# Debian/GNU Linux Remote Services

Remote Login Services, Remote Desktops

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## Agenda

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## Remote Login Services

### Application services to use remote hosts interactively

- Scenario: remote host offers interesting services:
  - Programs installed on remote host
  - Files located on remote host
  - Resources (CPU, memory, disk) provided by remote host
- Goal: use these remote services from local host
  - Use local host as a terminal to login to remote host
  - Run programs/commands on remote host
  - See output on local host (either Ascii terminal output or graphical output by X clients or some other way (vnc,rdp))
- Powerful server computer may be used from many clients

## Remote Login Services

### General application structure:

- Remote host runs a login service, a server
- client runs terminal program that contacts remote login service
- Login service creates process on remote host to execute commands on behalf of the user
- User enters commands in terminal program; commands are transferred to remote process and executed on remote host output transferred back to local host

### Relevant protocols/systems:

- TELNET (TCP/IP); rsh/rlogin (Unix/Linux), outdated
- SSH suite: ssh/slogin (secure shell, secure login)
- X-Windows X11 (network-transparent GUI)
- Real VNC (virtual network console)
- MS Windows Terminal Server (remote desktop)

## The Remote Login Server - an application program

TELNET or SSH Server

### Process

- Master server waits for new connection requests SSH: port 22
- For each connection, it spawns a slave server to handle the connection
- Multiple sessions (from the same or different cliens) may be active at the same time
- Slave server handles the connection
  - transfers data from local keyboard to remote host and outputs data from remote host on the local display
- OS must provide pseudo terminal for the slave server
  - Entry point to transfer characters to OS as if they came from a keyboard
  - Used by application programs like the TELNET server, SSHD, etc.

## Using TELNET for testing services

### Testing services with TELNET

- At RISC used only for testing services on remote computer
- Giving port number as parameter for Telnet: 25, 80, 110,etc.
- Checking if a mail server is running

```
uhu:~> telnet bullfinch.risc.uni-linz.ac.at 25
Trying 193.170.37.222
Connected to bullfinch.risc.uni-linz.ac.at.
Escape character is '^]'.
220 bullfinch.risc.uni-linz.ac.at ESMTP Sendmail 8.13.8/8.13.8/Debi
Sun, 19 Oct 2008 13:11:27 +0200; (No UCE/UBE) logging access from:
cm64-139.liwest.at(OK)-cm64-139.liwest.at [212.241.64.139]
quit
221 2.0.0 bullfinch.risc.uni-linz.ac.at closing connection
Connection closed by foreign host.
uhu:~>
```

## Telnet is outdates
SSH is the successor

### TELNET and Rsh/Rlogin outdated

- because of security problems
- All data are transferred in clear text
- Any listener between client and remote server can read everything
- True for any unencrypted connection, think on http !
- Telnet/rlogin not available at RISC anymore (remark: telnet-ssl)

### Replacement: Secure Shell (ssh, slogin)

- SSH suite is the modern replacement of TELNET and rlogin
- standard protocols for secure remote access over IP networks (RFCs: 4251-5254)
- All data are encrypted before they are transferred via IP
- Commercial implementations: `www.ssh.com`
- Free implementations: `www.openssh.org`, `www.putty.org`, etc.

