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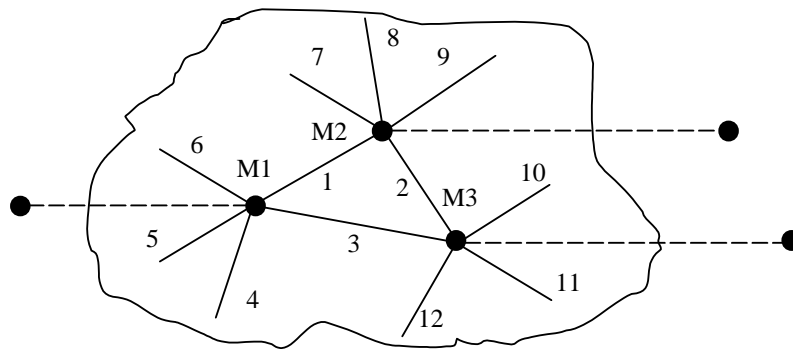
1.

1.1.

n, m, k , n , m , k , (1), (2), (3).

1.2.

« » « » .1. 1, 2, 3. (1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1) Internet.



1 –

1.3.

- 802.3, 10 Base T;
- BF – 802.3, 10 Base FL;
- 2 – 802.3, 10 Base 2;
- 5 – 802.3, 10 Base 5;
- R – 802.5 (IBM Token-Ring Network).

. 2
 () N
 $l, l -$
 10Base2 10Base5,
 (lobe) 10Base Token-Ring (PC)
 10BaseFL (UI (30+n)%
).
 .
 $l -$ « »

n	« »								nترنت	
1	1	2	4	5	6	7	8	10	3	
2	1	2	4	5	6	7	10	11	2	
3	1	2	4	5	7	8	9	11	3	
4	1	2	4	7	8	9	10	11	1	
5	1	2	4	7	8	10	11	12	1	1
6	1	2	4	5	7	10	11	12	2	
7	1	2	4	5	7	8	10	11	1	
8	1	2	4	5	6	8	9	10	3	
9	1	2	5	6	7	8	9	12	3	
10	1	2	5	8	9	10	11	12	1	1
11	2	3	4	5	6	7	9	11	3	
12	2	3	4	5	6	9	10	12	2	
13	2	3	5	6	7	8	9	12	3	
14	2	3	5	7	8	9	11	12	1	
15	2	3	5	8	9	10	11	12	1	1
16	2	3	4	6	8	10	11	12	1	
17	2	3	5	6	7	9	11	12	2	
18	2	3	4	5	6	7	9	11	2	
19	2	3	4	6	7	8	9	10	3	
20	2	3	6	7	9	10	11	12	1	1
21	1	3	4	5	6	7	9	12	3	
22	1	3	4	5	6	8	10	12	2	
23	1	3	4	6	7	8	9	10	3	
24	1	3	6	7	8	9	10	12	1	
25	1	3	6	7	9	10	11	12	1	1
26	1	3	4	6	8	10	11	12	2	
27	1	3	4	6	7	9	10	12	2	
28	1	3	4	5	6	7	8	12	3	
29	1	3	5	6	7	8	9	11	3	
30	1	3	4	7	9	10	11	12	1	1

