

• •

· :
· , - · · , · · ·

· · · :
· - : -
, 2004. -117 .

© · · 2004

© · · , 2004

1.

, , - . , -
: , -
.. (),
- ,
1. . -
() (-
) 7 -
, 105 7 -
(2 - , ,
- . - ,
- . , ASCII-
, - ,
" " ,
/ , " " .

2. " " ,
" " - . -
5 ,
" " .
" " .
() " " , -
-
.
.
" " , : (.: *digitizer*). , -
" " , , -
.
3. : ,
, , . ,
.
, , . -
, , . -
.
4. (.: *sound-blaster*), -
, , , .
5. (.: *video-blaster*) -
(.: *frame-grabber*). -
,
, , -
.
6. -
.

2.

2.1.

ASCII (American Standard Code for Information Interchange).

ASCII (128 255).

1) DOS Microsoft 866) Microsoft Code Page 866).

2) -8 (19768-74) UNIX Internet.

3) ANSI Code Page 1251 Windows. MS DOS, 866 1251 Windows-

4) Unicode Windows NT. 8- Unicode - 16- 65536 Unicode Unicode True Type Unicode 100 MB.

(: (: regular), (: italic), (: bold) (: underline),

;

- True Type

True Type

dir,

C:\

```

BAT      <      > 01.01.96 12:53
WINDOWS  <      > 01.01.96 22:29
COMMAND  COM    94 134 02.10.95 9:50
AUTOEXEC BAT   430 20.01.01 17:53
CONFIG    SYS   329 01.03.96 23:35
3      ( , )   94 893
2      ( , )  38 789 120

```

Windows

Courier New),

C:\

```

BAT      <      > 01.01.96 12:53
WINDOWS  <      > 01.01.96 22:29
COMMAND  COM    94 134 02.10.95 9:50
AUTOEXEC BAT   430 20.01.01 17:53
CONFIG    SYS   329 01.03.96 23:35
3      ( , )   94 893
2      ( , )  38 789 120

```

2.2.

, . , -
 . . , -
 . . , -
 , , , , , . .
 , -
 .
Microsoft Excel. -
 :
 ;
 ;
 ;
 ;
 ;
 .
 , .
 (), . -
 , , , -
 , - (*relation*). -
 , , -
 (). -
 :
 1) . -
 , -
 2) . -
 , -
 , .
 3) .

- SQL (Structured Query Language).

2.3.

()

:

2.4.

80-

Microsoft,

Windows

- OLE (Object Linking & Embedding).

OLE-

. OLE-

3.

1837 .
, . XX -
, . -
, 50 / . 5 -
2400 / . -
- -
-
, -
-
40 1/2 . 24
-
, -
-
, -
3.1 (.). -



. 3.1 -

"send/receive" (/).

"send/receive".

/

"Halftone"

"Light Original".

()

4 :

• G1 - 4 3,85

./ 6 .;

• G2 -

3 .;

• G3 -

1 .,

;

• G4 -

G3,

1)

2) RLE (Run Length Encoding) -

3)

1)

:8 / .

2)

- Normal: 3,85 / ;

- Fine: 7,7 / ;

- Super Fine: 15,4 / ().

3) : 2400 bit/s 4800 bit/s (V.27ter),

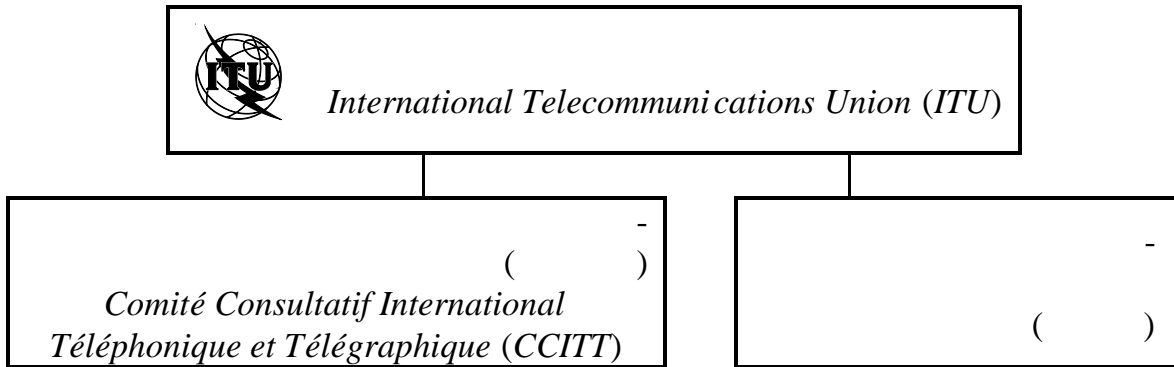
7200 bit/s 9600 bit/s (V.27ter V.29), 12000 bit/s 14400 bit/s (V.17).

/

. , . ,
 . - -
 , , -
 . - -
 . , -
 , . -
 , . -
 . , -
 . - ,
 - . -
 . : 1 2.
 2- ,
 ,
 . ,
 , . ,
 . , -
 . -

4.

4.1.



. 4.1 -

(, ').

300 3400 .

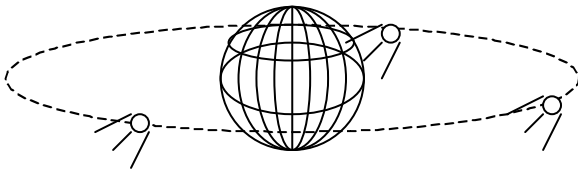
: ISDN (Integrated Services Digital Network) -

ISDN
64 / , D-
16 / .

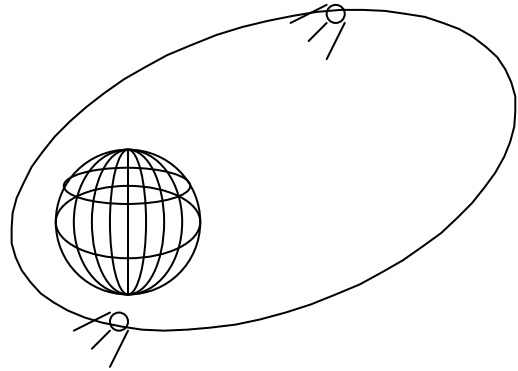
B

128 / .

ISDN - , -
 , , *ISDN* -
 - *xDSL (Digital Sub-*
scriber Line - *xDSL* -
 , *ISDN.* -
xDSL - ADSL (Asymmetric DSL -
). , , -
 , -
 , *ADSL*
 6,144 / , - 640 / (64 /
ADSL -
). () -
 32 / . *ADSL-*
 ,
xDSL - VDSL (Very-high bit rate DSL).
 (1,5) 12,9
 52,8 / , - 1,5 2,3 / . 2 /
xDSL - SDSL (Symmetric DSL)
HDSL (High-rate DSL) - 1,5 / .
 - , , - , -
 , (,), - , -
 .
 , : 2 ... 18 .
 , 200 ... 800 .
 . () -
 ,
 (. 4.2), -
 .



. 4.2 -

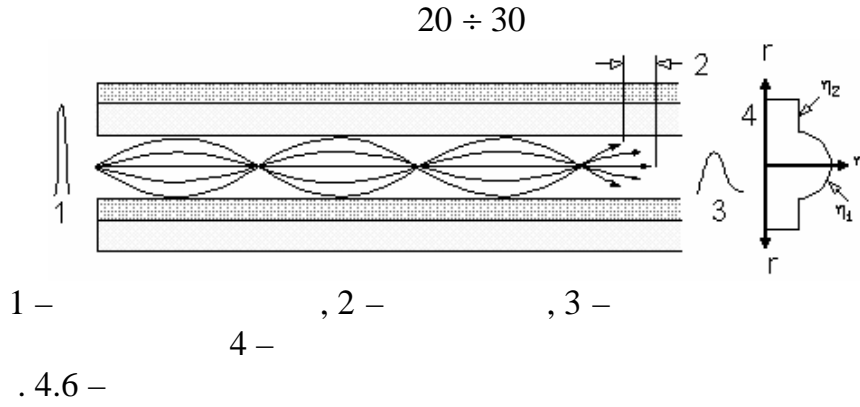


. 4.3 -

4.3.

(1 /)
Internet.

4.4:



4.6.

MM 62.5/125,

62,5

Multi Mode

100

1300

125

8

1300

~ 100

SM 8/125,

S

Single Mode

8

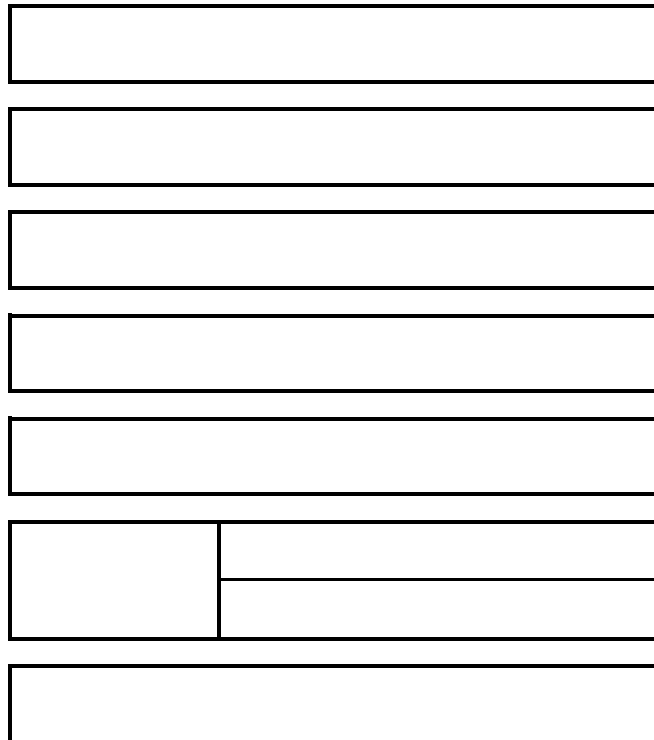
125

5.

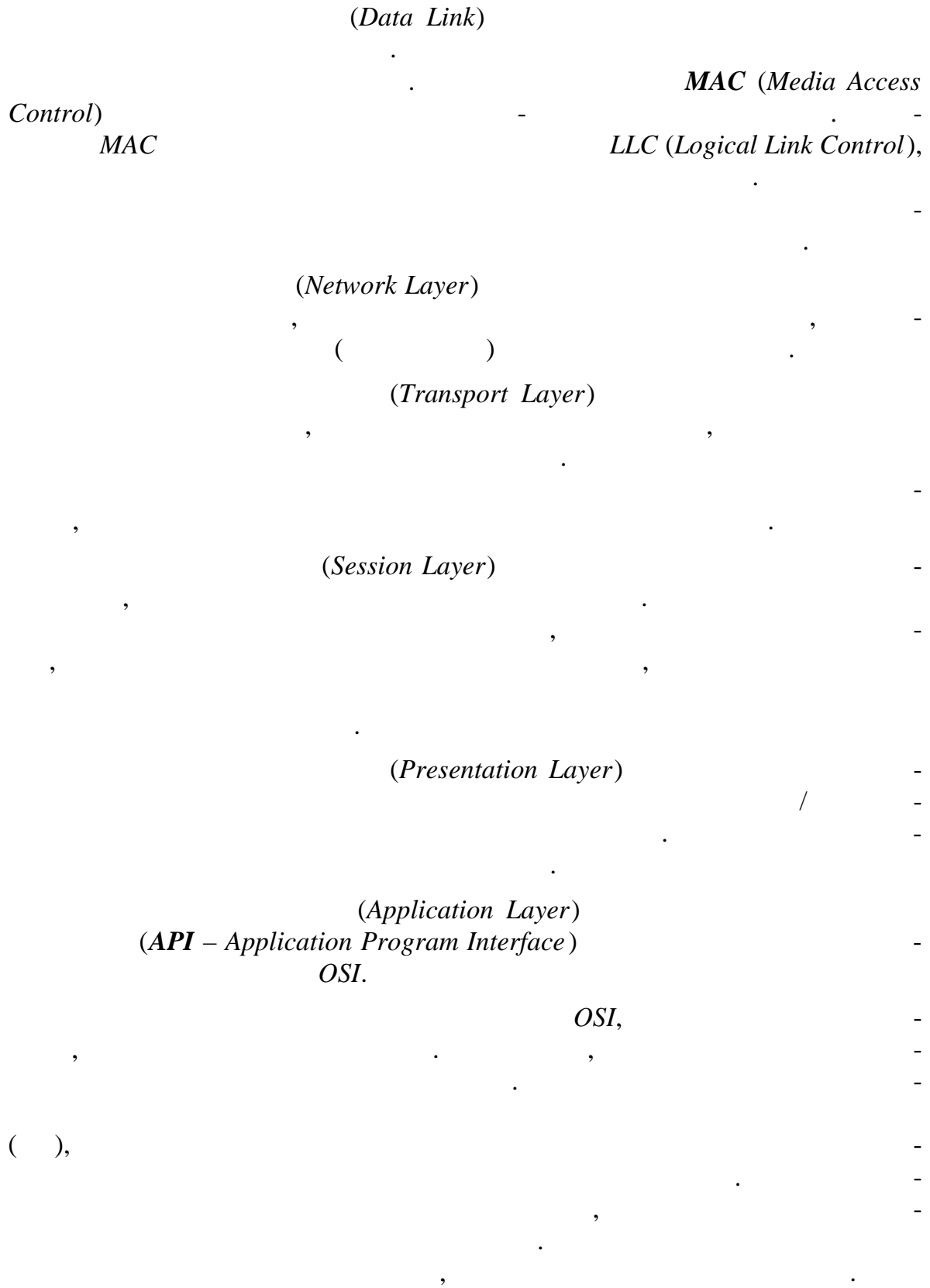
5.1.