## Agenda

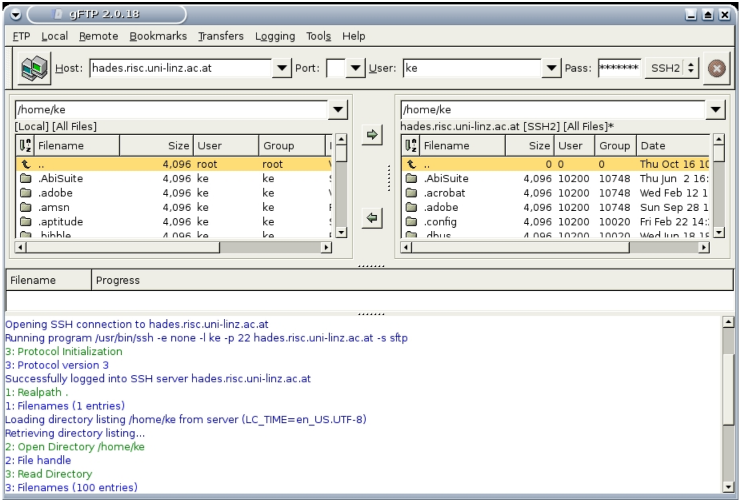
## File Services

File transfer, File sharing

### Application services to access files on remote hosts

- File transfer
  - Files are copied from one host to another
  - sftp (secure ftp), scp (secure remote copy), FTP is outdated !
  - Graphical tools: gftp, (kasablanca, etc.)
- File sharing
  - Files are accessed from a central server
  - Files are stored and backuped on central file server
  - Client applications operate on remote files like on local files
  - Transparent file access is provided by network file systems
  - NFS (Network File System), SMB (Server Message Blocks)

## FTP with gftp



Host: hades.risc.uni-linz.ac.at Port: User: ke Pass: ******** SSH2

/home/ke
[Local] [All Files]

| Filename | Size | User | Group |
|---|---|---|---|
| .. | 4,096 | root | root |
| .AbiSuite | 4,096 | ke | ke |
| .adobe | 4,096 | ke | ke |
| .amsn | 4,096 | ke | ke |
| .aptitude | 4,096 | ke | ke |
| bibble | 4,096 | ke | ke |

/home/ke
hades.risc.uni-linz.ac.at [SSH2] [All Files]*

| Filename | Size | User | Group | Date |
|---|---|---|---|---|
| .. | 0 | 0 | 0 | Thu Oct 16 1 |
| .AbiSuite | 4,096 | 10200 | 10748 | Thu Jun 2 16: |
| .acrobat | 4,096 | 10200 | 10748 | Wed Feb 12 1 |
| .adobe | 4,096 | 10200 | 10748 | Sun Sep 28 1 |
| .config | 4,096 | 10200 | 10020 | Fri Feb 22 14: |
| .dbus | 4,096 | 10200 | 10020 | Wed Jun 18 1 |

| Filename | Progress |
|---|---|

```
Opening SSH connection to hades.risc.uni-linz.ac.at
Running program /usr/bin/ssh -e none -l ke -p 22 hades.risc.uni-linz.ac.at -s sftp
3: Protocol Initialization
3: Protocol version 3
Successfully logged into SSH server hades.risc.uni-linz.ac.at
1: Realpath .
1: Filenames (1 entries)
Loading directory listing /home/ke from server (LC_TIME=en_US.UTF-8)
Retrieving directory listing...
2: Open Directory /home/ke
2: File handle
3: Read Directory
3: Filenames (100 entries)
```

## NFS (Network File System)

### NFS: access to remote files

- Developed by Sun Microsystems
- Used in many Intranets to interconnect file systems
- Mainly for Unix/Linux computers
- Remote file system can be accessed like local files
  - A remote file system is mounted to an empty local directory
  - Files below this directory can be used like local files
  - No special file transfer commands needed, no file duplication arises
- Implemented on top of UDP