, m			()											
			1	2	3	4	5	6	7	8	9	10	11	12
1			B5	+ 2		2	-	5	-	F	5	R		-
		, N	60-n	20+n	n	30+n	20+n	120-n	50-n	7+[n/2]	60+n	20+n	5+n	40-n
1		, L	Nl/60	0,7 l	0,8 l	Nl/30	0,9 l	Nl/60	Nl/50	0,9 l	Nl/90	0,9 l	0,7 l	0,8 l
2			BT	B5	BT+B2	TR	-	BT	-	B5	-	BT	BF	B5
		, N	8+n	40+n	20+n	20+[n/2]	40-n	30-[n/2]	60-n	80+n	40-n	10+[n/2]	30-n	120-n
2		, L	0,75 l	Nl/60	0,6 l	0,9 l	0,6 l	0,8 l	Nl/60	Nl/60	0,8 l	0,5 l	Nl/30	Nl/60
3			BT+B2	BT	-	BT	B5	B2	-	B5	B2	TR	-	BF
		, N	25+[n/2]	30-n	60-n	10+n	90+n	30+n	40-n	115-n	45-n	15+n	20+n	30-[n/2]
3		, L	0,6 l	0,85 l	Nl/60	0,9 l	Nl/60	Nl/30	0,8 l	Nl/60	Nl/30	0,9 l	Nl/50	0,7 l
4			B2	-	BT	-	B5	B2	BF	BT	-	B5	B2+BT	TR
		, N	10+[n/2]	35-n	n	20+n	120-n	30+n	30-[n/2]	8+[n/2]	50-n	90+n	40-n	60-n
1		, L	0,8 l	0,9 l	0,6 l	0,7 l	Nl/60	Nl/30	0,8 l	0,6 l	Nl/50	Nl/90	Nl/40	0,85 l
5			BT+B2	BT	B2	B5	BT	-	TR	-	B5	BF	-	B2
		, N	20+n	25-n	n	60+n	10+[n/2]	60-n	40-n	30+n	120-n	20-[n/2]	20+n	15+n
2		, L	0,8 l	0,6 l	0,75 l	Nl/90	0,8 l	Nl/60	0,5 l	0,9 l	Nl/60	0,85 l	0,7 l	Nl/30
6			-		+ 2	5	2		R	-	F	-		5
		, N	15+[n/2]	8+n	20+n	120-n	30-[n/2]	15+[n/2]	20+[n/2]	30-n	5+[n/2]	40-n	30-[n/2]	90+n
3		, L	0,9 l	0,9 l	0,8 l	Nl/60	Nl/30	0,85 l	0,7 l	Nl/30	0,9 l	0,8 l	0,75 l	Nl/50
1	IT		BF		-	2	5		-	TR	B2+BT	B5	BF	-
		, N	20-[n/2]	30-n	5+n	60-n	90+[n/2]	30-[n/2]	20-[n/2]	15+[n/2]	50-n	50+n	5+[n/2]	10+n
		, L	0,8 l	0,85 l	0,6 l	Nl/60	Nl/60	0,85 l	0,75 l	Nl/30	0,7 l	0,8 l	0,75 l	Nl/50
2	IT		-		+ 2	5	T		B2	-	F	B2	-	F
		, N	15+[n/2]	8+n	20+n	120-n	30-[n/2]	15+[n/2]	20+[n/2]	30-n	5+[n/2]	40-n	30-[n/2]	5+n
		, L	0,9 l	0,9 l	0,8 l	Nl/60	Nl/30	0,85 l	0,85 l	Nl/30	0,9 l	0,9 l	0,75 l	0,8 l

Internet

. 1

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– (–0,5);
 – (–0,5);
 – (0,3...3,4);
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1 – 64 / .

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 (2...3)% .

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UNIX

1.4.

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 nternet. – Internet
 (DDN Network Information Center-

InterNIC)

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Internet

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256 254

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 =8(n-1)+ , – « » .

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Ethernet

(Network Interface Card - NIC).

