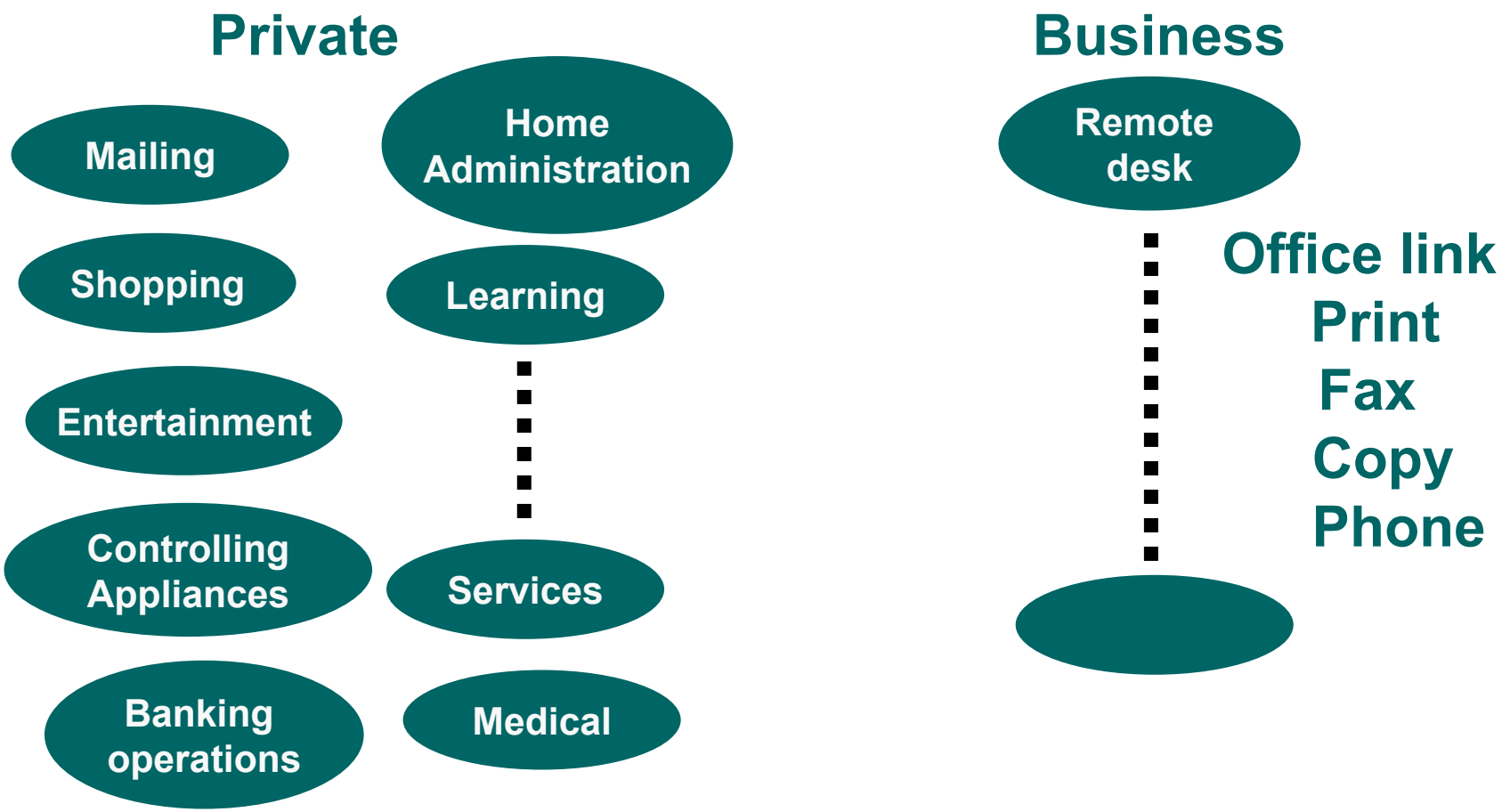
Constrain of development of new technologies is cost

- New equipment → No way to eliminate
- Instruction
- Installation
- infrastructure

→ Area of cost reduction

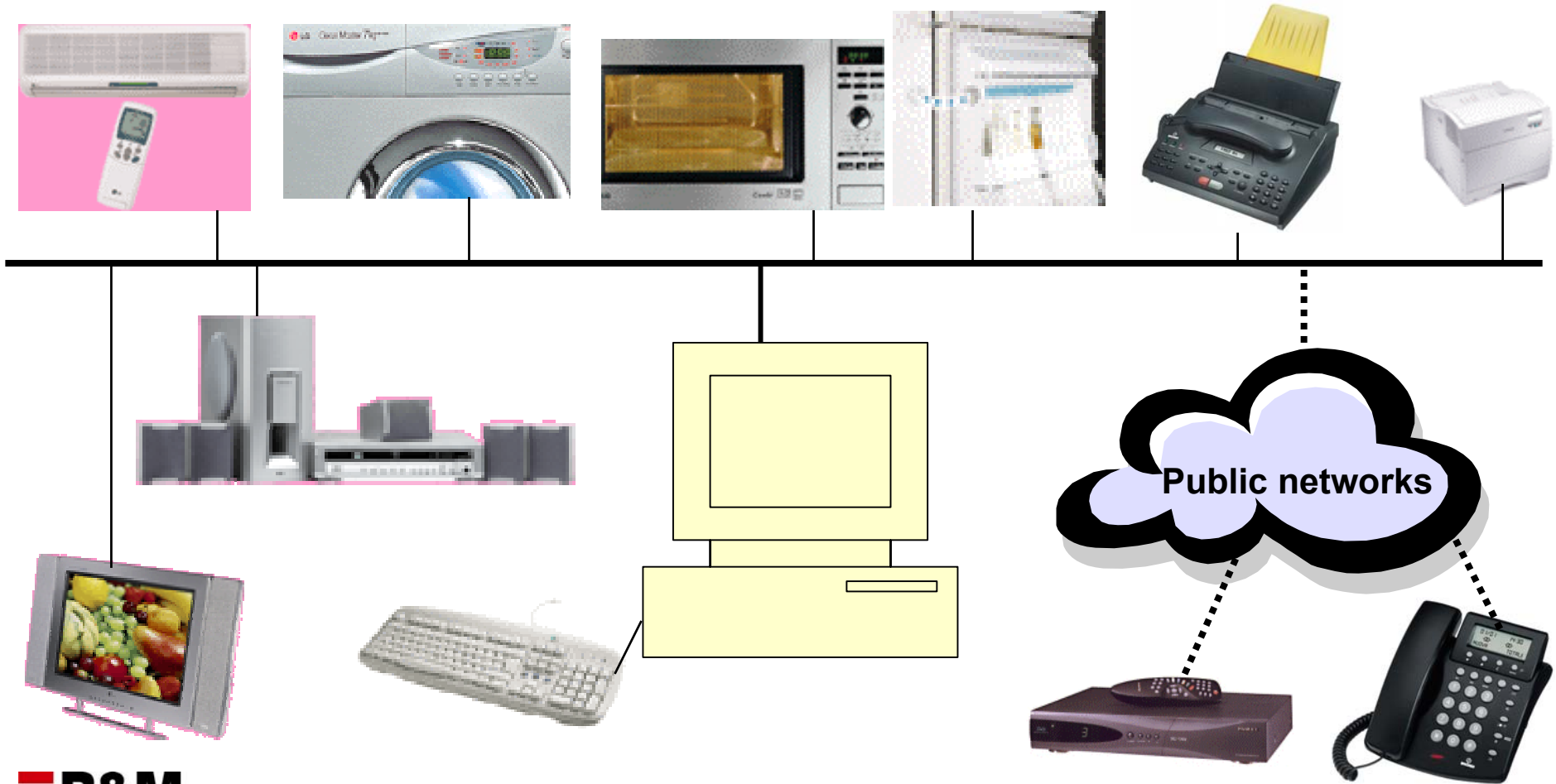
R&M
Convincing cabling solutions

What for?



