



EZŽ komunikacijski izdelki

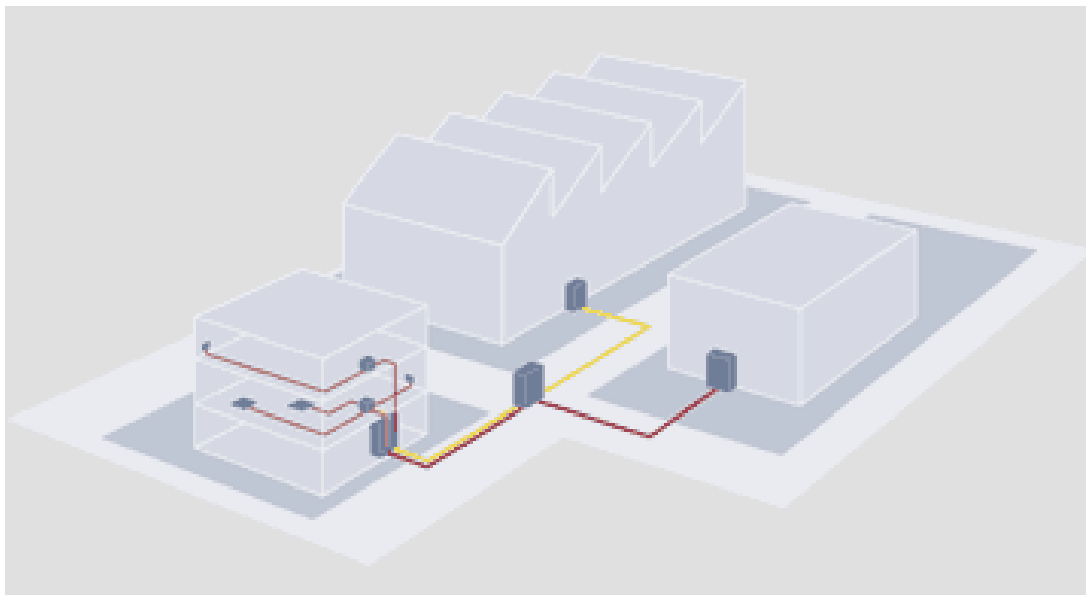
Novosti v LAN omrežjih

FE

8. November 2010, A. Z. Žagar

Pasivna mrežna oprema

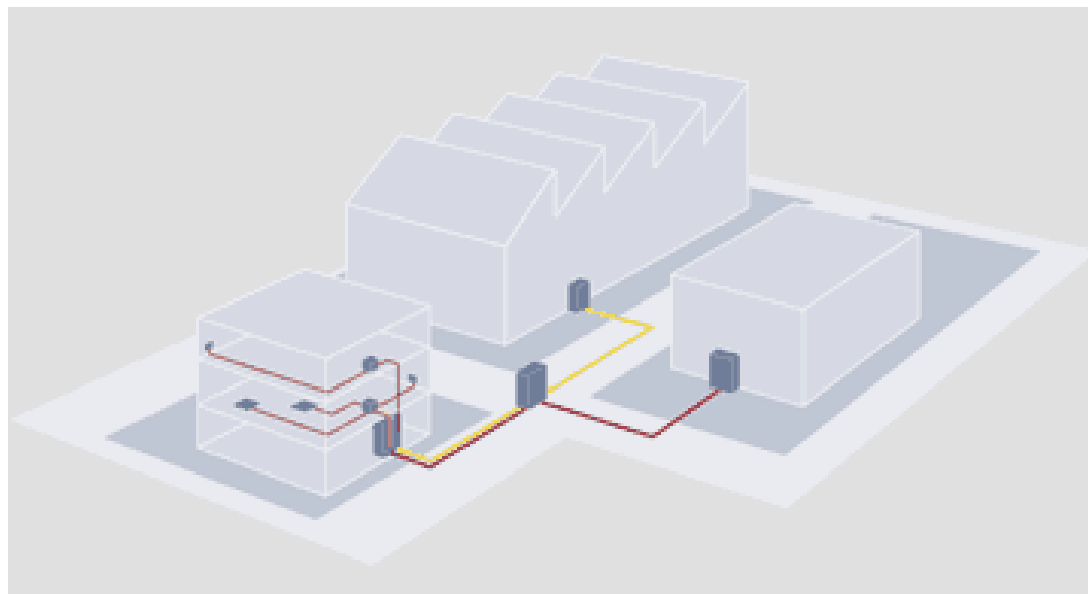
Vsebina



- 1. Kabelski standardi**
- 2. Mrežni standardi**
- 3. Gradniki**
- 4. Načrtovanje**



Standardi



ANSI/EIA/TIA-568-C

Commercial Building
Telecommunications Cabling
Standard

SIST/EN 50173 / 50174

CENELEC/EN 50173 / 50174

Informacijska tehnologija -
Splošni kabelski sistemi

ISO/IEC IS 11801

Information Technology - Generic
Cabling For Customer Premises

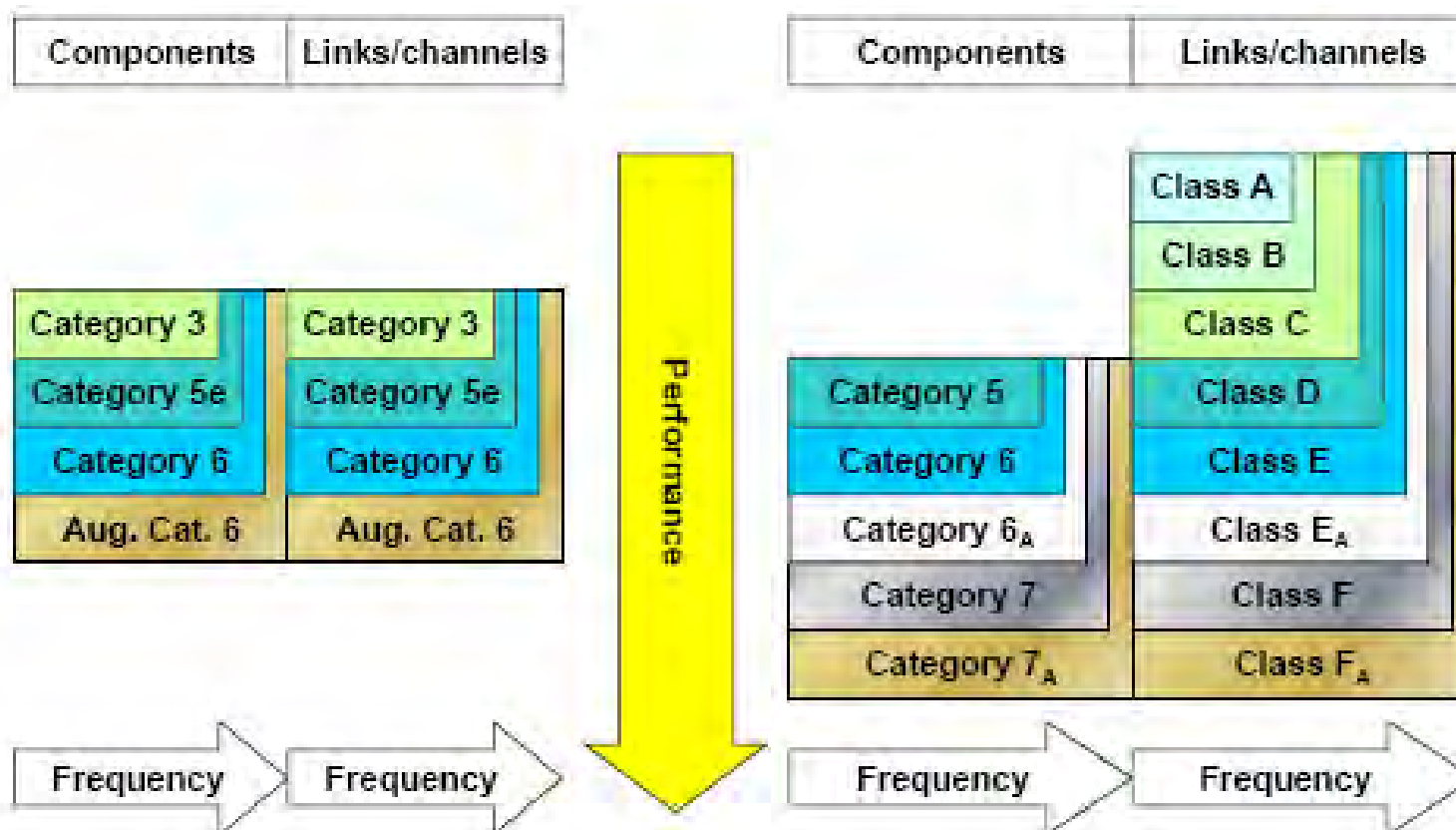


Standardi - razlike

FREQUENCY BANDWIDTH	TIA COMPONENTS)	TIA (CABLING)	ISO (COMPONENTS)	ISO (CABLING)
1 – 100 MHz	Category 5e	Category 5e	Category 5e	Class D
1 – 250 MHz	Category 6	Category 6	Category 6	Class E
1 – 500 MHz	Category 6A	Category 6A	Category 6 _A	Class E _A
1 – 600 MHz	n/s	n/s	Category 7	Class F
1 – 1,000 MHz	n/s	n/s	Category 7 _A	Class F _A

Pasivna mrežna oprema

Standardi - razlike



Pasivna mrežna oprema

ANSI/TIA

ANSI/TIA-568-A se razvije v **TIA-568-B** in ta v **TIA-568-C**

ANSI/TIA-568-C.0:2009

Generic Telecommunications Cabling for
Customer Premises

ANSI/TIA-568-C.1:2009

Commercial Building Telecommunications
Cabling Standard

ANSI/TIA-568-C.2:2009

Balanced Twisted-Pair
Telecommunications Cabling and
Components Standard

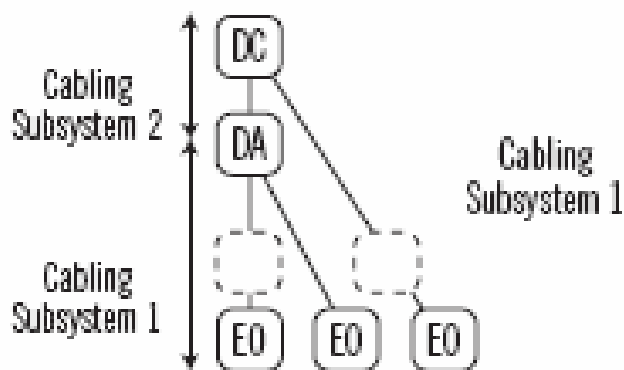
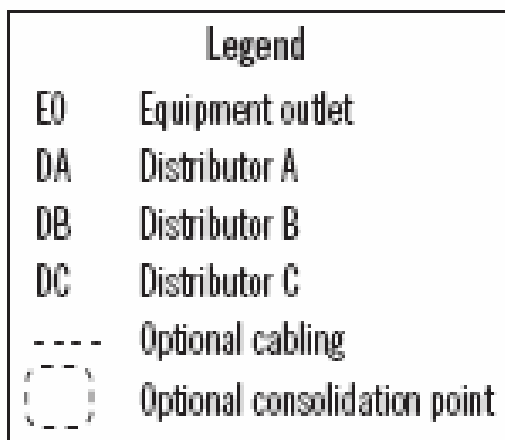
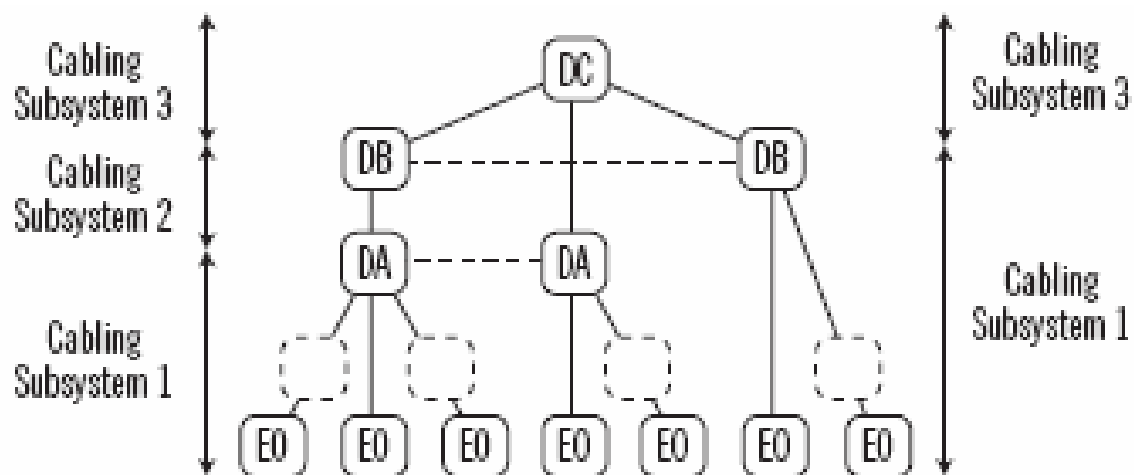
ANSI/TIA-568-C.3:2009

