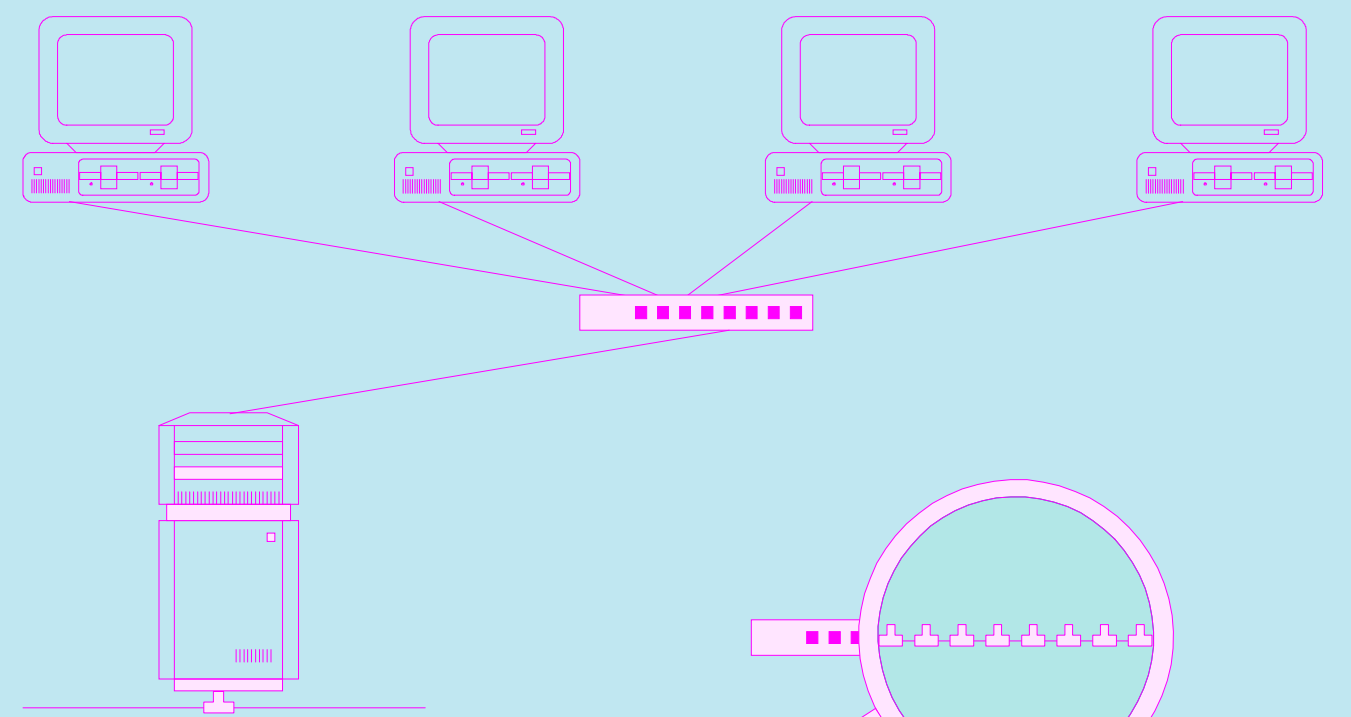
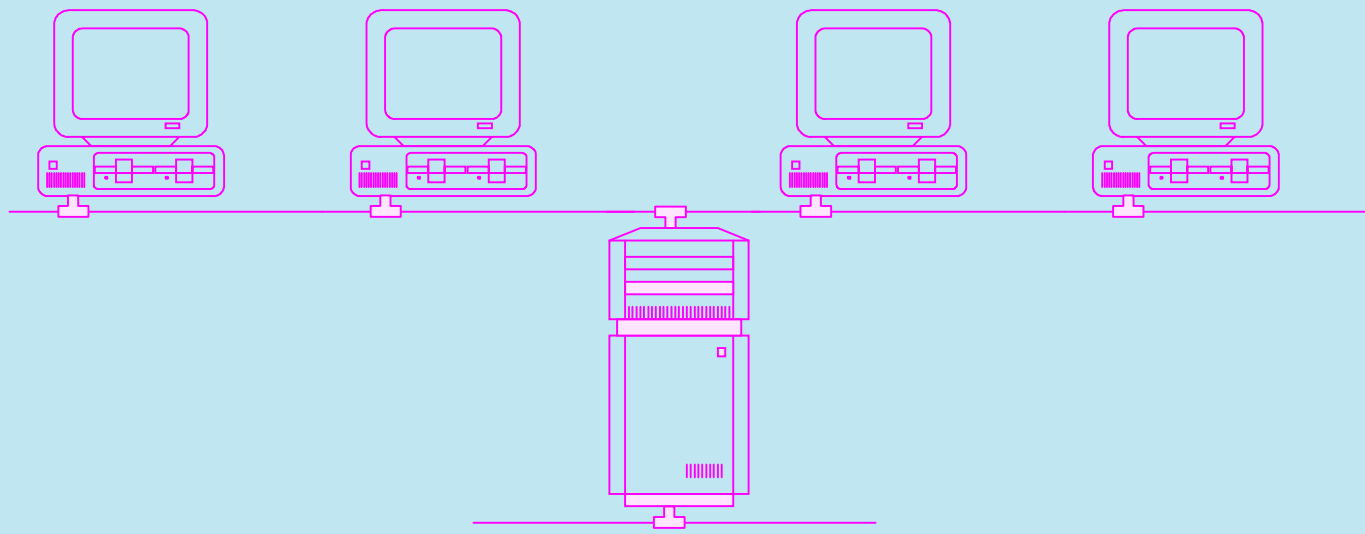


Connectivity between computers with different OS'es

... is it all about security, and why?

1. Some “frightening” background, which is well-known to everybody, but worth repeating three times a day...
2. Inter-computer communications from the user’s viewpoint:
 - remote command execution – exchange of terminal output;
 - “client-server tasks” – exchange of specially formatted information;
 - file transfers – exchange of arbitrary files.
3. ssh – what it provides and how is it configured?
4. ssh-tunneling and how can it help us in remote X-client execution.
5. “Client-server tasks” – should we use ssh-tunneling and how, if we would?
6. File transfers
 - peculiarities of ssh-tunneling with FTP;
 - netbios and samba – is there netbios-over-ssl?
7. The wireless “nightmare” – could we release it using ssh?

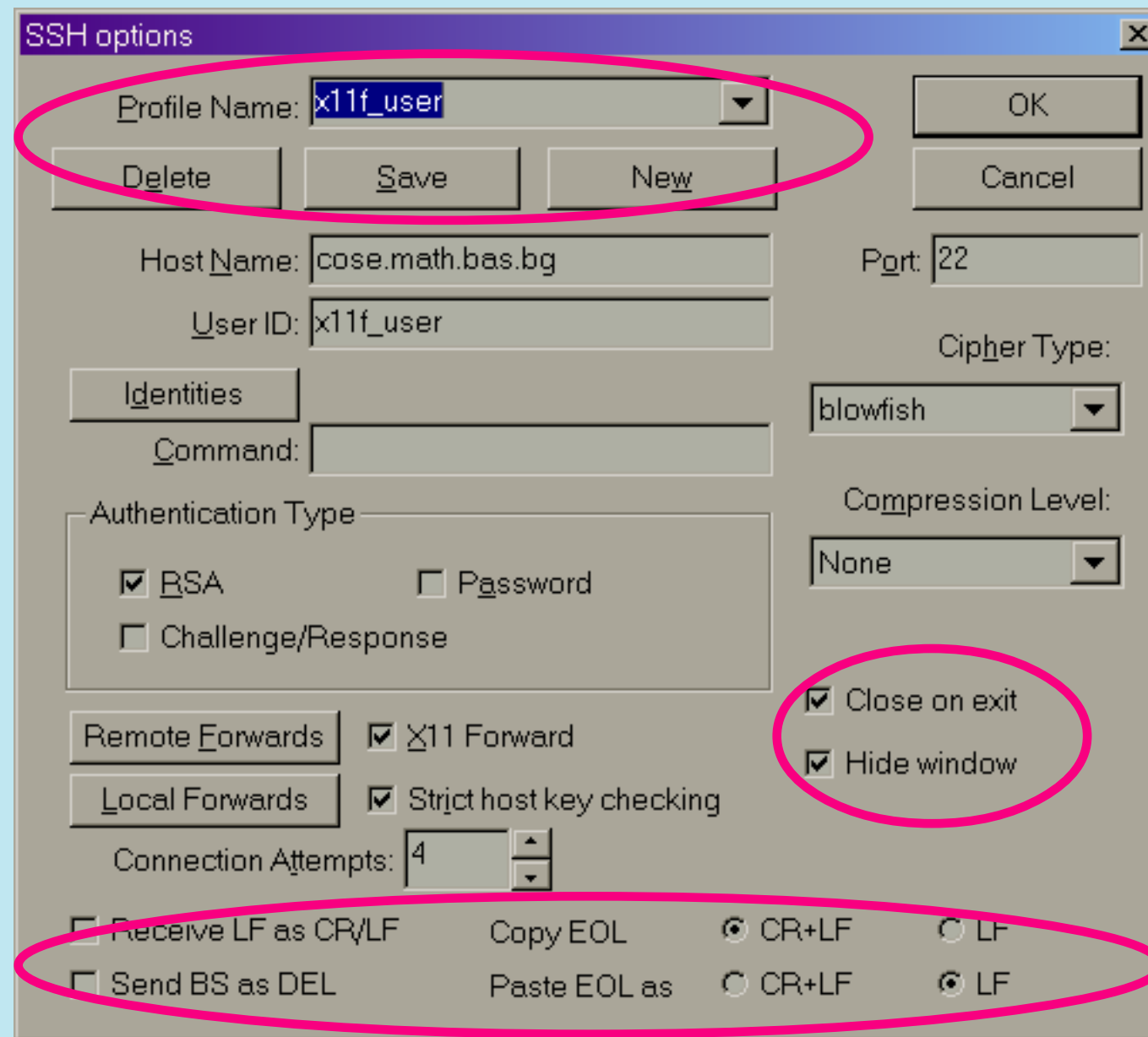


ssh (sshd server / ssh client pair) – what it provides?