ISO (International Standards Organization)
(*Open System Interconnection* – *OSI*).

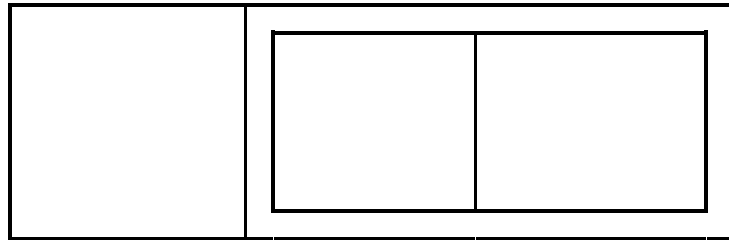
OSI 5.1.



5.1 – *OSI*
(*Physical Layer*)



5.2.



. 5.2 -

OSI-

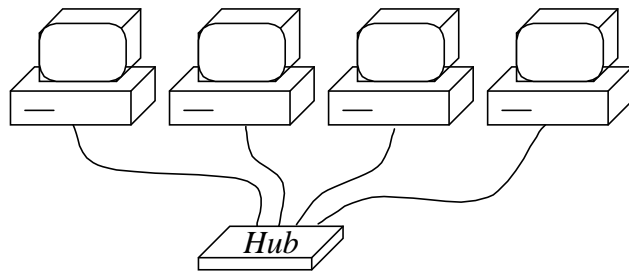
OSI,

5.2.

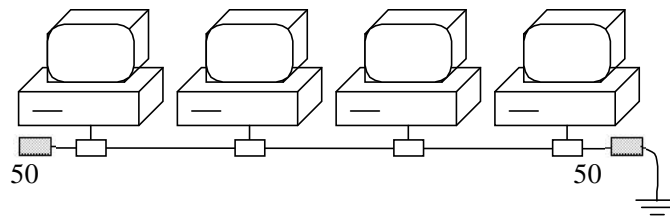
$$R = f \cdot \log_2 N, \quad (5.1)$$

5.3.

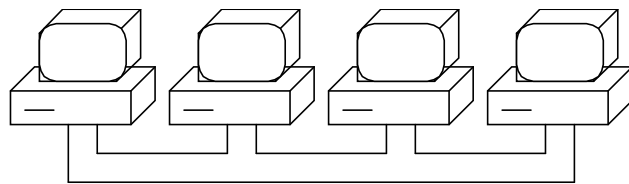
5.3 - 5.5.



. 5.3 -



. 5.4 -



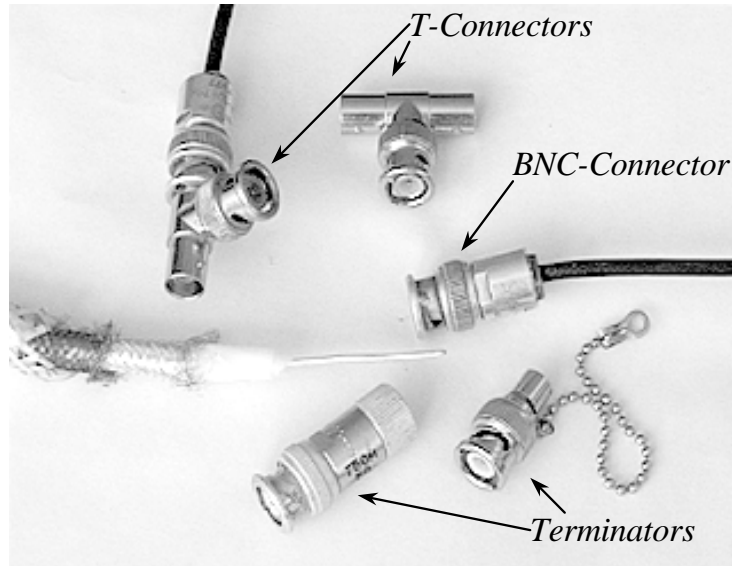
. 5.5 -

(\therefore gateway). : (\therefore router),

5.5,

5.6

BNC (Bayonet Neil Connector)



. 5.6

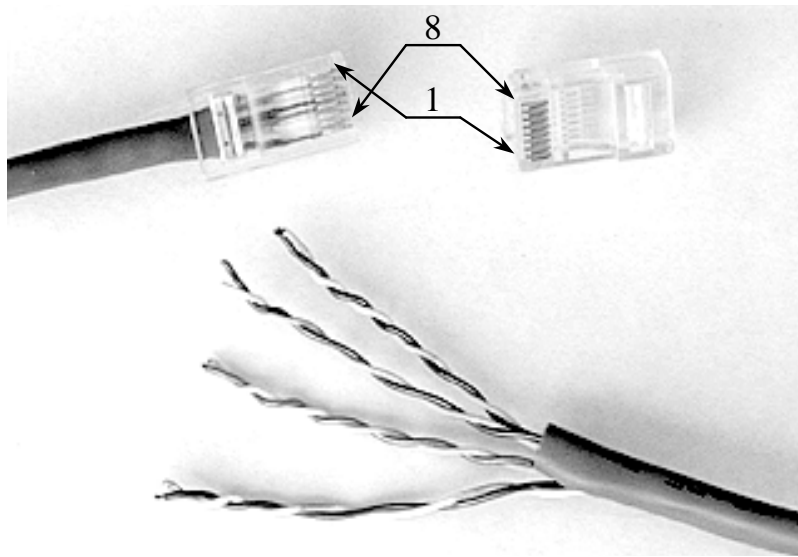
5.4.

50-

~100

, , " , " " .
 , , , 100
 , , ,
 ~ 300 .
 .
 " " " " 5 -
 " Level 5" " Category 5".
 5.7 " "

RJ-45.



.5.7

- RJ-45 :
- 1 - () ;
 - 2 - ;
 - 3 - ;
 - 4 - ;
 - 5 - ;
 - 6 - ;
 - 7 - ;
 - 8 - .

(50).

" - STP
 (Shielded Twist Pair).
 - FTP,
 " - UTP (Unshielded
 Twist Pair). UTP,
 5 -
 10 /
 100 / . ()
 ,)
 (Hub), 5.3. 8
 TP- , BNC- ,
 cross-over TP- ()
).
 10- -" " . switch).
 100- " " (. switch).
 " " TP- , " ".
 MAC- MAC- .
 MAC- - 5.5. " " MAC-
 , " " " " .
 cross-over . ,
 2 ,
 cross-over-
 RJ-45: (1-3, 2-6, 3-1, 4-4, 5-5, 6-2, 7-7, 8-8).
 , , -
 , -
 .
 .
 100 / .
 (,) . -

ATSO=1 –

(: auto-answer mode).

AT- (AT& AT*),

OK,

ATDP,

(: carrier).

()

1) FSK (Frequency Shift Keying) –

300 / .

1070

1270 –

2025 ,

– 2225 .

$$s(t) = A \cdot \sin([\omega + S(t)] \cdot t),$$

$s(t)$ –

, $S(t)$ –

(

) , ω –

, A –

, t –

.

2) PSK (Phase Shift Keying) –

. PSK

: – 2400 ,

– 1200 .

: 0°

00, 90°

01, 180°

10, 270°

11.

$$s(t) = A \cdot \sin(\omega \cdot t + S(t)).$$

3) QAM (Quadrature Amplitude Modulation) –

$$s(t) = S_1(t) \cdot \sin(\omega \cdot t) + S_2(t) \cdot \cos(\omega \cdot t).$$

CCITT. "V". Microcom Networking Protocol (MNP). V- : Microcom

CCITT- V- :
V.21: 300 / . 1964 . V.21-

V.23: 1964 . 1200 / ,
 75 / . ()

V.26: 1968 . 4-
 2400 / , 75 / .

V.26bis: 1972 . V.26, 2-

V.22: 1200 / .
 1980 . 4 -
 600 / - 2-

V.22bis: 2400 / . 1984 . 16-
 QAM. / .

75%

V.32: 9600 / . 1984 .

V.32bis: 14400 / . 32-

V.25bis:

9.2.

V.42:

(8

V.42bis:

LZ-

(arj, pkzip).

V.42bis

V.42bis "

V.42.

V.42,

Internet-

(.: provide -)

V.42bis

MNP-5.

V.34: 28800 / , 1994 . (V.34M: 33600 / , 1995

) 64-, 32-, 16-

. V.34-

150 ÷ 3750

()

MNP-
MNP class 1

MNP 1 ~70%,
 2400 / , 1 690

MNP class 2

MNP 2 ~84%,
 2400 / , 2000 / .

MNP class 3

MNP 3
 ~108%,
 2600 / . 2400 / ,

MNP class 4

bly™ Data Phase Optimization™. – *Adaptive Packet Assem-*
, MNP-

MNP-

(,),

~120%,
 2900 / . 2400 / ,

MNP class 5

~1,6 , 2400 / , *MNP 5* ~200%
 4800

MNP class 6

tion™ Statistical Duplexing™. " – *Universal Link Negotia-*
MNP " *MNP-*
 , *MNP 6*
 " ,

MNP class 7
MNP 4

300%.

MNP class 8
MNP class 9

MNP 7

V.32,

300%.

(upload)

(download)

: KERMIT, XMODEM, YMODEM ZMODEM.

: "
?".

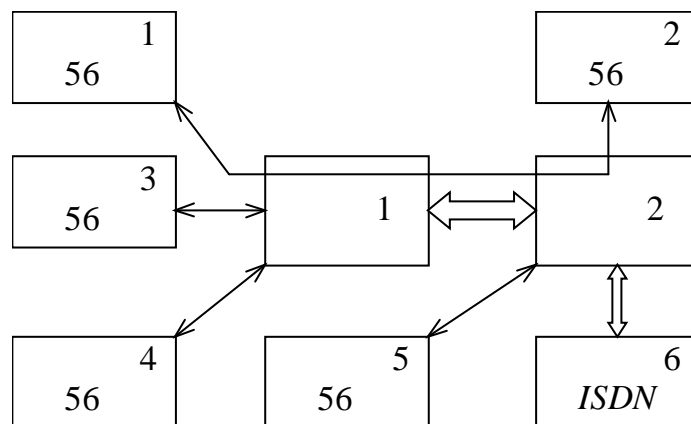
ISDN-
ISDN-
/ .

ISDN-
ISDN- : 64 / 128

: 33600 / . 56 / .