Optical Fiber Cabling Components Standard

Pasivna mrežna oprema

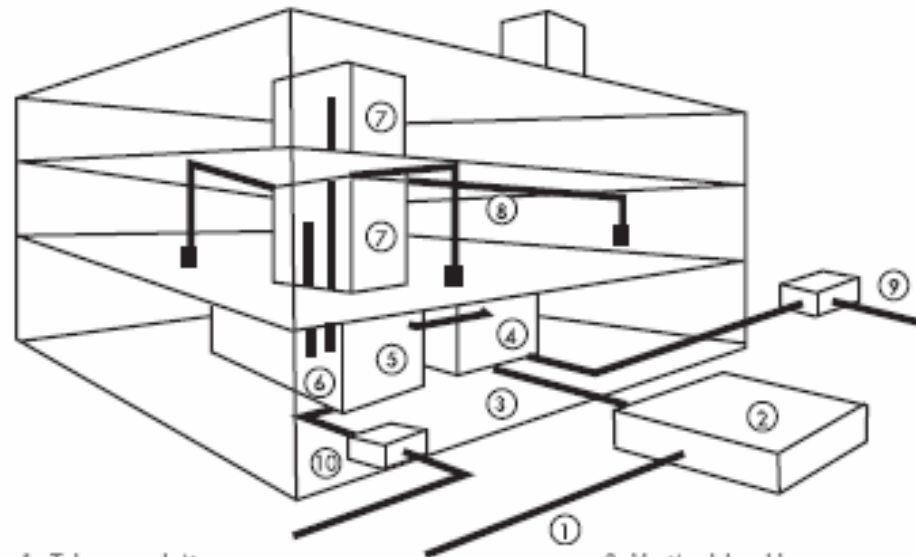
"568-C.0 "Generic Telecommunications Cabling for Customer Premises"	"568-C.1 "Commercial Building Telecommunications Cabling Standard"	"568-C.2 "Balanced Twisted-Pair Telecommunication Cabling and Components Standard"	"568-C.3 "Optical Fiber Cabling Components Standard"
<p>Cabling System Structure</p> <ul style="list-style-type: none"> Genetic topology Length Recognized cabling <p>Installation Requirements</p> <ul style="list-style-type: none"> Pull tension Bend radius Cable termination Separation from power Grounding and bonding Polarity (optical fiber only) <p>Optical Fiber Transmission/Test Requirements</p> <ul style="list-style-type: none"> Optical fiber cabling field test instruments Multimode test considerations (e.g. mandrel wrap) Link attenuation <p>Annex A: Centralized Optical Fiber Cabling Annex B: Optical Fiber Polarity</p> <ul style="list-style-type: none"> Consecutive-fiber and reverse-pair positioning for duplex systems Method A and Method B for array systems <p>Annex C: Multi-Tenant Cabling Annex D: Application Information Annex E: Optical Fiber Field Test Guidelines Annex F: Environmental Classifications</p> <ul style="list-style-type: none"> MICE (mechanical, ingress, climatic, and electromagnetic) conditions 	<p>Entrance Facilities</p> <ul style="list-style-type: none"> Design Electrical protection OSP connections <p>Equipment Rooms</p> <ul style="list-style-type: none"> Design Cabling practices <p>Telecommunications Rooms and Enclosures</p> <ul style="list-style-type: none"> Design Cross-connections and interconnections Centralized optical fiber cabling <p>Backbone Cabling</p> <ul style="list-style-type: none"> Star topology Length <p>Horizontal Cabling</p> <ul style="list-style-type: none"> Topology Length Recognized cabling Bundled and hybrid cables <p>Work Area</p> <ul style="list-style-type: none"> Cords Open office cabling Installation Administration Consolidation points 	<p>Mechanical Requirements</p> <ul style="list-style-type: none"> Channels, permanent links, cord, and connectors Pair assembly and color code Performance marking Reliability <p>Transmission Requirements</p> <ul style="list-style-type: none"> Channels, permanent links, cord, and connectors Return loss, insertion loss, NEXT loss, PSNEXT loss, FEXT loss, ACRF, PSACRF, TCL, TCTL, ELTCTL, coupling attenuation, propagation delay, propagation delay skew, PSANEXT loss, average PSANEXT loss, PSAACRF, and average PSAACRF DC loop resistance and DC-resistance unbalance <p>Annex A: Connector Reliability Annex B: Measurement Requirements Annex C: Test Procedures Annex D: Connector Transfer Impedance Test Method Annex E: Connector Test fixtures Annex F: Multipoint Measurement Considerations Annex G: Installation in Higher Temperatures Annex H: Propagation Delay Derivations Annex I: Return Loss Limit Derivation Annex J: Modeling Configurations Annex K: NEXT Loss Limit Considerations Annex L: PSAACRF and AFEXT Loss Normalization Annex M: Category 5 Channel Parameters</p>	<p>Optical Fiber Cable</p> <ul style="list-style-type: none"> Inside plant, indoor-outdoor, outside plant, drop cable Wavelength specification Attenuation, overfilled modal bandwidth - length, and effective modal bandwidth - length <p>Connecting hardware and adapters</p> <ul style="list-style-type: none"> Duplex and array Keying and fiber positions Identification <p>Patch Cords and Fiber Transitions</p> <ul style="list-style-type: none"> Simplex Duplex (A-to-A and A-to-B) Array (Type-A, Type-B, and Type-C) <p>Annex A: Connector performance specifications</p> <ul style="list-style-type: none"> Attenuation and return loss Mechanical, temperature, humidity, impact, durability, retention, flex, and twist

Shema sistema



Izjemoma lahko vgradimo dodatno vmesno spojno točko (CP), vendar v razdalji najmanj 15 m proč od delovnega mesta (EO) in vozlišča ter na lahko dostopnem mestu.

Vodoravne in navpične poti

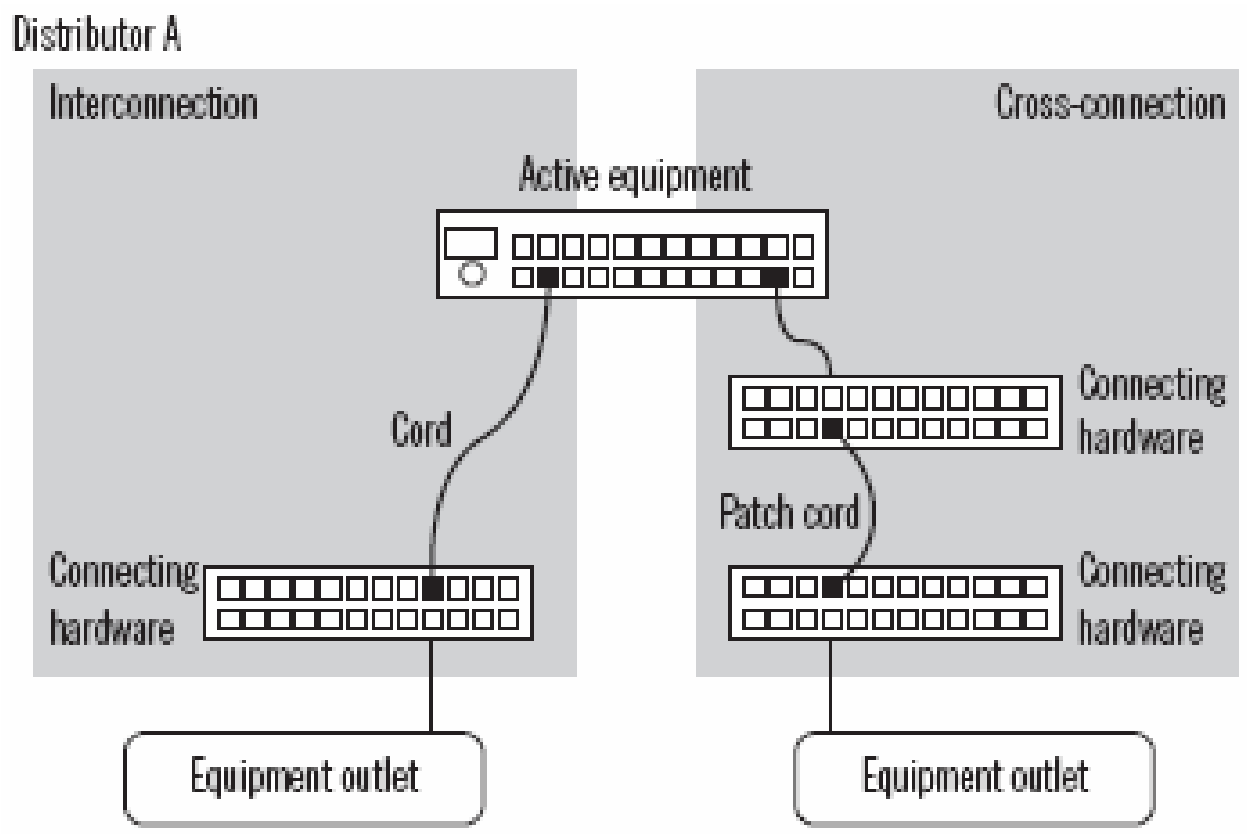


- | | |
|--------------------------------------|----------------------------------|
| 1. Telco conduit | 6. Vertical backbone |
| 2. Telco manhole | 7. Telecommunications room |
| 3. Entrance conduit | 8. Horizontal cabling |
| 4. Telco entrance facility | 9. Interbuilding backbone |
| 5. Telecommunications equipment room | 10. Electrical entrance facility |

Pasivna mrežna oprema



Tip vozlišča



Pasivna mrežna oprema

Cabling Lengths

Razdalje za baker

Application	Media	Distance m (ft.)	Comments
Ethernet 10BASE-T	Category 3, 5e, 6, 6A	100 (328)	
Ethernet 100BASE-TX	Category 5e, 6, 6A	100 (328)	
Ethernet 1000BASE-T	Category 5e, 6, 6A	100 (328)	
Ethernet 10GBASE-T	Category 6A	100 (328)	
ASDL	Category 3, 5e, 6, 6A	5,000 (16,404)	1.5 Mbps to 9 Mbps
VDSL	Category 3, 5e, 6, 6A	5,000 (16,404)	1,500 m (4,900 ft.) for 12.9 Mbps; 300 m (1,000 ft.) for 52.8 Mbps
Analog Phone	Category 3, 5e, 6, 6A	800 (2,625)	
FAX	Category 3, 5e, 6, 6A	5,000 (16,404)	
ATM 25.6	Category 3, 5e, 6, 6A	100 (328)	
ATM 51.84	Category 3, 5e, 6, 6A	100 (328)	
ATM 155.52	Category 5e, 6, 6A	100 (328)	
ATM 1.2G	Category 6, 6A	100 (328)	
ISDN BRI	Category 3, 5e, 6, 6A	5,000 (16,404)	128 kbps
ISDN PRI	Category 3, 5e, 6, 6A	5,000 (16,404)	1.472 Mbps

Dolžine bakrenih priključnih kablov

Maximum Length of Horizontal Cables and Work Area Cords					
Length of horizontal cable	24 AWG Cords			26 AWG Cords	
	Maximum length of work area cord	Maximum combined length of work area cord, patch cords and equipment cord	C	Maximum length of work area cord	Maximum combined length of work area cord, patch cords and equipment cord
H m (ft.)	W m (ft.)	C m (ft.)	W m (ft.)	C m (ft.)	
90 (295)	5 (16)	10 (33)	4 (13)	8 (26)	
85 (279)	9 (30)	14 (46)	7 (23)	11 (35)	
80 (262)	13 (44)	18 (59)	11 (35)	15 (49)	
75 (246)	17 (57)	22 (72)	14 (46)	18 (59)	
70 (230)	22 (72)	27 (89)	17 (56)	21 (70)	

Pasivna mrežna oprema

ANSI/TIA, spremljajoči standardi

ANSI/TIA-570-B:2004 Residential Telecommunications Cabling Standard
ANSI/TIA-570-B1:2009 Add. Requirements for Broadband Coaxial Cabling

ANSI/TIA-862:2002 Building Automation Systems Cabling Standard for Commercial Buildings

ANSI/TIA-942: 2005 Telecomm. Infrastructure Standard for Data Centers
ANSI/TIA-942-1: 2008 Coaxial Cabling Specifications and Application Distances

ANSI/TIA-1005: 2009 Telecommunications Infrastructure Standard for Industrial Premises

CENELEC/EN

Information technology - Cabling installation

EN 50173-1:2007	General requirements
EN 50173-1 A1:2009	Amendment 1
EN 50173-2:2007	Office premises
EN 50173-3:2007	Industrial premises
EN 50173-4:2007	Homes
EN 50173-5:2007	Data centres

Pasivna mrežna oprema



CENELEC/EN

Information technology - Cabling installation

- | | |
|-----------------------------|--|
| EN 50174-1:2009 | Installation Specification and quality assurance |
| EN 50174-2:2009 | Installation planning and practices inside buildings |
| EN 50174-3:2003 | Installation planning and practices outside buildings |
| EN 50310 Ed.2:2006 | Application of Equipotential Bonding and Earthing in Buildings with Information Technology Equipment |
| EN 50346 Ed 1.1:2009 | Testing of Installed Cabling |

Pasivna mrežna oprema

ISO/IEC

ISO/IEC 11801 Ed. 2.1: 2008 IT- Generic cabling for customer premises

ISO/IEC 15018:2004
ISO/IEC 15018 A1:2009

IT- Generic cabling for homes
Amendment 1

ISO/IEC 24702:2006
ISO/IEC 24702 A1:2009

IT- Generic cabling - Industrial premises
Amendment 1. Change to plastic optical
fibre specifications

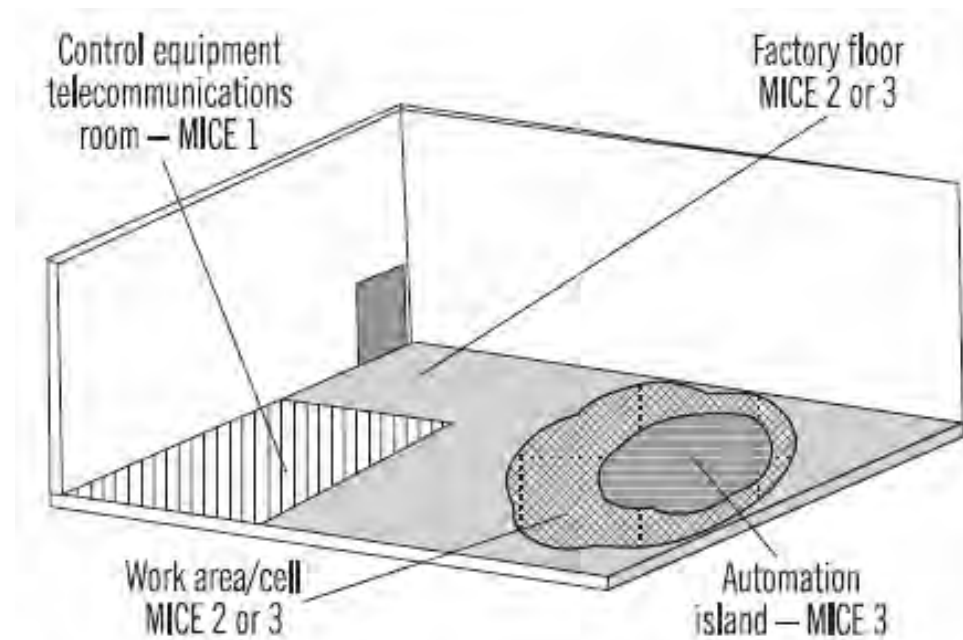
Dodatno določanje sistema

Mechanical	M₁	M₂	M₃
Ingress	I₁	I₂	I₃
Climatic	C₁	C₂	C₃
Electromagnetic	E₁	E₂	E₃
	Commercial Level 1	Light Industrial Level 2	Heavy Industrial Level 3

- M** mehanski vplivi
- I** tekočine, plini, nevarne snovi
- C** klimatske in kemijski vpliv
- E** elektromagnetni vpliv