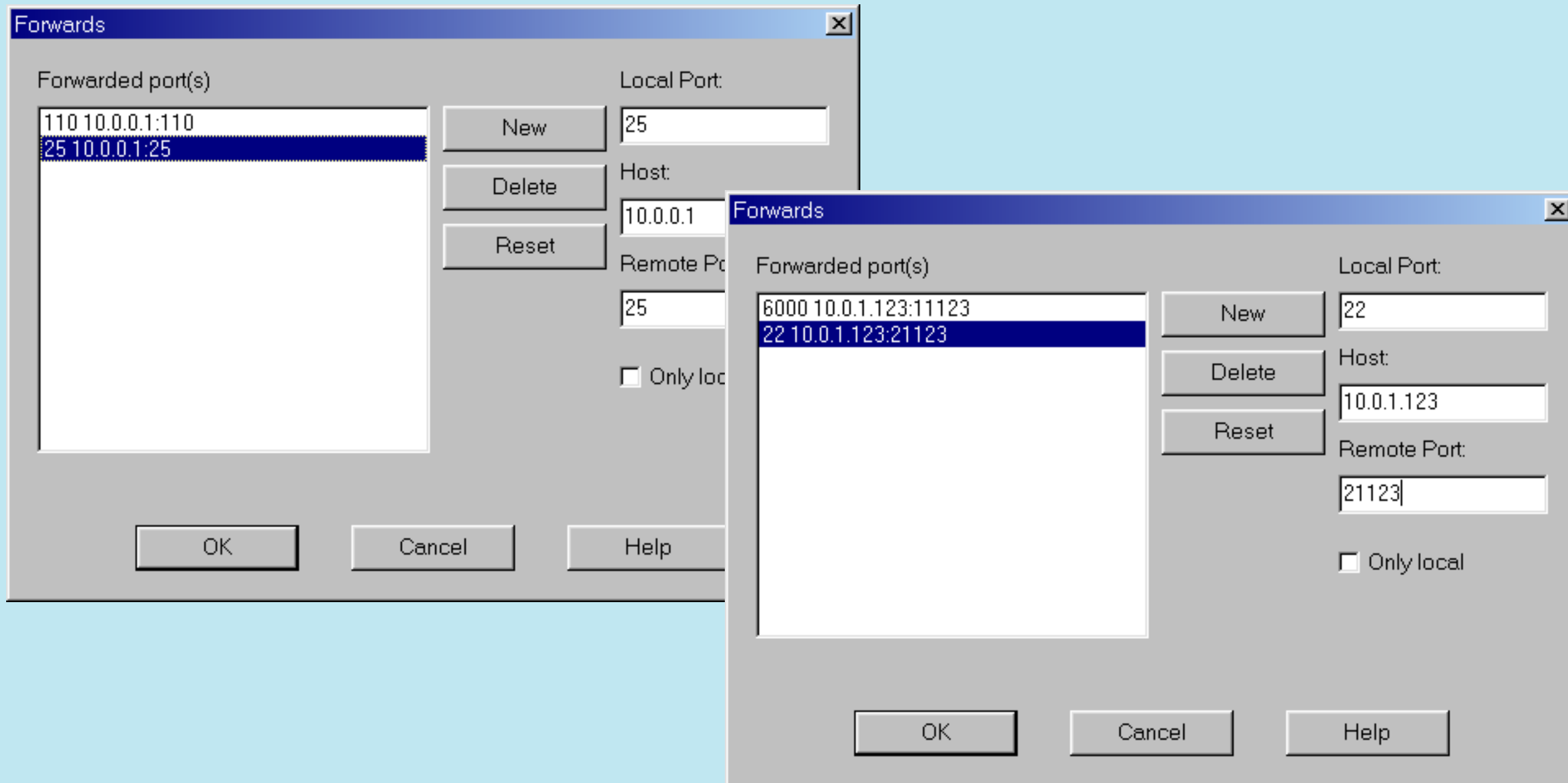
	ssh1	ssh2
server host identification by means of asymmetric encryption algorithm (private/public key pair)	+	+
negotiation of the session encryption algorithm and the symmetric session key	+	+
session integrity verification (hashing, keep-alives over the encrypted channel)	–	+
user authentication on the server host (host-based, public key, TIS challenge/response, password)	+	+
port forwarding (local, remote, X11 session)	+	+
interactive or non-interactive command execution on the server host	+	+
auxiliary subsystems (key generator, authentication agent, file transfer subsystem)	+	+

ssh clients and client-side configuration

- ssh1-only clients: C. Igaly ssh16/ssh32; teraterm/ttssh
- ssh1/ssh2 clients: Putty; mindterm (Java-based); OpenSSH (command line only)



ssh local and remote port-forwarding



OpenSSH ssh-client and port-forwarding configuration

- `ssh -L 110:10.0.0.1:110 -L 25:10.0.0.1:25 user@10.0.0.1`
- `ssh -R 11123:10.0.1.123:6000 -R 21123:10.0.1.123:22 user@10.0.0.1`

ssh daemons and server-side configuration

- OpenSSH (UNIX and Win NT/2000/XP only)

sshd.conf and some useful settings there

```
.....
# Port 22
  Port 8022
.....
# PasswordAuthentication yes
# PermitEmptyPasswords no
.....
X11Forwarding yes
# AllowTcpForwarding yes
  GatewayPorts yes
# X11DisplayOffset 10
# X11UseLocalhost yes
# KeepAlive yes
  ClientAliveInterval 15
  ClientAliveCountMax 3
.....
```

authorized_keys(2) format and per-user (per-key) customization of sshd

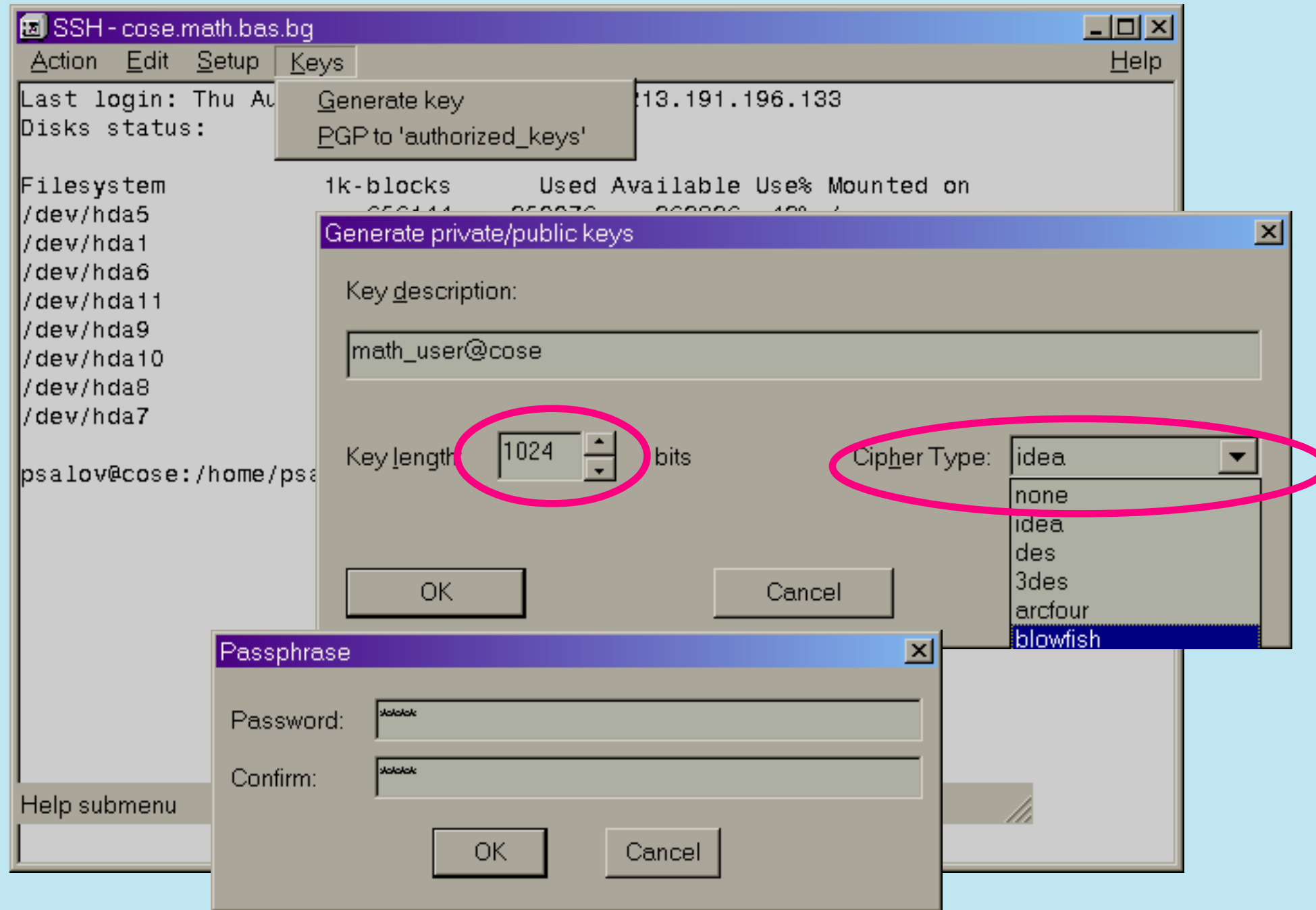
```
[ options ] { public key components } { comment }
```

access-control options: `from="pattern-list" permitopen="host:port"`

feature-limiting options: `no-port-forwarding no-X11-forwarding no-agent-forwarding no-pty`

forced-command options: `command="command" environment="NAME=value"`

ssh key generation:



establishing an ssh connection and executing commands on the remote host (receiving character-based output):

The image shows a sequence of windows during an SSH connection:

- Host is not known:** A dialog box titled "New key" with a list of numbers: 1024 35, 1167785591730890392990824170678294926712605837197707633185210697058779095363, 7605228640114168576687130131059069094436318863290400145269613207608451523484, 42057, 87504, 43131.
- Password for psalov@cose.math.bas.bg:** A dialog box with a password field containing seven asterisks (*****).
- SSH - cose.math.bas.bg:** A terminal window with a menu open. The menu items are: Background colour, Text colour, Select font, Select crypto library, Set screen size, File location(s), Save settings, and Set default character sets. The terminal output shows the IP address "from 213.191.196.133" and a disk status table.