CCITT.

5.8.



. 5.8 -

1)

1 2.

. -56 / . , -
 , ...
 2) 3 6. , -
 256 8 (, -
) 64 / .
 (4 256) (5.1) -
 ~ 32 / . -
 3 6 33600 / . -
 (3) -
 56 / . , -
 ISDN- 6. 6 3 -
 56 / . -
 3) 3 5. 3 5 - -
 33 600 / . -
 4) 3 4. , -
 1 56 / .
 33 600 / .
 ISDN- (5.8) -
 128 / .
 512 / . , -
 , -
 xDSL- .

5.5.

()

Ethernet (IEEE 802.3).

Xerox 1975 .

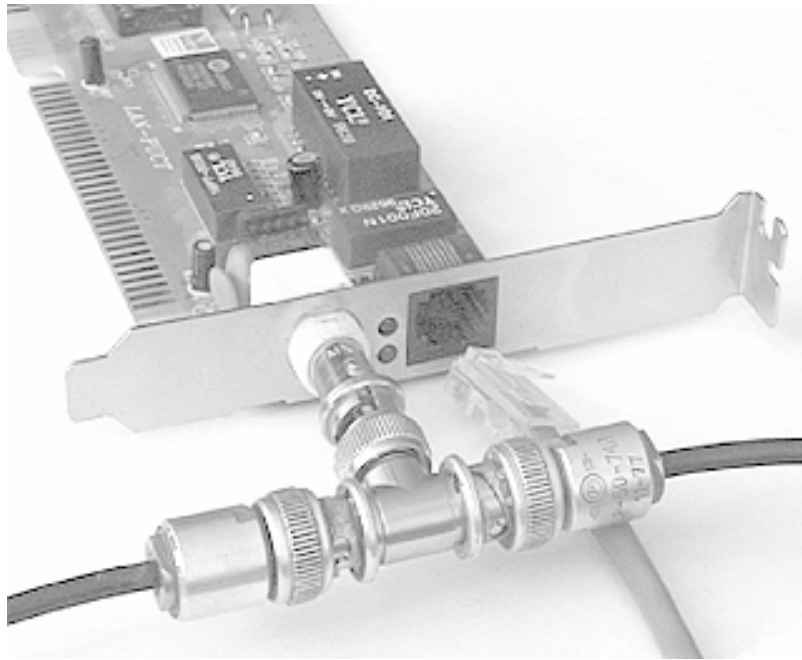
:
(Carrier Sense Multiple Access with Collision Detection -

CSMA/CD). 10 / 100 / .

Ethernet

5.9

Ethernet BNC RJ-45



. 5.9 -

Ethernet

Ethernet,

Ethernet.

(. *collisio* -

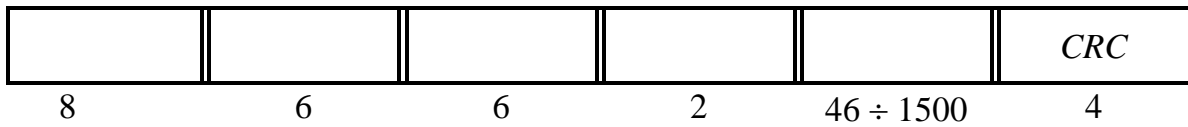
Ethernet

Ethernet

(Hub).

5.10

Ethernet.



5.10 - Ethernet

_____ - 7 10101010, 10101011, -

_____ - MAC- Ethernet,

_____ - MAC- - .

CRC - (Cyclic Redundancy Checksum). -

Ethernet MAC- , -

MAC - -

OSI- . -

CRC. -

(IRQ) -

MAC- .

" "

: " - ?" .

" "

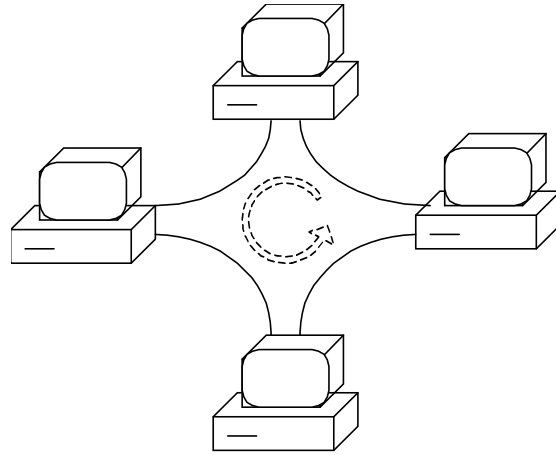
MAC- .

" MAC- () "

MAC-

Token Ring (IEEE 802.5)

4 ÷ 16 / .
5.11,

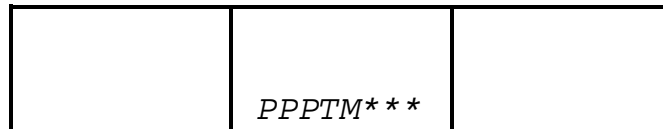


. 5.11

(∴ token).

5.12 5.13

Token Ring.



. 5.12 -

_____ : PPP - , T - , -

5.1 -

	<i>Ethernet</i>	<i>Ethernet</i>	<i>Ethernet TP</i>	<i>Token- Ring</i>	<i>ARCNet</i>
	500	185	100	100	300
-	5	5	5	12 -	.
	2,5	925	500	120	6
-	~ 30	~ 30	~ 30	96	
-	2,5	0,5			0,9
-				45	600

ATM (Asynchronous Transfer Mode -

)

ATM-

ATM-

ATM-

53

25 / *ATM-*

(*UTP*), 155 /

(STP) , 4,8 /

, NetWare Novell Microsoft Network.

Internet,

: "
?"

ODI (Open Datalink

Interface) Novell Apple Computer,
Driver Interface Specification) Microsoft 3Com.

NDIS (Network

5.6.

(,)

— , : , -
— , ; , -
— : ...; , -
— : ; -
— : . -
— : -
— , -

NetBIOS (Network Base Input/Output System)
IBM.

NetBIOS

— (, /
— /);
— ();

TCP/IP

7.

6.

LOCAL AREA NETWORK (LAN)

()

6.1.

(Resource)

(Sharing)

(Server)

(),
();

1.

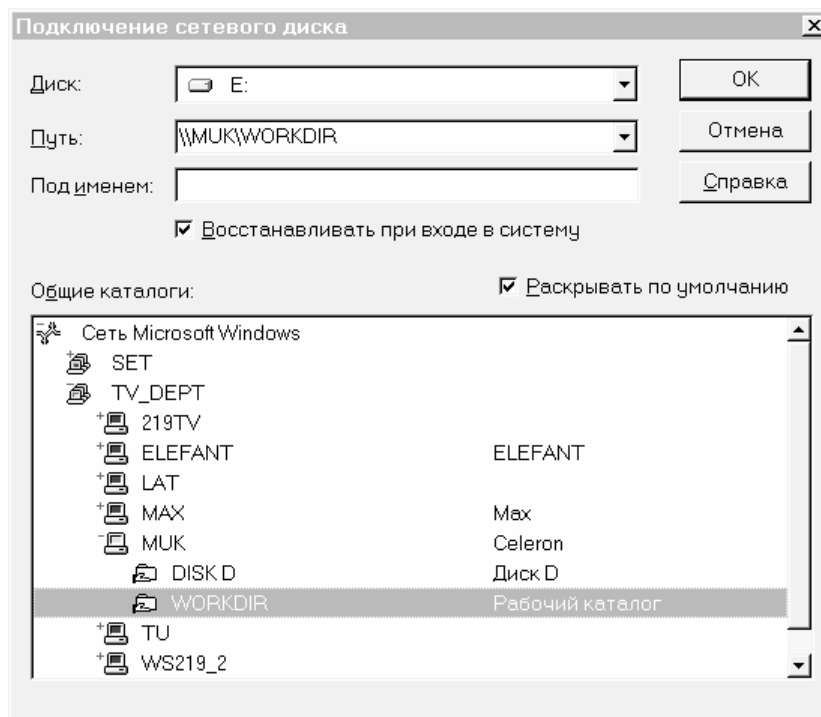
UNC (Uniform Naming Convention)
\\ \ \ \ .

2.

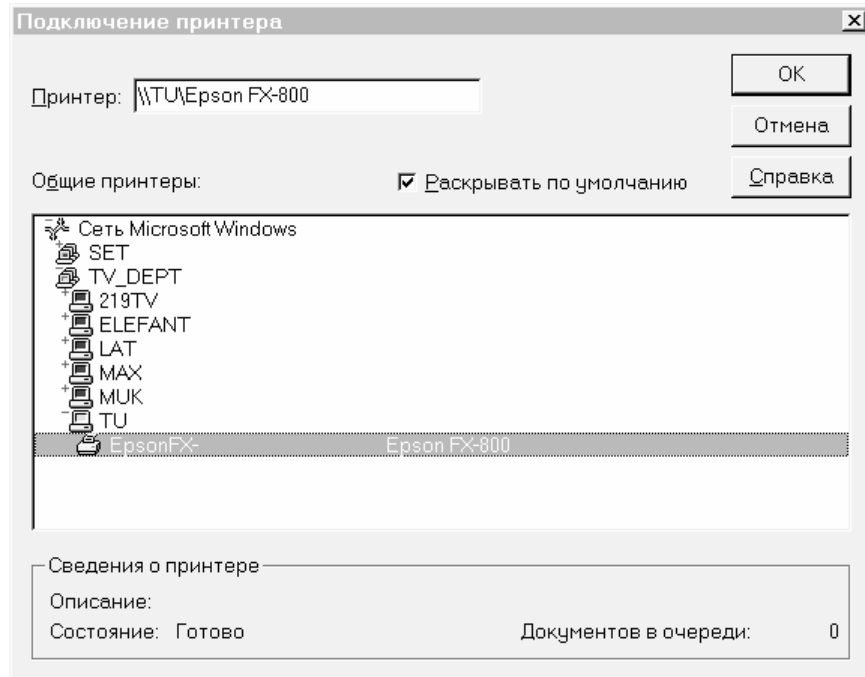
(d:, e:, ...),
(lpt1, lpt2, ...)
(com1, com2, ...).
" " " ",

6.1 6.2

```
net use x: \\computer\resource  
net use lpt3: \\computer\printer,  
x: - , lpt3: -
```



. 6.1 -



. 6.2 -

tion)

redirector.

✓

✓

✓

✓

✓

(*redirec-*

✓

✓

✓

Internet.

- WEB.

6.1

6.1 -

<p>() .</p>	<p>() .</p>
<p>,</p>	<p>Windows (Profiles), - .pwl</p>
<p>(SID - Security Identifier) - SID,</p>	<p>· , - .pwl.</p>
<p>· Novell NetWare; · OS/2 LAN Server; · Windows NT Server, Windows 2000 Server, Windows 2003. · Windows 3.11, 95, 98, NT, 2000, XP ().</p>	<p>· Novell NetWare Lite; · Artisoft LANtastic; · Windows 3.11, 95, 98, 2000, XP. · Windows NT Workstation .</p>

6.2. NetWare

1985
Novell,

- . 80- -

. Novell -

NetWare -

() -

NetWare 90- -

NetWare , -

- TTS (Transactions

Tracking System). " "

? -

, -

- . -

, -

TTS.

NetWare (MS DOS) -

:

• - Execute Only;

• - Shareable;

• , ;

• Transaction Bit - -

(, ,);

• , , ;

•

NetWare

- NDS (NetWare Directory Service). -

NetWare:

• (-

, ,);

- ();
- , :
- ;
- ();
- ;
- ;
- , ();
- ();
- ;

- ().

NetWare.

" " 0456h

(= 0, = -1) " " 0456h.

NetWare
(*NetWare* 4.0), . . .

()

6.3. *Microsoft Windows NT*

Windows NT

().

- . (),

().

() *Windows NT*

, - .