Pasivna mrežna oprema

Dodatno določanje sistema



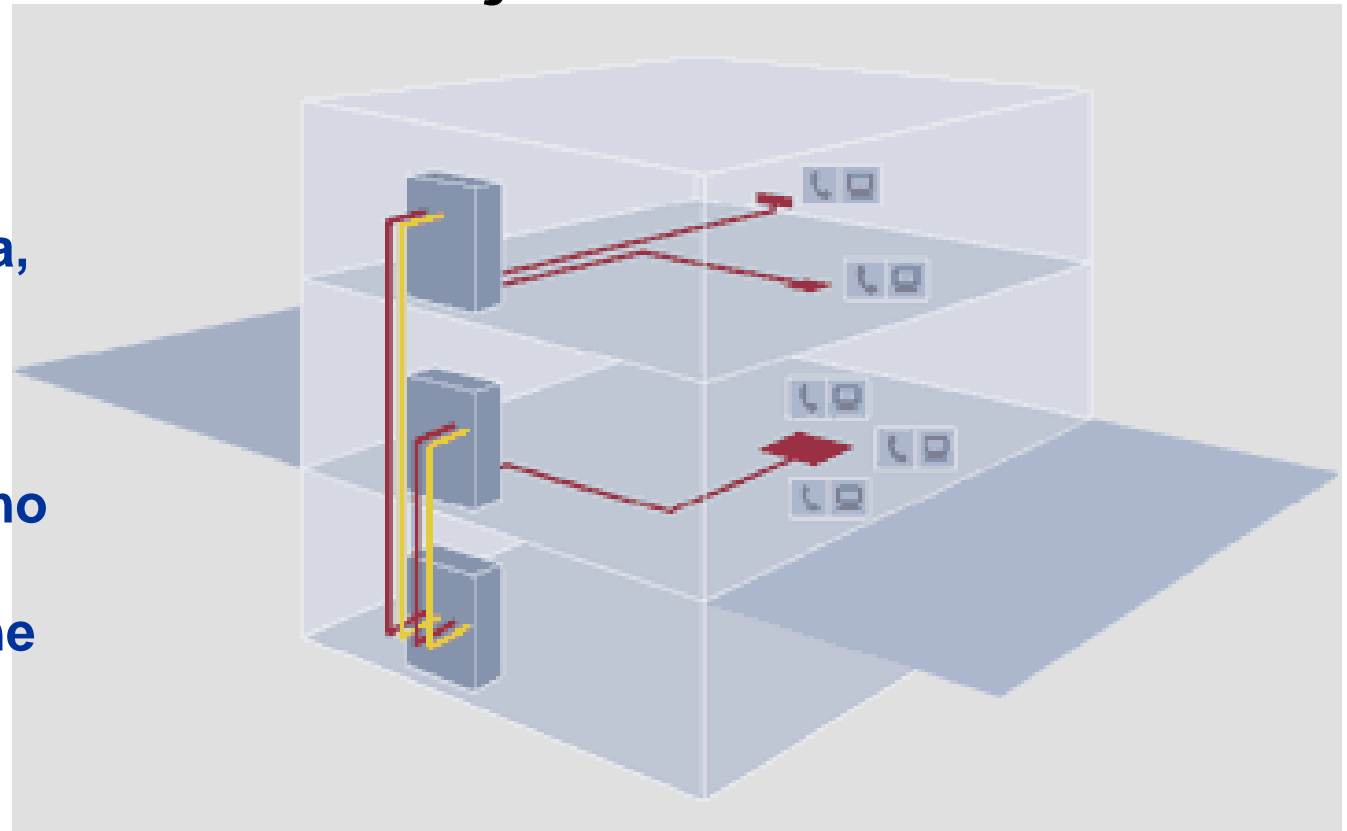
Pasivna mrežna oprema

Omrežje

cilji :

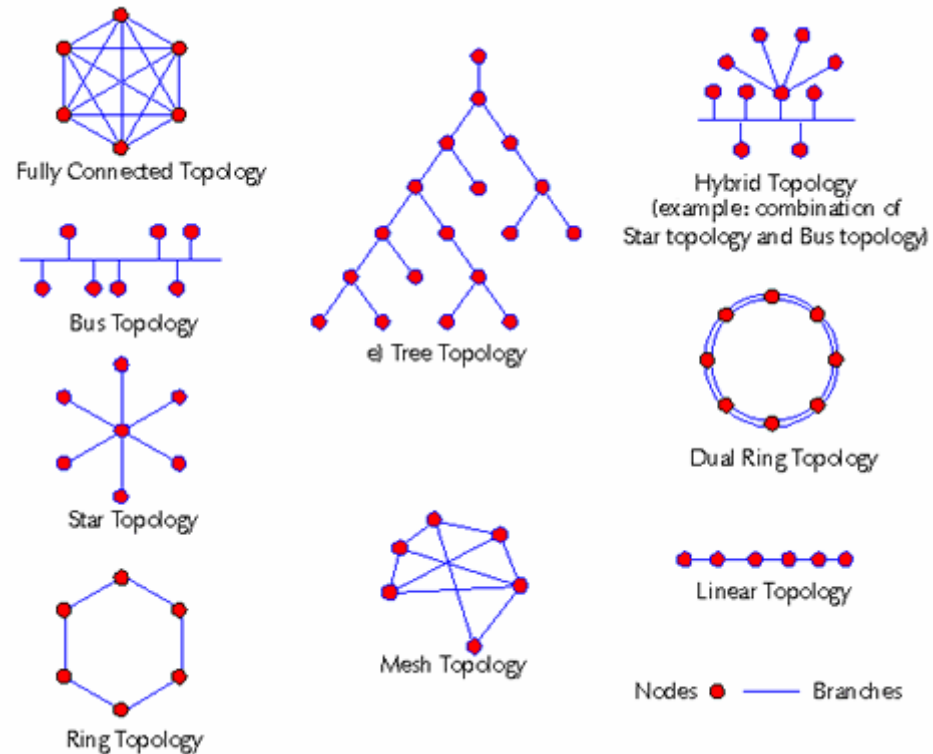
**popolna distribucija,
nadgradljivost,
modularna gradnja**

**enotno obravnavamo
podatke, telefon,
ISDN, xDSL, alarmne
signale, idr.,**

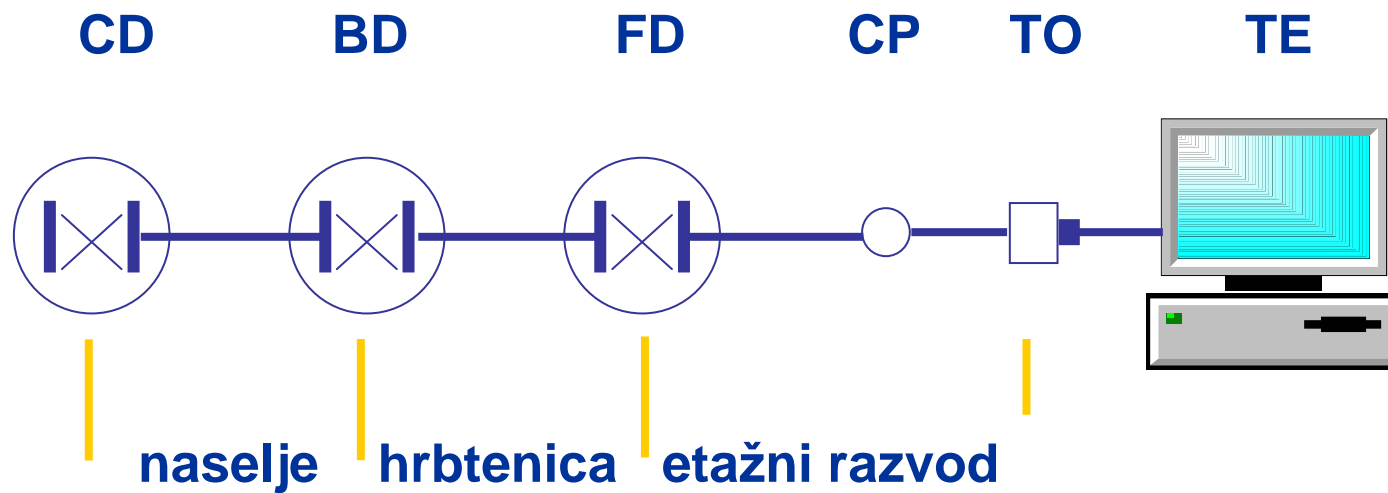


Pasivna mrežna oprema

Topologije



Pod-sistemi



CD(campus distributor) BD(building distributor) FD(floor distributor)
CP(Consolidation point) TO(Telecomm. Outlet) TE(Term. Equipment)

Pasivna mrežna oprema

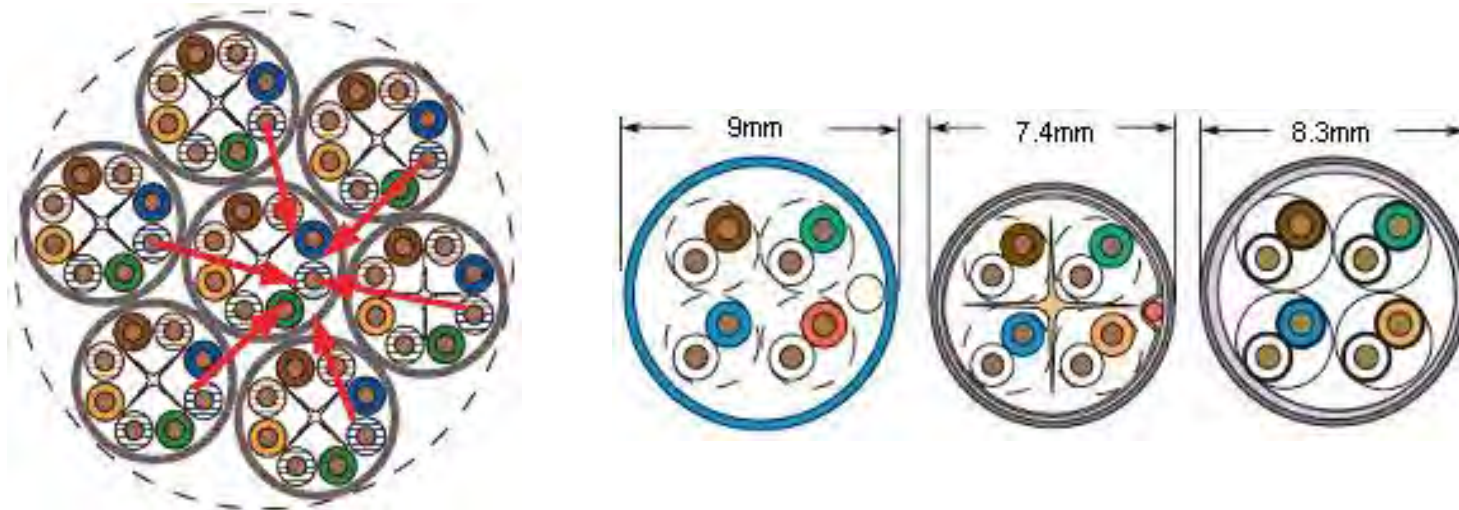
Kategorija : Razred

5e	6	6A	7	7A	OM1	OM2	OM3	OM4	OS1	OS2
D	E	EA	F	FA	OF 300	OF 500	OF 2000	OF 2000	OF 5000	OF 10000
100	250	500	600	1000	160-300	200-500	250-2000	500-4700	-	-

5-5e-6-6A / OM1-OM2-OM3-OM4 / 10/100Mb/s-1Gb/s-10Gb/s

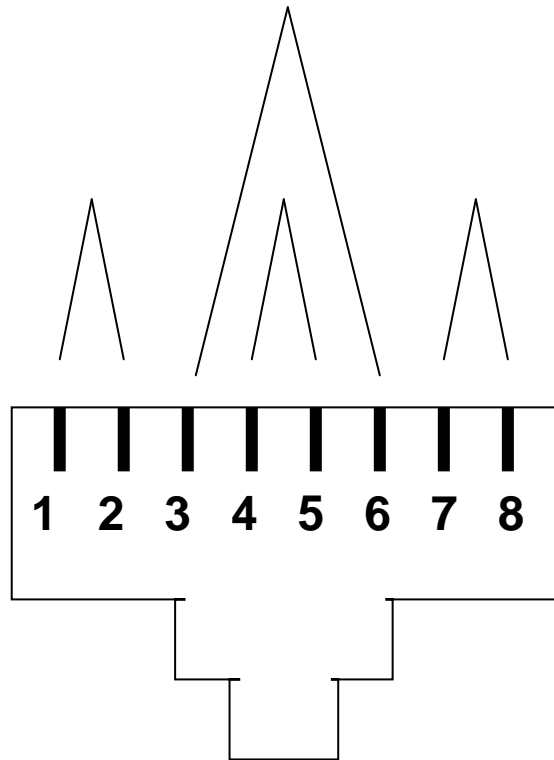
Pasivna mrežna oprema

Alien Crosstalk (AXTalk) in kat. 6A

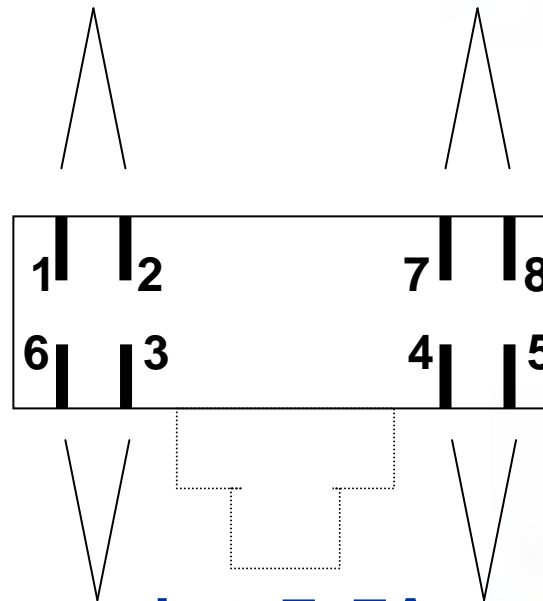


Kategorija 6A / Razred EA (Augmented) je izboljšana Kat. 6 / Razred E, oba posebej prirejena za 10GBase-T Ethernet (IEEE 802.3an)

Konektorji kat. 7, 7A



kat. 5, 5e in kat. 6, 6A



kat. 7, 7A



Nexans
GG45



Stewart
ARJ45

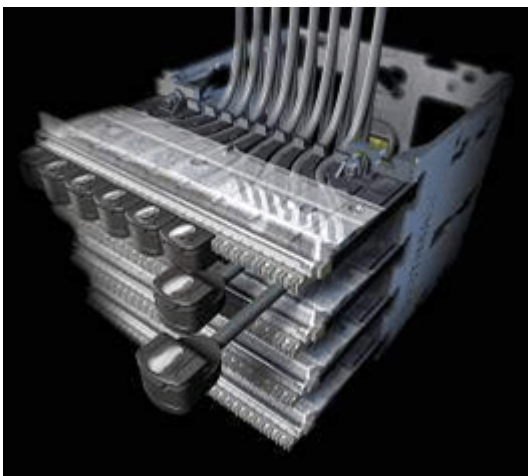


Konektorji kat. 7, 7A

visipatch



Tera



Visipatch 360





EZŽ komunikacijski izdelki

Novi standard za konektorje

RJ point five



Pasivna mrežna oprema



Povezava mrežnih in kabelskih standardov

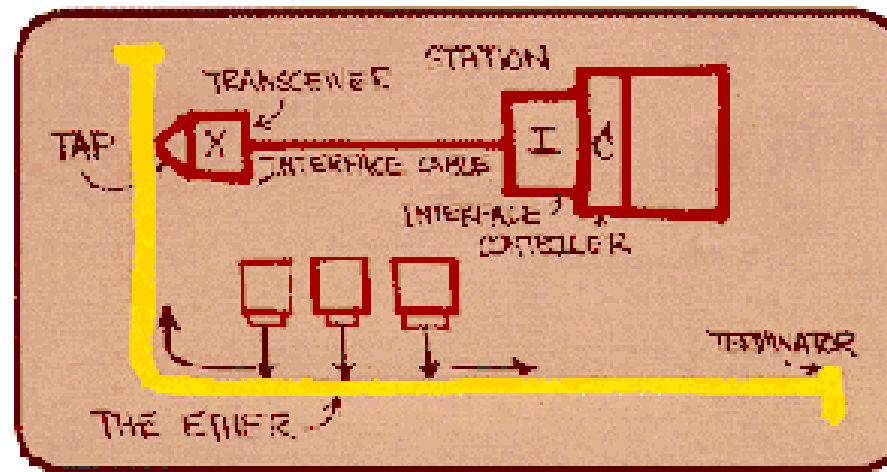
	CATEGORY 5E CLASS D	CATEGORY 6 CLASS E	CATEGORY 6A CLASS E _A	CLASS F	CLASS F _A
4/16 MBPS TOKEN RING	●	●	●	●	●
10BASE-T	●	●	●	●	●
100BASE-T4	●	●	●	●	●
155 MBPS ATM	●	●	●	●	●
1000BASE-T	●	●	●	●	●
1000BASE-TX		●	●	●	●
10GBASE-T			●	●	●
ISO/IEC 14165-144				●	●
BROADBAND CATV					●