Filesystem	Used	Available	Use%	Mounted on
/dev/hda5	9976	362836	42%	/
/dev/hda1	8278	11443	23%	/boot
/dev/hda6	6900	605912	3%	/tmp
/dev/hda11	1860	371192	63%	/opt
/dev/hda9	7776	3452764	30%	/usr
/dev/hda10	2308	5143888	13%	/usr/local
/dev/hda8	8340	4777200	3%	/var
/dev/hda7	656144	198560	424252	32% /var/log

psalov@cose:/home/psalov> █

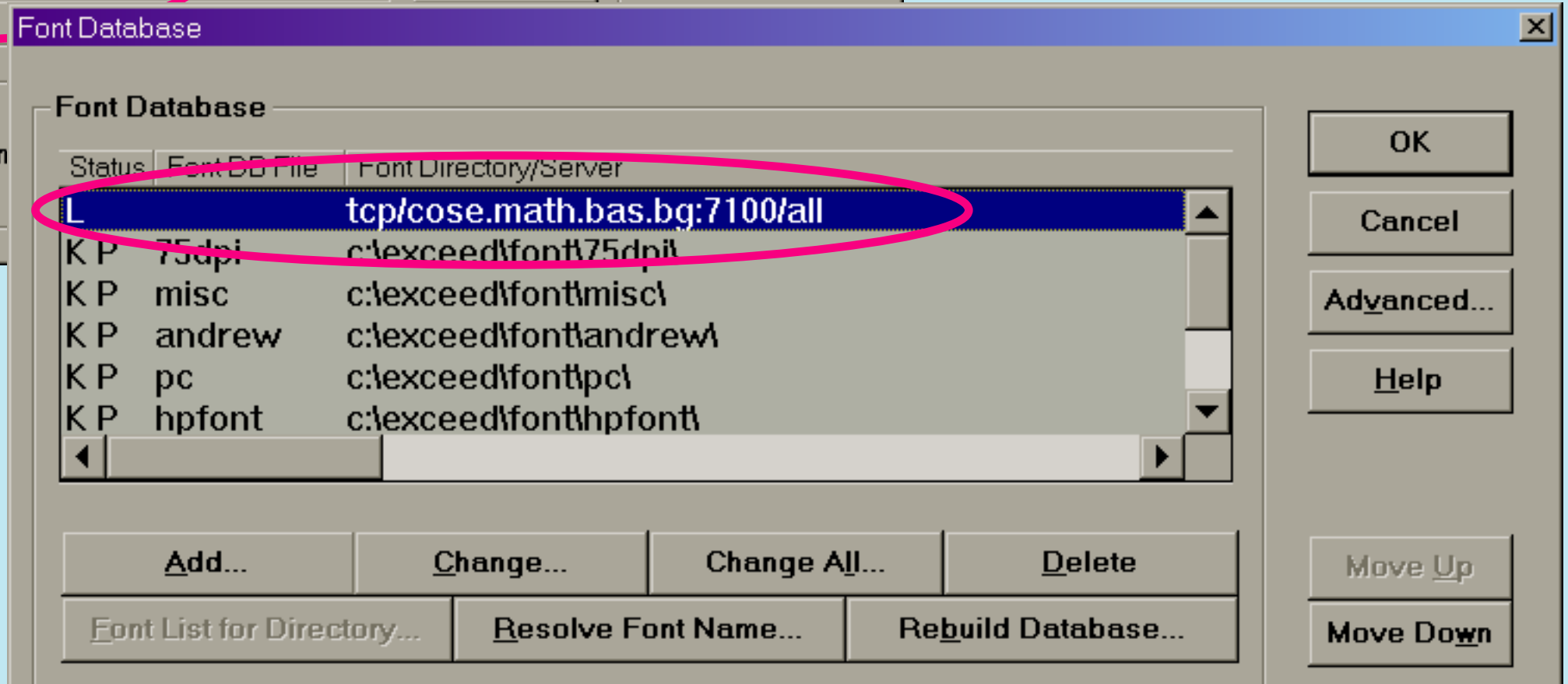
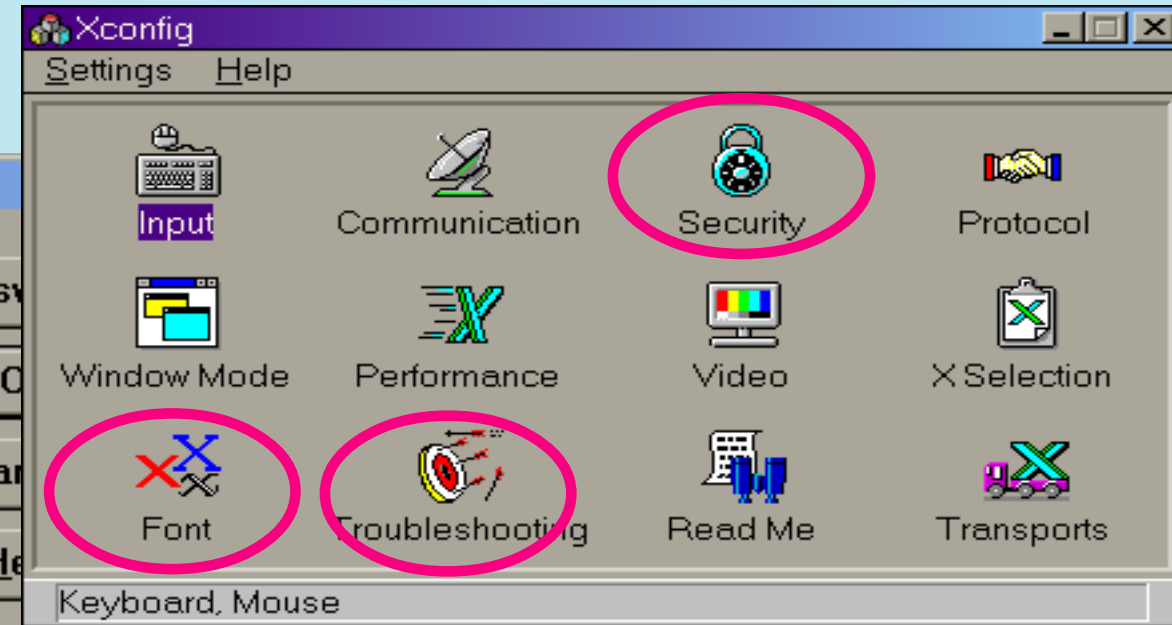
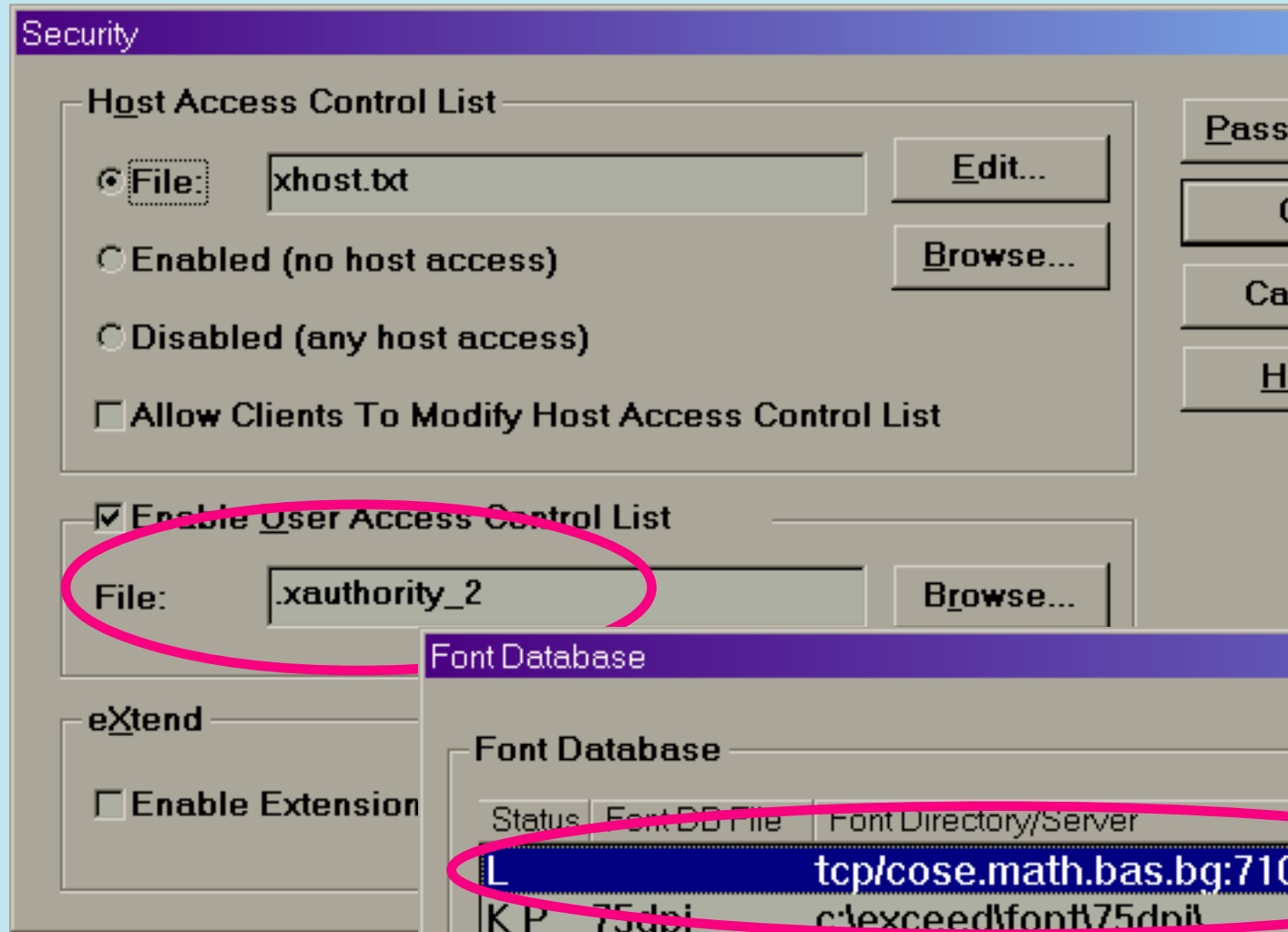
Keys submenu