- :

- *API* , -
 ;
 - (, ,
);
 - , ... -
 , .
 . *Windows NT* -
 (,
), .
 , -
 6.2. *Windows NT*
 ,
 (*threads*), . -
 4 ,
Windows 95 - 2 2 , .
 -
 , - , -
 , , ,
 , -
 .
Windows NT - NTFS . -
 (). -
UNICODE. , . -
 (" - ").
 . *NTFS* -
SCSI- -
 , / . *NTFS*
 .
NTFS :
 - ,
 ;
 - *NTFS*;
 - ;
 - (*RAID-*) *hot-*
swap , ;

()
).
Windows NT
Windows NT
 (PDC – Primary Domain Controller).
 (DC – Domain Controller)
 (BDC – Backup Domain Controller)
Windows 2000 2003
 – "Active Directory", . Active Directory
 .
Active Directory
Operation – FSMO (Flexible Single-Master
).
 ()
 .
 – se-
curity accounts manager (SAM) database.
Windows NT , . . .
 , .
 .
Windows NT.
Windows NT
Windows NT ,
 (.: script – ,)
 ,
 ,
 .
API Windows NT:
 – Win32 API / UNC-
 ;
 – WNet
NetWare , UNC,
 ;

- Win32 API . " "

, .

" " " " MS DOS, 16- Windows

- API NetBIOS OS/2;

- API Windows Sockets UNIX Internet;

- Remote Procedure Call (RPC) .

Windows NT Server :
- - (Windows 95 -

, -
);

- ;
- ;

- , (backup server);
- (RAS,

PPP SLIP);

- Internet- (WWW, FTP, Gooper, SMTP ... -
7);

- , .
(Microsoft network browser system)

Windows , :
• (Domain master browser);

• (Master browsers) -
, ;

• (Backup browsers) - ;

• - " " -

, . -

" ' " ' " "

" " " "

(browser list) ()

```

),
(
),
NetBIOS-
• - \0x1b - ;
• - \0x1d - ;
• - \0x1e -
NetBIOS-
- \0x1d.
" "
"
PDC
- Primary Domain Controller.
Internet.
" "
nbtstat, NetBIOS-
C:\>nbtstat -n
NetBIOS
-----
REMOTED <00> UNIQUE
REMOTED <20> UNIQUE
WORKGROUP <00> GROUP
REMOTED <03> UNIQUE
ULW <03> UNIQUE
NetBIOS.
ULW REMOTED,
"WORKGROUP"
" NetBIOS-
POLYN.

```

C:\>nbtstat -a polyn

NetBIOS

```

-----
POLYN          <00>  UNIQUE
WORKGROUP     <00>  GROUP
POLYN          <03>  UNIQUE
POLYN          <20>  UNIQUE
WORKGROUP     <1E>  GROUP
WORKGROUP     <1D>  UNIQUE
..__MSBROWSE__.<01>  GROUP
(MAC) = 00-60-52-02-B2-05

```

POLYN -

6.4. Microsoft Windows

Novell , " " , Microsoft

Microsoft . -

Microsoft

IBM OS/2. Microsoft

soft Windows for Work Groups (Windows 3.11). Windows 3.11, Micro-95

98, NetWare

Windows NT.

Windows 3.11 NetBEUI, -

. Windows 3.11 -

, -

. Windows 3.11 -

4 ÷ 8 , . . -

Windows 95 98 32-IP-

IP-

Internet.

Windows NT NetWare 4.0 -

. Windows 95, -

98 " " , -

7.

WIDE AREA NETWORK (WAN)

7.1. IP

IP (Internet Protocol)

ARPA (Advanced Research Project Agency)

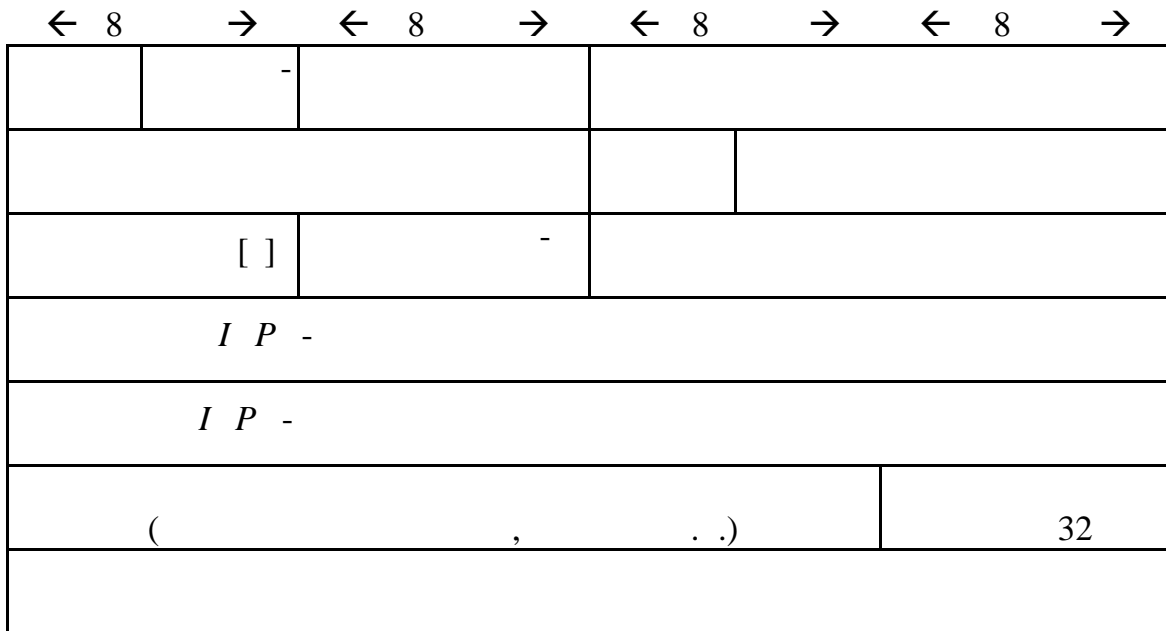
RFC-791. RFC (Request for

Comments) -

Internet Activities Board (IAB).

IP 4

7.1.



. 7.1 - IP-

" " 3 , :

/ / " " : -

" " (Time to Live - TTL) , TTL -

Internet. TTL

IP- IP-

Internet.

" "

7.1, IP-

32-

IP-

5

IP-

7.2.

A	1-126	
B	128-191.xxx -	
C	192-223.xxx.xxx -	
D	224-239	
E	240-247	

. 7.2 - IP-

A		16 777 214	-
B	65534	C	254 -
D			-
E	IP-		-

CIDR (Classless Inter-Domain Routing).

CIDR-

- 32-

1,

0.

1

IP-

IP-

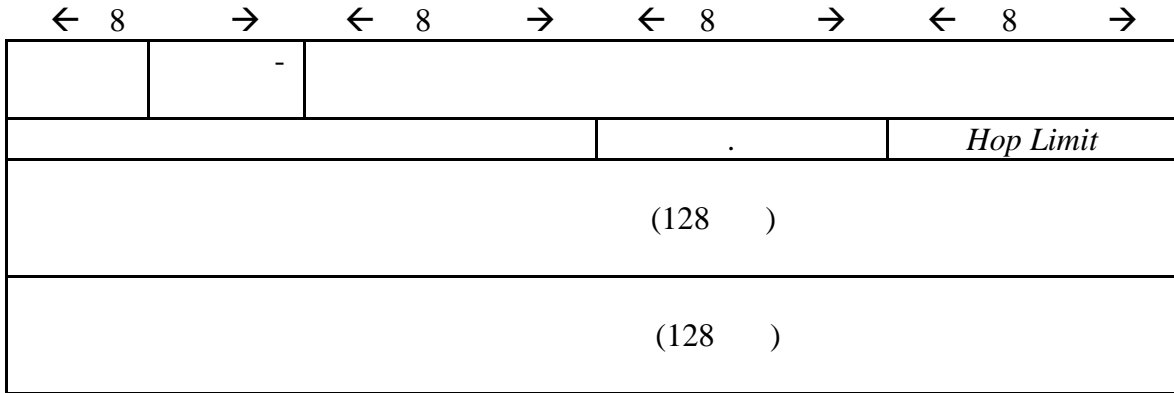
7.3.

" "

IP-

" " IP-

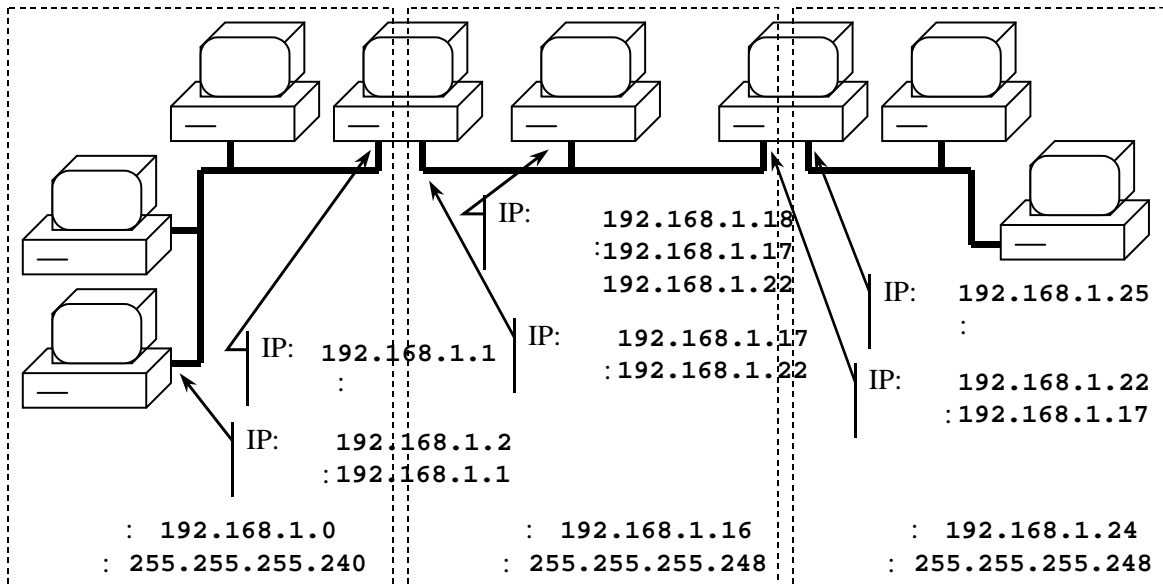
14 . , " " .
 , " " .
 IP- 1995
 IP- 6, RFC 1884, 1885.
 IP-
 IP- 7.4. IP-



7.4 - IP- 6
 () 128 -
 128 , ($2^{128} \approx 10^{38}$). : -
 " , " , $\sim 10^{39}$.
 / .
TTL *Hop Limit*,
Internet
TTL 1. , -
TTL *Hop Limit*

7.2. IP-
 (\therefore routing) -
 , -
 (. router).
 IP -
 , IP-

IP-
 Ethernet.
 Ethernet:
 7.5
 IP-
 IP-



.7.5 - IP-
 IP
 5.2. IP- Ethernet.
 MAC- IP- ARP
 Ethernet. IP- ARP- IP- MAC- IP-
 ARP- IP- MAC- IP-
 ARP- IP-

Ethernet- , *ARP* -
 : " *IP-* ?"
 , *Ethernet-* *MAC-* -
 , *IP-* ,
Ethernet- *MAC-* . -
ARP, , *ARP-*
 . *ARP-*
 , *ARP-*

```

C:\>arp -a
      : 192.168.24.1 on Interface 2
      IP
192.168.24.2          00-60-52-02-b2-05
  
```

. *IP-* , *IP-* -
 7.5. *IP:*192.168.1.2 -
*IP:*192.168.1.18. *IP* " "

$$(192.168.1.18) \& (255.255.255.240) = 192.168.1.16$$

Ethernet *MAC-* .
IP- (192.168.1.1), -
 192.168.1.18. -
 192.168.1.18, .
 , *IP-* -

7.1 -

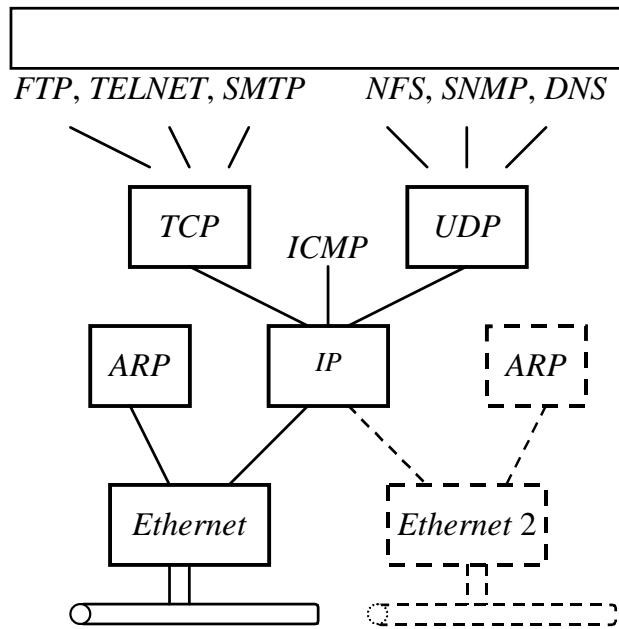
	-		-
192.168.1.0			1
192.168.1.16			2
192.168.1.24		192.168.1.22	2

" MAC- " ?", "

7.3. , IP

IP-

7.6.