ISO/IEC 14165-144 (Fibre Channel)

1000Base-T (vsi pari v obe smeri), 1000Base-TX (dva para za eno smer)

Pasivna mrežna oprema

Ethernet



(Dr. Robert M. Metcalfe, 1976)

vodilo → zvezda

10BaseT, 100BaseT, 1000BaseT (IEEE 802.3z), 10GBaseT (IEEE 802.3an),
EFM (IEEE 802.3ah)

Pasivna mrežna oprema

1 Gb Ethernet

GbE UTP : 1000Base-T (IEEE 802.3z)
uporablja 4 pare, 250Mb/s na par, hkrati v obeh smereh
DSP(Digital Signal Processing)

GbE optika : 1000Base-SX in 1000Base-LX
SX, Short wave, 850 nm, 50 in 62.5 mikronska vlakna
LX, Long wave, 1300 nm, 9, 50 in 62,5 mikronska vlakna
1GbE in 10GbE delujeta po dveh vlaknih

10 GbE (IEEE 802.3ae)

je v osnovi tehnologija Nivoja 2 OSI modela, in je načrtovana tudi za povezavo z SONET(Synchronous Optical Network)/SDH(Synchronous Digital Hierarchy) in TDM(Time Division Multiplexing) okolji

802.3ae je sestavljen iz LAN/PHY in WAN/PHY različice standarda

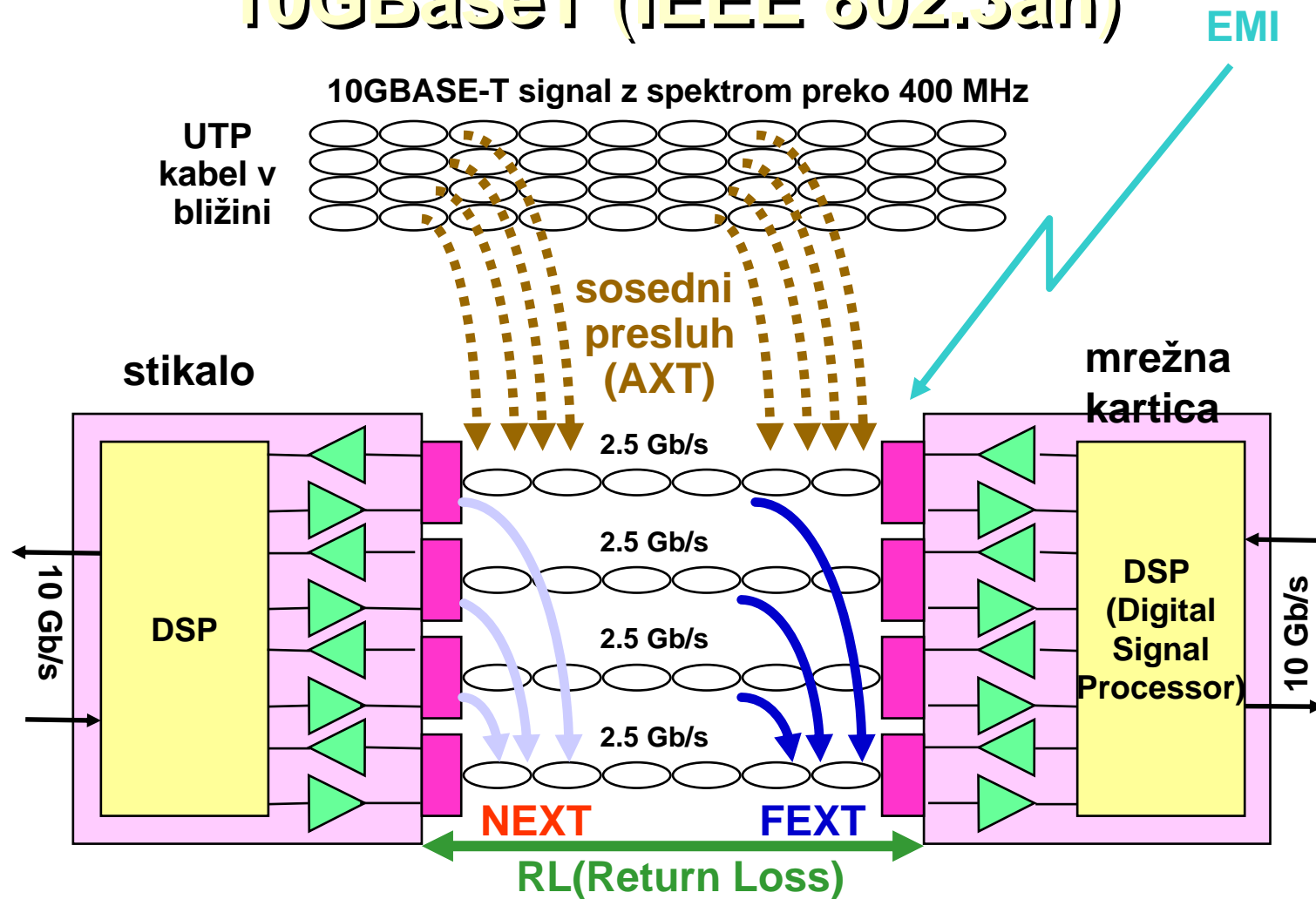
10 GbE deluje po optiki in po bakru

10GBaseT (IEEE 802.3an)

10 Giga bitov na sekundo po bakru. Z uporabo deset nivojske pulzne amplitudne modulacije PAM in drugih prijemov bo možno uporabljati 10GBaseT po bakrenih kablkih.

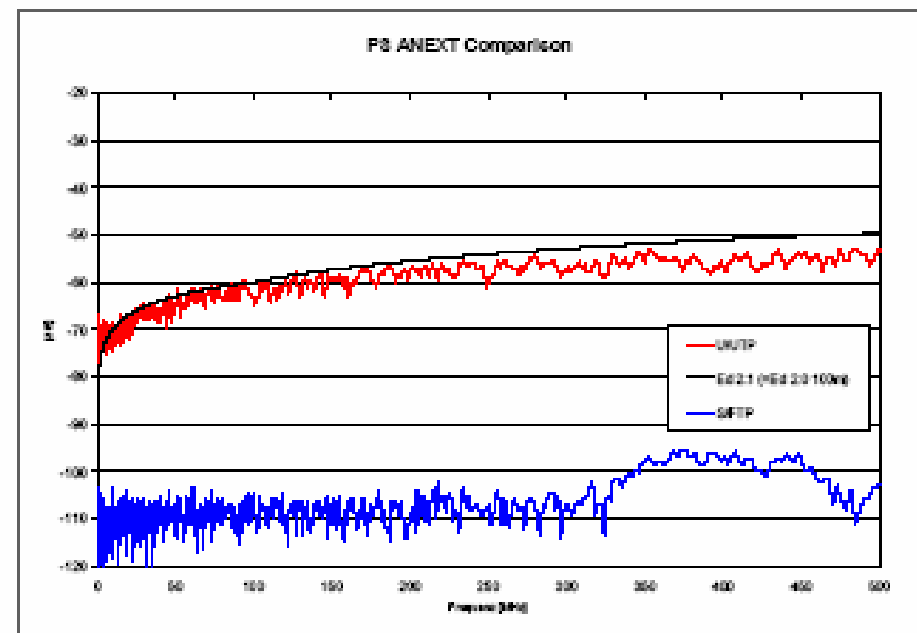
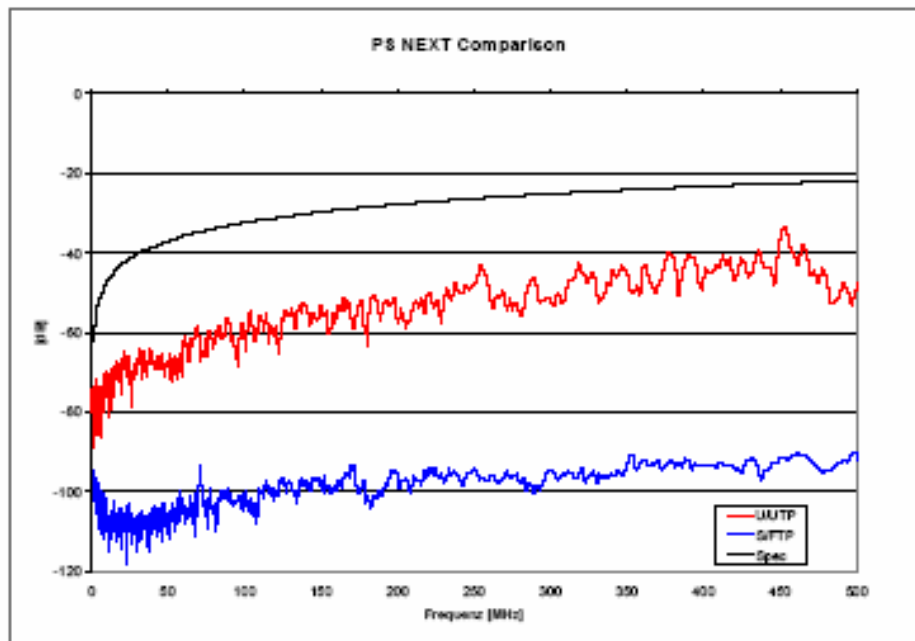
Polna uporaba 10 Giga-bitnega Ethernet na razdalji do 100 metrov je možna po kablju kategorije 6a, 7 in 7a, kar je še vedno cenejše kot po optiki.

10GBaseT (IEEE 802.3an)



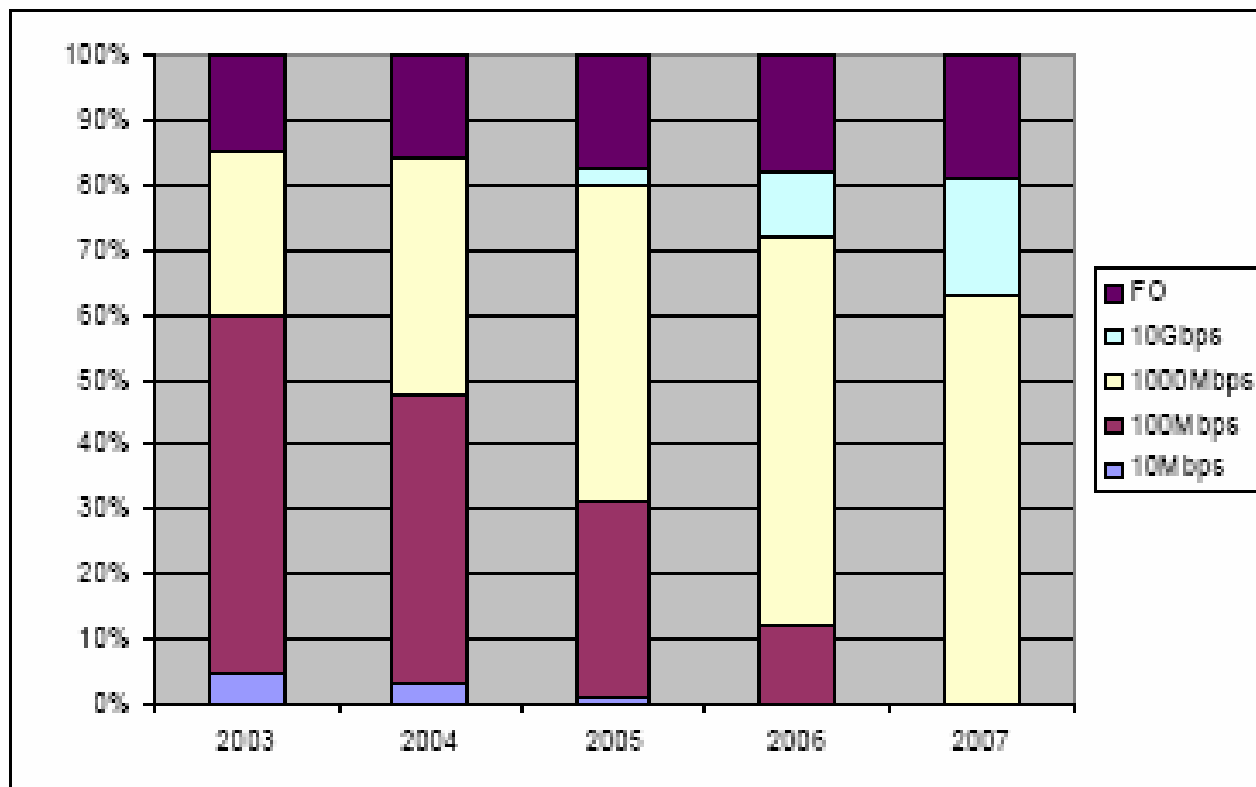
Pasivna mrežna oprema

10GBaseT (IEEE 802.3an)



Pasivna mrežna oprema

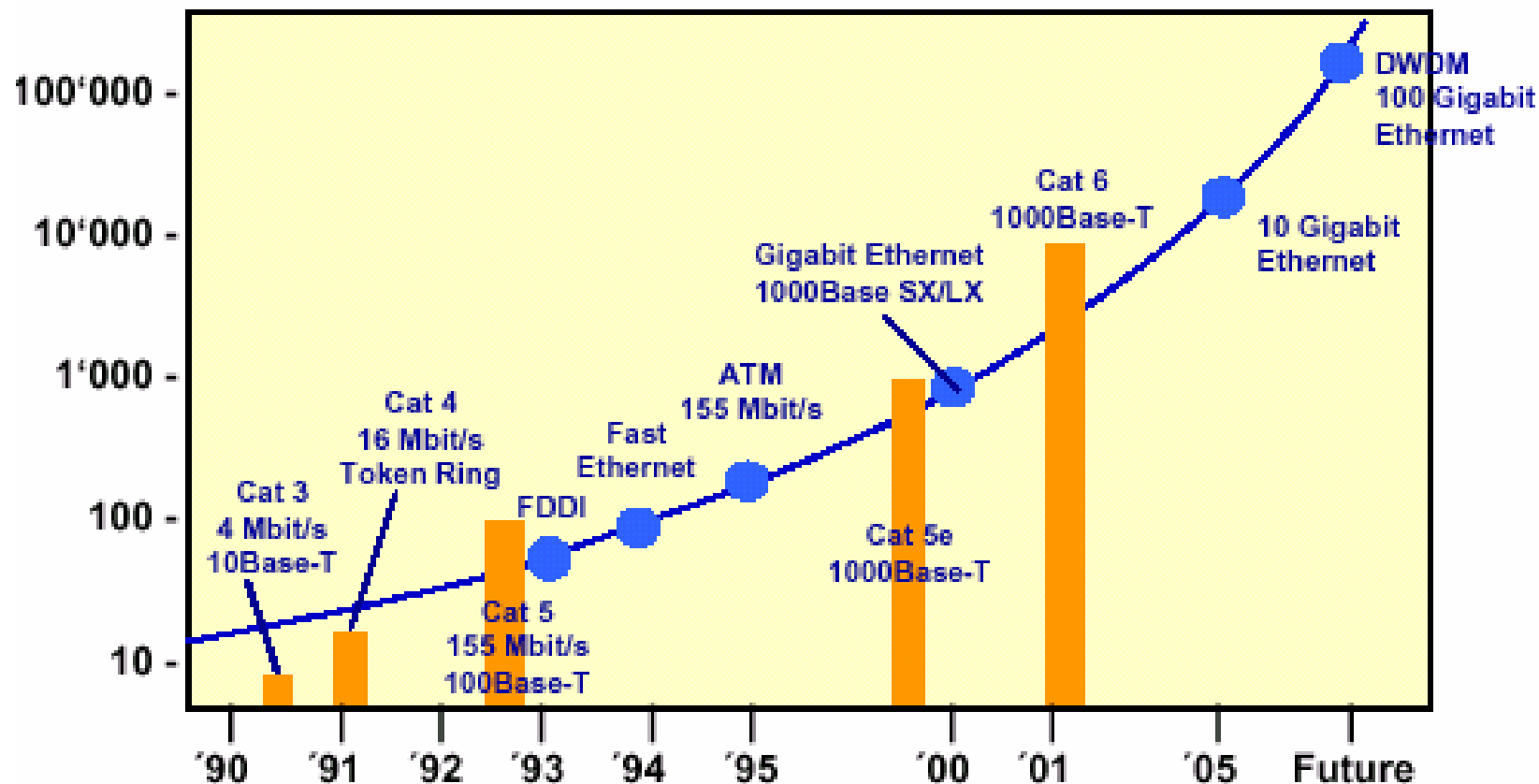
predvidevanja



(kat. 5e, 6, 6a, 7 in 7a za 1GbE, kat. 6, 6a, 7 in 7a za 10GbE)