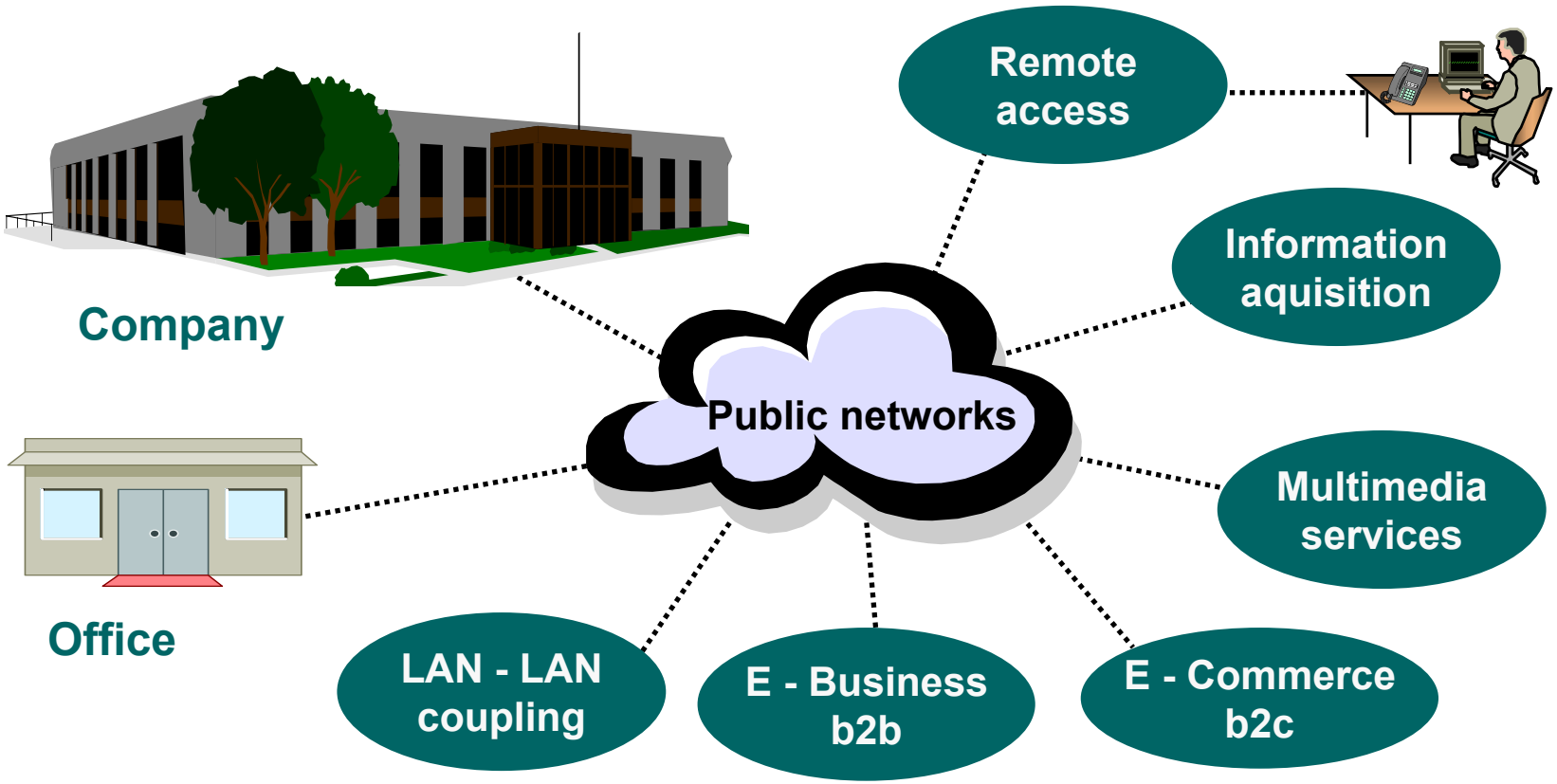
R&M
Convincing cabling solutions

Future home applications

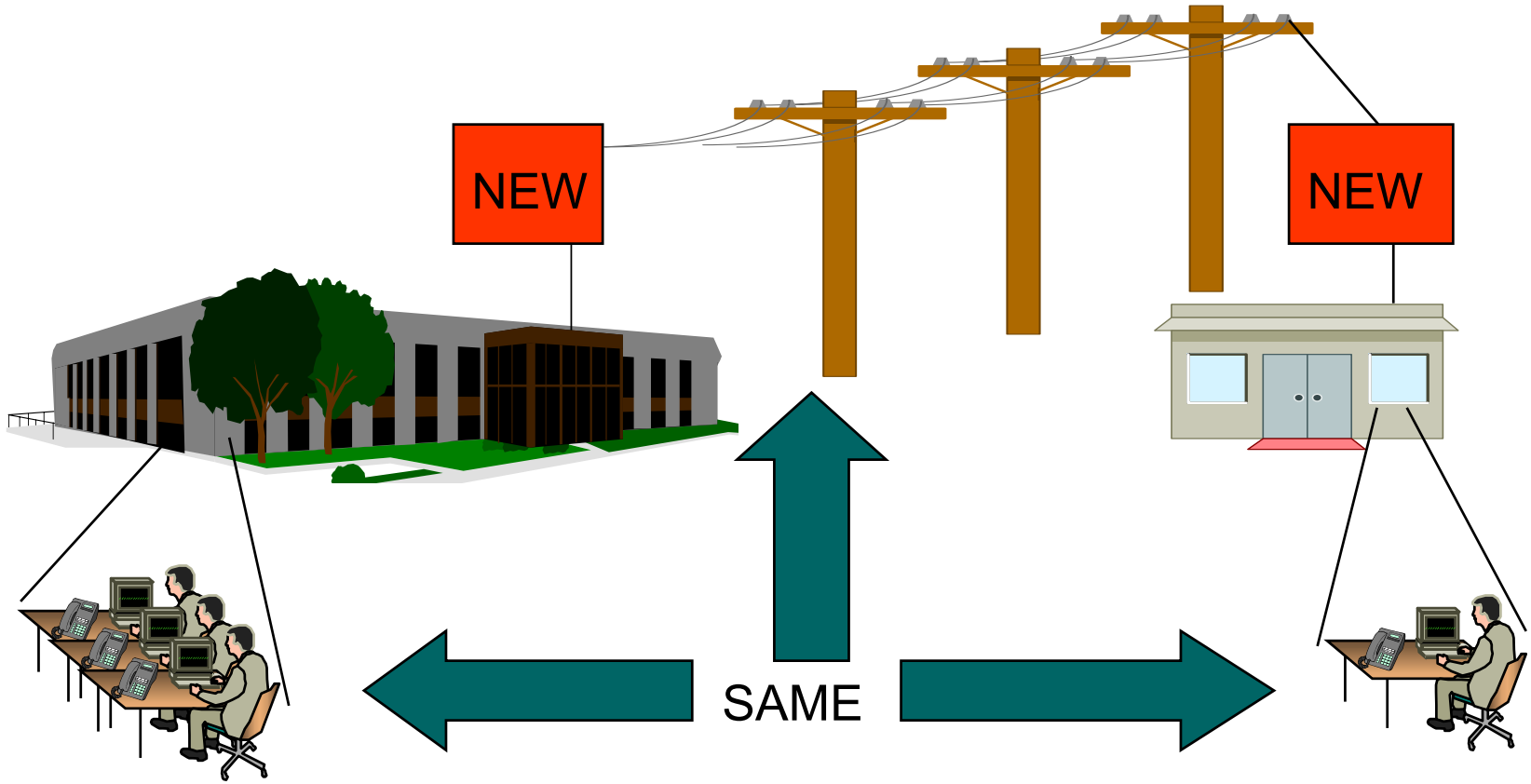


R&M
Convincing cabling solutions

Business applications

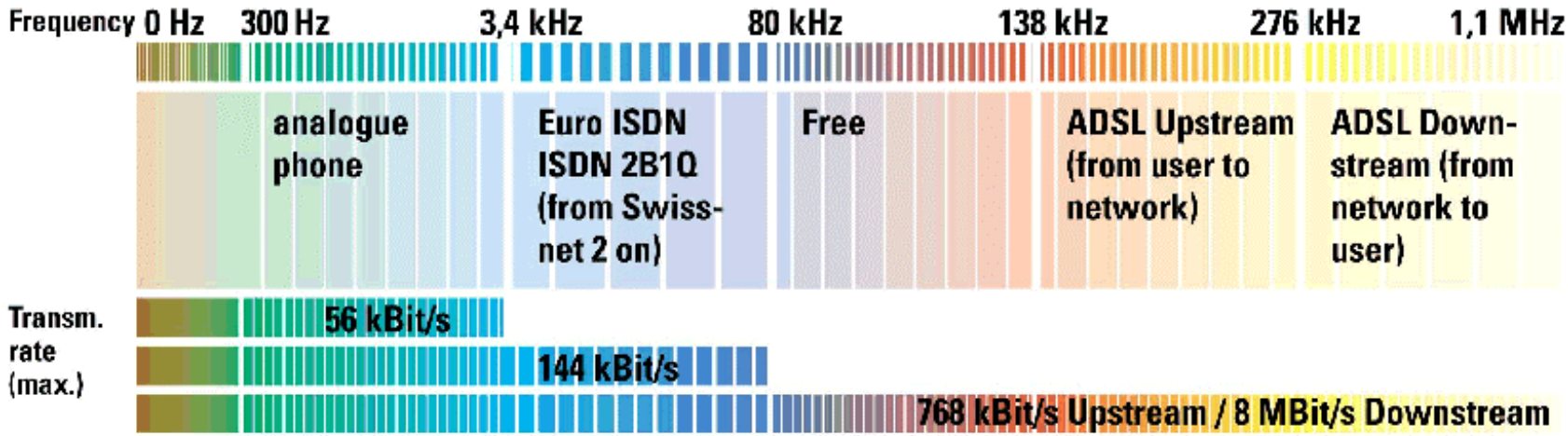


The economic solution



Frequency ranges and transmission rates of the different WAN applications

- **POTS (analogue telephony), comparing ISDN and ADSL**



- The simultaneous transmission of voice, ISDN applications and ADSL data is achieved thanks to the transmission of ADSL signals on a significantly higher frequency range.

1. Introduction ISDN

- ISDN stands for the international abbreviation Integrated Services Digital Network and is considered the universal, digital telecommunications network of the future.

- There is a worldwide standard for ISDN (issued by CCITT). In Europe (by ETSI) it is also known as Euro ISDN.

- The integration of different telecommunications services in ISDN (data, video, fax, voice) led to new ways to make use of these services in much more efficient way.

- With ISDN inter-connected applications the user's communication options are more convenient, safer, faster, more effective and therefore cost-saving.

2. Base and primary access

2.1 Basics

- In order to cater for all different communication needs, all voice, text, image and data services in ISDN are offered by means of two types of universal accesses, the **base access and the primary access**. These ISDN accesses are offered at a so-called network access with standardized interface.

Base Access (private or small enterprises)	**Primary Multiplex Access (larger enterprises)**
2 B channels (2 x 64 kbit/s)	30 B channels (30 x 64 kbit/s)
D channel (1 x 16 kbit/s)	D channel (1 x 64 kbit/s)
1 copper pair	2 copper pairs or 2 optical fibres

2.2 Base access

- The base access does physically correspond to a present-day telephone connection, offering, however, 2 bearer channels (B channels) of 64 kbit/s each for transmission, and 1 control channel (D channel of 16 kbit/s) for signaling.

64 kbit/s channel for voice, data, text, video

64 kbit/s channel for voice, data, text, video