### For security reasons, only used within an administrative domain

## Agenda

## SSH features

### SSH - a client-server solution for network security

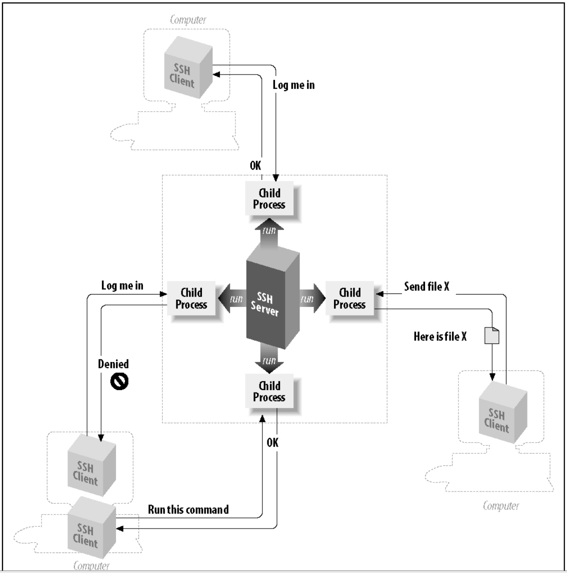
- client-server solution for network security
  - encryption: all data will encrypted before sending from localhost to remote computer and vice verse
  - transparent for the user (does not notice background activities)
  - client side: login, authentication, data transfer, command execution
- it is a protocol: describes how to conduct secure communication over a network
- full, secure replacement for FTP and Telnet and the UNIX r-series of commands: rlogin, rsh, rcp, rexec
  - creates a secure channel for running a shell on the remote computer
  - sftp, scp is integrated in the protocol
- supports more authentication methods: password, public key, certificate, smart card, PAM and SecurID

## SSH features

### Security

- uses multiple high security algorithms and strong authentication methods
  - prevents such security threats as identity spoofing and man-in-the-middle attacks
  - man-in-the-middle attack: changing the IP in the packet you communicate with the remote computer, stating: I'm the remote computer
- Transparent and automatic tunneling of X11 connections
- Port forwarding or SSH tunneling: for arbitrary TCP/IP-based applications, such as e-mail
- Multiple channels that allow
  - to have multiple terminal windows and file transfers going through one secure and authenticated connection

## The base services of SSH



## Complete Structure of the SSH protocol

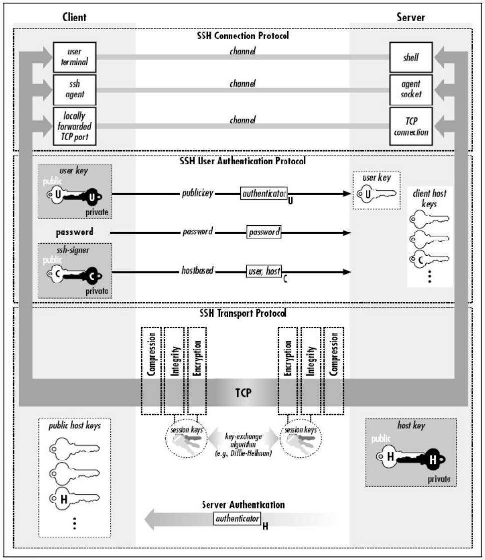


Figure 3-4. SSH-2 architecture

## The structure of the SSH-2 Protocol

### Very clean 3-layer internal architecture (RFC 4251)

- Transport Layer (RFC 4253)
  - initial key exchange, server authentication, data confidentiality, data integrity, compression, key re-exchange ( algorithm negotiation, session-ID, privacy)
- User Authentication Layer (RFC 4252)
  - Client Authentication: provides various authentication methods (public key, host bases, password, etc.)
- Connection Layer (RFC 4254)
  - defines the logical channels and the requests to handle the services like: secure interactive shell session, X11 forwarding, TCP/IP forwarding (channel multiplexing, pseudo terminals, flow control, remote program execution, authentication agent forwarding, terminal handling, etc.)

## Agenda

## SSH tunneling

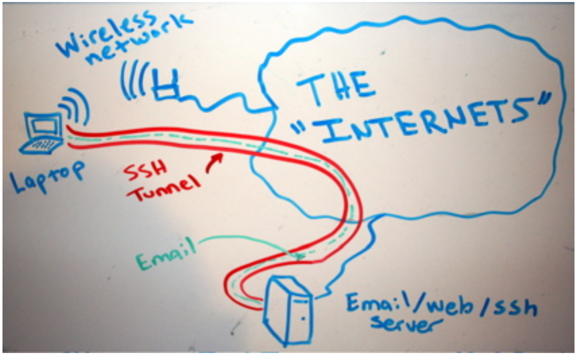
### What is an SSH tunnel

- tunnel is a networking term, means a connection, usually encrypted
- connects two computers together across another usually untrusted network

### Why do we need it - the Internet is very insecure !

- your laptop/home computer connects to another computer without encryption
- some protocols do have encryption built in, some do not
- your email client, your ftp program, VNC client, etc.
- Never use clear text connections !
- definitively not for login/password data!
- configure SSH tunnel for your connections!