Pasivna mrežna oprema

predvidevanja



Pasivna mrežna oprema

inštalacijski kabli

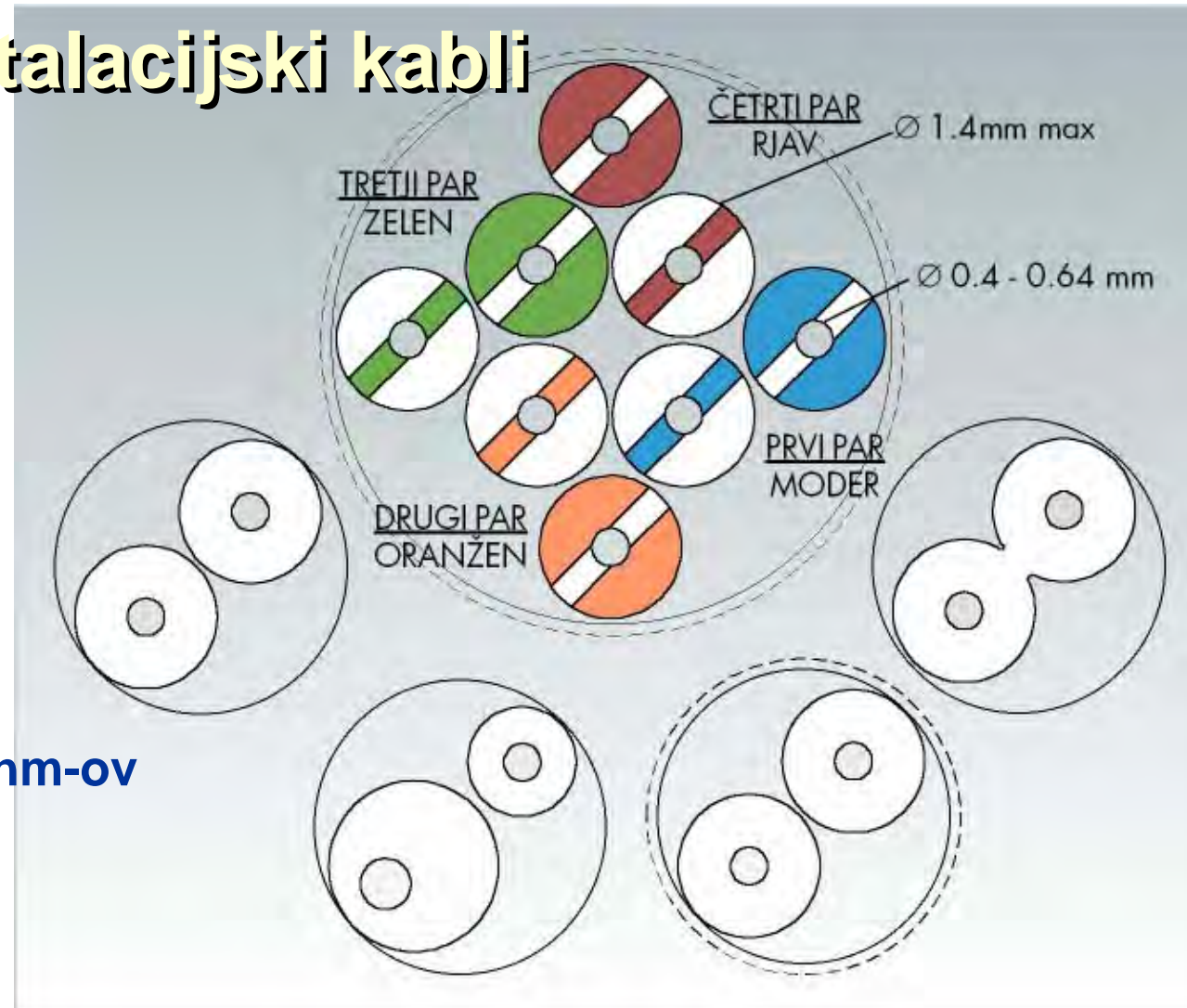
UTP, FTP, SFTP,
STP, SSTP, PiMF

nove oznake :

U/UTP
U/FTP
F/FTP
S/FTP

impedanca je 100 Ohm-ov

pari so zaviti v
različnih korakih



Pasivna mrežna oprema

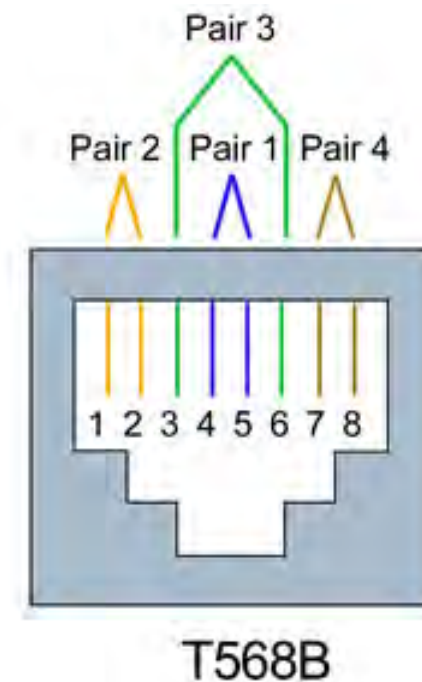
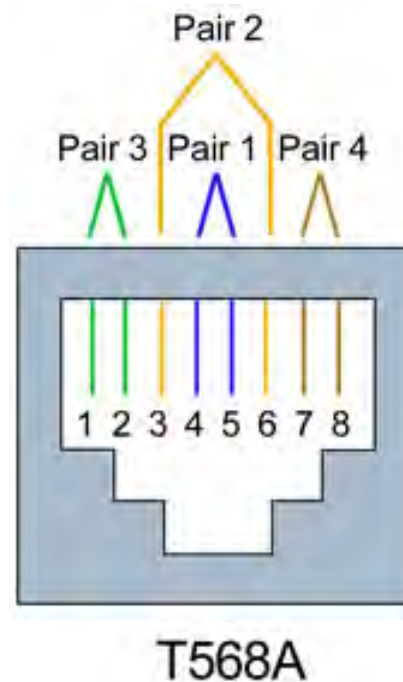
naloge parov

para 3 in 4 sta
namenjena za ATM,
155MHz

para 2 in 3 sta
namenjena za 10/100
Base T Ethernet

para 1 in 2 sta
namenjena za Token
Ring, ISDN, fax modem,
AS400, IBM 3270

vsi pari : xGbE



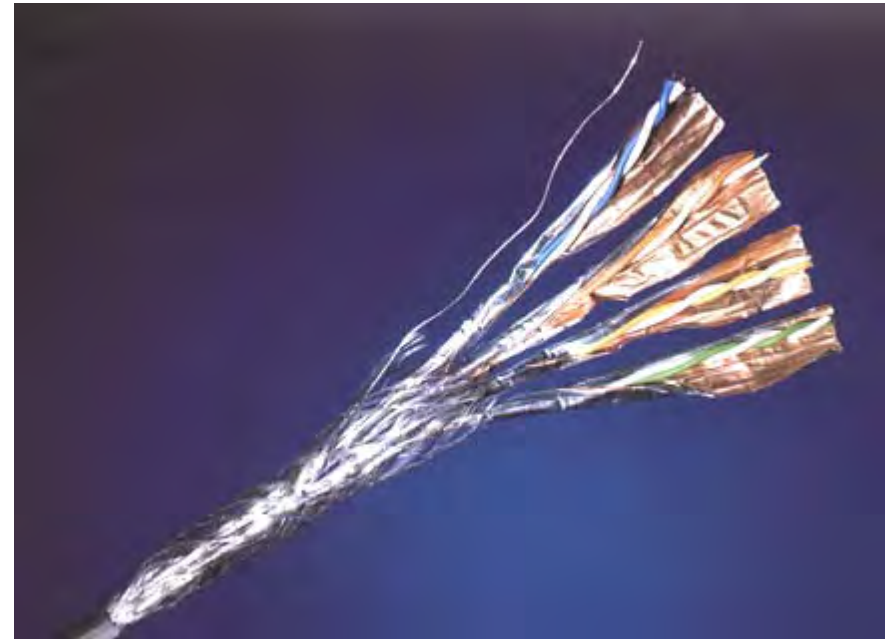
oklop

Oklop ščiti kabel pred zunanjimi vplivi, ali okolje pred sevanjem iz kabla.

Večje prenosne hitrosti - večje EMI/RFI onesnaženje.

Oklopi se ozemljijo v vsaki komunikacijski omari na rack, ki je povezan z hišno ozemljitvijo.

Večji onesnaževalci so : DC in AC motorji, zatemnitvena stikala, računalniki, fluorescenčna razsvetljava, oprema v komunikacijski omari, idr...



potencialne razlike med hišnimi ozemljitvami, optika

ženski spojni elementi

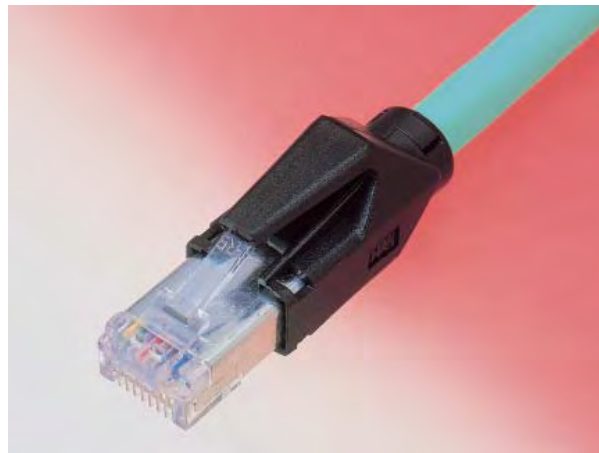


**IDC priključne letve
(Insulation Displacement
Contact)
110, AT&T, AMP, Krone LSA,
IBM, Panduit, Molex**

**RJ45 (ne)oklopljen
različne geometrije, patenti,
mehanski ključi**

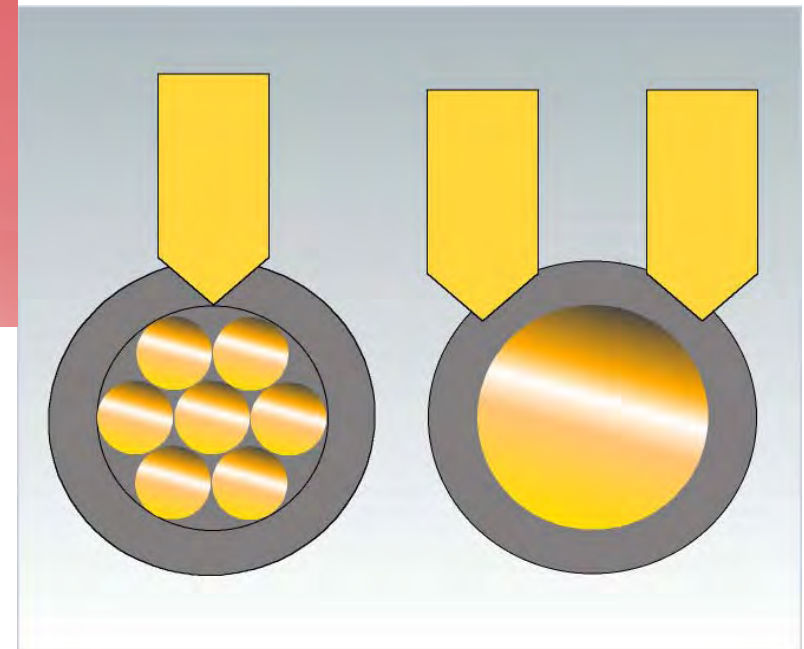
(max. dolžina odvitega para je 12,7mm)

moški spojni elementi



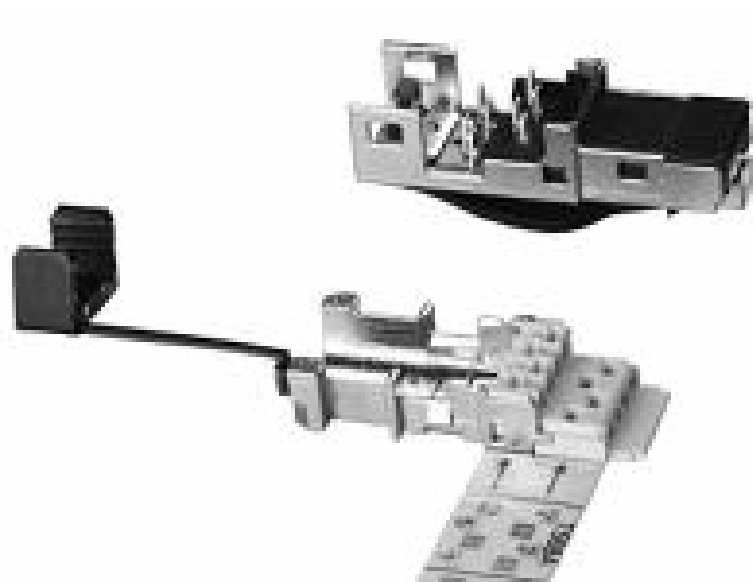
RJ45
(ne)oklopljen, za mehko ali
trdo žilo, za ploščati ali
okrogli kabel