. 3

NIC (Ethernet-)

Ethernet

3 –

<i>k</i>	–	– Internet	Ethernet –
1	223.200.1. 223.200.2. 223.200.3.	150.27.120.5 150.27.120.6	08:00:39:00:2F:C3 08:00:39:0 :46:29 08:00:39:F1:02:2 08:00:39:24:15:33
2	191.110. .	195.240.50.9 195.240.50.10	08:48:20: 1:90:01 08:48:88:54:67:97 08:48:0F:77:89:09 08:48:A5:A4:B1:2B
3	200.30.20.X 200.30.21.X 200.30.22.X 200.30.23.X	198.88.34.17 198.88.34.18	08:C1:01:00:A3:B7 08:C1:11:09:08:C1 08:C1:11:31:C8:F1 08:C1:1B:18:93:28
4	190.40.P.X	160.100.10.1 160.100.10.2	08.:0A:22:15:70:16 08:0A:46:19:F1:2D 08:0A:20:F4:60:90 08.0A:30:00:21:18
5	210.50.51.X 210.50.52.X 210.50.53.X	199.20.55.129 199.20.55.130	08:00:01: :36:17 08:00:02:72:D2:05 08:00:03:03:15:0F 08:00:04:0B:18:44
6	140.60. .	210.44.1.65 210.44.1.66	08.:0A:22:15:70:17 08:0A:30:19:F1:2D 08:0A:20:F4:60:90 08.0A:30:00:22:18

2.

(, , ,)

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20...25

4.

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1.

« »

3.

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4 –

	8	9	10	11	12	13	14	15	16
.2	-	1...3	4...6	7...9	10...12	13...15	16, 17	-	-

1. *Microsoft Corporation*. ; . .- .: Channel Trading Ltg, 1997. – 696 c.
2. *C* . ; . .- .: BNV, 1996. – 288 c.
3. . – . 2: *Networking Essentials*. - ; / . .- .: , 1999. – 432 .
4. . ; .- .: , 1995. – 400 .
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6. . ; .- .: , 1989. – 272 .
7. . ; . .- .: , 1986. – 359 .
8. ; , 1999. – 50 .

1. Ethernet Token Ring

Ethernet, Token Ring, FDDI
Ethernet

(/) (Carrier Sense, Multiple Access with Collision Detection – CSMA/CD).

DIX Ethernet (Ethernet 2)

Xerox, Digital, Intel,
IEEE 802.3. 802
Engineers)

IEEE (Institute of Electrical and Electronic

(LAN)

(MAN)

Ethernet

IEEE 802.3,

1... 4.

1 –

Ethernet

802.3

10Base2

	10Base2		
1	RG-58 A/U BNC-		185 0,5
2	BNC- 50		2 ()
3	BNC- - (T - connectors)	(NIC,	1
4	BNC –Barrel connectors		
5	(NIC) BNC		30 NIC 10 /
6	BNC	10Base2 (925)	

10Base5 Ethernet IEEE 802.3 (thick)
10 / .

10Base2, Ethernet (thin)

10Base Ethernet –
10BaseT –
(Unshielded Twisted Pair – UTP).

2 – Ethernet 802.3
10Base5

	10Base5		
1	RG-11 N-		500
2	N- 50		2 ()
3	N-Barrel (connectors)	N-	2-3
4	DIX- (DB-15) AUI-	(,). , , ,	100 , 2,5
5	AUI- UTP	(,)	AUI – 50 , – 2,5
6	DB-15 (DIX- onne tors)	AUI-	2 AUI -
7	(NIC) DIX	NIC , /	100 NIC , 10 /
8	DIX-	10Base5 (2500)	

10BaseT

(u) DTE (Data Terminal Equipment) DCE (Data Communication Equipment).

DTE , , NIC. DCE

3 – Ethernet 802.3

10BaseT Fast Ethernet

	10Base	Fast Ethernet*		
1	UTP: 3– 5– 100BaseTX, UTP 3– 100BaseT4	10BaseT, 100BaseTX, UTP 3– 100BaseT4		100
2		RJ-45	UTP	2
3	(Hub) / / (4, 8,...) RJ-45 RJ-45 -		(). 10Base2, 10Base5, 10BaseFX BNC DB-15**	- - - 10 / (10Base) 100 / (Fast Ethernet)
4	(NIC), RJ - 45			NIC, 1024
5				
6	RJ-45			
*	802.3z		Gigabit Ethernet (1000 Base CX)	
**	Ethernet 10		Fast Ethernet 100 /	