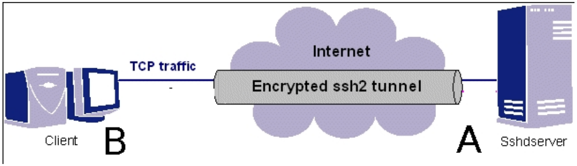
## Secure WLAN connection through the Internet



## SSH tunnel through the Internet

### SSH Tunnel Topology

- Client B (laptop, PC at home, etc) connects using local ports
- Server A running the sshd server program
  - mail server: port 25 smtp; VNC server: port 5901
- through an SSH tunnel - encrypted connection !



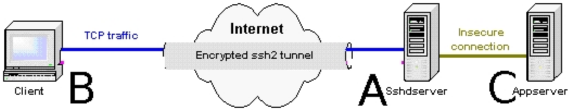
## How to make SSH tunnel in Linux

### basic version:

- ssh -L localport:hostname:hostport hostname
- Example: ssh -L 22000:bullfinch.risc.uni-linz.ac.at:143 bullfinch.risc.uni-linz.ac.at
- ssh -L 20000:kernel.risc.uni-linz.ac.at:143 bullfinch.risc.uni-linz.ac.at
- you can use more -L option in one command, (create more tunnel!)

### full version

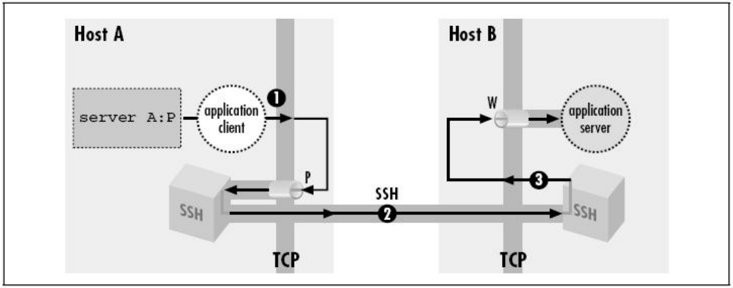
- ssh -f -N -L localport:host:hostport sshd-server-computer (C, A)
- -N do not execure command ( -N is for portforwarding)
- -f go into background