IDC
AT&T, AMP, Mod Tap,
KRONE



moški spojni elementi

Za inštalacijski kabel
AWG-23 in AWG-22



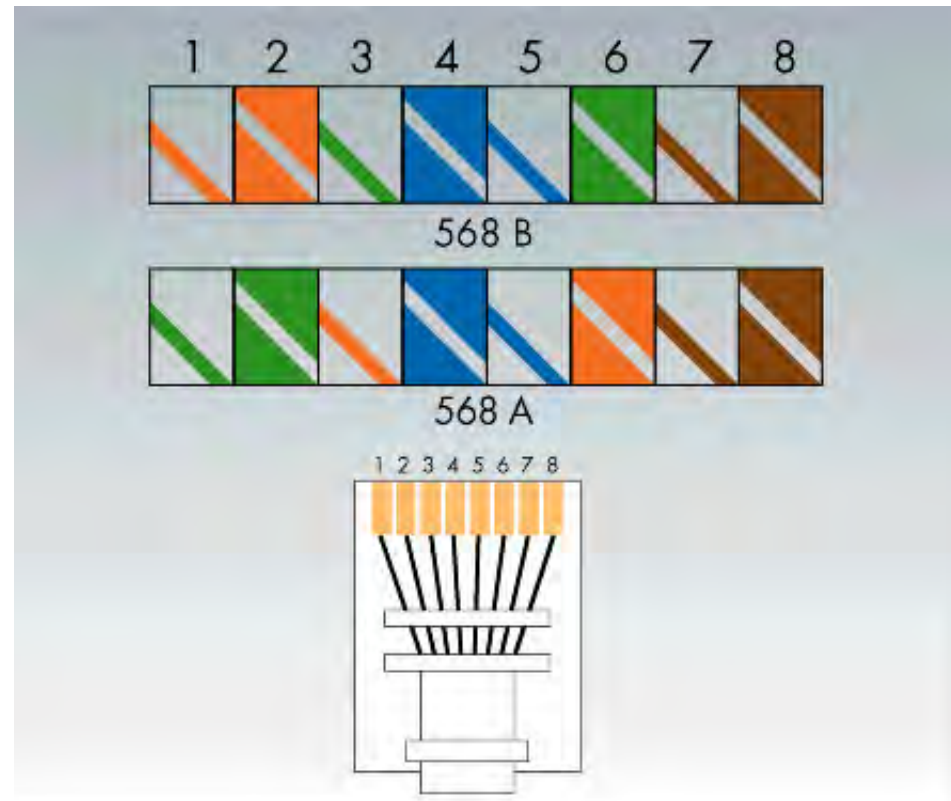
Pasivna mrežna oprema

priključni kabli

**UTP, FTP, STP, FSTP, SSTP,
PiMF(Pair in Metallic Foil)**

**uporablja se mehka žila,
AWG24 ali 26, premera 0.4 do
0.51mm**

konektorji kat. 3, 5e, 6, 6a, 7



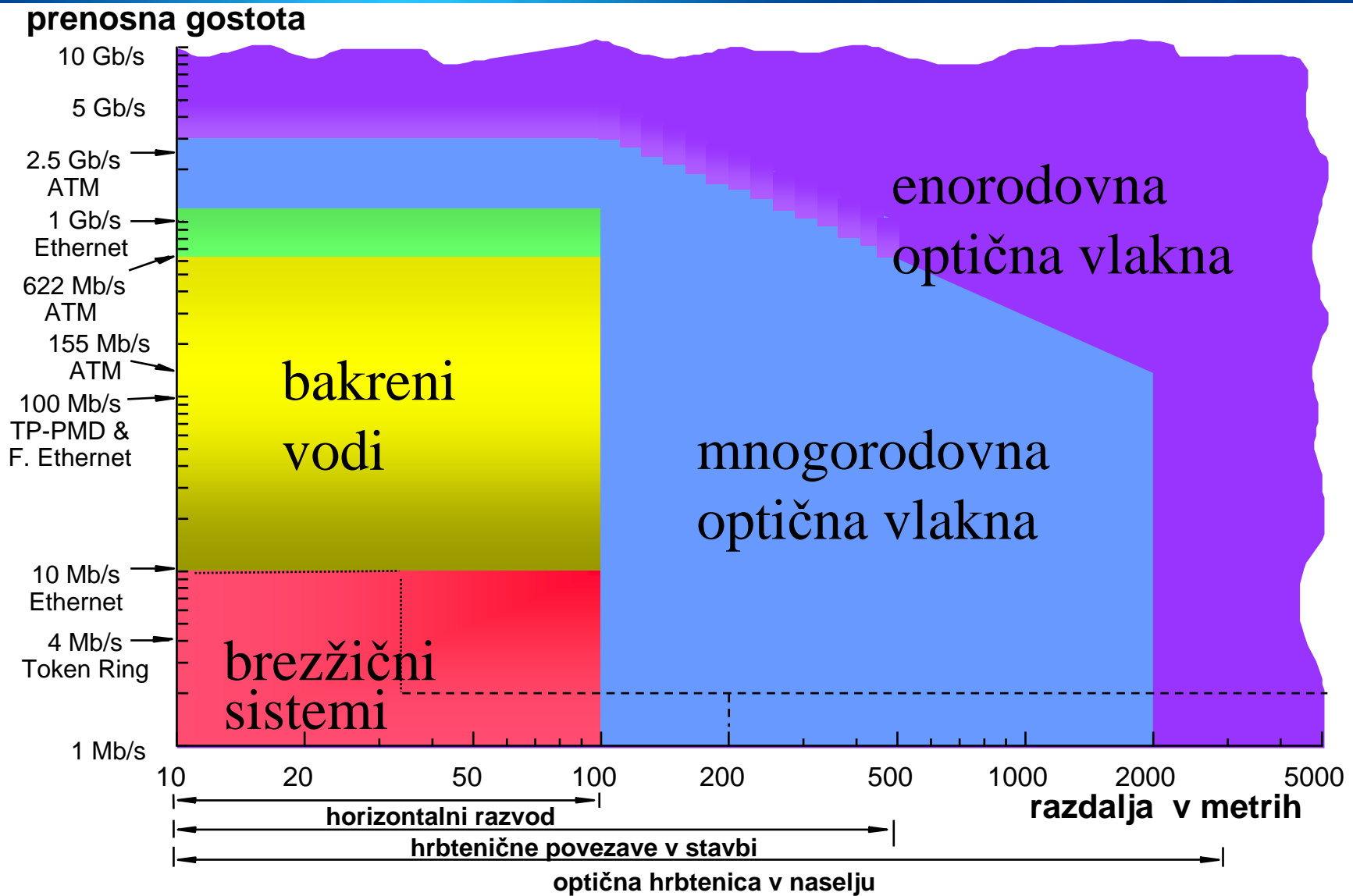
Vtičnice, delilniki



spojni elementi so osnovni sestavni del vtičnic in delilnikov

vtičnice so enojne, dvojne, trojne,.. za različne načine montaže

delilniki so 6, 8, 12, 16, 24, 32, 48 ali več delni za 10 ali 19 inčno montažo, za vgradnjo v kabelske spojke ali za prosto montažo



Pasivna mrežna oprema

UTP ? ali STP ?

(na izbrani tip kabla se vežejo spojni elementi)

tip kabla	UTP	FTP	S-FTP	UTP	FTP	S-FTP	S-STP	MM/SM
kategorija	5e	5e	5e	6	6	6	7	FO
EMC zaščita	nizka	srednja	visoka	nizka	srednja	visoka	zelo visoka	/

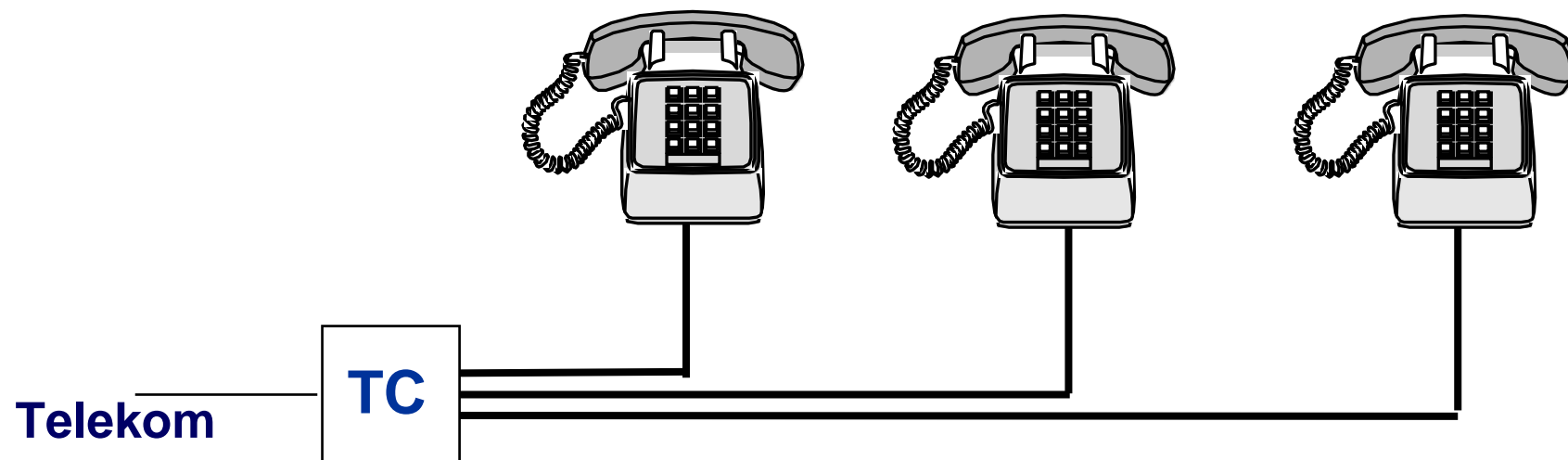
EMC (Electro Magnetic Compatibility)

Pasivna mrežna oprema

POTS (Plain Old Telephone Service)

dve ali štiri žične povezave

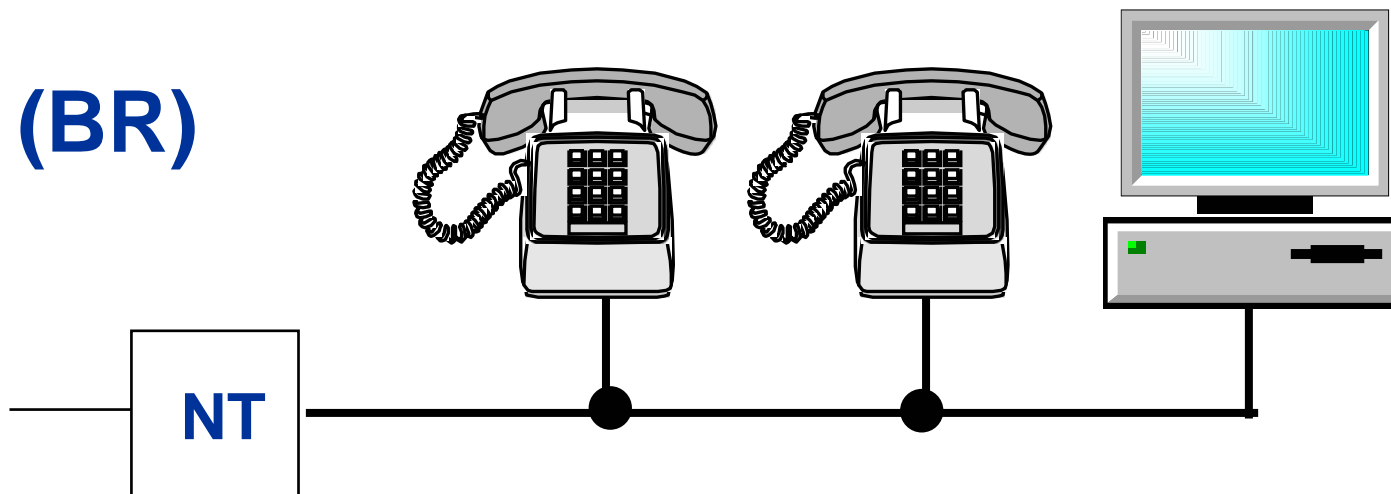
vtičnica in konektor je RJ45, izogibamo se RJ11 ali RJ12



Pasivna mrežna oprema

ISDN (Integrated Service Digital Network)

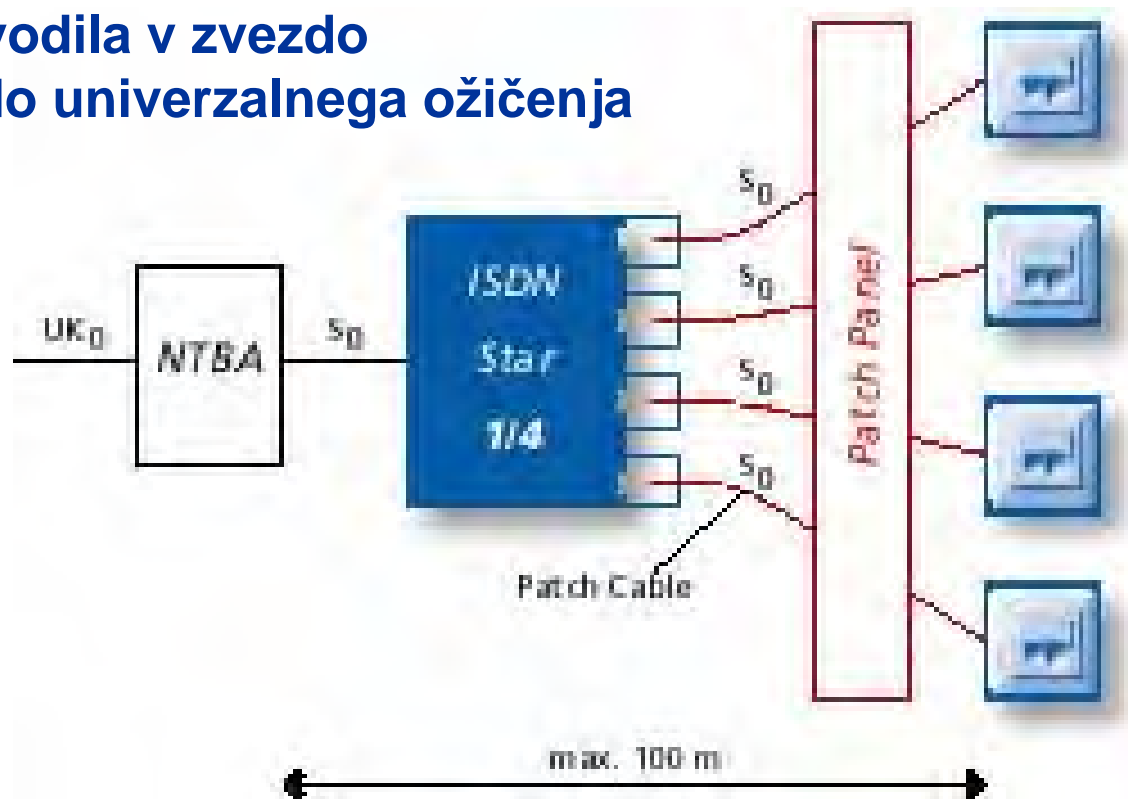
4 žične povezave
univerzalna ali ISDN vtičnica RJ45