10BaseT

)
–
DCE;

) DCE
 DTE);
) () DTE DCE
 ;
) - , , ,
 10 / 100 /
 Fast Ethernet 100Base X
 UTP 5- 100BaseT4 UTP
 3- .
 Ethernet
 (fiber optic) ,
 , -
 Ethernet 10Base FL
 . 4.
 4 - Ethernet 802.3
 10BaseFL

	10BaseFL		
1	ST- ' -		62,5/125 2 , -
2	(FO MSAU) DIX AU RX ST- ' -		10 /
3	AUI DB-15		UTP 50
4	RX TX ST- ' -		
5	(NIC) ' DB-15		NIC, - RX/TX

CSMA/CD

Ethernet

-

Token Ring,

(oken)

(Ring).

, NIC

MSAU

Token Ring

(lobe)

(path)

4...5

Ethernet.

5

Token Ring

IEEE 802.5.

5 -

Token Ring IEEE 802.5

	Token Ring		
1	(2 STP 22 AWG), (4 UTP 22 24 AWG)*	(MSAU)	3 1 101 , 45
2	(2 STP 26 AWG)		
3	RJ-45 DB-9 1 3		2
4	MSAU (4,8,12,...) RJ-45 RO, R MSAU		260 (33 MSAU) 1 - 72 (9 MSAU) 3
5	()		4 / 16 / , 4 / **
6			
7	RJ-45	(lobe)	
*	5,	(pacth)	(lobe)
**	802.5 100 / , 128 / , 1000 / .		

2.

CSMA/CD

Ethernet

51,2

10

/

Token Ring

10

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Ethernet

Token Ring,

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6-

RG-11	4,33 /
RG-58	5,14 /
(UTP) (STP)	5,7 /
62,5/125	5,0 /
(HUB)	0,1
HUB	1,55
	0,2

3.

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Ethernet

IEEE 802.3

IEEE

Token Ring
802.5.