.7.6 -

UDP (User Datagram Protocol) -

IP- , -

UDP , IP- . -

(. 7.1.) *UDP-* -

. *UDP-* , -

IP- , 192.168.0.1:161 -

SNMP- 192.168.0.1 *UDP-* 161, -

UDP , -

. *UDP* , -

IP. , -

, , -

TCP (Transmission Control Protocol) –

. TCP
 " – TCP- ,
 ,
 TCP- . , 192.168.0.1:21 , UDP,
 TCP- 21,
 FTP- .

ICMP (Internet Control Message Protocol) –

. ICMP ping.exe tracert.exe,
 7.4.

DNS (Domain Name System) –

IP- .
 IP- .
 Internet ,
 . : www.tomsk.ru 213.59.238.14.
 Internet ,
 , , , (), .
 , .
 ".com",
 ".org", ".edu", ".gov".
 : ".su", ".ru",
 ".uk", ".de", ".it" .. ,

. DNS DNS-

, DNS- , DNS. DNS-

Internet

IP-

– Internet.

DNS.

RIP (Routing Information Protocol) –

. RIP ver.1
 (distance vector protocol): RIP- 30

" " , (,
) . RIP-

() -

16, *RIP* 17

16, *RIP-* *RIP* -

RIP -

1988, *RIP*, *Cisco* -

IGRP (Internet Gateway Routing Protocol).

EIGRP (Extended IGRP),

(*multipath*), *EIGRP* -

Cisco. *Cisco* -

Cisco, -

- *SLIP (Serial Line Internet Protocol)* - *UNIX*. -
- *PPP (Point to Point Protocol)* - -

IPX. *Windows NT 4.0* *PPP* - *TCP/IP, NetBEUI,*
to Point Tunneling Protocol, *PPTP (Point*
PPTP -

Windows 2000
 - *L2TP (Level 2 Tunneling Protocol)*, -

- *IPSec (IP Se-*
curity). *PPP, PPTP L2TP* -

RAS (Remote Access Service), -

RAS - *RRAS (Routing*

and Remote Access Service),
IP- . RAS RRAS
Internet,

- **GPRS** (*General Packet Radio Service*)
Internet.

UUCP (*UNIX to UNIX Copy Protocol*) –
UNIX-

FTP (*File Transfer Protocol*)

FTP- , FTP- . FTP-
IP- . FTP-
FTP-
Internet.

FTP- . ()
FTP-

TELNET

TCP-

TCP-

TELNET,

SMTP- (25)

TELNET

UNIX-

TELNET

TELNET

Gopher **WAIS** (*Wide-Area Information Server*).

NFS (*Network File System*) –

Sun Microsystems, UNIX.

SNMP – *Simple Network Management Protocol*.

DHCP – *Dynamic Host Computer Configuration Protocol*.

: IP-

WINS – *Windows Internet Names Server*.

NetBIOS-

IP-

DNS,

IP-

. WINS
 , DNS
NBT (NetBIOS over TCP/IP) – NetBIOS- IP-
 WINS, . -
 , .
 , IP- -
 , IP- -
 , IP- -
7.4. IP- Windows
 - IP- -
 IP- **ipconfig**
winipcfg (Windows 9x). :
 C:\>ipconfig
 IP Windows NT
 Ethernet E9303:
 IP : 192.168.24.1
 : 255.255.255.248
 :
 PPP NdisWan4:
 IP : 213.210.75.248
 : 255.255.255.0
 : 213.210.75.248
 , -
DHCP- Ethernet . ipconfig -
 , IP- . -
 , IP- -
 , IP- IP- -
 , . PPP- ipconfig /all, -
 .
DNS- . , -

ping (*.: Ping-Pong -*) -

```

C:\>ping 217.18.130.30
          217.18.130.30    32    :
217.18.130.30:           =32    =140  TTL=62
217.18.130.30:           =32    =131  TTL=62
217.18.130.30:           =32    =130  TTL=62
217.18.130.30:           =32    =120  TTL=62

```

NetBIOS- . *-t,* *: IP-* , *DNS-* -

NetBIOS- , *DNS* *DNS-* -

tracert (*.: Trace Routing*) -

```

C:\>tracert www.tusur.ru
          www.tusur.ru [212.192.163.22]
          30:
 1  *    131    *    astigris.tomsknet.ru [217.18.129.45]
 2 130   130   130   peering-sibptus.tomsknet.ru [217.18.130.222]
 3 120   130   130   346-tgu.trecom.tomsk.ru [213.183.111.225]
 4 130   130   131   tsu-gw-c3745-100Mbit.tsc.ru [212.192.126.122]
 5 130   131   130   backbone-GW-100Mbit.tsc.ru [212.192.126.125]
 6 130   131   130   su.tsc.ru [212.192.126.17]
 7 131   120   120   tusur.city.tsu.ru [212.192.100.147]
 8 141   140   140   www.tusur.ru [212.192.163.22]

```

tracert.exe , -
ICMP (Internet Control Message Protocol)
TTL IP- . TTL (Time to Live)
TTL = 1 " " -
, TTL = 2 - . . , -
tracert.exe. -
ICMP- . -

route

IP- . :

C:\>route print

```

=====
0x1 ..... MS TCP Loopback interface
0x2 ...00 80 ad c8 02 ab ..... Novell 2000 Adapter.
0x3 ...00 01 70 c6 5e 80 ..... NdisWan Adapter
=====
:
      0.0.0.0          0.0.0.0 213.210.75.193 213.210.75.193 1
      127.0.0.0        255.0.0.0   127.0.0.1   127.0.0.1 1
      192.168.24.0     255.255.255.248 192.168.24.1 192.168.24.1 2
      192.168.24.1     255.255.255.255   127.0.0.1   127.0.0.1 1
      192.168.24.255   255.255.255.255   192.168.24.1 192.168.24.1 1
      213.210.75.0     255.255.255.0   213.210.75.193 213.210.75.193 1
      213.210.75.193   255.255.255.255   127.0.0.1   127.0.0.1 1
      213.210.75.255   255.255.255.255   213.210.75.193 213.210.75.193 1
      224.0.0.0         224.0.0.0   192.168.24.1 192.168.24.1 1
      224.0.0.0         224.0.0.0   213.210.75.193 213.210.75.193 1
      255.255.255.255   255.255.255.255   192.168.24.1 192.168.24.1 1
=====

```

```

IP:192.168.24.1,      255.255.255.248
      IP:213.210.75.193      255.255.255.0. -
      0.0.0.0      ,      , -
      ,      ,      213.210.75.193. ,
      .      2
      ,      , -
      :

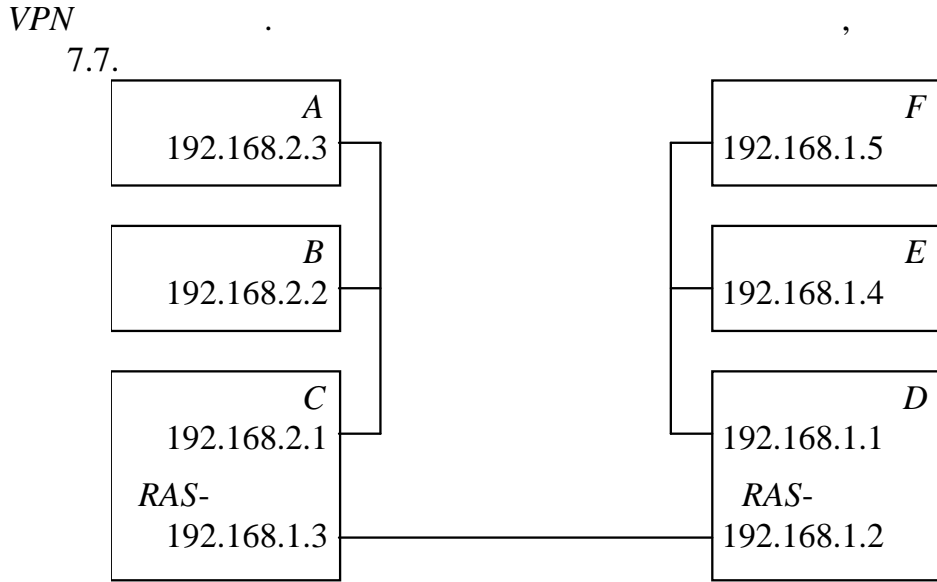
```

C:\>route print

```

=====
0x1 ..... MS TCP Loopback interface
0x2 ...00 80 ad c8 02 ab ..... Novell 2000 Adapter.
0x3 ...00 00 00 00 00 00 ..... NdisWan Adapter
=====
:
      127.0.0.0        255.0.0.0   127.0.0.1   127.0.0.1 1
      192.168.24.0     255.255.255.248 192.168.24.1 192.168.24.1 1
      192.168.24.1     255.255.255.255   127.0.0.1   127.0.0.1 1
      192.168.24.255   255.255.255.255   192.168.24.1 192.168.24.1 1
      224.0.0.0         224.0.0.0   192.168.24.1 192.168.24.1 1
      255.255.255.255   255.255.255.255   192.168.24.1 192.168.24.1 1
=====

```



.7.7 -

D

D

RAS

RAS

TCP/IP.

TCP/IP

192.168.1.3.

PPP,

RAS,

IP-

, ...

192.168.1.3,

RAS

IP-

0

DWORD DisableOtherSrcPackets

HKey_Local_Machine\System\CurrentControlSet\Services\Ras

Arp\Parameters.

:

D

192.168.2.0

D

:

route add 192.168.2.0 mask 255.255.255.0 192.168.1.3 if 3,

:

192.168.2.0

255.255.255.0

192.168.1.3

3".

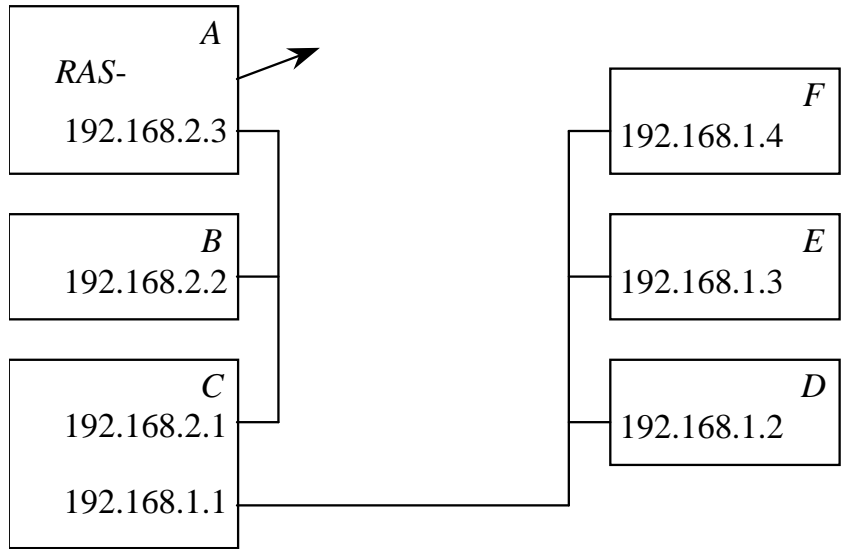
()

route print.