## SSH Tunnel - Port forwarding

Window SSH client from www.ssh.com

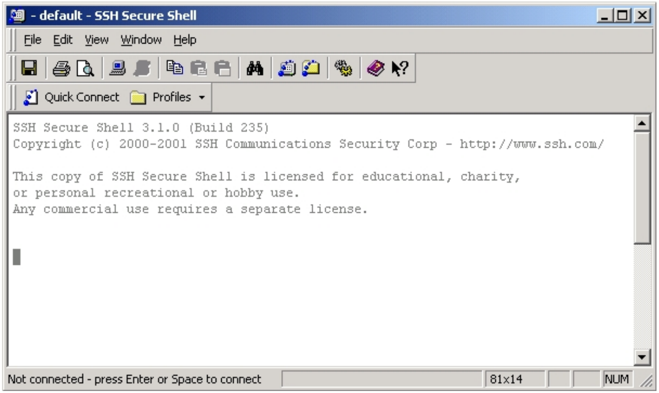
### Port forwarding



### Windows SSH-Client (ssh.com) from TU-Wien:

- ftp://gd.tuwien.ac.at/utils/shells/ssh/SSHSecureShellClient-3.2.9.exe

## SSH Tunnel - MS Windows
SSH Shell from ssh.com

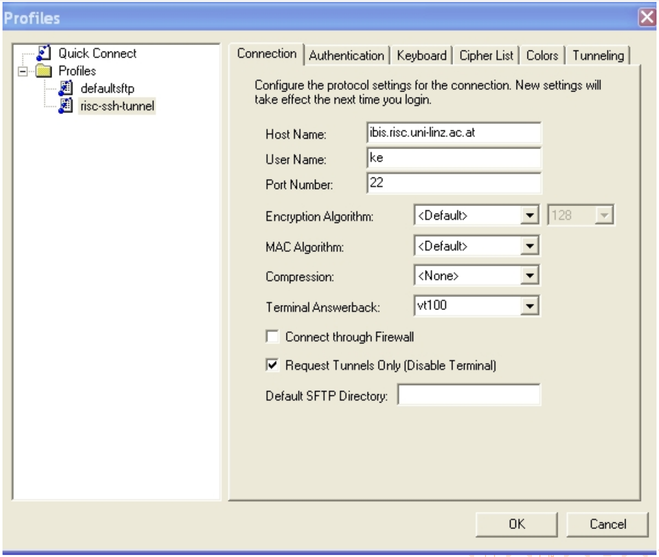


```
SSH Secure Shell 3.1.0 (Build 235)
Copyright (c) 2000-2001 SSH Communications Security Corp - http://www.ssh.com/

This copy of SSH Secure Shell is licensed for educational, charity,
or personal recreational or hobby use.
Any commercial use requires a separate license.
```

Not connected - press Enter or Space to connect 81x14 NUM

## SSH Tunnel - MS Windows

Connection configuration



Configure the protocol settings for the connection. New settings will take effect the next time you login.

| | |
|---|---|
| Host Name: | ibis.risc.uni-linz.ac.at |
| User Name: | ke |
| Port Number: | 22 |
| Encryption Algorithm: | <Default> 128 |
| MAC Algorithm: | <Default> |
| Compression: | <None> |
| Terminal Answerback: | vt100 |

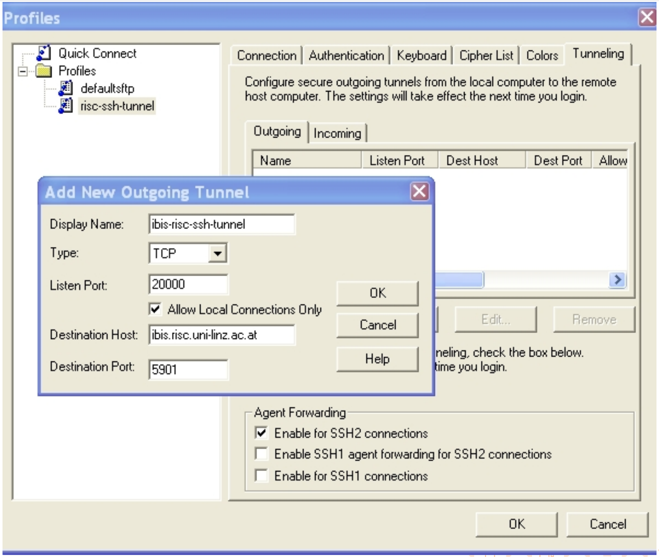
☐ Connect through Firewall

☑ Request Tunnels Only (Disable Terminal)

Default SFTP Directory:

## SSH Tunnel - MS Windows

### Configuring ports



Configure secure outgoing tunnels from the local computer to the remote host computer. The settings will take effect the next time you login.

Add New Outgoing Tunnel

Display Name: ibis-risc-ssh-tunnel

Type: TCP

Listen Port: 20000

[✓] Allow Local Connections Only

Destination Host: ibis.risc.uni-linz.ac.at

Destination Port: 5901

neling, check the box below.
time you login.