Pasivna mrežna oprema

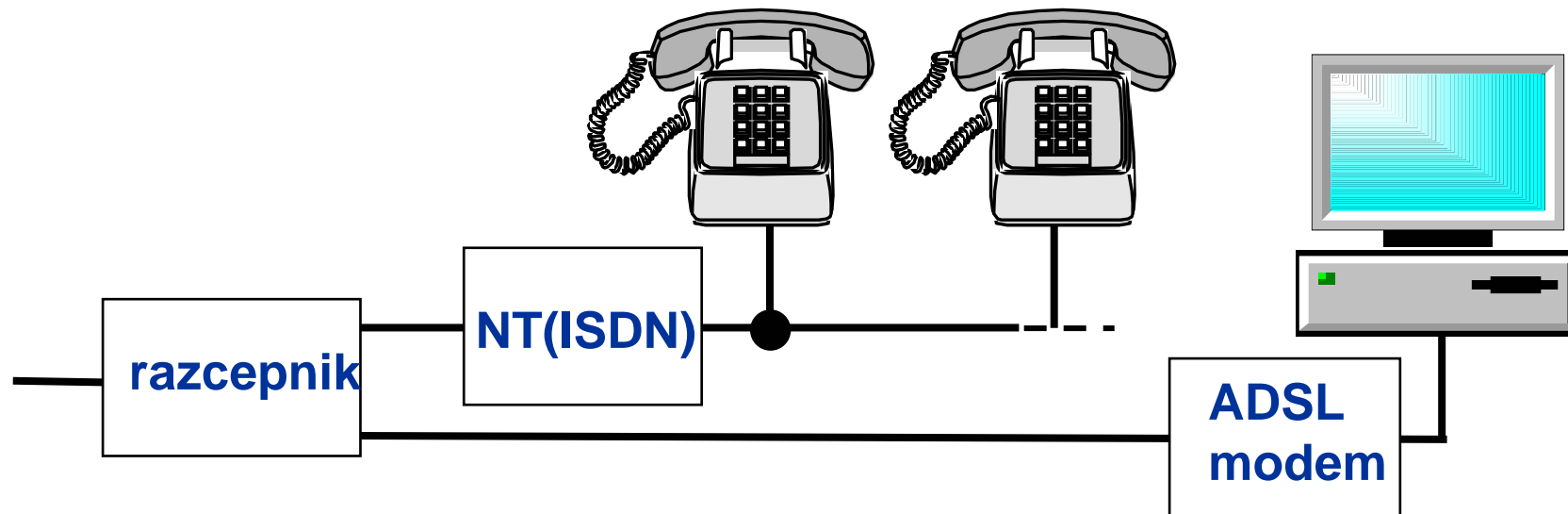
Pretvornik topologije

pretvorba vodila v zvezdo
in dostop do univerzalnega ožičenja



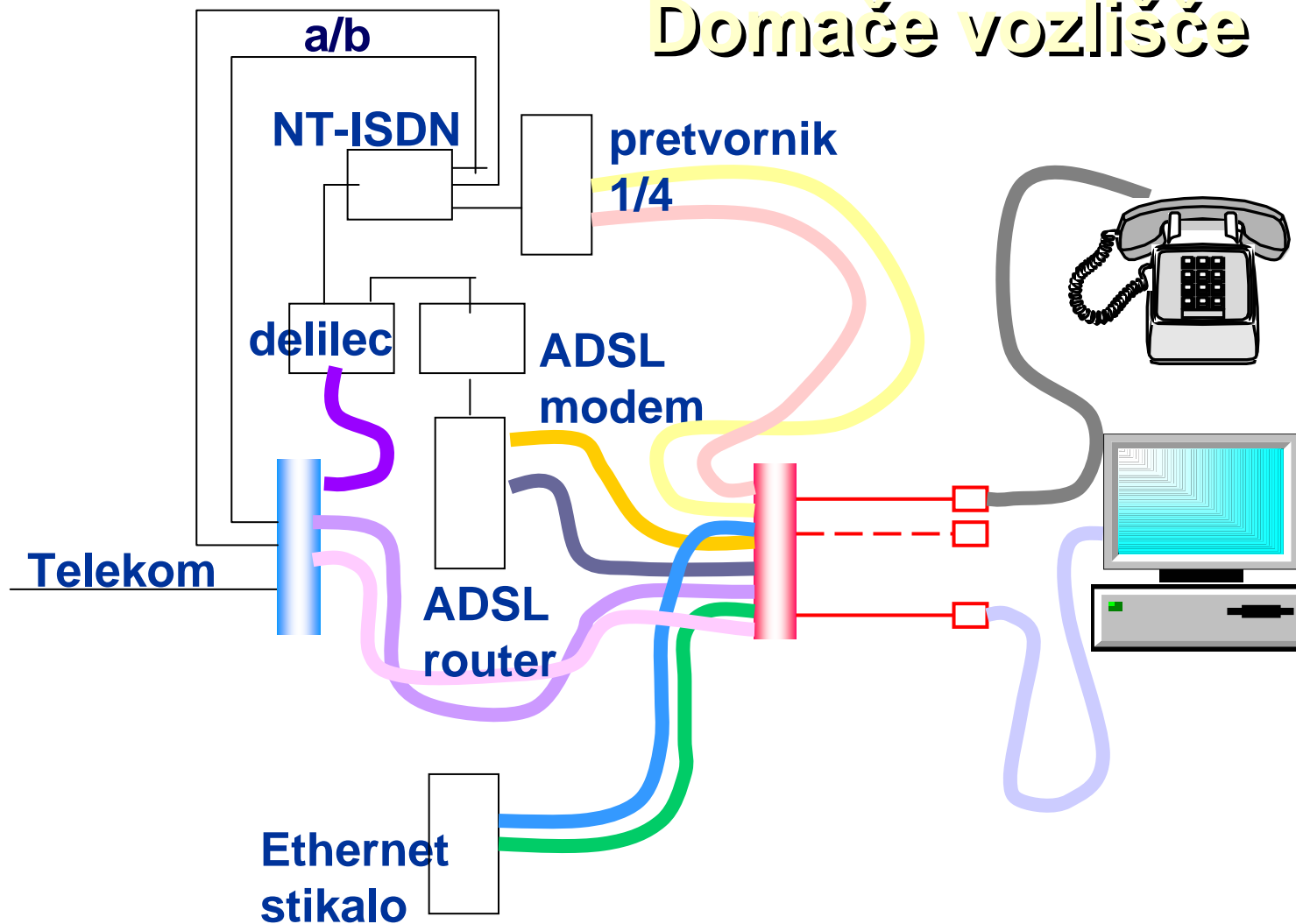
Pasivna mrežna oprema

ADSL (Asymmetric Digital Subscriber Line)



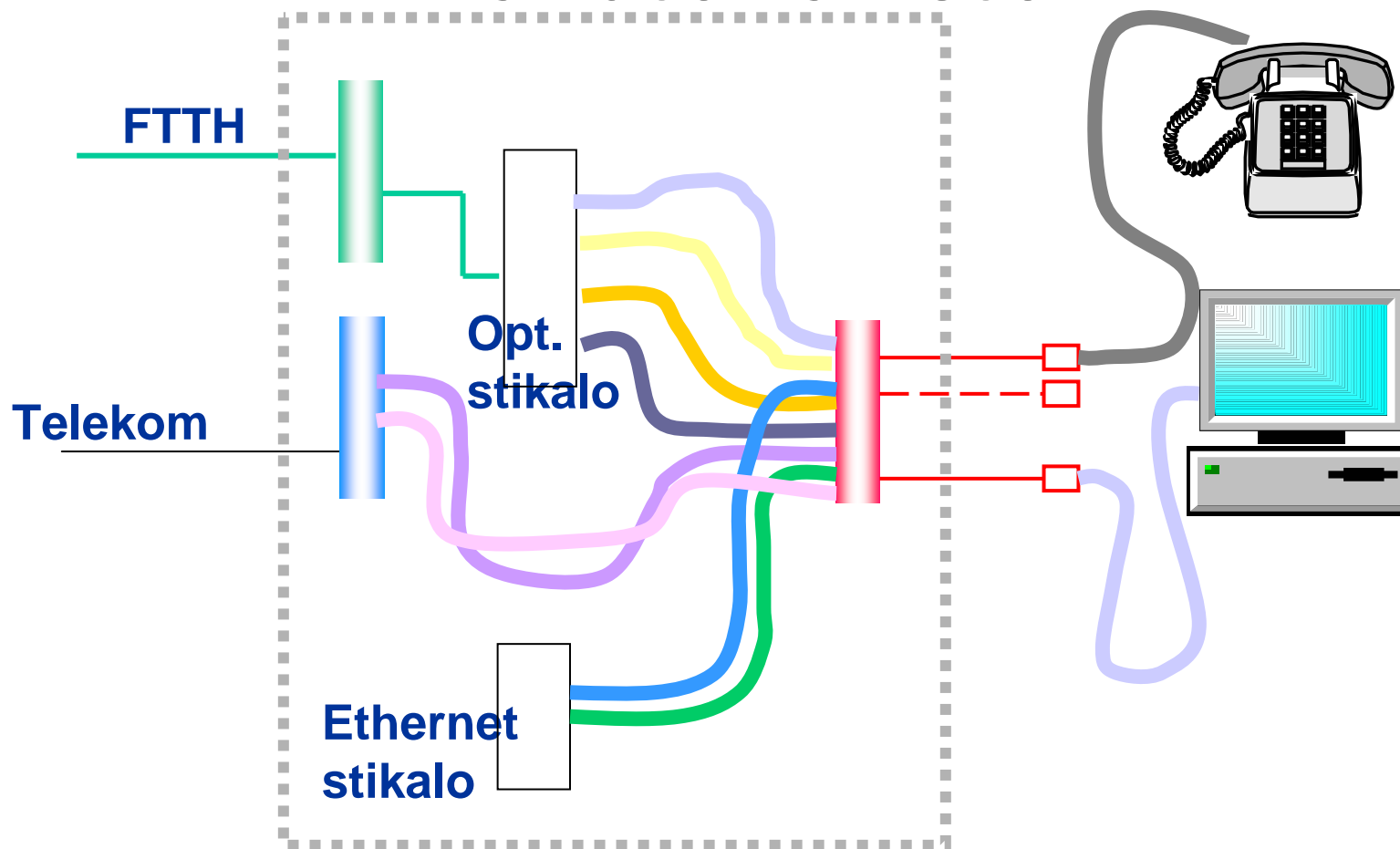
Pasivna mrežna oprema

Domače vozlišče



Pasivna mrežna oprema

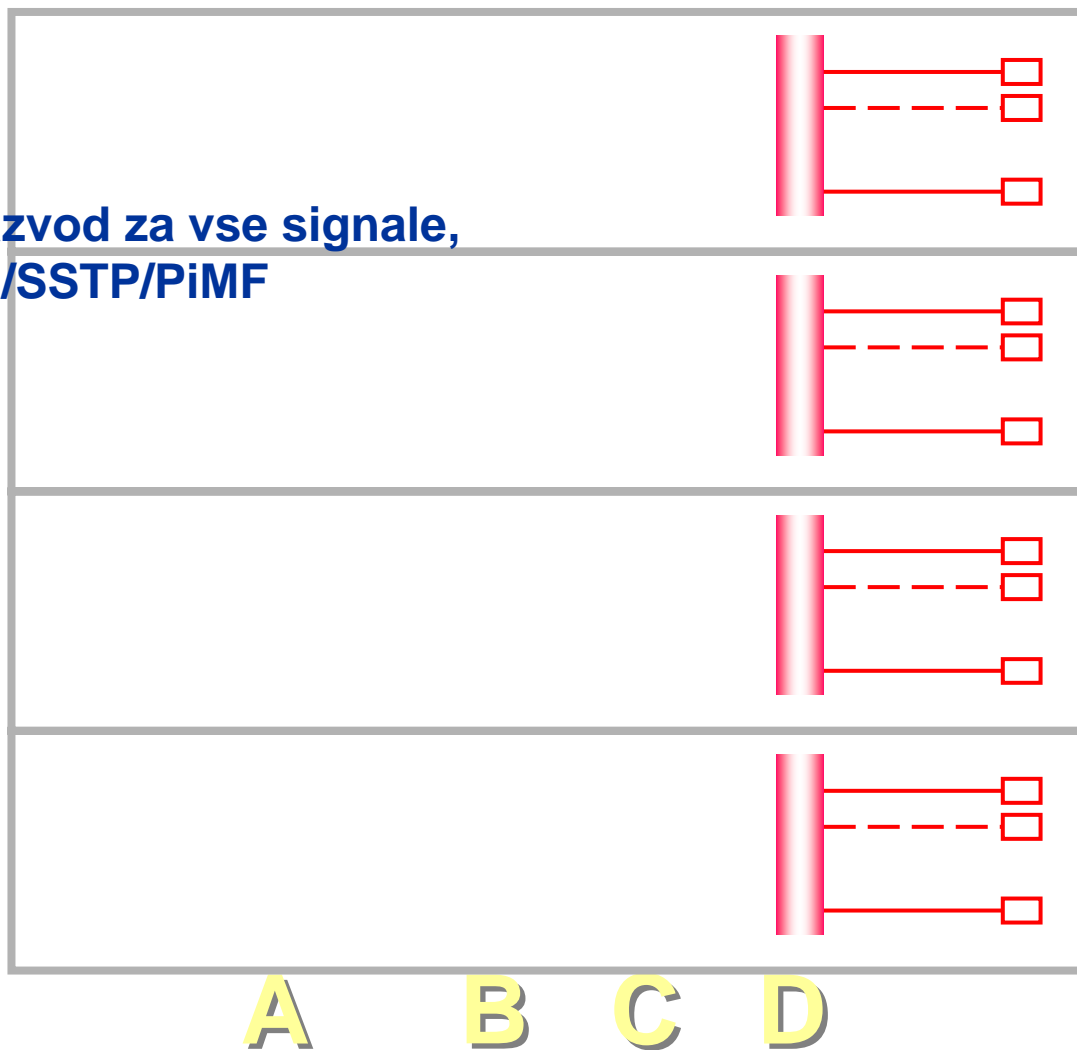
Domače vozlišče



Pasivna mrežna oprema

D

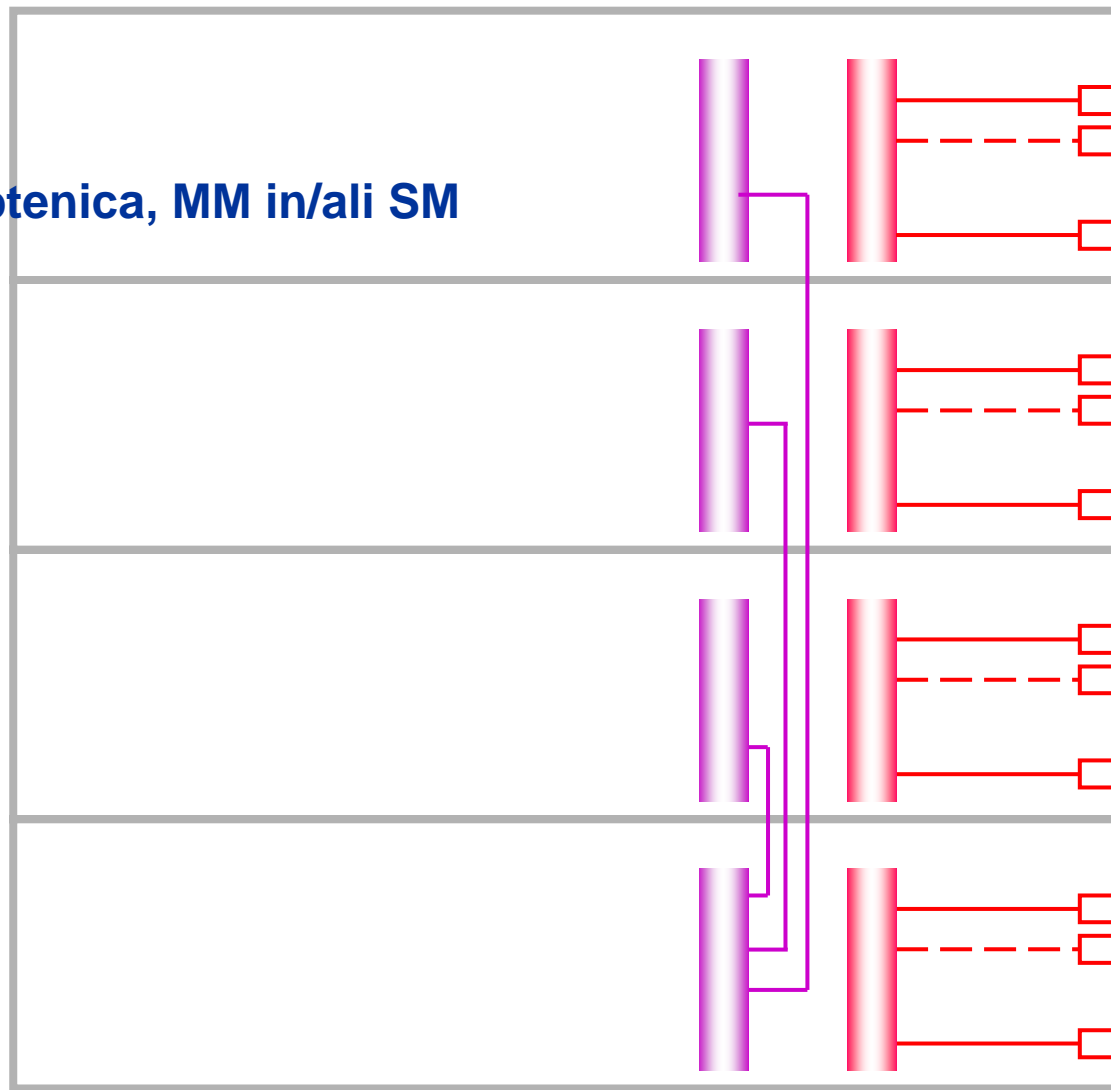
Horizontalni razvod za vse signale,
UTP/FTP/SFTP/SSTP/PiMF