Programs with graphics output or GUI

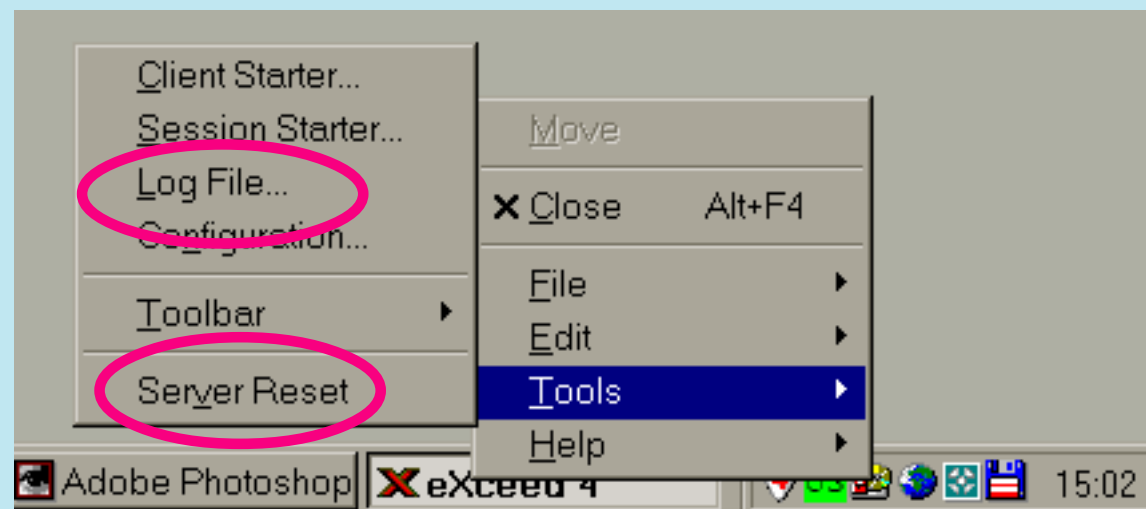
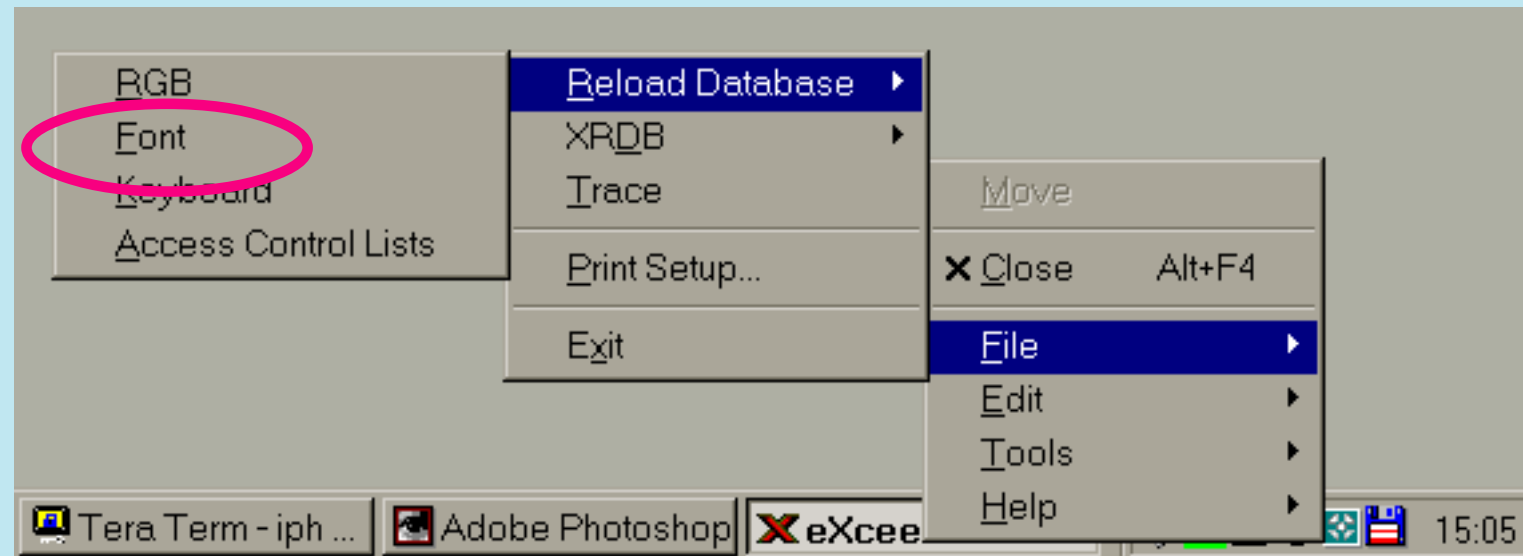
- UNIX graphical X-terminal;
- X-server, X-font server and X-clients;
- where does X-server reside?
- displays and how to connect to them?
- X-server access control (host-based via xhost and user-based via xauth);
- VNC servers / clients (Virtual Network Computing) as an extension of the idea of X-terminal.

X-servers for Windows: is there anything free except for OpenVNC?

X-server configuration:



X-server runtime reconfiguration and troubleshooting:



establishing an X-connection with the assistance of ssh in cases of:

1. application server (host where X-clients are executed) is running sshd without X11-forwarding, X-server host has a real IP;
2. application server is running sshd without X11-forwarding, X-server host is positioned behind a NAT-firewall.
3. application server is running sshd with X11-forwarding allowed;

#	Security settings of the X-server	ssh connection to ...	type of forwarding used	additional requirements
1	user-based (MIT-cookie)	application server	none	firewall should allow transit of X-traffic
2	user-based (MIT-cookie)	<u>firewall host</u>	remote	firewall should <u>accept</u> inbound X-traffic and allow <u>gateway ports</u>
3	host-based (only localhost allowed)	application server	X-11	none

Built-in Functions Add-ons

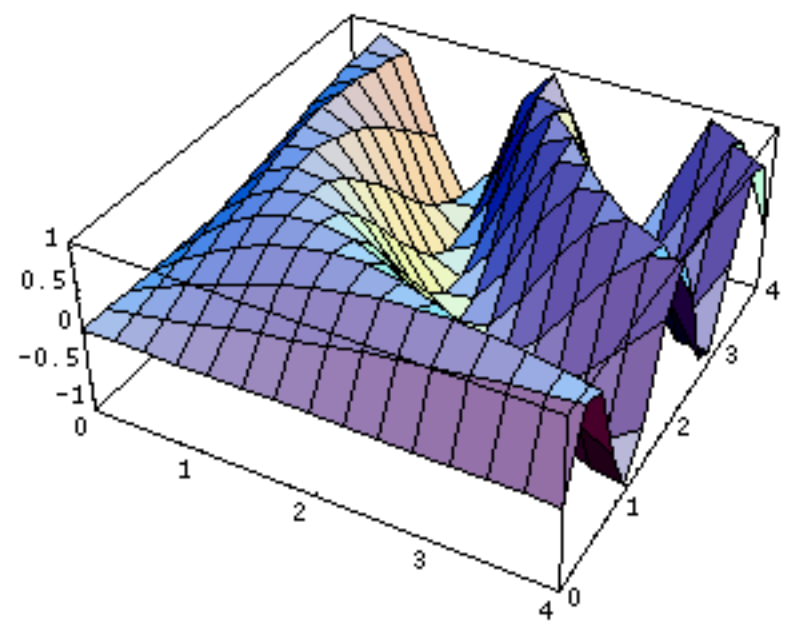
Getting Started/Demos Other Information

Go To: Plot3D

Numerical Computation (Alphabetical List)
Algebraic Computation
Mathematical Function: 2D Plots
Lists and Matrices 3D Plots
Graphics and Sound Contour Plots
Density Plots