16 kbit/s channel for control

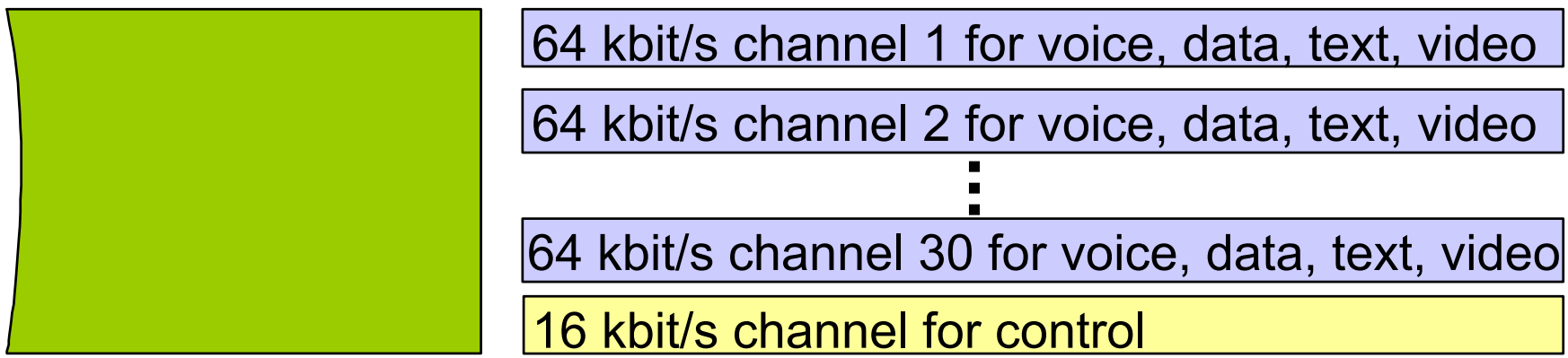
2.2 Base access continuation

- Every base channel can be simultaneously and individually used for all communications services offered in ISDN.

- Two connections per base access are thus possible. The user can, for example, establish two phone connections with different subscribers via one exchange line, or telephone with one and send the other a fax, or telephone with one and transmit data to another one, all at the same time. A local communication, i.e. One connection between two telephones at the same base access, is not possible. Such a connection must be established through the public telephone network, and is subject to fee.

2.3 Primary or primary multiplex access

- To interconnect, for example, a multi-user system or a complete LAN, a base access with its two B channels does not fulfill communications requirements. A similar situation presents itself to operators of public telephone networks (PABXs) which appear as private ISDN nodes. In such cases the ISND access can either be established via several bases accesses or via an ISDN **primary access or primary multiplex access** (PMxA).



2.3 Primary access or primary mulitplex access (2)

- A connection between the NT 1 and the PABX (NT 2) is always a point-to-point connection, and only one PABX or data processing system can be connected to such an access. The 30 B channels of 64 kbit/s each can be interconnected for applications that require a high transmission rate (e.g. the videotelephone). This way a maximum transmission speed of 2 Mbit/s can be achieved, occupying all 30 B channels as a result.
- The CCITT (Comité Consultatif International Télégraphique et Téléphonique) recommendation for primary access provides for a further channel structure, which consists of 23 B channels and one D channel and has a total bit-rate of 1.544 Mbit/s. Many European countries employ the version of 2 Mbit/s which is also called the E1 System.
- The other version of 1.5 Mbit/s (T1 System) is employed by the U.S, Canada and Japan, among other countries.