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-4

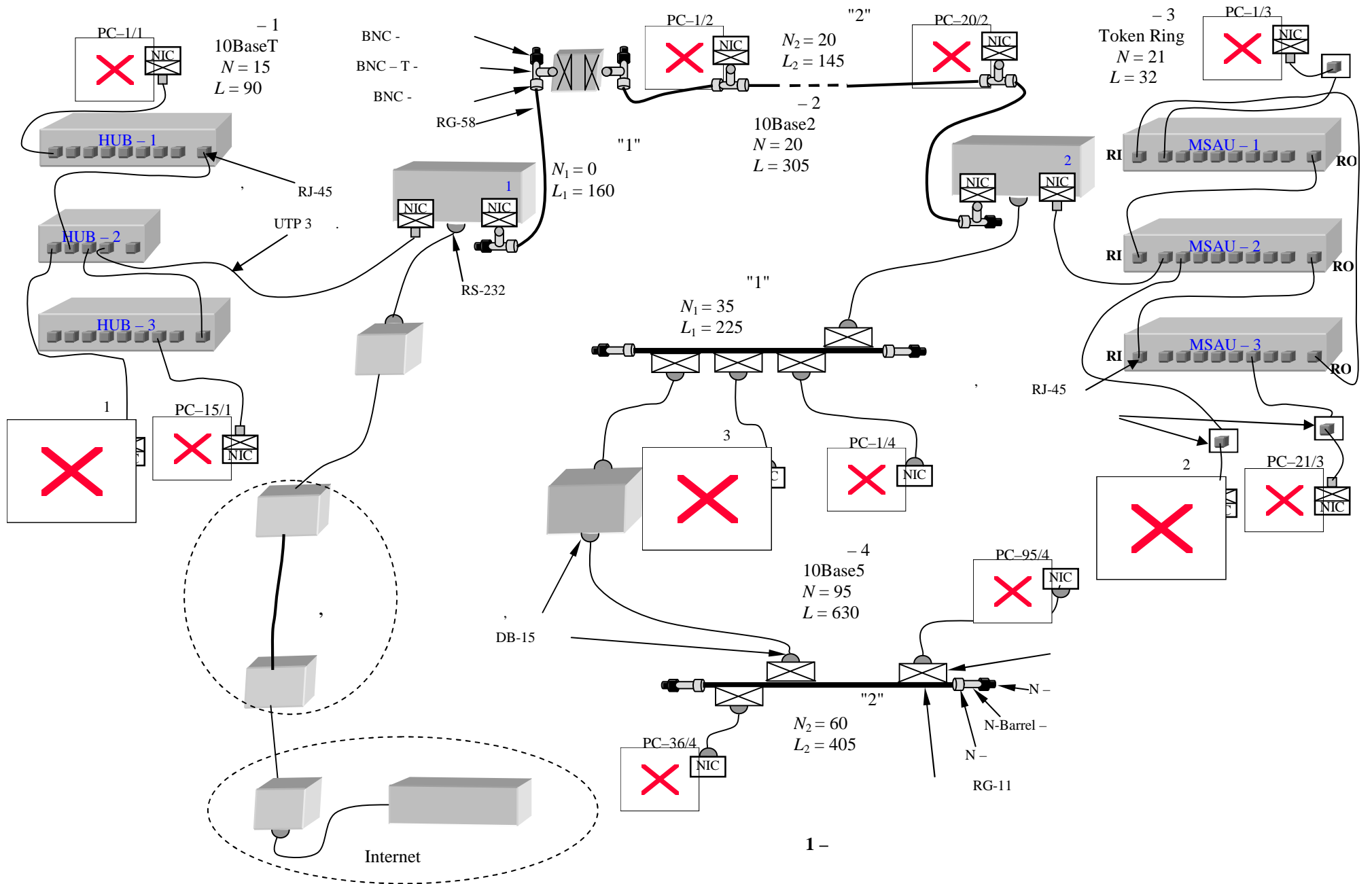
NIC.

Internet

() .

0,3...3,4

RS-232.



(. 1),

. 7.

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.
			-1	-2	-3	-4		
1.	Ethernet DIX-	.	–	–	–	1	1	
2.	10Base5	.	–	–	–	99	99	
3.	Ethernet BNC	.	–	1	–	–	1	
4.	Ethernet 8+1 RJ-45	.	2	–	–	–	2	
5.	Ethernet 4+1 RJ-45	.	1	–	–	–	1	
6.	Token Ring 8+2 RJ-45	.	–	–	3	–	3	
7.	NIC Ethernet DB-15	.	–	–	–	97	97	
8.	NIC Ethernet RJ-45	.	17	–	–	–	17	
9.	NIC Ethernet BNC	.	–	22	–	–	22	
10.	NIC Token Ring RJ-45	.	–	–	23	–	23	
11.	RJ-45	.	–	–	22	–	22	
12.	N-	.	–	–	–	4	4	
13.	BNC-	.	–	4	–	–	4	
14.		.	–	–	–	–	1	
15.	N-barrel connector	.	–	–	–	4	4	
16.	N-connector	.	–	–	–	4	4	
17.	DB-15 (DIX-connector)	.	–	–	–	198	198	
18.	BNC	.	–	44	–	–	44	
19.	BNC-T	.	–	24	–	–	24	
20.	RJ-45	.	38	–	52	–	90	
21.	RG-11	.	–	–	–	630	630	
22.	RG-58 A/U	.	–	305	–	–	305	
23.	2 UTP 3-	.	60x19	–	–	–	1140	
24.	– 3	.	–	–	30x23	–	690	
25.	– 6	.	–	–	2x25	–	50	
26.	AUI (4 UTP)	.	–	–	–	10x99	990	
27.	Pentium 200 , RAM 16 Mb, HDD 2,1Gb	.	15	20	21	95	151	
28.	Pentium II 400 , RAM 128 Mb, HDD 4x9,2 Gb	.	1	–	1	1	5	
29.	Windows 95	.	15	20	21	95	151	
30.	UNIX	.	–	–	–	–	2	
31.	Windows NT	.	1	–	1	1	3	

4.