See also: [ListPlot3D](#), [ContourPlot3D](#)

```
In[1]:= Plot3D[Sin[x y], {x, 0, 4}, {y, 0, 4}];
```



Further Examples

Here are two three-dimensional surface plots. Evaluate the cells to see the graphics.

```
In[1]:= Plot3D[Sin[x y], {x, 0,
```

```
In[2]:= Plot3D[Sin[x y], {x, 0, 4}, {y, 0, 4}, PlotPoints -> 40, Mesh -> None, AxesLabel -> {"Length", "Width", "Height"}];
```

Here is how to see all the possible options for Plot3D:

```
In[3]:= Options[Plot3D]
```

```
Out[3]:= {AmbientLight -> GrayLevel, Axes -> True, AxesEdge -> Automatic, AxesStyle -> Automatic, Boxed -> True, BoxRatio -> Automatic, ClipFill -> Automatic, ColorFunctionScaling -> Automatic, Compiled -> True, DefaultOptions -> {}, Epilog -> {}, FaceGrids -> Automatic, ImageSize -> Automatic, LightSources -> {{1., 1., 1.}, RGBColor[1., 1., 1.]}, {{0., 1., 1.}, RGBColor[0., 1., 1.]}}, MeshStyle -> Automatic, Plot3DMatrix -> Automatic,
```