Pasivna mrežna oprema

C

optična hrbtnica, MM in/ali SM



3

2

1

P

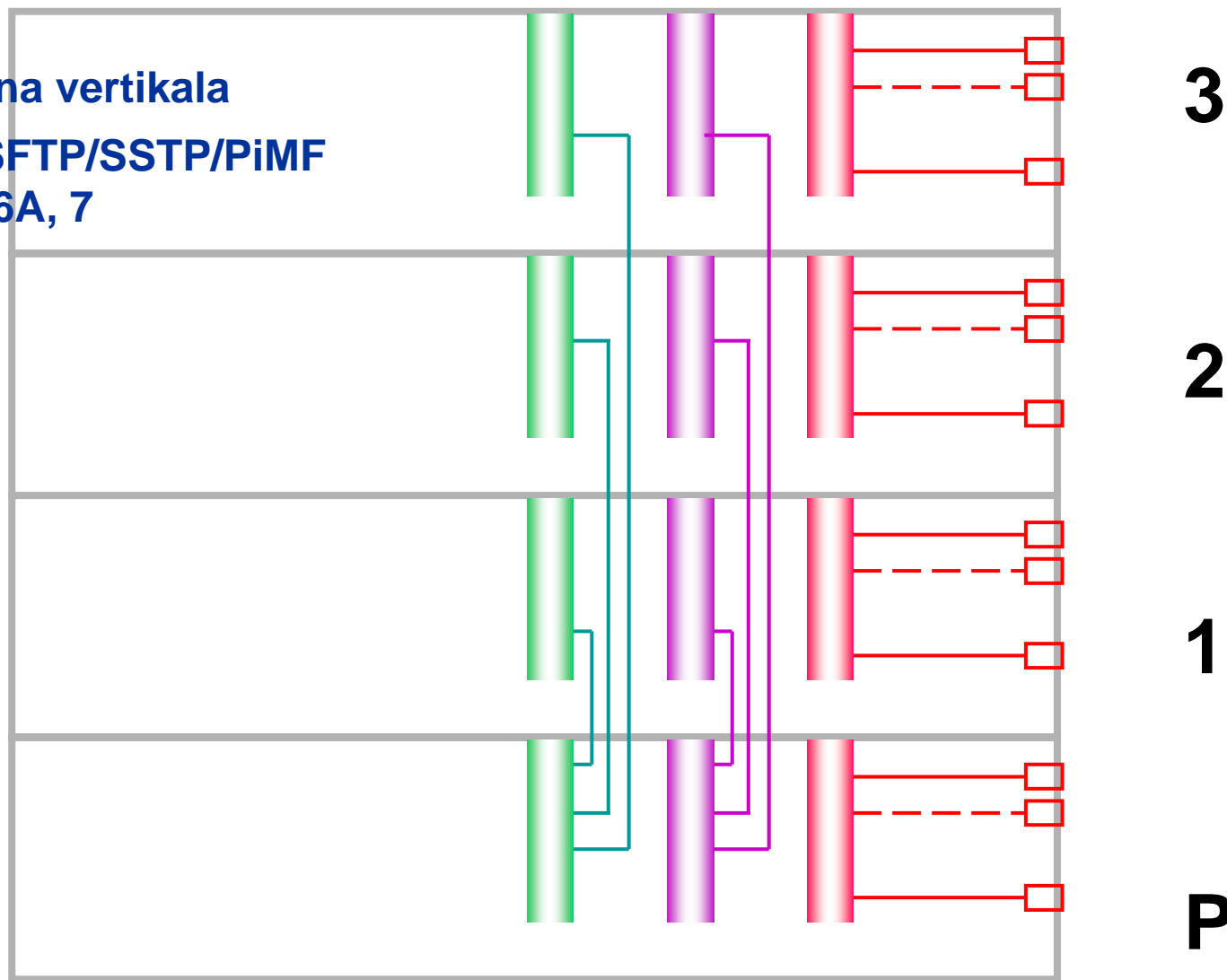
A

B

C

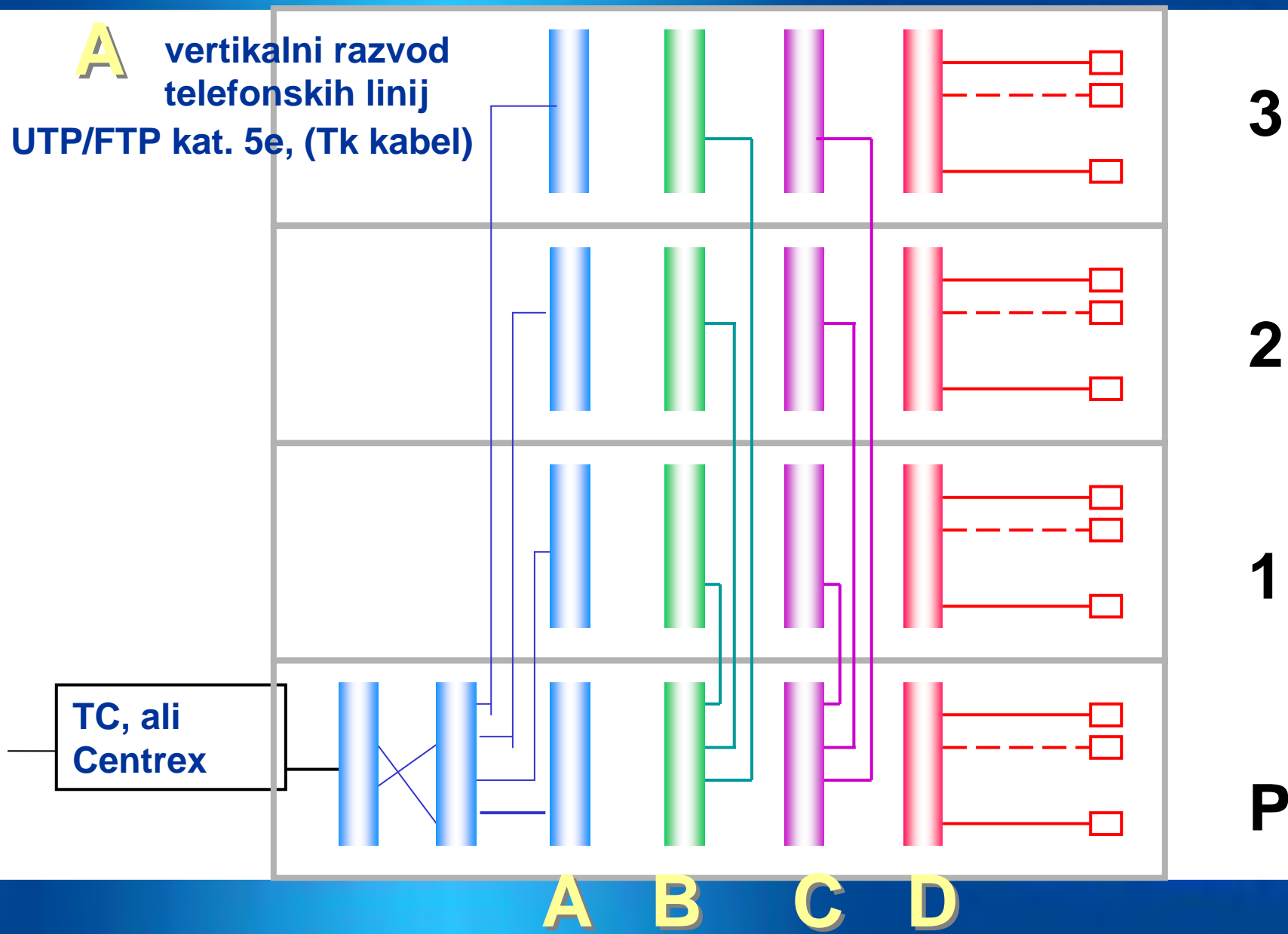
D

B rezervna vertikala
UTP/FTP/SFTP/SSTP/PiMF
kat. 5e, 6, 6A, 7



A B C D

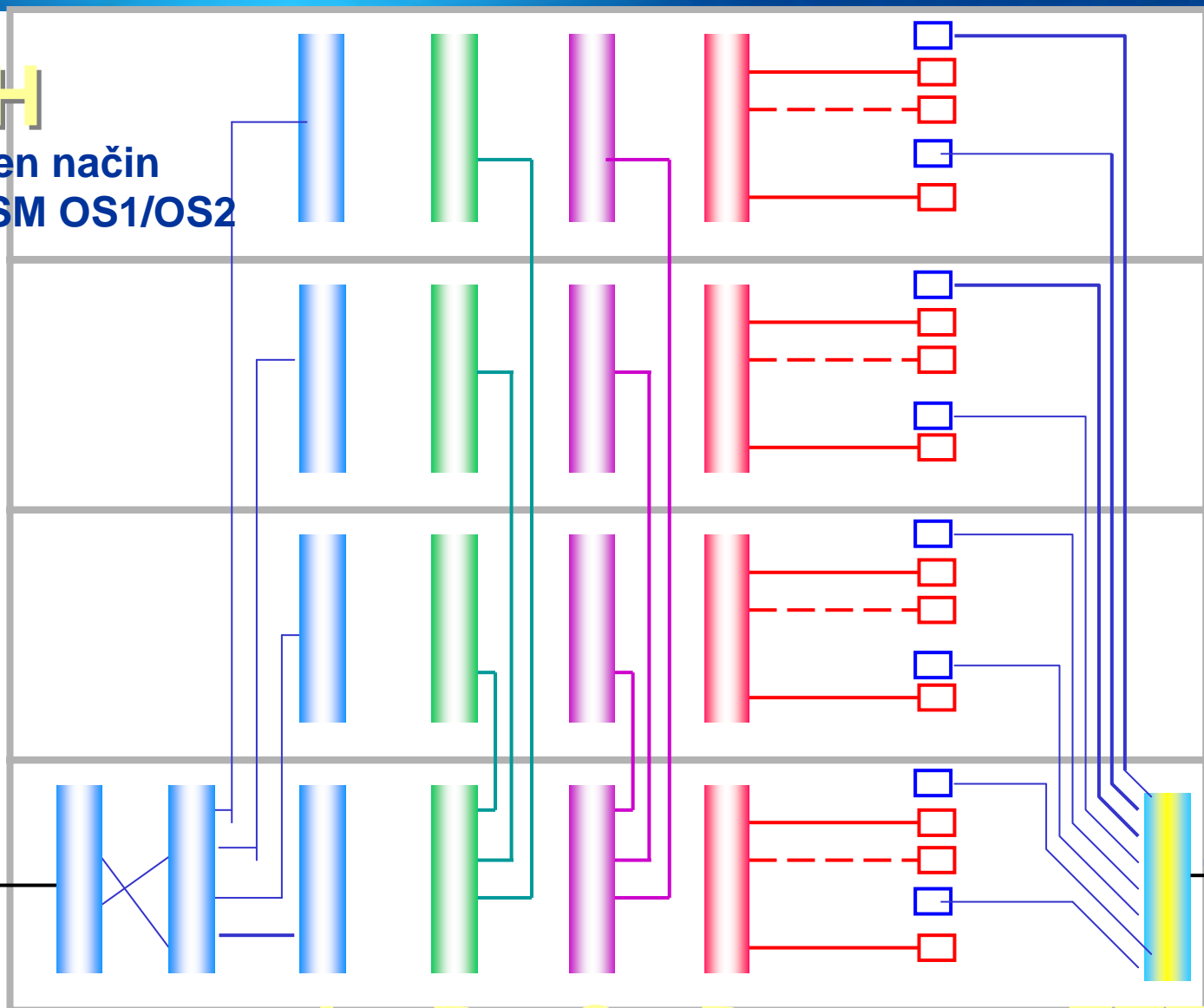
A vertikalni razvod telefonskih linij
UTP/FTP kat. 5e, (Tk kabel)



FTTH

neposreden način
razvoda, SM OS1/OS2

TC, ali
Centrex



3

2

1

P

A B C D

FTTH

Kaj preverjamo z meritvami?



Odločitev je lahko na strani merilca ali instrumenta

Pasivna mrežna oprema



Meritve bakra nekoč

	Kategorija 5	Kategorija 5E	Kategorija 6
Dušenje	✓	✓	✓
NEXT PP	✓	✓	✓
NEXT PS		✓	✓
FEXT PP		✓	✓
FEXT PS		✓	✓
ACR PS		✓	✓
ELFEXT PS		✓	✓
Return Loss		✓	✓
Prop. Delay		✓	✓
Delay Skew		✓	✓
frekv. področje	100 MHz	100 MHz	250 MHz

Pasivna mrežna oprema

RL	Return loss	Meritve bakra danes
IL	Insertion loss (ATTN)	
NEXT loss	(near-end crosstalk)	
PSNEXT loss	(powersum near-end crosstalk)	
FEXT loss	(far-end crosstalk)	
ACRF	(attenuation to crosstalk ratio, far-end)	
ELFEXT	(equal-level far-end crosstalk)	
PSFEXT loss	(attenuation to crosstalk ratio, far-end)	
PSACRF	(powersum insertion loss to alien crosstalk ratio far-end)	
PSELFEXT	(powersum equal-level far-end crosstalk)	
PD	Propagation delay	
DS	Delay skew	
ANEXT loss	(alien near-end crosstalk)	
PSANEXT loss	(powersum alien near-end crosstalk)	
AFEXT loss	(alien far-end crosstalk)	
PSAFEXT loss	(powersum alien far-end crosstalk)	
PSAACRF	(powersum insertion loss to alien crosstalk ratio far-end)	
PSAELFEXT	(powersum alien equal-level far-end crosstalk)	



EZŽ komunikacijski izdelki

hvala za pozornost

info@ezz.si

Pasivna mrežna oprema