Agent Forwarding

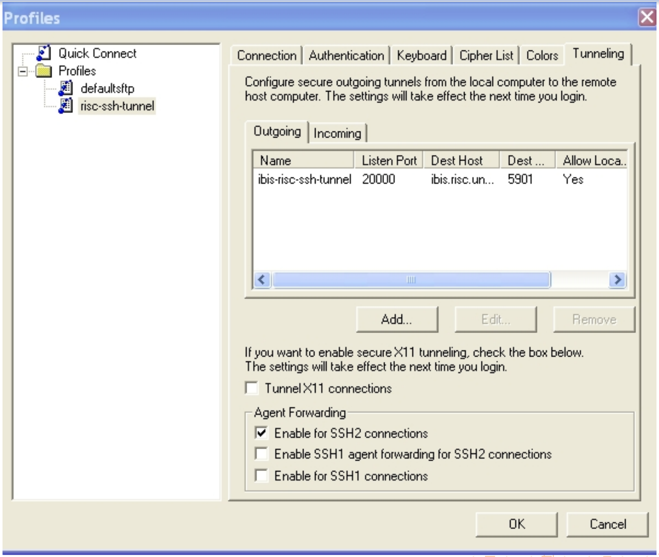
[✓] Enable for SSH2 connections

[ ] Enable SSH1 agent forwarding for SSH2 connections

[ ] Enable for SSH1 connections

## SSH Tunnel - MS Windows

Established tunnel



Configure secure outgoing tunnels from the local computer to the remote host computer. The settings will take effect the next time you login.

| Name | Listen Port | Dest Host | Dest ... | Allow Loca.. |
|---|---|---|---|---|
| ibis-risc-ssh-tunnel | 20000 | ibis.risc.un... | 5901 | Yes |

If you want to enable secure X11 tunneling, check the box below. The settings will take effect the next time you login.

☐ Tunnel X11 connections

Agent Forwarding

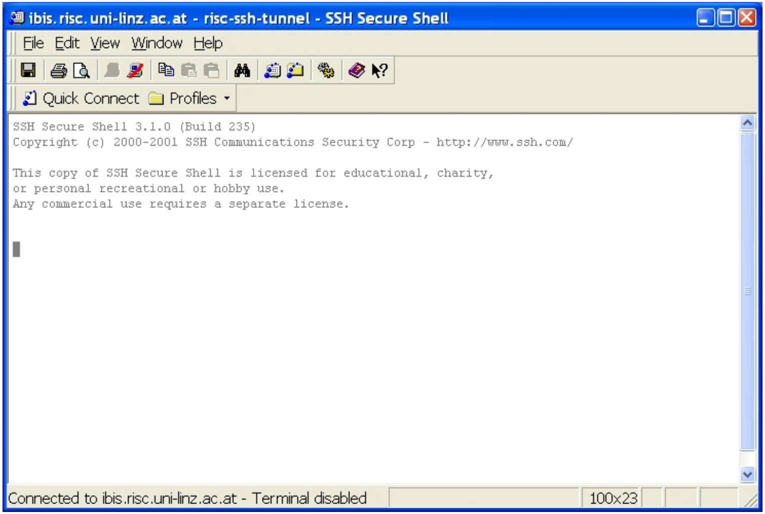
☑ Enable for SSH2 connections

☐ Enable SSH1 agent forwarding for SSH2 connections

☐ Enable for SSH1 connections

## SSH Tunnel - MS Windows

Established tunnel


ibis.risc.uni-linz.ac.at - risc-ssh-tunnel - SSH Secure Shell
File Edit View Window Help
Quick Connect
Profiles

```
SSH Secure Shell 3.1.0 (Build 235)
Copyright (c) 2000-2001 SSH Communications Security Corp - http://www.ssh.com/

This copy of SSH Secure Shell is licensed for educational, charity,
or personal recreational or hobby use.
Any commercial use requires a separate license.
```