Welcome to **MATHEMATICA**

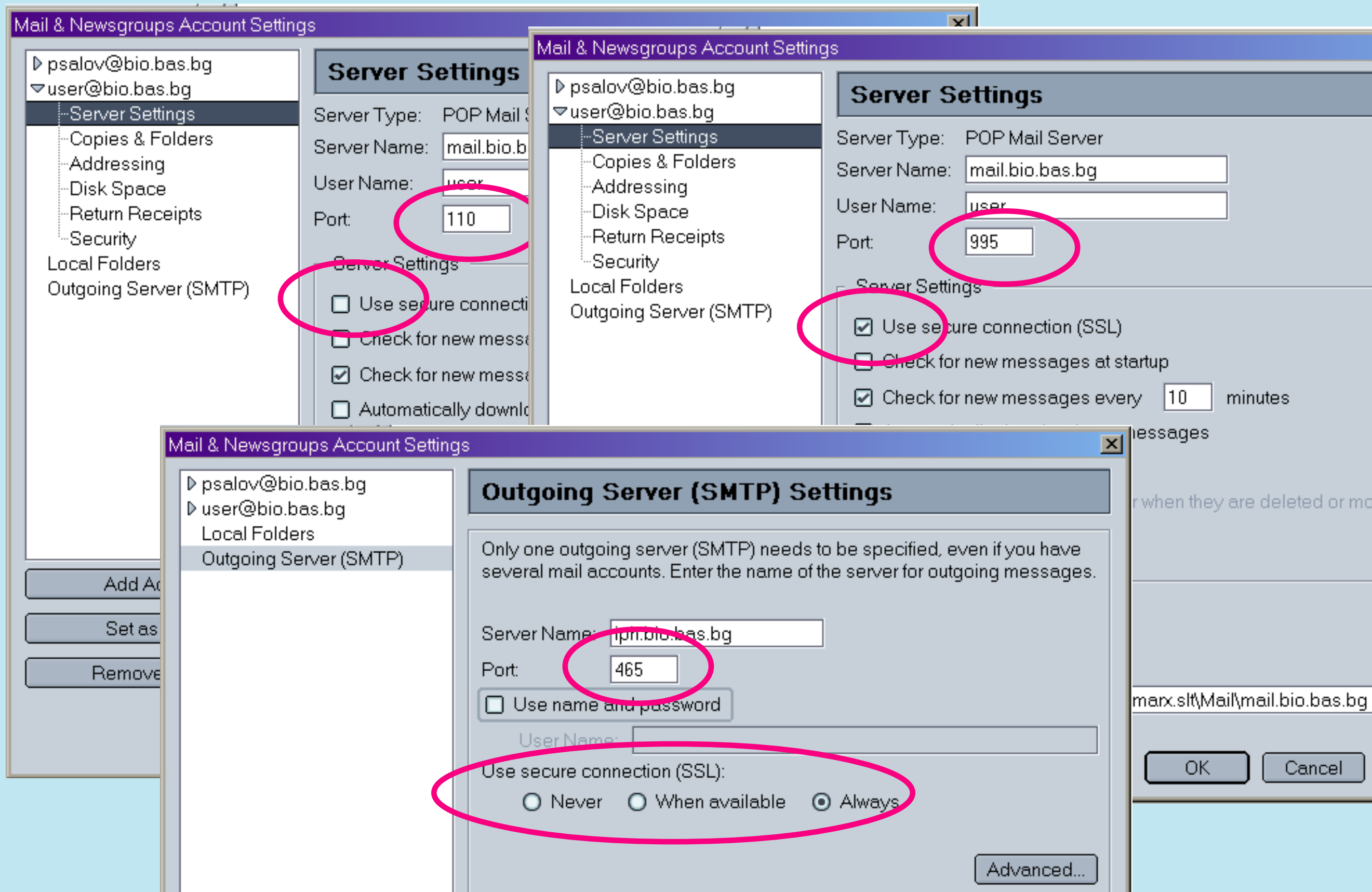
Get Tutorial Help Browser Website

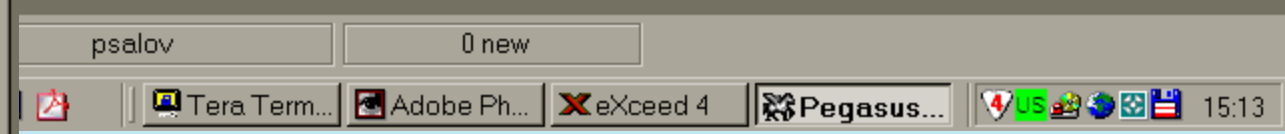
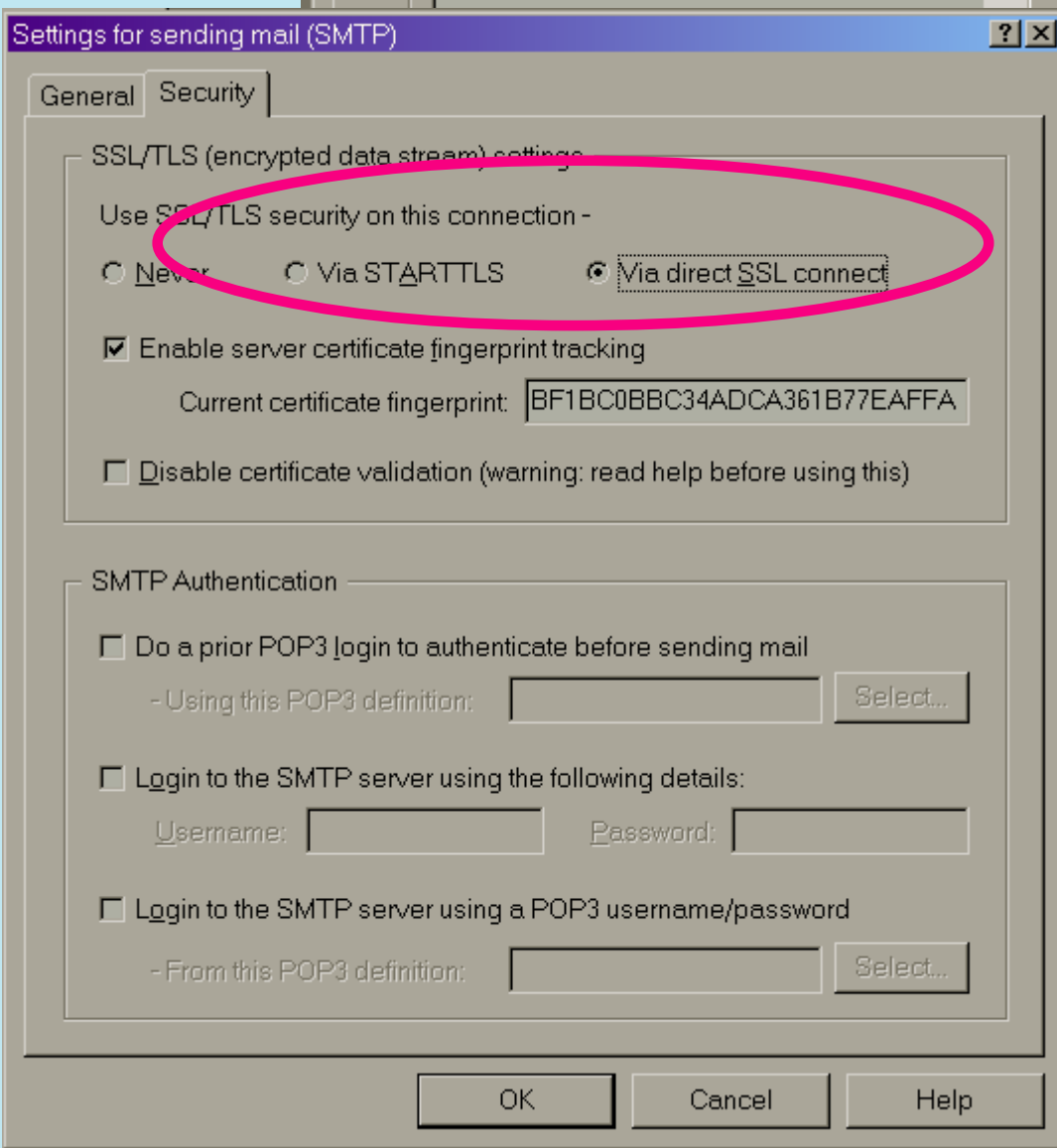
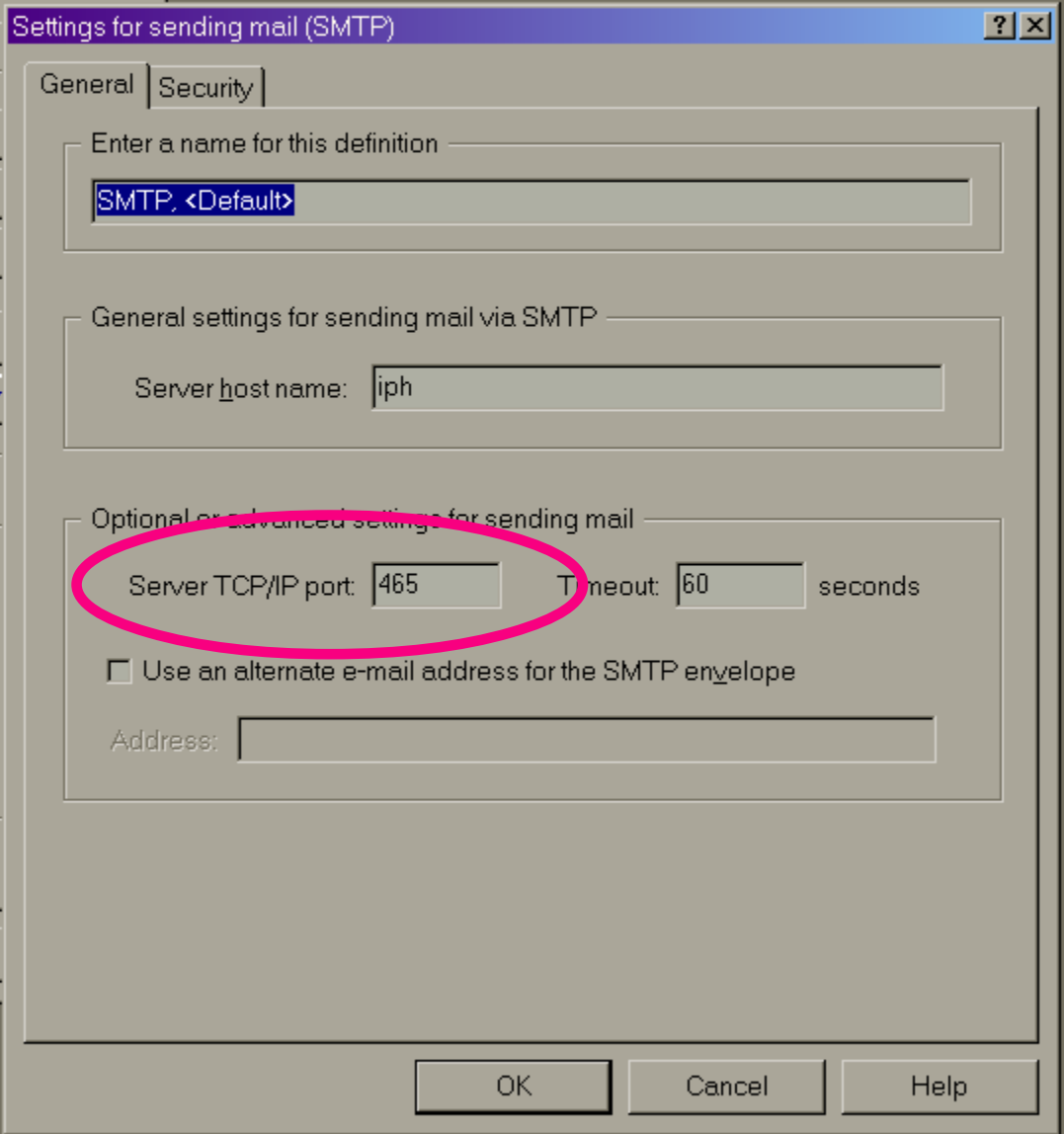
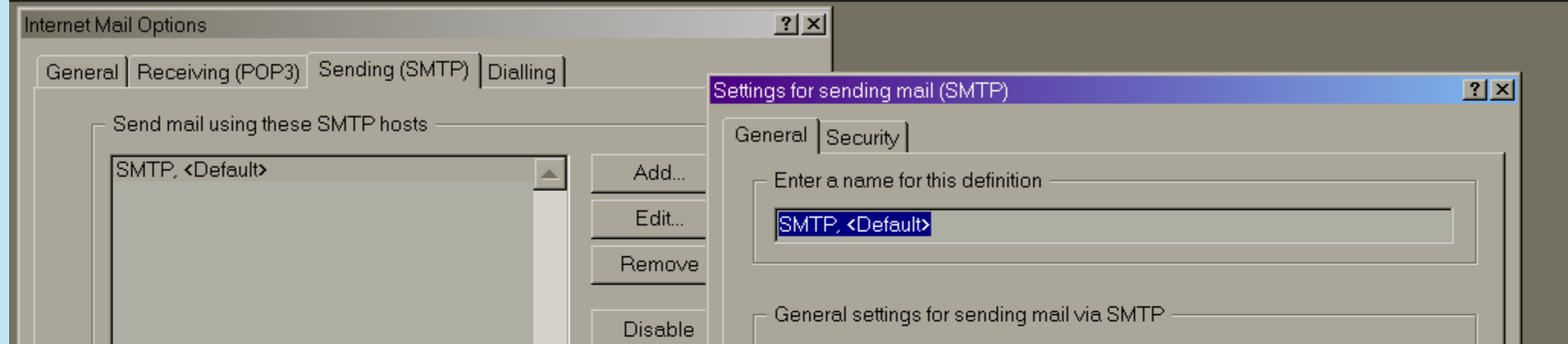
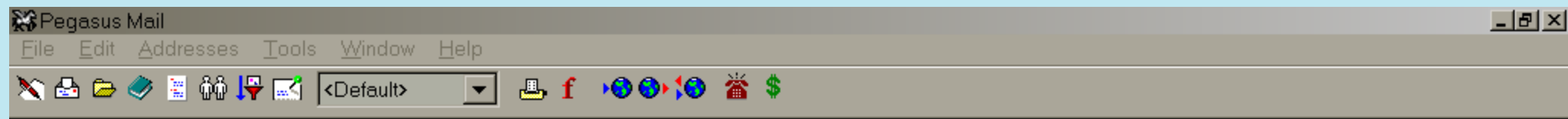
Open Window at Startup Close Window

“Client-server” tasks – exchange of specially formatted information (files). Should we use ssh-tunneling or the alternatives?

- pop3 (post office protocol), smtp (simple mail transfer protocol), imap (internet mail access protocol) as examples;
- SSL (secure socket layer) and pop3s, smtps, imaps;
- TLS (transport layer security); pop3 (post office protocol), smtp (simple mail transfer protocol), imap (internet mail access protocol) as examples;
- certificates vs. public keys (is it really “vs.”?) and some common problems;
- ssh local port forwarding and configuration of the clients.
- server-side configuration; stunnel – SSL “wrapper” for no-SSL servers.

SSL (TLS)-enabled pop3, smtp , imap clients: Outlook Express, Netscape mail, Mozilla mail, Eudora, Pegassus mail ...





Arbitrary file transfers

- FTP peculiarities and the peculiarities of ssh-tunneling of FTP; TLS-enabled FTP-servers and clients;
- netbios, SMB, samba (access of Win-hosts to UNIX-resources);
- smb-client and smbfs – samba inside-out (access of UNIX-hosts to Win-resources);
- SSL-enabled netbios clients?
- scp and sftp – file transfer subsystems of ssh

MindTerm - Basic Tunnels Setup

Current local tunnels:

```
local: 21 -> remote: iph/21
```

Local port: Protocol:

Remote host:

Remote port:

FTP: connection details

Session:

Host name (.Port):

Anonymous login (e-mail address as password)

User name:

Password:

PORT 127.0.0.1,4,143
502 Illegal PORT Command

[system] 383 512 k of 2 044 232 k free

Name	Size	Date	Attr
<DIR>		31.05.01 15:41	
<DIR>		03.05.01 12:00	
<DIR>		15.06.99 10:42	
<DIR>		31.05.01 14:39	
<DIR>		06.08.03 21:15	
<DIR>		20.02.03 15:10	
<DIR>		14.12.99 13:47	
<DIR>		20.07.00 14:08	
<DIR>		10.03.03 12:58	
<DIR>		01.10.02 18:01	
<DIR>		03.05.01 11:36	
<DIR>		10.09.02 16:19	
<DIR>		01.08.03 20:18	
<DIR>		08.02.02 20:15	
<DIR>		10.06.99 15:04	
<DIR>		11.12.99 11:11	
<DIR>		14.01.00 18:37	
<DIR>		10.06.99 15:06	
<DIR>		10.06.99 15:51	
<DIR>		02.05.01 20:14	
<DIR>		14.01.03 20:04	
<DIR>		10.06.99 14:13	
<DIR>		11.06.99 17:38	
<DIR>		28.04.01 14:25	
<DIR>		28.04.01 14:41	
<DIR>		11.03.03 19:32	

0 k / 2 k in 0 / 3 files

c:\>

F3 View F4 Edit F5 Copy F6 Move F7 NewFolder F8 Delete Alt+F4 Exit

502 Illegal PORT Command

Get directory

ftp

PORT command failed!