192.168.1.0

192.168.2.0

" " , Windows 2003 -
 .
 VPN- -
 , ... -
 . ,
 - IP- , RAS- -
 - RAS- IP- -
 , , -
 , A , 7.8, -
 ,
 D, E, F .



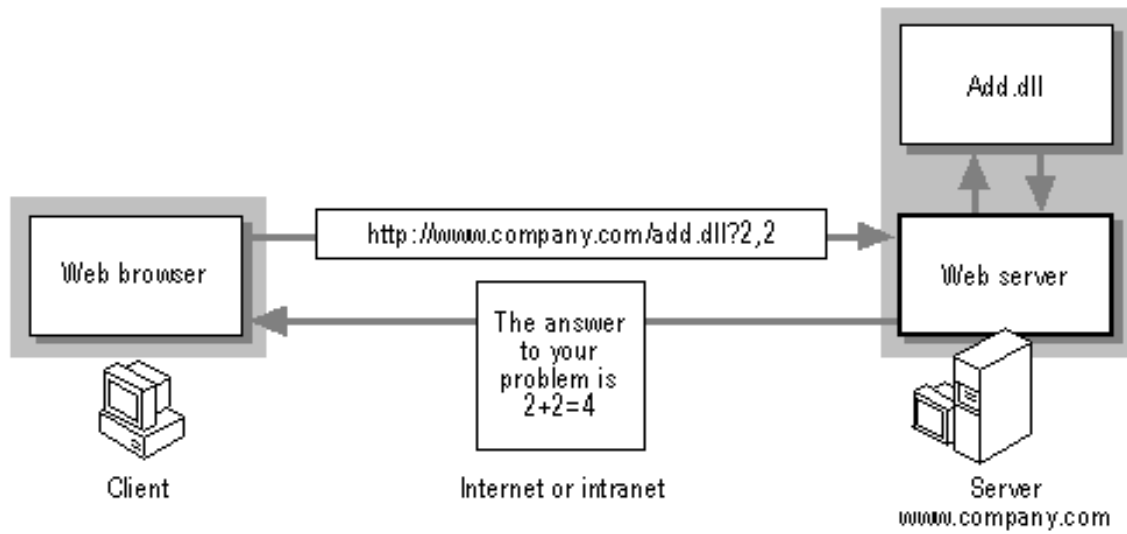
. 7.8 -
 A B 192.168.2.1 -
 D, E F.
 IP- .
 , ... ,
 . ,
 D, ,
 , A , ...
 , A 192.168.1.0 ,
 , C, A -

```
route -p add 192.168.1.0 mask 255.255.255.0 192.168.2.1 ,  

-p (      .: permanent -      ) -
```

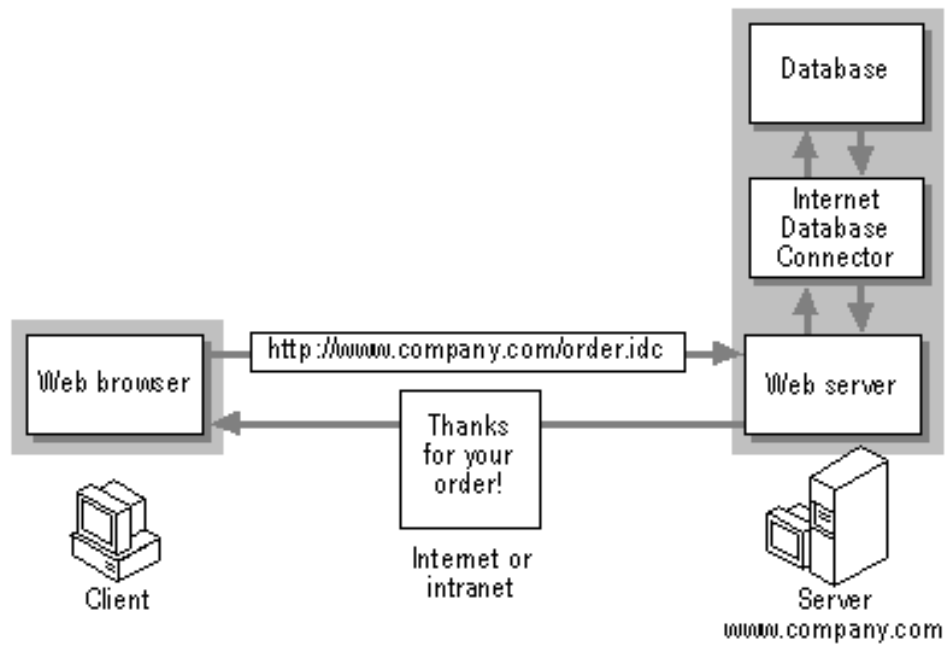
7.5. Internet

Internet , -
1969 , -
ARPANET, .
1972 ARPANET 50 -
1973 , . -
ARPANET . -
Internet. 1983 -
TCP/IP, Military Standards (MIL STD), . . -
, , , -
DARPA -
Berkley Software Design - TCP/IP
Berkeley (BSD) UNIX. UNIX TCP/IP. -
Internet 1990 , RELCOM -
Internet - EUnet. -
" Internet -
" (World Wide Web - WWW) - -
Internet . 1992 -
, -
Mosaic UNIX. (. browser - Web-)
, - , - -
Web Internet, -
,
World Wide Web Consortium
(W3C) HTML (Hypertext
Markup Language). HTML-
HTTP (Hypertext Transfer Protocol). HTML- -
Internet
URI (Universal Resource Identifier).



. 7.10 -

HTML-



. 7.11 -

HTML-

HTML-

HTML

Web-

: CGI, JAVA, PERL.

Web-

, Web-
Internet

, Web-
Web-

SMTP- NNTP-

Web-

Web-

Internet-

Web-

,
Internet

Web-

World Wide Web.

(general portals)
(niche portals).

- AOL, CNN, Yahoo,

MSN, Lycos Excite,

- Rambler, ndex, Aport, Port.Ru, List.Ru

eStart,

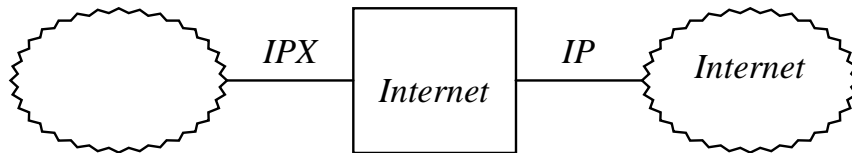
7.6.

Internet

Internet,

Internet

7.12



. 7.12 -

IPX

Internet

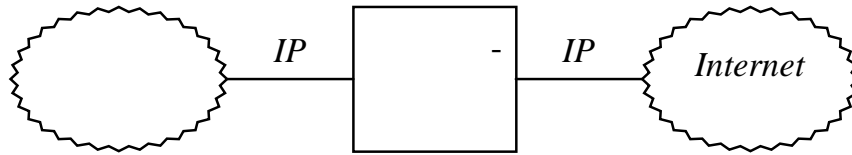
IP,

Internet.

Internet.

Internet.

7.13.



. 7.13

IP-

IP-
Internet

Internet.

IP-

(firewall,

UDP
/

TCP

IP-

TCP UDP

- FTP, HTTP, SMTP, POP3

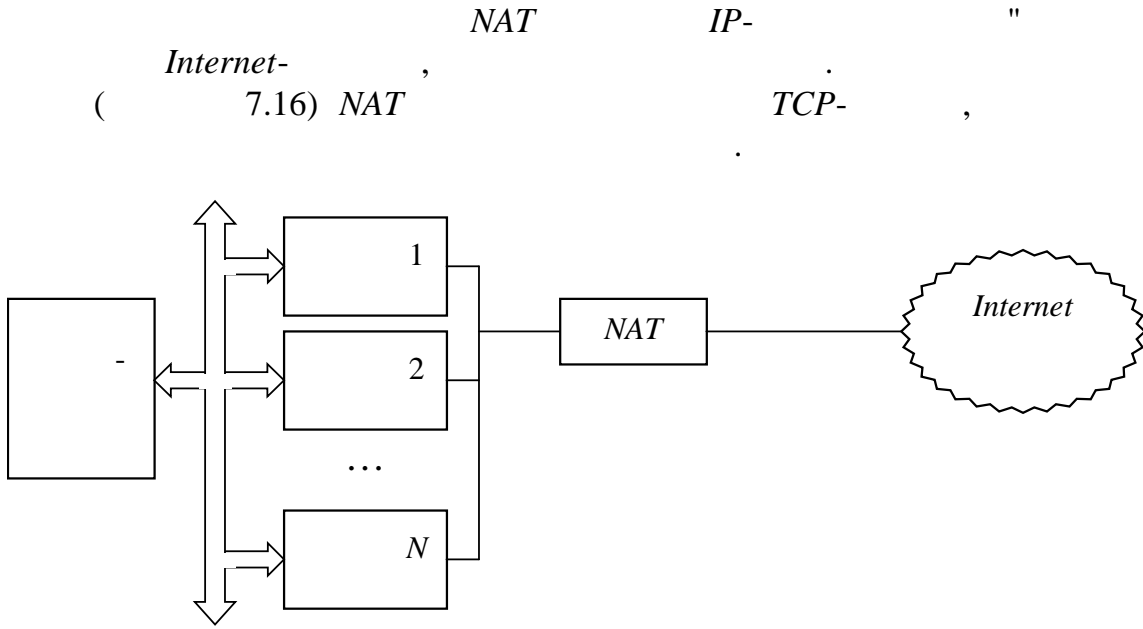
JavaScript VBScript,

HTTP-
- ActiveX, Java,

Internet.

IP-

IP- - , . " " *IP-*
IP- .
Internet. *Internet* -
 , *NAT* *VPN.* , -
Internet " -
 " *Internet* , -
 " " . -
net, ? ? *Inter-*
 ? *TCP.* - *Internet,* -
TCP- -
 , *Internet* . *UDP* -
 , *UDP* *UDP-Mapping* -
 - , *Internet.* *UDP-* -
UDP-Mapping, *Internet* ,
 - - *Internet* .
 " " , -
Internet. (
 1 3), -
Internet .
HTTP *FTP* . -
 , - , -
 , *NAT,* -
 , *VPN-* , -
 , - - -



. 7.16 -

TCP-

, Internet-
TCP-
,
, Internet-
www.rambler.ru,
. NAT
- TCP-
(
)
-
-

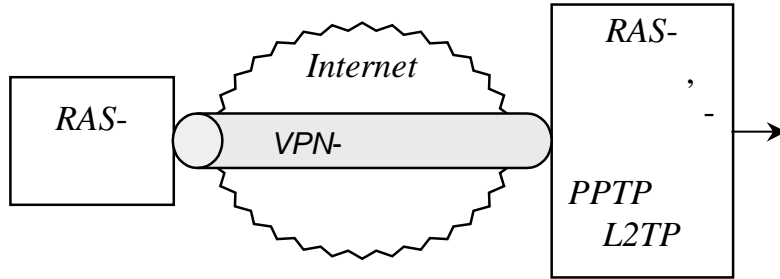
- VPN (Virtual Private Network),

VPN-
,
-
VPN-

: VPN- VPN- VPN

7.17

?



. 7.17 -

VPN-
PPTP L2TP,
IP, IPX NetBEUI

VPN-

Internet,
Internet,

VPN-

VPN-

Internet.

7.7.

1. " (GLASNET).
 (APC). APC
 RELCOM 15-20%
 RELCOM,
 :
 , , , , " , " ,
 " , "Compnet".
2. ().
 / , , ,
 , , . .
 MaxLink.
3. SprintNet.
 Sprint International () "
 (). +
 + =>
 .
4. " ,
 (), " " (), " " (), " -
 -2" ().
5. FidoNet.
 ,
 .
 FidoNet Internet.
 Internet
 FidoNet.