3. ISDN services

- Transparent 64 kbit/s transmission without any restrictions
- 3.1 kHz - a/b carrier service
- Telephone service of 3.1 kHz bandwidth
- FAX
- Internet with 64 kbit/s
- Videotelephone service
- Packet oriented data transmission of 64 kbit/s in the B channel and of 9.6 kbit/s in the basic access D channel

4. ISDN features (1)

- ISDN has many extra features which greatly simplify telephone service as it is today. Up to now, most of these services could only be achieved with the help of PABXs. Today, all any private subscriber needs to make use of these services is a base access.

- **Some of the main features of an ISDN base access are:**
  - display of subscriber number and waiting call
  - holding (parking) a call
  - ring-back feature/alternation between lines
  - tripartite conference
  - automatic call-back when a line is busy

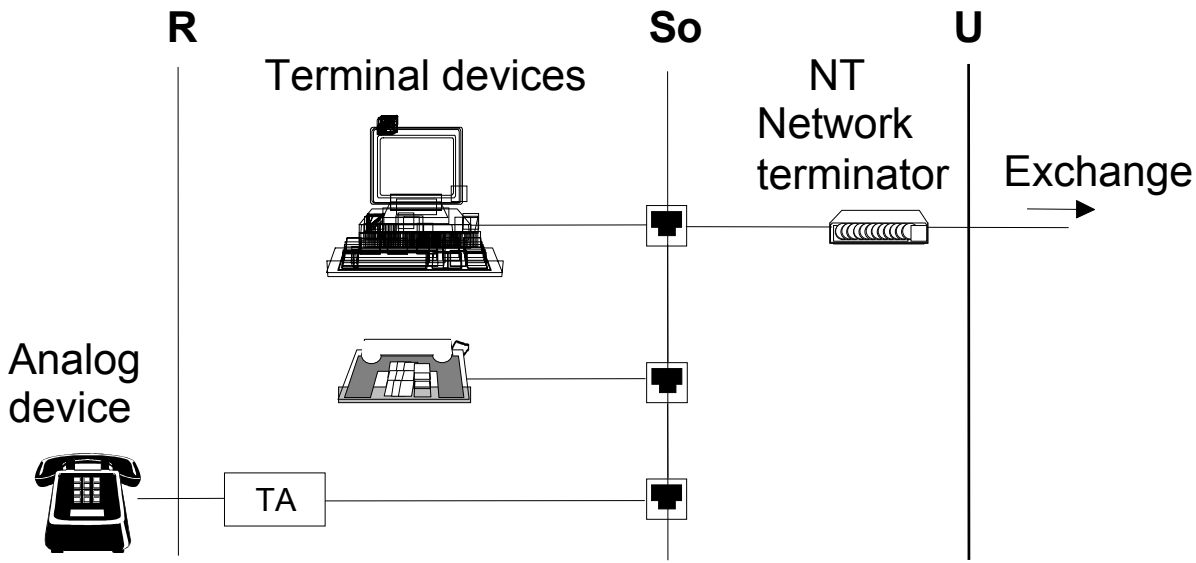
4. ISDN features (2)

- in-dialing to branch exchanges to telecommunications systems
- multiple dial number, individual assignment of up to 10 dial numbers
- call forwarding
- changing of service during a connection
- re-plugging terminal devices
- changing of a terminal device without change of service
- closed user groups

5. Reference points

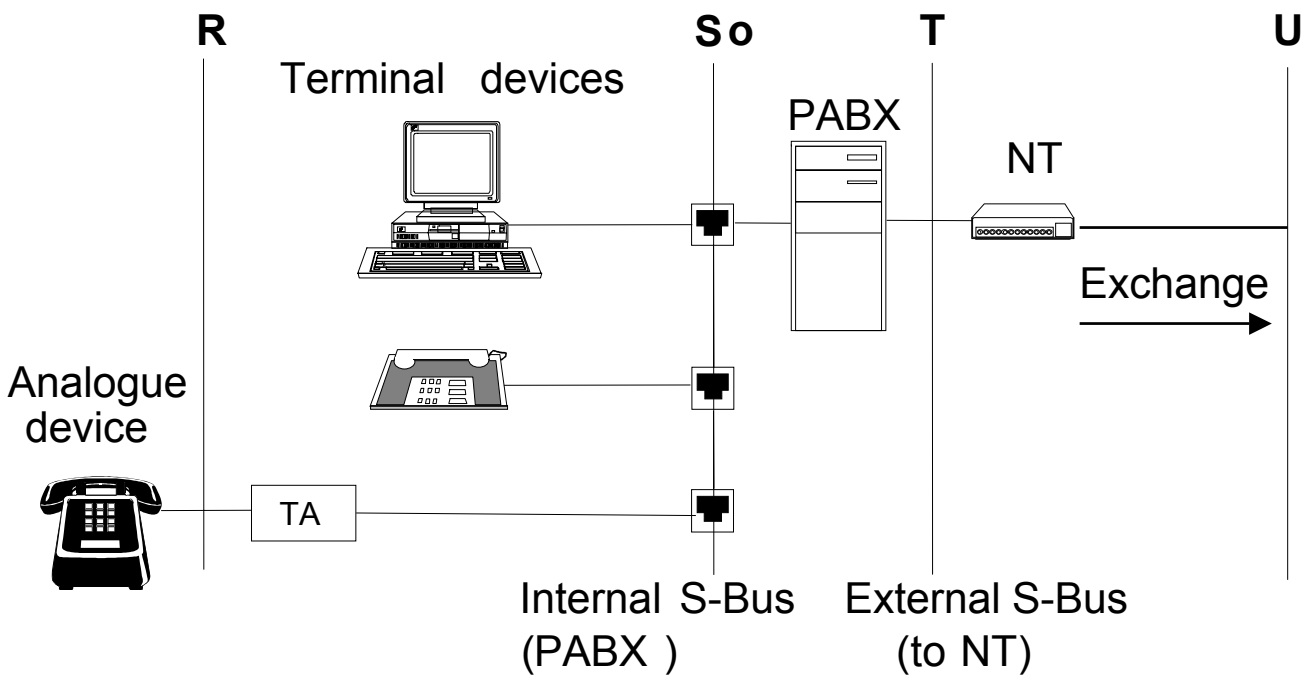
5.1 ISDN without PABX

- ISDN is a worldwide network that consists of the PTT networks of the individual countries. In order to ensure worldwide communication the CCITT (Comité Consultatif International Télégraphique et Téléphonique) has determined so-called reference points at the interfaces. These reference points are internationally standardised, guaranteeing thus that a a ISDN terminal device can be used everywhere in the world.



5.2 ISDN with PABX

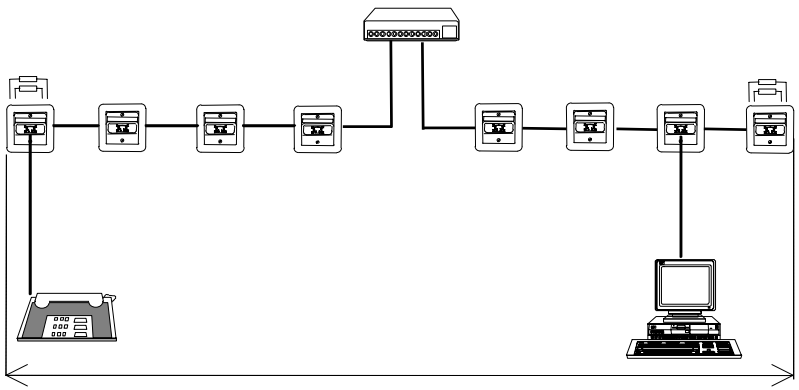
- In ISDN system with PABXs the PABX and NT 2 are thus identical. Terminal devices which are not ISDN-capable can be connected via the terminal adapter (TA) (e.g. analogue telephones, group 3 faxes).