MindTerm - Basic Tunnels Setup

Current local tunnels:

```
local: 21 -> remote: iph/21 (plugin: ftp)
```

Local port: Protocol: **ftp**

Remote host:

Remote port:

FTP: connection details

Session:

Host name (.Port): **localhost**

Anonymous login (e-mail address as password)

User name:

Password:

Waiting for server...
226 Transfer complete

ftp://localhost

0:/home/psalov/*.*

Name	Ext	Size	Date	Attr
[..]		<DIR>	00.00.80 00:00	—
[download]		<DIR>	20.06.03 14:41	-755
[mail]		<DIR>	29.08.03 15:22	-700
[pictures]		<DIR>	10.03.03 00:00	-751
[public_html]		<DIR>	04.03.03 00:00	-755
[tmp]		<DIR>	04.07.03 12:56	-755
[vir_collection]		<DIR>	31.01.03 00:00	-700
authfile		49	07.08.03 13:35	-640
kinetic_treatment_new.doc		558 592	04.08.03 22:29	-644
index.html		1 606	27.05.03 00:00	-640
kinetic_treatment_new.pdf		69 710	04.08.03 22:29	-644
op.ps		493 194	21.05.02 00:00	-444
regex.samples		162	03.08.01 00:00	-644
replace.script		216	06.08.98 00:00	-744

0 k / 2 k in 0 / 3 files

0 k / 1 097 k in 0 / 7 files

0:/home/psalov/>

F3 View | F4 Edit | F5 Copy | F6 Move | F7 NewFolder | F8 Delete | Alt+F4 Exit

interval: every s

samba server configuration (smb.conf)

```
[global]
# workgroup = NT-Domain-Name or Workgroup-Name
  netbios name = TOX3
  workgroup = PHYSIOL
  browse list = yes
  browseable = yes

# Browser Control Options:
  local master = yes

# OS Level determines the precedence of this server in master browser elections. The default
  value should be reasonable
  os level = 65

# Security mode. Most people will want user level security. See security_level.txt for details.
  security = share

# Password Level allows matching of _n_ characters of the password for all combinations of upper
  and lower case
  password level = 8
  username level = 8

# Case Preservation can be handy - system default is _no_ NOTE: These can be set on a per share
  basis
  preserve case = yes
  short preserve case = no

# Default case is normally upper case for all DOS files
  default case = lower

# Be very careful with case sensitivity - it can break things!
  case sensitive = no

# How much free space to report to the clients (DOS connectivity)
  max disk size = 1000
```

samba server configuration (smb.conf)

```
[e]
  comment = software archive
  browseable = yes
  path = /mnt/e
  only guest = yes
  writable = no
  printable = no
  veto files = /iso/recycled/*.swp/
  public = yes
;
[opt]
  comment = software archive
  browseable = yes
  path = /opt
  only guest = yes
  writable = no
  printable = no
  public = yes
;
[cd]
  comment = r_cd
  browseable = yes
  path = /mnt/r_cd
  only guest = yes
  writable = no
  printable = no
  public = yes
;
```

scp and sftp – file transfer subsystems of ssh

Total Commander 5.51 - NOT REGISTERED

Files Mark Commands Net Show Configuration Start Help

[data] 248 584 k of 513 776 k free

d:\DOC**

Name	↑Ext	Size	Date	Attr
[..]		<DIR>	08.06.99 19:35	
[blagoevgrad]		<DIR>	13.08.03 20:56	
[budapest]		<DIR>	07.03.03 15:26	
[lili]		<DIR>	15.05.02 12:18	
[masha]		<DIR>	13.02.02 14:25	
[PA]		<DIR>	23.09.97 19:41	
[SCI]		<DIR>	23.09.97 19:41	
[TRD]		<DIR>	23.09.97 19:42	
iph.ai		39 846	04.02.03 17:53	
ip15-300.bmp		4 648	04.07.96 15:42	
ip3-300.bmp		18 448	04.07.96 15:33	
iph3-300.cdr		15 254	08.09.99 16:17	
iph3-300.cmx		11 334	08.09.99 13:58	
iph3-300.cpt		30 339	08.09.99 13:36	
balkan11.doc		443 904	04.02.99 15:05	
holydays.doc		1 536	17.09.96 14:21	
iph-p.doc		7 605	30.07.99 14:26	
isn-trav.doc		28 672	27.08.98 13:42	
print.doc		3 072	21.03.00 14:47	
normal.gly		1 536	16.05.96 19:12	
mw.ini		317	14.01.00 18:20	
logitect.prd		1 976	07.04.97 14:34	
iph-bg.rtf		23 048	14.05.02 11:29	
iph-eng.rtf		22 553	14.05.02 11:29	
iph-blank.t65		65 024	18.01.00 11:46	
ip15-120.tif		962	19.06.96 16:56	
ip15-300.tif		4 662	19.06.96 16:54	
iph3-120.tif		3 022	19.06.96 13:34	

\\Network Neighborhood**

Name	↑Ext	Size	Date	Attr
[Secure FTP Connections]		<DIR>		
[Entire Network]		<DIR>		
[Expsv3]		<DIR>		
[FExpsv3]		<DIR>		

F3 View F4 Ec

Total Commander 5.51 - NOT REGISTERED

Files Mark Commands Net Show Configuration Start Help

[data] 248 432 k of 513 776 k free

d:\DOC**

Name	↑Ext	Size	Date	Attr
[..]		<DIR>	08.06.99 19:35	
[blagoevgrad]		<DIR>	13.08.03 20:56	
[budapest]		<DIR>	07.03.03 15:26	
[lili]		<DIR>	15.05.02 12:18	
[masha]		<DIR>	13.02.02 14:25	
[PA]		<DIR>	23.09.97 19:41	
[SCI]		<DIR>	23.09.97 19:41	
[TRD]		<DIR>	23.09.97 19:42	
iph.ai		39 846	04.02.03 17:53	
ip15-300.bmp		4 648	04.07.96 15:42	
ip3-300.bmp		18 448	04.07.96 15:33	
iph3-300.cdr		15 254	08.09.99 16:17	
iph3-300.cmx		11 334	08.09.99 13:58	
iph3-300.cpt		30 339	08.09.99 13:36	
balkan11.doc		443 904	04.02.99 15:05	
holydays.doc		1 536	17.09.96 14:21	
iph-p.doc		7 605	30.07.99 14:26	
isn-trav.doc		28 672	27.08.98 13:42	
print.doc		3 072	21.03.00 14:47	
normal.gly		1 536	16.05.96 19:12	
mw.ini		317	14.01.00 18:20	
logitect.prd		1 976	07.04.97 14:34	
iph-bg.rtf		23 048	14.05.02 11:29	
iph-eng.rtf		22 553	14.05.02 11:29	
iph-blank.t65		65 024	18.01.00 11:46	
ip15-120.tif		962	19.06.96 16:56	
ip15-300.tif		4 662	19.06.96 16:54	
iph3-120.tif		3 022	19.06.96 13:34	

\\Secure FTP Connections**

Name	↑Ext	Size	Date	Attr
[..]		<DIR>		
[cose]		<DIR>		
[iph]		<DIR>		
[Quick connection]		<DIR>		
Add connections.lnk		0		
Edit connections.lnk		0		

Total Commander 5.51 - NOT REGISTERED

Files Mark Commands Net Show Configuration Start Help

FTP Transfer mode Binary (archives, doc etc.) Disconnect **connected successfully!**

[data] 248 296 k of 513 776 k free [none_]

d:\DOC**					\\Secure FTP Connections\cose**				
Name	↑Ext	Size	Date	Attr	Name	↑Ext	Size	Date	Attr
↑..[.]		<DIR>	08.06.99 19:35	-▲	↑..[.]		<DIR>		-▲
[blagoevgrad]		<DIR>	13.08.03 20:56	-	[.kde]		4 096	01.10.02 15:55	-
[budapest]		<DIR>	07.03.03 15:26	-	[.Mathematica]		4 096	22.10.02 12:42	-
[lili]		<DIR>	15.05.02 12:18	-	[.mc]		4 096	10.10.02 12:39	-
[masha]		<DIR>	13.02.02 14:25	-	[.mcp]		4 096	24.07.03 15:01	-
[PA]		<DIR>	23.09.97 19:41	-	[.mozilla]		4 096	29.11.02 17:34	-
[SCI]		<DIR>	23.09.97 19:41	-	[.netscape]		4 096	22.10.02 14:48	-
[TRD]		<DIR>	23.09.97 19:42	-	[.ssh]		4 096	09.10.02 14:15	-
iph.ai		39 846	04.02.03 17:53	-	[Desktop]		4 096	24.07.03 16:02	-
ip15-300.bmp		4 648	04.07.96 15:42	-	[mail]		4 096	24.03.03 18:43	-
ip3-300.bmp		18 448	04.07.96 15:33	-	[nsmail]		4 096	10.10.02 13:21	-
iph3-300.cdr		15 254	08.09.99 16:17	-	addressbook		0	24.09.02 12:57	-
iph3-300.cmx		11 334	08.09.99 13:58	-	.bash_history		9 127	21.08.03 14:57	-
iph3-300.cpt		20 220	08.09.99 13:20	-	back-logout		24	02.08.02 10:47	-
balkan11.doc				-					-
holydays.doc				-					-
iph-p.doc				-					-
isn-trav.doc				-					-
print.doc				-					-
normal.gly				-					-
mw.ini				-					-
logitect.prd				-					-
iph-bg.rtf				-					-
iph-eng.rtf				-					-
iph-blank.t65				-					-
ip15-120.tif				-					-

0 k / 758 k in 0 / 28 files

\\Secure FT

F3 View

Recycle Bin

Lister - [C:\TEMP_tc\wcfplug.txt]