IP- 32- IP- n IP-
 $n = 7, n = 24;$ - $n = 14, n = 16;$ - $n = 21, n = 8.$
 N N

$$N = 2^M, \quad N = 2^{n_B} - 2.$$

n IP- (, ,)

(subnet mask).

32- 111...111000...000 (- n
 1, - 0).
 n_1 c ,
 n_0 ,
 : $n = n_1 + n_0.$

$$N = 2^{n_1} = 2^{n - n_0}, \quad N = 2^{n_0} - 2.$$

(“ ” , : n n_0); - (“ ”
 n n_0).
 : 255.255.255.0 (), 195.5.27.1 (-).
 . 8

IP-

5. IP –

, 156 , ; 1, ’
 IP-
 IP-
 IP- IP- :
 195.5.30. : 255. 255. 255.0.
 (. 1) 95 , IP –
 255.255.255.128.
 126 IP- (. 8).
 15 21 .
 IP-

255. 255. 255.224.
 30 IP- (. 8).
 2 IP-

IP-

8 –

IP-

			IP-	IP-		IP-
1	255.255.255.0	1	195.5.27.0	195.5.27.255	254	195.5.27.1, ... ,195.5.27.254
2	255.255.255.128	1	195.5.27.0	195.5.27.127	126	195.5.27.1, ... ,195.5.27.126
	255.255.255.128	2	195.5.27.128	195.5.27.255	126	195.5.27.129,...,195.5.27.254
3	255.255.255.192	1	195.5.27.0	195.5.27.63	62	195.5.27.1, ... ,195.5.27.62
	255.255.255.192	2	195.5.27.64	195.5.27.127	62	195.5.27.65, ... ,195.5.27.126
	255.255.255.192	3	195.5.27.128	195.5.27.191	62	195.5.27.129,...,195.5.27.190
	255.255.255.192	4	195.5.27.192	195.5.27.255	62	195.5.27.193,...,195.5.27.254
4	255.255.255.224	1	195.5.27.0	195.5.27.31	30	195.5.27.1, ... ,195.5.27.30
	255.255.255.224	2	195.5.27.32	195.5.27.63	30	195.5.27.33, ... ,195.5.27.62
	255.255.255.224	3	195.5.27.64	195.5.27.95	30	195.5.27.65, ..., 195.5.27.94
	255.255.255.224	4	195.5.27.96	195.5.27.127	30	195.5.27.97, ... ,195.5.27.126
	255.255.255.224	5	195.5.27.128	195.5.27.159	30	195.5.27.129,...,195.5.27.158
	255.255.255.224	6	195.5.27.160	195.5.27.191	30	195.5.27.161,...,195.5.27.190
	255.255.255.224	7	195.5.27.192	195.5.27.223	30	195.5.27.193,...,195.5.27.222
	255.255.255.224	8	195.5.27.224	195.5.27.255	30	195.5.27.225,...,195.5.27.254
5	255.255.255.240	1	195.5.27.0	195.5.27.15	14	195.5.27.1, ... ,195.5.27.14
	255.255.255.240	2	195.5.27.16	195.5.27.31	14	195.5.27.17, ... ,195.5.27.30
	255.255.255.240	3	195.5.27.32	195.5.27.47	14	195.5.27.33, ... ,195.5.27.46
	255.255.255.240	4	195.5.27.48	195.5.27.63	14	195.5.27.49, ... ,195.5.27.62
	255.255.255.240	5	195.5.27.64	195.5.27.79	14	195.5.27.65, ... ,195.5.27.78
	255.255.255.240	6	195.5.27.80	195.5.27.95	14	195.5.27.81, ... ,195.5.27.94
	255.255.255.240	7	195.5.27.96	195.5.27.111	14	195.5.27.97, ... ,195.5.27.110
	255.255.255.240	8	195.5.27.112	195.5.27.127	14	195.5.27.113,...,195.5.27.126
	255.255.255.240	9	195.5.27.128	195.5.27.143	14	195.5.27.129,...,195.5.27.142
	255.255.255.240	10	195.5.27.144	195.5.27.159	14	195.5.27.145,...,195.5.27.158
	255.255.255.240	11	195.5.27.160	195.5.27.175	14	195.5.27.161,...,195.5.27.174
	255.255.255.240	12	195.5.27.176	195.5.27.191	14	195.5.27.177,...,195.5.27.190
	255.255.255.240	13	195.5.27.192	195.5.27.207	14	195.5.27.193,...,195.5.27.206
	255.255.255.240	14	195.5.27.208	195.5.27.223	14	195.5.27.209,...,195.5.27.222
	255.255.255.240	15	195.5.27.224	195.5.27.239	14	195.5.27.225,...,195.5.27.238
	255.255.255.240	16	195.5.27.240	195.5.27.255	14	195.5.27.241,...,195.5.27.254
6	255.255.255.128	1	195.5.27.0	195.5.27.127	126	195.5.27.1, ... ,195.5.27.126
	255.255.255.192	2	195.5.27.128	195.5.27.191	62	195.5.27.129,...,195.5.27.190
	255.255.255.192	3	195.5.27.192	195.5.27.255	62	195.5.27.193,...,195.5.27.254
7	255.255.255.128	1	195.5.27.0	195.5.27.127	126	195.5.27.1, ... ,195.5.27.126
	255.255.255.192	2	195.5.27.128	195.5.27.191	62	195.5.27.129,...,195.5.27.190
	255.255.255.224	3	195.5.27.192	195.5.27.223	30	195.5.27.193,...,195.5.27.254
	255.255.255.240	4	195.5.27.224	195.5.27.239	14	195.5.27.245,...,195.5.27.238
	255.255.255.248	5	195.5.27.240	195.5.27.248	6	195.5.27.241,...,195.5.27.247
	255.255.255.248	6	195.5.27.248	195.5.27.255	6	195.5.27.249,...,195.5.27.254