6. Configuration types

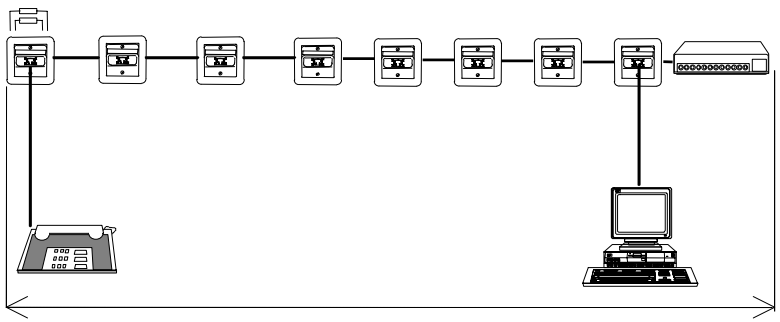
6.1 Configuration types in base access (1)

Short passive bus and NT between the outlets



- Maximum length 300 m
- Maximum 8 terminal devices

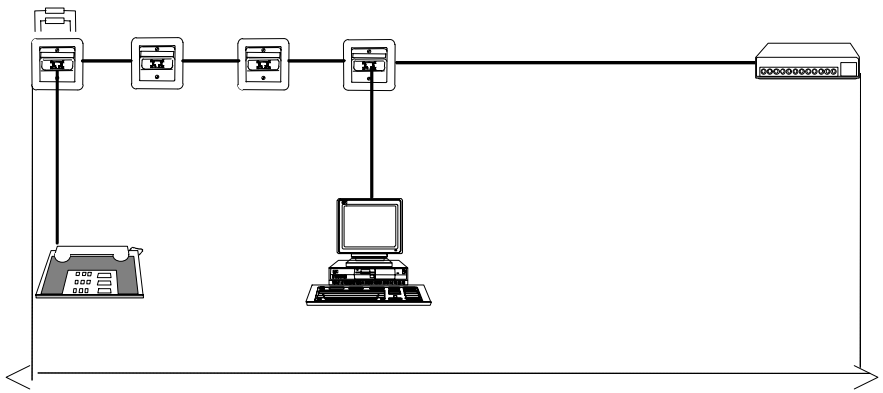
Short passive bus and NT at bus start



- Maximum length 200 m
- Maximum 8 terminal devices

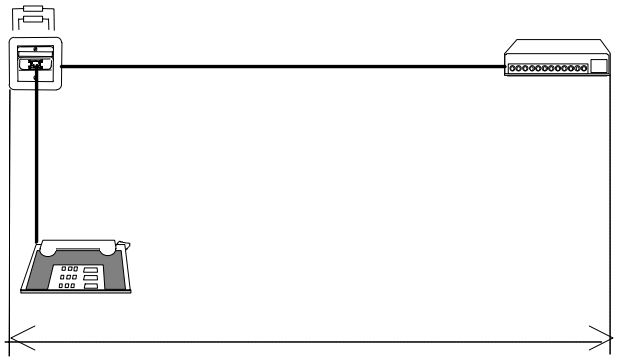
6.1 Configuration types in base access (2)

Extended bus



- Maximum length 450 m
- Maximum 4 terminal devices
- Maximum attenuation 6db/96kHz

Point-to-point Connection

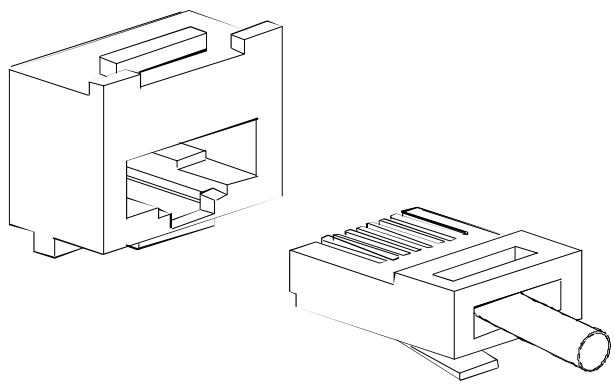


- Maximum length 700 m
- Maximum 1 terminal device
- Maximum attenuation 6db/96kHz