8.

8.1.

NetWare
 "send",
 , , ,
 Ctrl+Enter. NetWare
 , , ,
 Windows NT
 "net send", , ,
 , , ,
 Windows NT OK, : "Alerter"
 "Messenger". , "Net Logon"
 , ,
 " Windows 95 98 Windows NT
 Server,
 on-line " " (chat). " "
 UNIX IRC (Internet Relay Chat),
 IRC - IRC- , IRC-
 IRC- , IRC-
 , IRC
 DCC (Direct Client Connection),
 Web- Internet ,
 , ,
 , ,

Web- ,
 - " ",
Internet ICQ ("I seek you").
ICQ ICQ,
UIN (Universal Internet
Number). Internet ICQ.
Internet ICQ, -
UIN on-line. -
ICQ. ICQ -
UIN, on-line. -
Internet, Internet -
 (1,5 - 2) ,
 , ICQ -

8.2.

- . CCITT 1984 1988 . :
- X.400 ;
 - X.401 ;
 - X.410
- OSI;
- X.411 .

X.400 :

C=RU;ADMD=EDU;PRMD=Organization;O=Site;SN=Petrov;FN=Ivan

C - , ADMD - (-
 , PRMD -
 (), O - , SN - -
 , FN - . X.400 -
 X.400 .
 X.500 .
 Mail, Internet RFC 821 822. Internet-
 Internet .
 1) :
 , CC:Mail, Microsoft Mail, GroupWise.
 Internet- : Pegasus Mail
 NetWare UUPC. -
 , .
 , .
 , , , -
 , .
 () , -
 . - ,
 .
 , -
 2) " - ".
 ,
 , , , -
 , -
 - .
 , -

- Workflow- . Workflow-

Lotus Notes, Stafware, Action Workflow.

8.3. Internet

(Simple Mail Transfer Protocol).

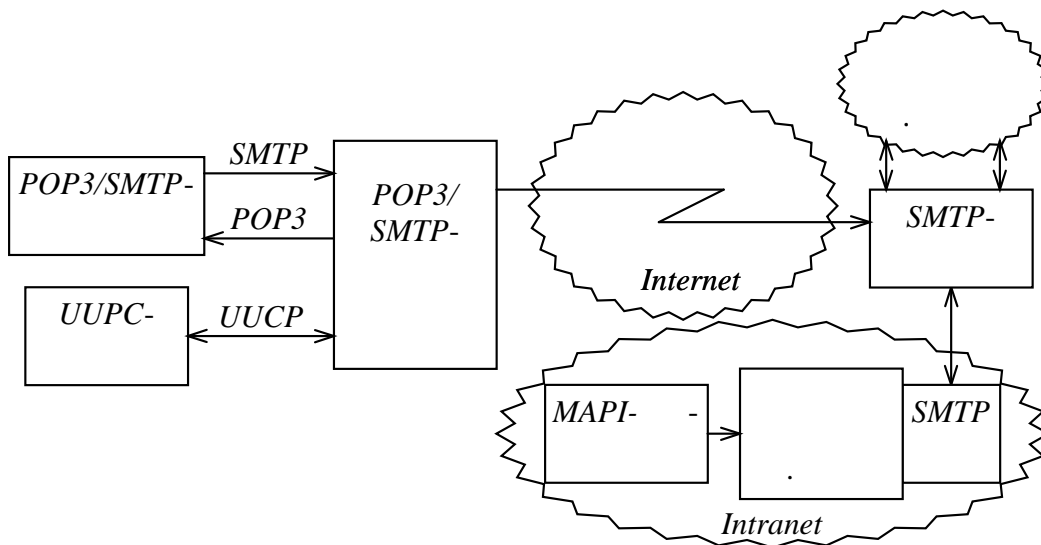
- SMTP-

Internet

SMTP

SMTP-
SMTP-

8.1.



. 8.1

, SMTP-

SMTP.

Microsoft Exchange

Server SMTP-, NNTP-, POP3-, X.400/500-

POP3 (Post Office Protocol 3). POP3

Protocol). POP3 - IMAP (Internet Message Access Protocol), IMAP

DOS- UUPC - Windows). MS DOS (

UUPC UUCP SMTP-

Internet, SMTP-

Web- HTML-

Internet :
"@", :
_N. _2. _1

DNS- SMTP- SMTP-
SMTP-

- " " IP- (192.168.xxx.xxx),
SMTP- . , -
- 1) , ,
SMTP- , -
- 2) , ,
SMTP- , -
- 3) SMTP- ,
DNS) TCP- 25 (IP- - (-
SMTP- SMTP-).
DNS, ,
25
- 4) ,
SMTP- ,
SMTP- ,
SMTP- ,
- 5) SMTP- ,
RFC 822, ,
SMTP- ,

Received: from localhost by tiasur.tomsk.su id TAA08668;
 (8.6.4/IDA-8.5) Wed, 2 Feb 1994 19:05:21 +0700;
 Received: by altserv.altai.su; Wed, 2 Feb 94 14:04:46 +0300
 Received: by sovcom.kiae.su; Wed, 2 Feb 94 13:47:38 +0300
 Received: from cerc.wvu.edu (cathedral.cerc.wvu.edu) by
 sovcom.kiae.su with SMTP id AA11361; Wed, 2 Feb 1994 13:37:12
 +0300
 Received: from hampshire (hampshire.cerc.wvu.edu) by cerc.wvu.edu
 (4.1/SMI-4.0:RAL-041790)id AA23495; Tue, 1 Feb 94 19:15:31 EST
 From: sobol@cerc.wvu.edu (Michael Sobolewski)
 Subject: CERA'94 Paper Format
 To: naeger@ira.uka.de, melt@ctc.com, mklein@atc.boeing.com,
 p.w.h.chung@lut.ac.uk, gssh@tiasur.tomsk.su
 Date: Tue, 1 Feb 1994 19:14:56 -0500 (EST)
 X-Mailer: ELM [version 2.4 PL21]
 Content-Type: text/plain; charset=US-ASCII
 Content-Transfer-Encoding: 7bit
 Content-Length: 7011
 Return-Receipt-To: sobol@cerc.wvu.edu

"From:" -
 . "From:" -
 . "Subject:" .
 "To:" , -
 . "Return-Receipt-To:" -
 . , -
 . "Received:", ,
 . , -
 .
 : *UUENCODE (UNIX to UNIX Encode), MIME (Multipurpose Internet Mail
 Extension)* . , ,
UUENCODE,

```
begin 666 config.sys
M1$5624-%/4,Z7%=)3D1/5U-<2$E-14TN4UE3#0ID979I8V4]8SI<=VEN9&]W
M<UQE;6TS.#8N97AE(&YO96US#0ID;W,]:&EG:"QU;6(-"D1%5DE#16AI9V@]
MOSI<0T123TU$4E9<4$%.+4E$12Y365,@+T0Z2$%234].60T*1DE,15,]-C`-
M"DYU;6QO8VL]3V9F#0I"<F5A:SU/;@T*9&5V:6-E:&EG:#U#.EQ724Y$3U=3
M7$-/34U!3D1<9&ES<&QA>2YS>7,@8V]N/2AE9V$L+#$I#0I#;W5N=')Y/3`P
M-RPX-C8L0SI<5TE.1$]74UQ#3TU-04Y$7&-O=6YT<GDN<WES#0I$159)0T5(
K24=(/4,Z7%=)3D1/5U-<0T]-34%.1%Q$4E934$%#12Y365,@+TU/5D4-"D5(
end
```

Internet.

- *HTML-*
-
- (*:: forwarding*)
-
-
-
-

email – UCE, or spam). (*:: unsolicited commercial*

SMTP- . *SMTP-* *SMTP-*

1999 *IETC* *RFC-2505 "Anti-Spam Recommendations for SMTP MTAs"*.

(*:: inbound*), *SMTP-* (*:: outbound*). *SMTP-*

IP-

8.4.

(Usenet, NNTP (Network News Transfer Protocol) Usenet.

30 000 Usenet off-line. Usenet,

"To:" , sci.image.procesing. NNTP Web-

"Distribution:", : world, eunet, su, russia, (: moderated).

(),

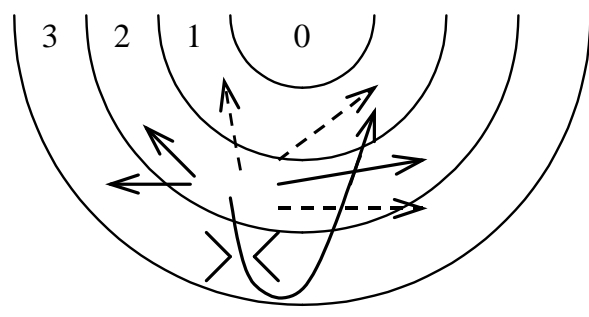
-
-
-
-
-
-
-
-
-

, , - , -
.
:
;
/
;
back doors;
- ;
;
;
IP- , ,
TCP- ;
DoS (Deny of Service -).
DoS-

9.2.

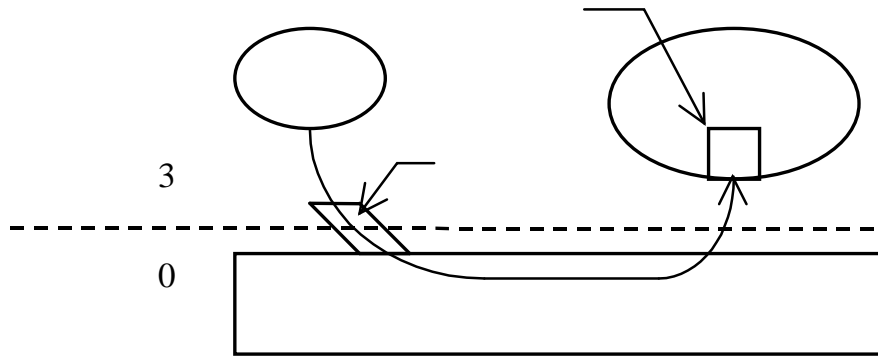
, *Intel* , -

9.1



.9.1 -

, -
 -
 . , () . , ,
 , . , ,
 . , -
 , -
 , -
 " " . , " -
 " , , " -
Flat- , . , -
 , -
 , -
 , -
 . , -
 , -
 , -
 : -
 , -
 , -
 " - " . () , -
 () . 3 , -
 , -
 : 3 0 ,
 0 3 3 . ,



.9.2 -

Windows NT

proxy-

7.6.

POP3;

- TELNET, FTP,

" "
Kerberos . . .

SSL, S-HTTP,

90-

- *IDS (Intrusion Detection Systems)*. *IDS*,

,

,

IDS

IDS

TCP-

,

.

,

.

,

,

, *IDS*

-

,

,

.

,

,

,

"

"

,

.

9.3.

(*∴ kryptos* - *grapho* -) -

F,

$$\{x_1, x_2, \dots\} = \vec{x}$$

$$, \{k_1, k_2, \dots\} = \vec{k}$$

,

$$\{y_1, y_2, \dots\} = \vec{y}$$

$$\vec{y} = F(\vec{x}, \vec{k}). \tag{9.1}$$

$$\vec{x} = F^{-1}(\vec{y}, \vec{k}'). \tag{9.2}$$

F

:

1.

$$\vec{k} .$$

\vec{x}

2.

\vec{y} ,

\vec{x}
 \vec{k}' .