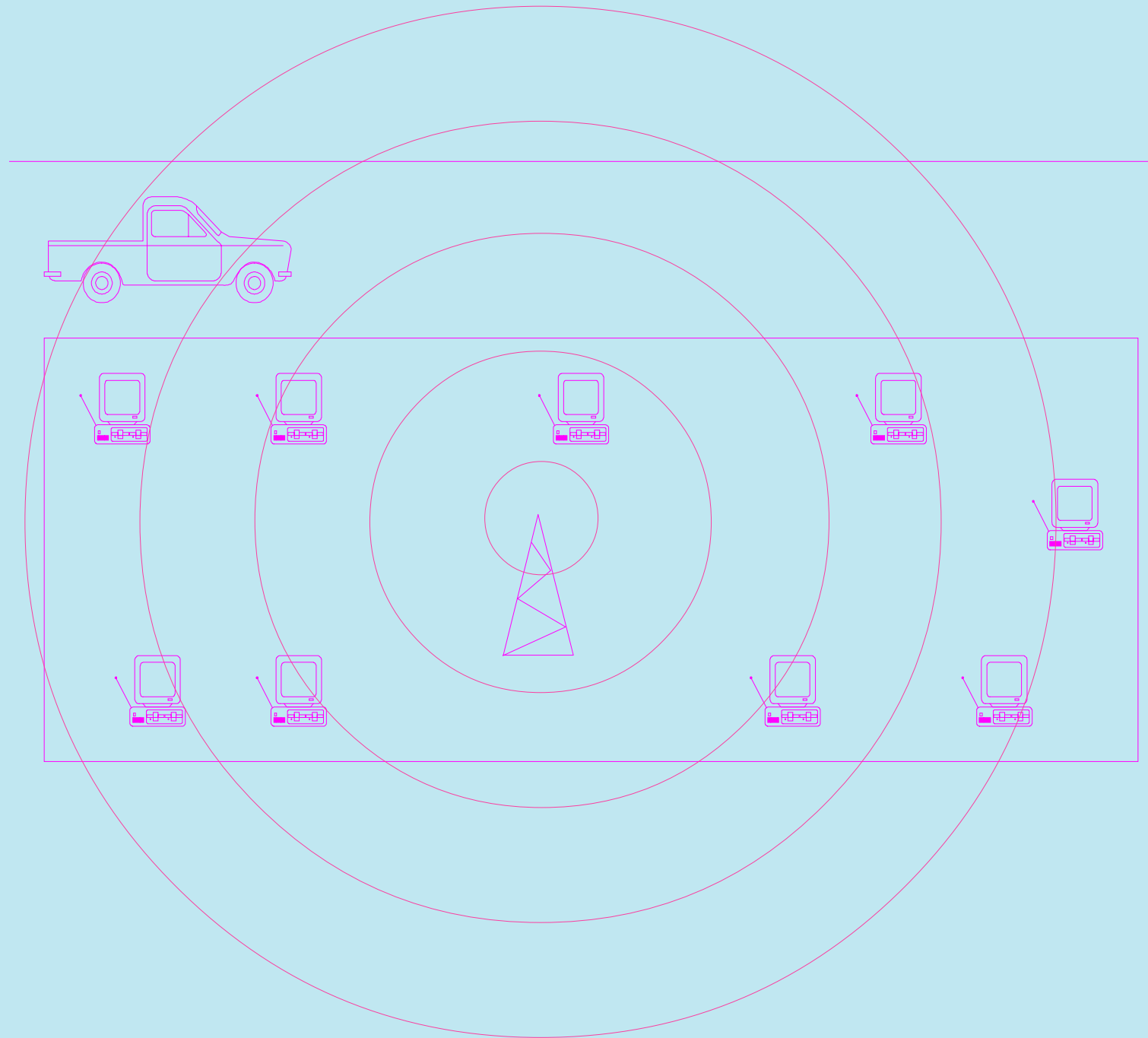
File Edit Options Help 100 %

```

CONNECT \iph
connecting to psalov@iph.bio.bas.bg:22 using password authentication
connected successfully!
iph: ls "."
CONNECT \cose
connecting to psalov@cose.math.bas.bg:22 using password authentication
connected successfully!
cose: ls "."

```

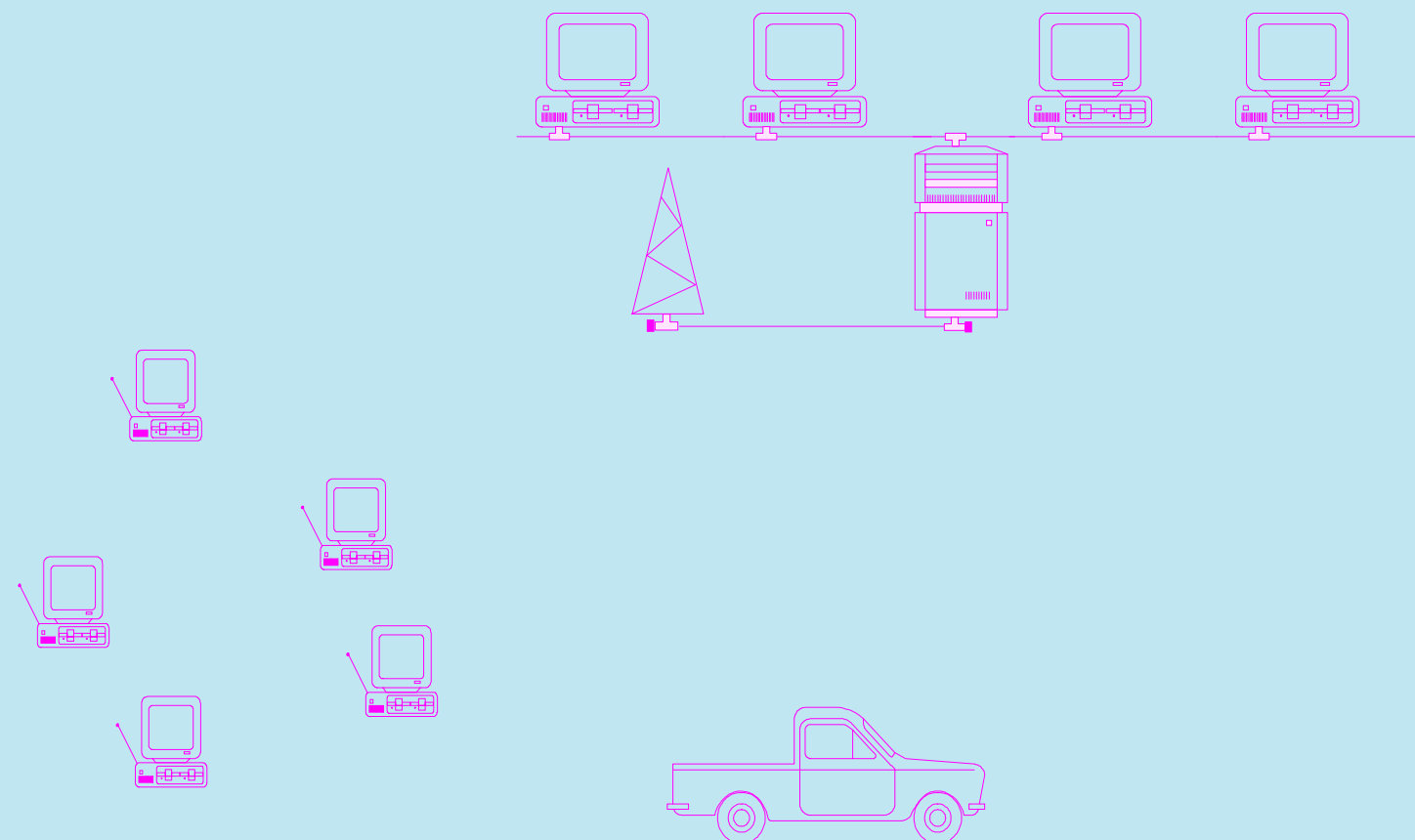

The wireless “nightmare” – could we release it using ssh?



WEP (Wired Equivalent Privacy) – what is it and how secure is it?

Peculiarities of the wireless ethernet communications.

- SSID, SSID broadcasts and WEP keys;
- arp (Address Resolution Protocol) problems with WEP;
- additional anti-eavesdropping features of WAPs (MAC-filters);
- DHCP servers on WAP – to use or not to use?
- authentication gateways – PAM-netfilter, NoCat, sshd



Building an authentication gateway with a “default” Linux installation.

- necessary components (what NOT to uninstall !): bash; iptables; OpenSSH; sudo;
- configuration:

/etc/ssh/sshd.conf:

```
PasswordAuthentication no || PermitEmptyPasswords no
ClientAliveInterval 15
ClientAliveCountMax 3
```

/etc/init.d/ipfw_start:

```
iptables -t filter -N wrls_login
```

/etc/sudoers:

```
%wireless ALL = NOPASSWD: \
```

```
/bin/iptables -t filter -[ID] wrls_login -s [0-9]*.[0-9]*.[0-9]*.[0-9]* -j RETURN
```

~/.ssh/authorized_keys2:

```
command="
```

```
  trap '. .bash_logout ; exit' 2 ;
```

```
  trap '. .bash_logout' 0 ;
```

```
  sudo iptables -t filter -I wrls_login -s ${SSH_CLIENT%% *} -j RETURN ;
```

```
  read -n 1 -p 'Press any key to logout:' l_out ;
```

```
  sudo iptables -t filter -D wrls_login -s ${SSH_CLIENT%% *} -j RETURN
```

```
  " ssh-dss AAAAB3NzaC1kc3MAAACBAK0lq.....jOuTNWItVG4mkV39g= wireless_test@tox3
```

~/.bash_logout:

```
sudo iptables -t filter -D wrls_login -s ${SSH_CLIENT%% *} -j RETURN
```