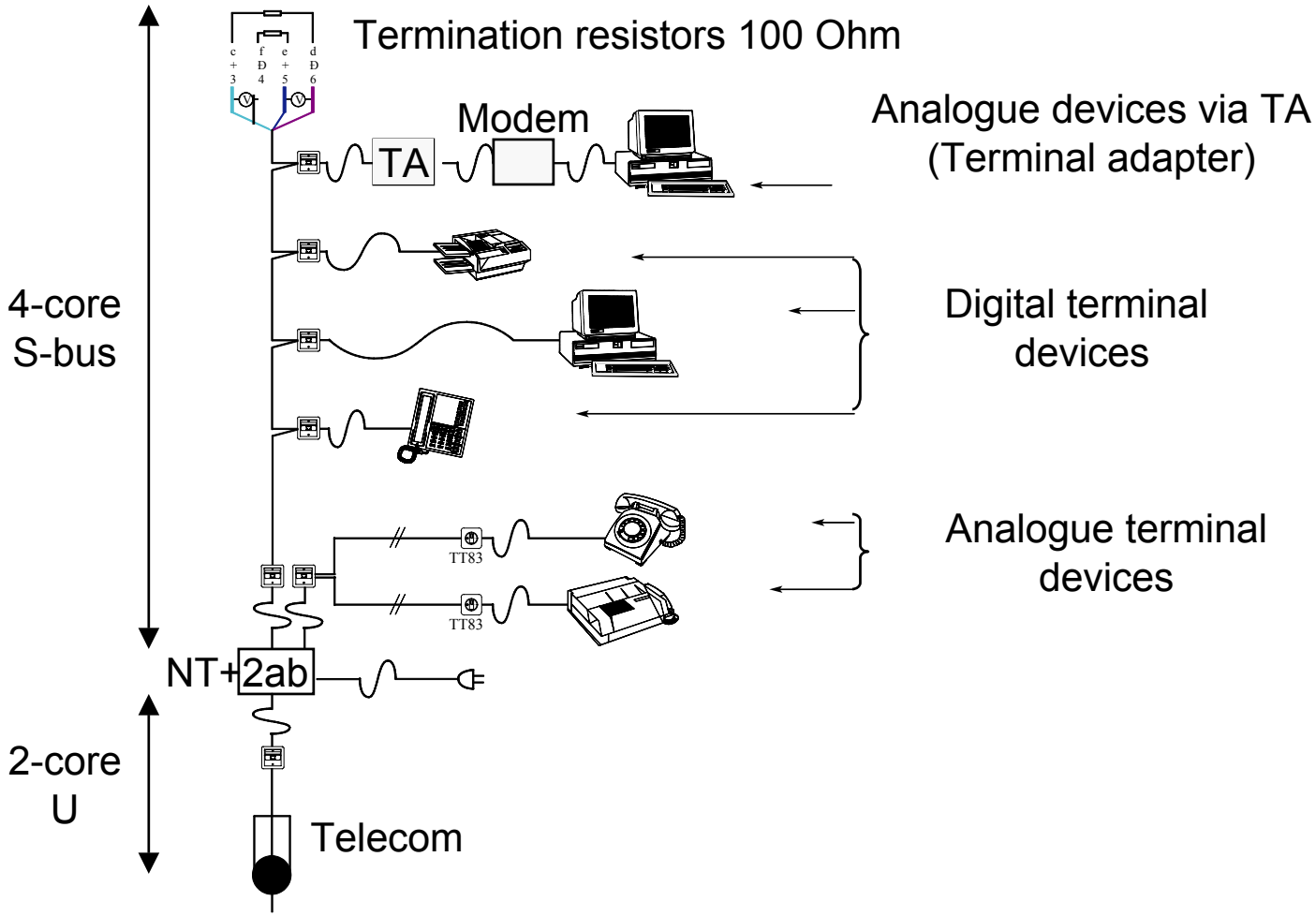
7. ISDN plug system

7.1 The ISDN RJ45 plug

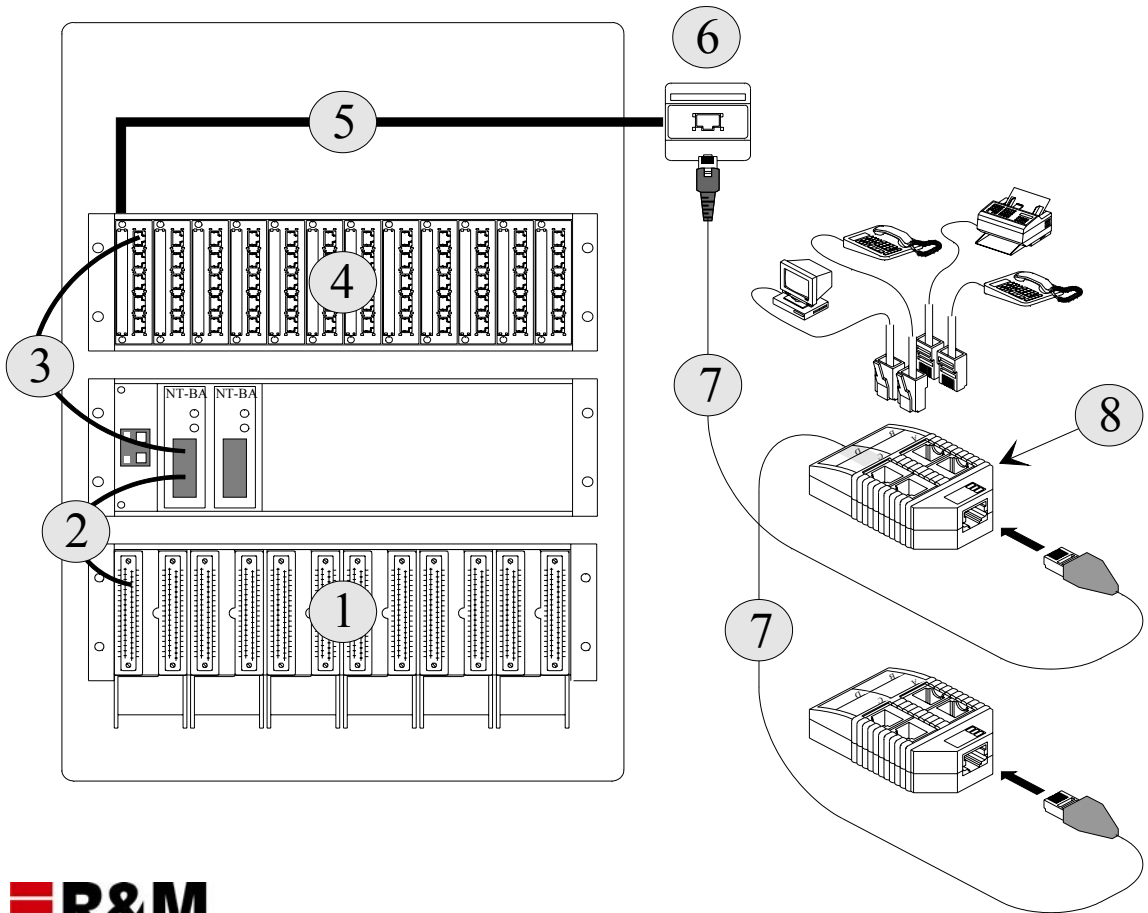
- The EURO ISDN were introduced to make terminal devices plug-compatible throughout Europe. The applied plug system is the RJ45, a plug that is also known under other names such as FCC 68-Plug, western plug or modular plug. Technically, it can be called an 8-pole plug. The technology behind it originates in the U.S. and was initially intended for the connections between terminal devices and the public telephone network. It was "invented" in the beginning of the seventies. Nowadays, it finds wide use in generic cabling systems as well.



7.2 ISDN cabling



8. ISDN integration in structured cabling systems (NT in 19“ racks)



Legend:

① Voice Panel (SRV)

② Patch Cord Voice Panel for NT (U)

③ Patch Cord NT (S) for Tertiary Patch Panel

④ Tertiary Patch Panel

⑤ Installation Cable

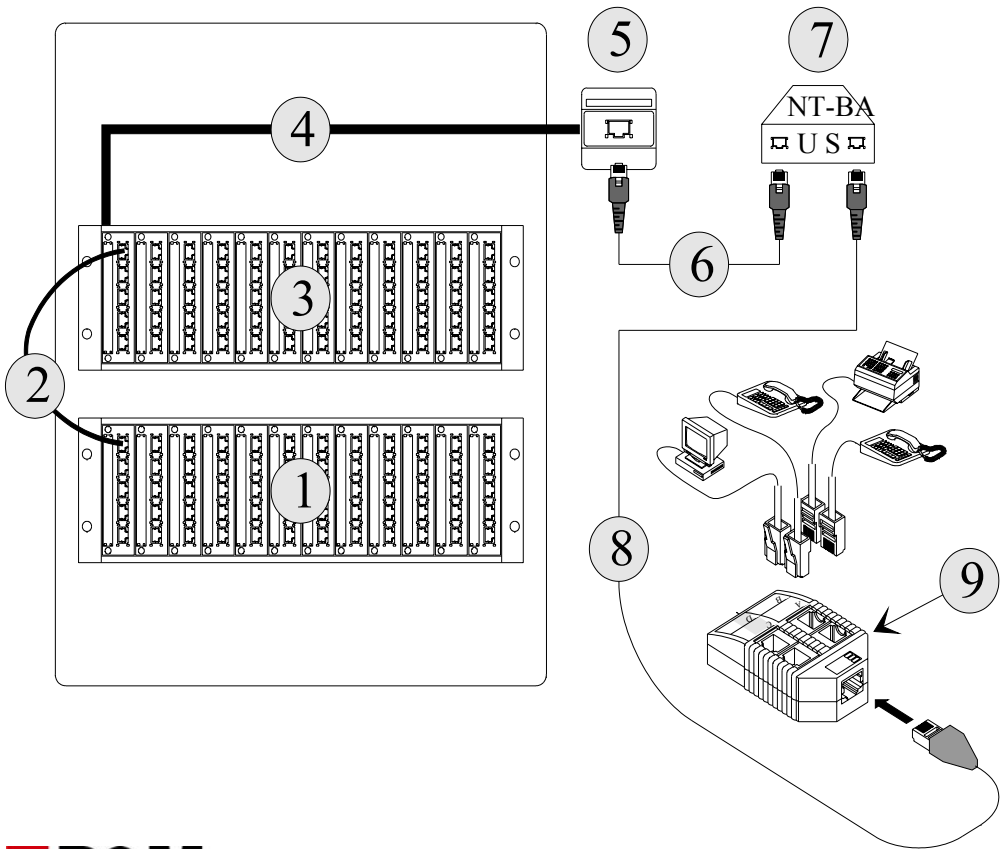
⑥ Telecommunications Outlet

⑦ Connection Cable

⑧ Mini-S-Bus

R&M
Convincing cabling solutions

8. ISDN integration in structured cabling systems (NT at work place)



Legend:

① Voice Panel

② Patch Cord Voice Panel for Tertiary Patch Panel

③ Tertiary Patch Panel

④ Installation Cable

⑤ Telecommunications Outlet

⑥ Connection Cable, Jack - NT

⑦ NT (Network Terminator)

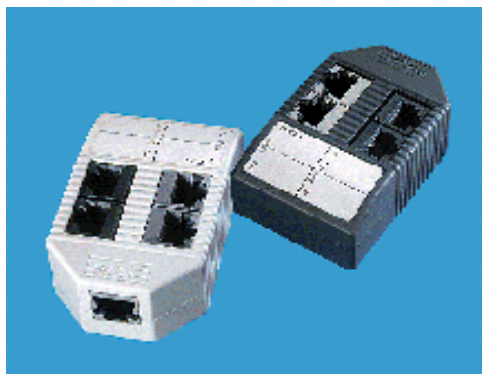
⑧ Connection Cable NT - Mini-S-Bus

⑨ Mini-S-Bus

9. ISDN plug system Mini-S-bus

Mini-S-Bus digital

Mini-S-Bus analog/digital



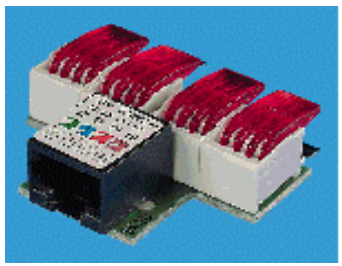
The RJ45 Mini-S-Bus replaces or extends S-Bus cabling, while allowing a fast and economical connection of maximum 5 ISDN devices or 2 analogue and 2 digital devices.

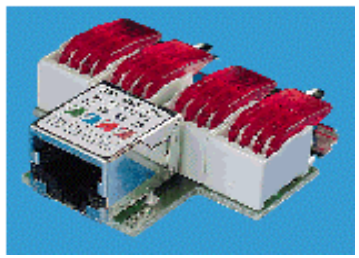
Features

- 4 or 5 terminal devices can be connected.
- Attractive design, in white and charcoal.
- Shielded and unshielded version available.
- Large labelling area.
- Integrated 100 ohm termination resistors (can be switched off with jumpers).
- Simple connecting by plug or cable.
- Small dimensions.

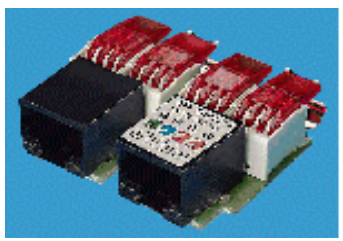
9. ISDN plug system - Connection modules with "Easy Lock"

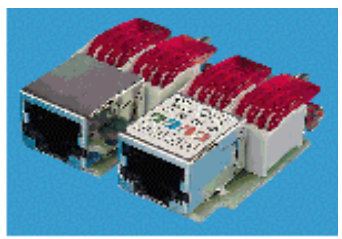
1xRJ45 Connection Modules





2xRJ45 Connection Modules





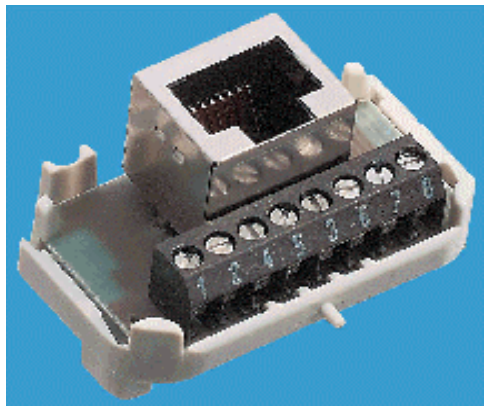
The RJ45 ISDN connection modules are the centre piece of ISDN cabling. They feature unshielded or shielded RJ45 ports and allow a tool-free and fast connecting of S-FTP-, FTP- and UTP installation cables.

Features

- Tool-free «Easy Lock» connection technique (IDC) for data cables of AWG 24-22 wires.
- Error-free connection thanks to wiring chart.
- Conductors wired without crossover.
- Neat and easy shield contacting.

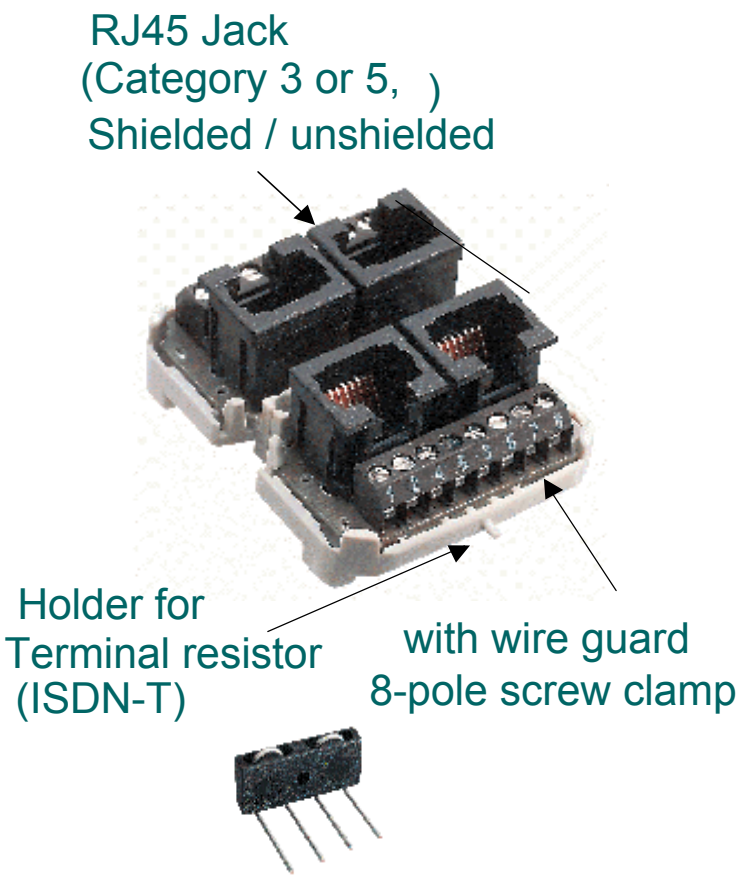
R&M
Convincing cabling solutions

9. ISDN plug system - Connection modules with screw clamps



All RJ45 inserts are suitable for all applications in ISDN, xDSL and analogue telephonic (Class B, according to ISO IEC 11801 and EN 50173). In addition, the Cat. 5 inserts are ideal for building up smaller-scale networks, while offering Cat. 5 performance according to ISO IEC 11801 and EN 50173. Thanks to the screw clamps with wire guard bus systems (ISDN), xDSL and analogue telephonic can be very easily implemented, the screw clamps allowing an easy contacting of two wires of up to 8mm in diameter. All RJ45 inserts are available in shielded or unshielded version.