6.

(. 2)

v4
(next – hop routing).

();

(default).

UNIX

195.5.30.0 (. 2)

(. 9)

```
Ifconfig ie0 195.5.30.0 netmask 255.255.255.224.
195.5.30.64
```

```
Route add 195.5.30.64 195.5.30.62 1,
195.5.30.62 – ( ),
```

1 – “ ”
195.5.30.64.

Internet (. 2) 195.6.10.1
1 (. 9)

(default).

```
Route add default 195.6.10.1 1 .
```

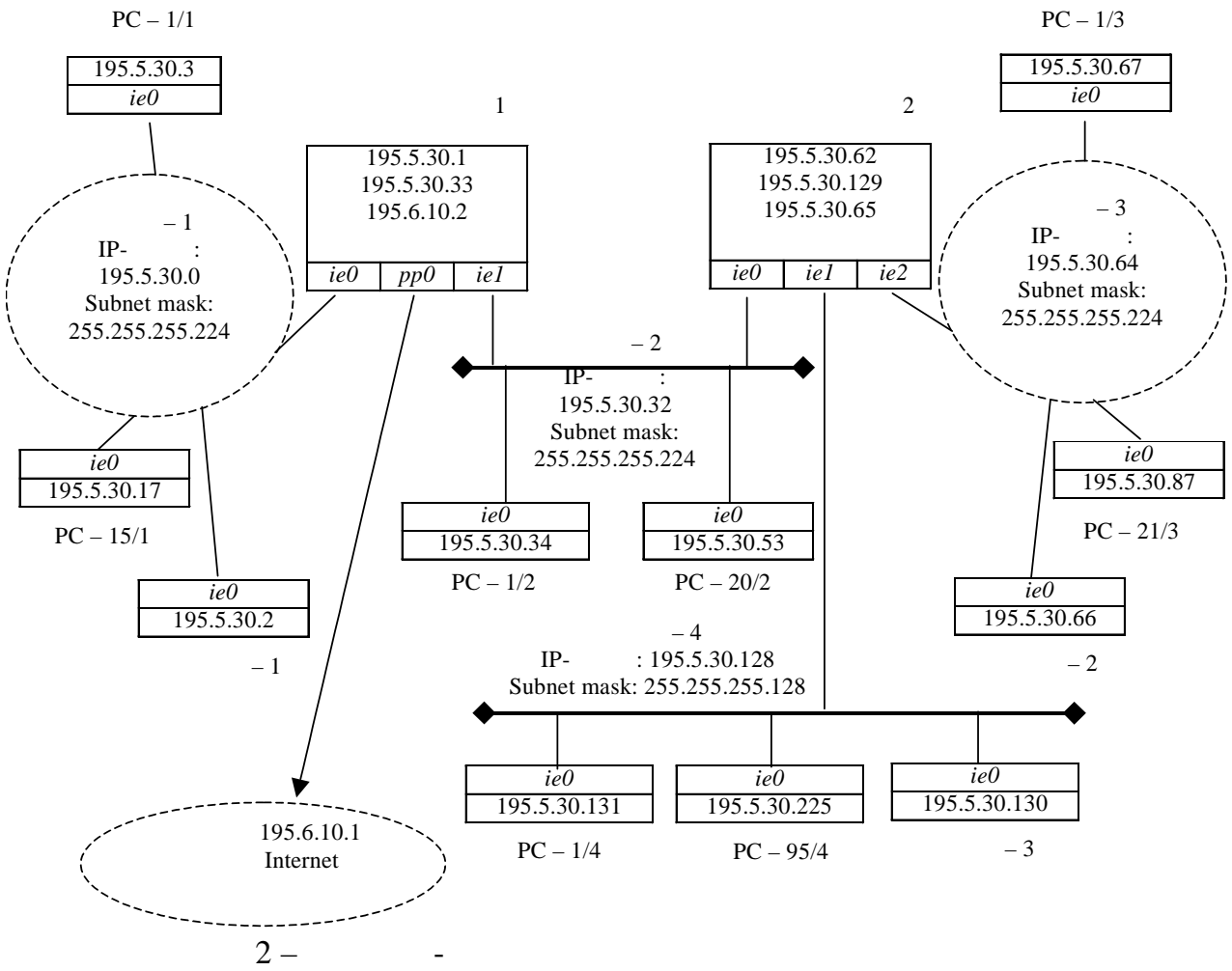
9 – M

1 (. 2)

IP –		IP –	
195.5.30.0		–	<i>ie0</i>
195.5.30.32		–	<i>ie1</i>
195.5.30.64		195.5.30.62	<i>ie1</i>
195.5.30.128		195.5.30.62	<i>ie1</i>
Default		195.6.10.1	<i>pp0</i>

IP-		IP-	
195.5.30.64		-	ie0
Default		195.5.30.65	pp0

IP-		IP-	
195.5.30.32		-	ie0
195.5.30.64		195.5.30.62	ie0
195.5.30.128		195.5.30.62	ie0
Default		195.5.30.33	pp0



	.....	3
1.	.....	4
1.1	.....	4
1.2	.....	4
1.3.	.....	4
1.4	.....	7
2.	.....	8
3.	.....	10
4.	.....	10
	.....	11
1.	Ethernet Token Ring.....	11
2.	.....	16
3.	.....	16
4.	.....	19
5.	IP -	19
6.	-	21