128- 10^{21} F, F^{-1} \bar{y} $F F^{-1}$

$$\vec{y} = F(\vec{x}, \vec{k}), \quad \vec{x} = F(\vec{y}, \vec{k}) \quad \vec{x} = F(F(\vec{x}, \vec{k}), \vec{k}).$$

N

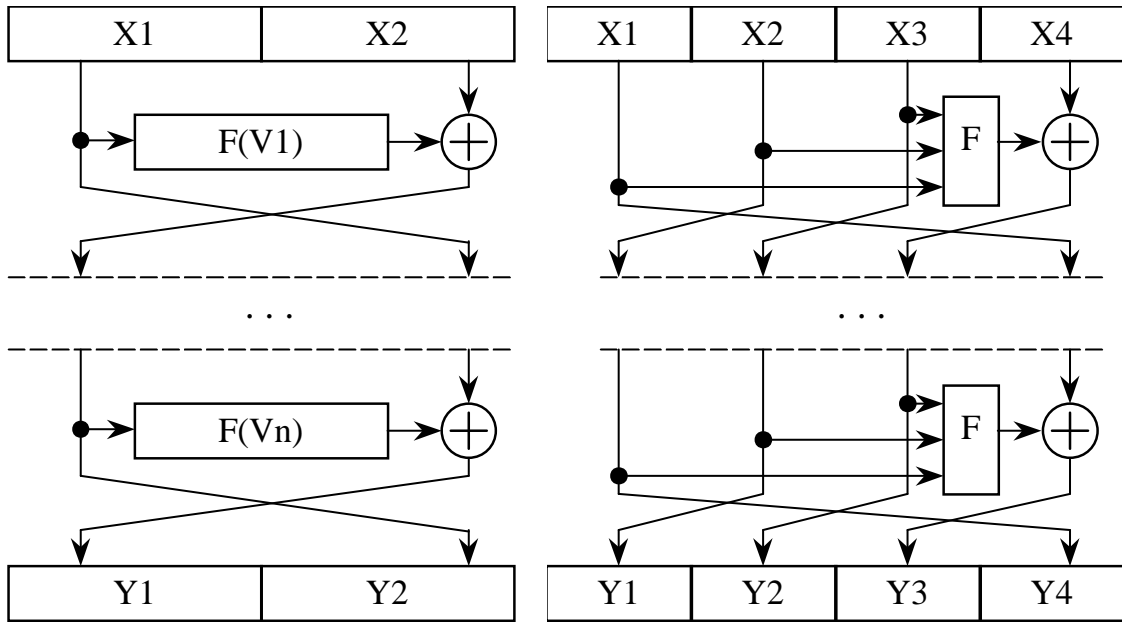
$$2^N - 1.$$

9.5.

()

(\therefore Feistel)

9.4.



. 9.4 -

(-)

8 . \oplus 9.4

$F(V_i)$

V_i

(\therefore round)

8 32.

(, -)

$F(V_i)$

9.3).

1977

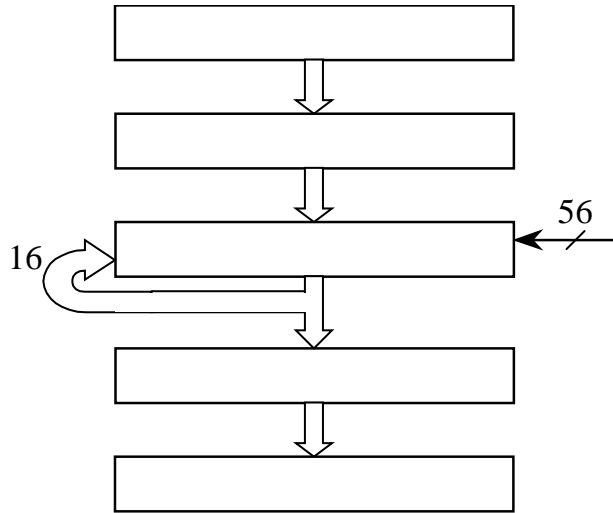
(NBS)

Data Encryption Standard (DES),

9.5

1980

ANSI.
DES.



. 9.5 - DES

DES

64-

, . . . 8

()

DES

16

ECB - Electronic Code Book ();

CBC - Cipher Block Chaining ();

CFB - Cipher Feedback ();

OFB - Output Feedback ().

- DES-ECB,

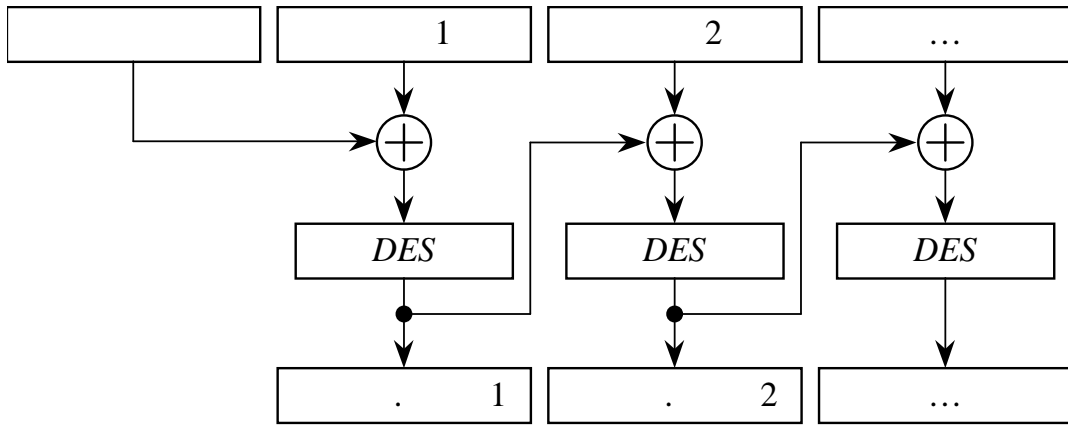
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DES-CBC

DES-ECB

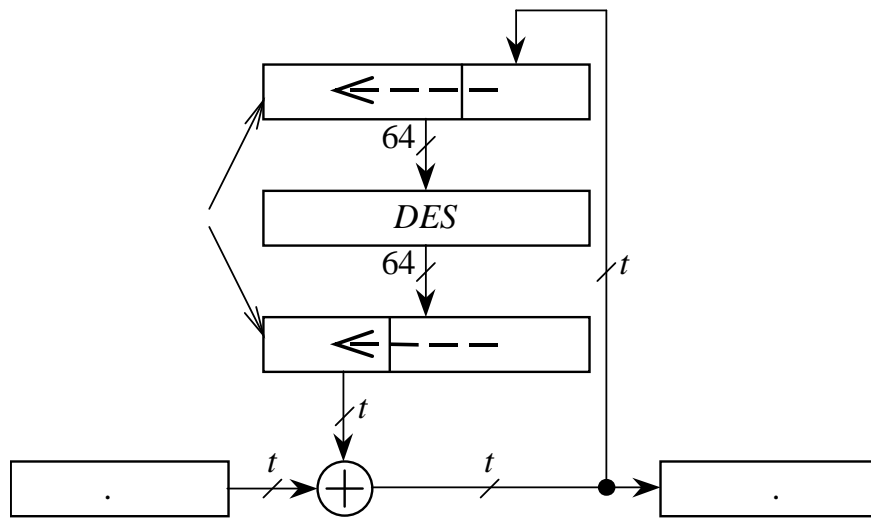
64-

9.6.



. 9.6 - DES CBC

DES-CFB DES-OFB
 1 64 . , 64 ,
 9.7.



. 9.7 - DES CFB t

DES

, Windows 2000

DES-CBC
 DES

25 !

, DES

vanced Encryption Standard,

- 1) ;
- 2) ;
- 3) 128 , 128, 192, 256 .

2000 NIST AES -
 RIJNDAEL,
 AES.

4x4, 4x6 4x8

32- 8- 4

Windows 2000
 - EFS (Encrypted File System),
 DES. Windows XP 2003 AES 256-
 . EFS NTFS-

" "

9.6.

()

$$\vec{y} = F(\vec{x}, \vec{k}_{Public}), \quad \vec{x} = F^{-1}(\vec{y}, \vec{k}_{Private}).$$

vate key).
 (\therefore public key) (\therefore pri-
DES.
F
 (: " ")
 " " "
 (" ")
 $x \bmod n$
 x/n
 $0 \quad n - 1,$
 n

$x \in [0, 256]$, $n = 257$, $a \in X$, $b \in X$, $[a \times b] \bmod n$
 a^{-1} , $[a \times a^{-1}] \bmod n = 1$.
 $k = 100$, $k^{-1} = 18$.
 9.1

9.1

								!
ANSI-	x_i	207	240	232	226	229	242	33
	$x_i \times k$	140	99	70	241	27	42	216
	$x_i \times k \times k^{-1}$	207	240	232	226	229	242	33
								!

1977-78
 (R. Rivest), (A. Shamir)
 (L. Adleman) - **RSA**,
RSA
 1. 2 $p \cdot q$
 2. $N = p \times q$
 3. $e < N$ (
 4. d e $T = (p - 1) \times (q - 1)$, ...
 $[e \times d] \bmod T = 1$. (9.3)
 5. (e, n) , d

$$k = \lfloor \log_2(N) \rfloor, \quad \lfloor \cdot \rfloor$$

$$y_i = [x_i^e] \bmod N. \quad (9.4)$$

$$x_i = [y_i^d] \bmod N. \quad (9.5)$$

$$x^{(p-1) \times (q-1)} \bmod N = 1. \quad (9.6)$$

$$T = (p - 1) \times (q - 1). \quad (9.6)$$

$$x^T \bmod N = x^0 = 1 \quad x^{\phi + n \times T} \bmod N = x^\phi,$$

$n -$

$$x^{e \times d} \bmod N \equiv x^{1 + n \times T} \bmod N. \quad (9.3)$$

RSA. $p = 19, q = 13, N = 247, T = 216,$

RSA $p \quad q \quad N$

$e = 7,$ (9.3)

$d = 31$.

9.2

" !".

9.2

								!
ANSI-	x_i	207	240	232	226	229	242	33
RSA-	$(x_i)^7 \bmod 247$	233	202	158	138	96	174	136
	$((x_i)^7)^{31} \bmod 247$	207	240	232	226	229	242	33
								!

RSA-
 p q ,

-

N .
 d .

(General Number Field Sieve, GNFS).

RSA 1024

RSA

129

1994

RSA Security

RSA Factoring Challenge,

576 2048

10

RSA-576 200

RSA-2048.

1999

512-

RSA.

RSA-576

2003
GNFS

RSA -

1999

TWINKLE (The Weizmann Institute

Key Locating Engine -

twinkle -
) . TWINKLE

100

200

512 . 2003

TWIRL (The Weizmann

Institute Relation Locator – ()
) . *twirl* . *TWIRL*

1024 - 40 000 1
TWIRL 5 000 44 . 40 000
(10) 1024 -
10 512 -
100 10 , 768 - - 50 -
4096 , 2048

9.7.

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- , -
(2003) 60 ÷ 90 .
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 - . SAM
 Windows 2000
 NTHash.
 2003 Windows-
 (1,4) -
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 - Li-
 nux, Unix Mac OS X
 12 ,
 4096 " "
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 Windows 3 - 5
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(\therefore integrity)

(\therefore non-repudiation)

DSA (Digital Signature Algorithm),

Windows 2000

Diffie-Hellman).

(Diffie)

(Hellman)

D-A (Diffie-Hellman)

RSA.

$v \ N$.

$x \ y$.

$$v^x \bmod N,$$

$$v^y \bmod N.$$

$$\left(v^x \bmod N\right)^y \bmod N = \left(v^y \bmod N\right)^x \bmod N = v^{x \cdot y} \bmod N,$$

(: Certificate Authority) -

ITU-T X.509.

Kerberos,

Kerberos

RFC-1510, 1964.

Intranet
curity),

RFC.

IP-

Internet
- IPSec (IP Se-

9.8.

" (steganos - ; graphy -).

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4.

5.

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100%

10%

BMP 24 32
50%.

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1. -
, 1993. - 208 .: .
2. -
- , 1990. - 240 .
3. -
:- .: , 1989. - 240 .
4. - :
, 1989. - 304 .
5. " " 4, 7, 8, 9, 16. - :
" - ", 1993 - 1995.
6. - : , 1995. - 400 .
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, 1990 - 256 .: .
8. *Windows NT™*: . . - .: *BHV* - -
, 1996. - 496 .: .
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10. . . *Microsoft Windows 2000 Professional*. /
. - .: - , 2001.
- 752 .: .
11. . . *Windows 2000 Active Directory*. - .: - ,
2001. - 400 .: .

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