9. ISDN plug system - Connection modules with screw clamps



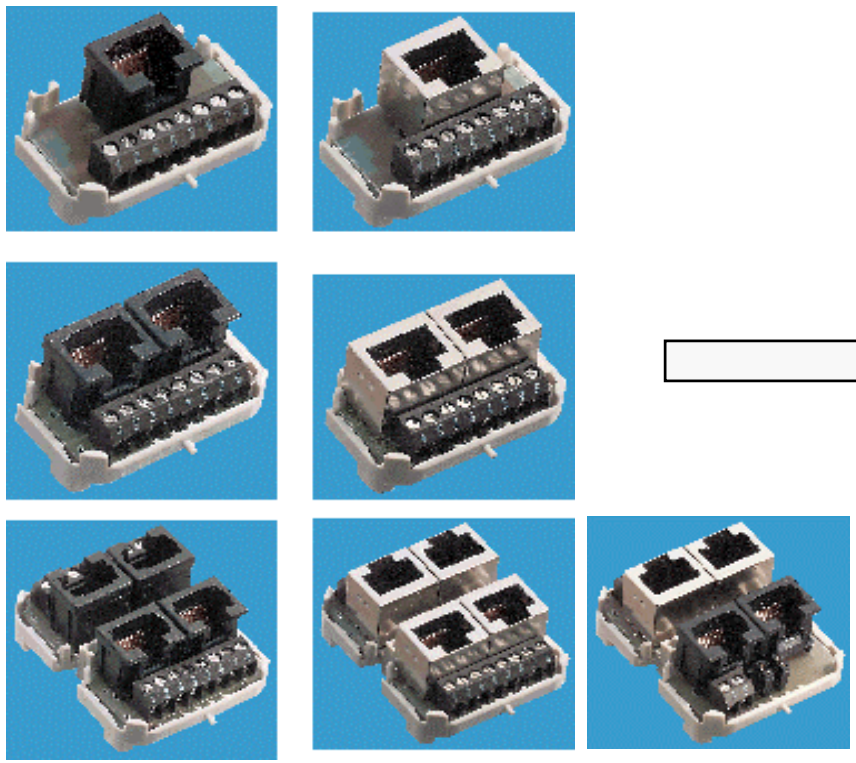
Features

- All RJ45 inserts fulfil the Class B requirements according to ISO IEC 11801 and EN 50173.
- On top of that the one- and two-fold RJ45 inserts fulfil the Category 3 requirements according to ISO IEC 11801 and EN 50173.
- The CAT 5 RJ45 inserts fulfil the Category 5 requirements according to ISO IEC 11801 and EN 50173.
- Fast and easy R&M patented shield contacting (in shielded versions).
- The inserts can be combined at will.
- Screw clamps with wire guard.
- Every screw clamp is labelled with the respective RJ45 contact number.
- Holder for the terminal resistor (snap-in attachment).

R&M
Convincing cabling solutions

9. ISDN plug system - Connection modules with screw clamps

The RJ45 inserts can be combined at will



Various 1xRJ45 versions, up to 4xRJ45

R&M
Convincing cabling solutions

9. xDSL - The copper data highway
9.1 Introduction (1)

- The demand for still higher transmission rates is ever increasing. Due to a wider use of the Internet, the amount of data being transmitted is rapidly growing, too. At the same time there is an increasing demand of availability of services and slow transmissions are not accepted anymore.
- The bottle neck that leads to slower transmission results in a limited capacity of the connecting line between Telecom public exchange and domestic telephone outlet. Thanks to ISDN there is a certain speed advantage but in the so-called core network (backbone) data will be transmitted at a much higher transmission rate.
- There is a medium copper connection line in every household, yet it is presently only used for the 4 kHz analogue telephone i.e. the 144 kbit/s ISDN service.

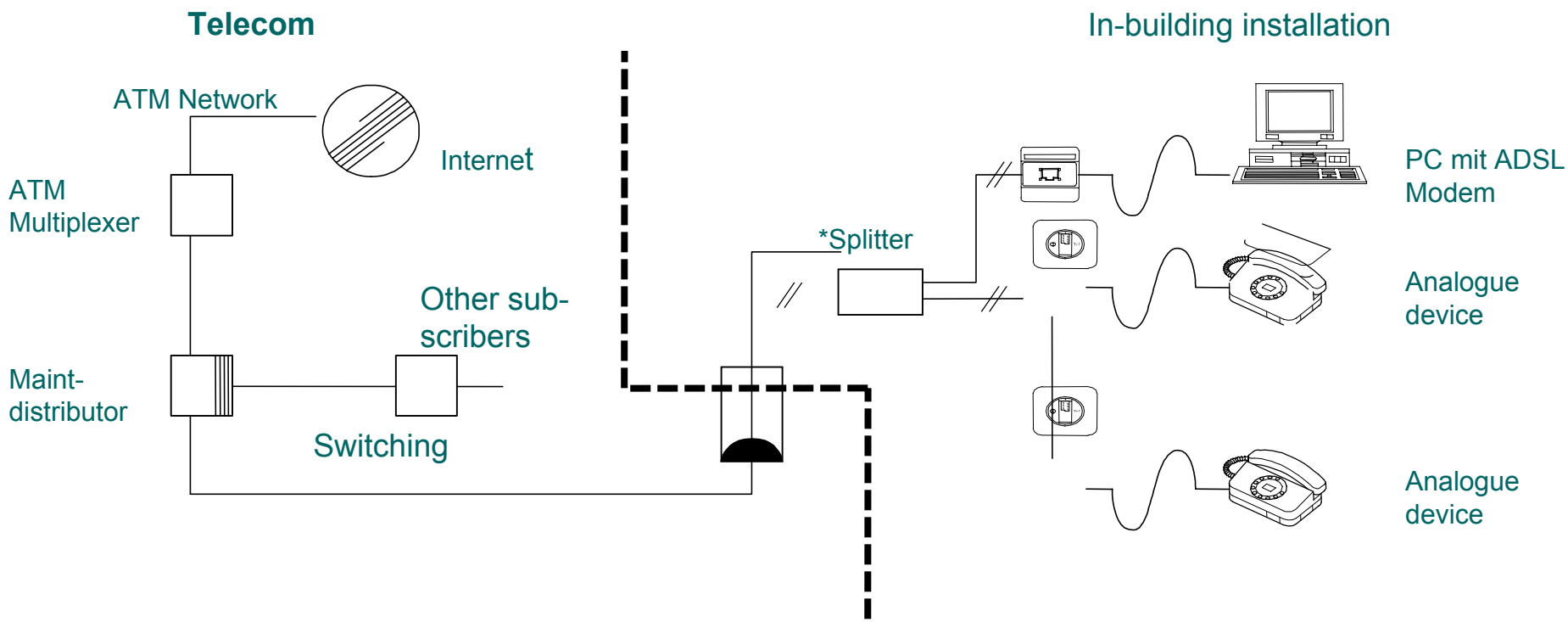
9.1 Introduction (2)

- Thanks to the enormous progress in digital signal processing in Micro Chip technology (DSP), however, it is possible to transmit data over a telephone line at a transmission rate of up to 8 Mbit/s. The current bandwidth of 300 Hz – 3400 Hz is increased to new up to 1,1 MHz (thanks to DSP technology). Also relevant here, however, is the distance from subscriber terminal to public exchange and the condition of the telephone line.

- **Different xDSL technologies**

  The spectrum ranges from HDSL (High-Speed DSL), SDSL (Symmetric DSL), VDSL (Very High Speed DSL) up to ADSL (Asymmetric Digital Subscriber Line). From these different technologies, **ADSL** is the type with the best prospects.

9.2 Overview chard ADSL



* Splitter: Serves as a frequency divider, forwarding incoming phone calls to the telephone and data to the ADSL modem.