Connected to ibis.risc.uni-linz.ac.at - Terminal disabled 100x23

## SSH host authentification

how known hosts works need work one slide only

## Presentation of SSH tunneling

Now please make a short on-line demonstration

how the SSH tunneling works for the e-mailing

## Agenda

## Remote login without passwd by SSH

How to set up

### Basics of the authentication

- SSH authentication methods
  - password authentication; private key authentication
- private key authentication
  - Create a public key with ssh (set the passphrase !)
  - Copy the public key to the remote computer
  - Configure the authentication agent: ssh-agent
  - use ssh-add command to add your identity to the `ssh-agent`
- Customizing the authentication
  - installing ssh-askpass
  - Starting `ssh-add` by an icon

## Remote login with SSH

### Create public key

- Create a public key: ssh-keygen -t dsa
  - always USE a passphrase
  - without passphrase: if your private key is stolen your identity is stolen
  - choose it different from your password, choose a long one
  - it must as save as your password, it can be more save (less restriction)

```
bienenfresser:~> ssh-keygen -t dsa
Generating public/private dsa key pair.
Enter file in which to save the key (/home/ke/.ssh/id_dsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ke/.ssh/id_dsa.
Your public key has been saved in /home/ke/.ssh/id_dsa.pub.
The key fingerprint is:
a8:00:0e:39:b9:5e:30:a0:c7:70:cd ke@bienenfresser
bienenfresser:~>
```

## Remote login with SSH

### Copy public key

- copy the public key to the RISC computer
- add to .ssh/authorized_keys file

```
bienenfresser:~> cat .ssh/id_dsa.pub |
   ssh goose.risc.uni-linz.ac.at 'cat - >>.ssh/authorized_keys'

   ke@goose.risc.uni-linz.ac.at's password:
bienenfresser:~>
```

- you will be asked for your password on the remote computer
- check that it works:
  - ssh -X goose.risc.uni-linz.ac.at
  - passphrase will be asked for

## Remote login with SSH

### ssh-agent

- Authentication agent, ssh-agent
  - saves the identity value (private key) in the memory
  - supports authentication requests from SSH
  - started by login in KDE, GNOME

### ssh-add

- transfers the identification (.ssh/id_dsa) to ssh-agent
- asks for the passphrase, to decrypt the private key

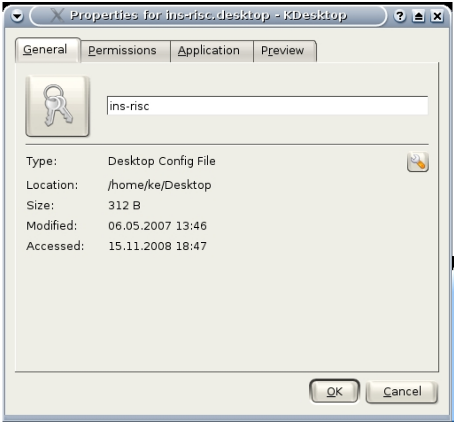
```
bienenfresser:~> ssh-add .ssh/id_dsa
Enter passphrase for .ssh/id_dsa:
Identity added: .ssh/id_dsa (.ssh/id_dsa)
bienenfresser:~>
```

- will invoke ssh-askpass, if get a zero in standard input

## Customizing ssh-add

Create a small script in i.e. /usr/local/bin/ or ~/bin

```
#!/bin/csh
cat /dev/null | ssh-add .ssh/id_dsa
```

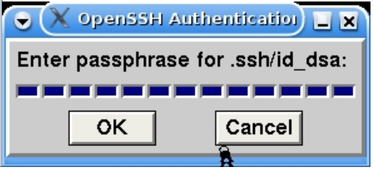


Properties for ins-risc.desktop - KDesktop

General | Permissions | Application | Preview

ins-risc

Type: Desktop Config File
Location: /home/ke/Desktop
Size: 312 B
Modified: 06.05.2007 13:46
Accessed: 15.11.2008 18:47

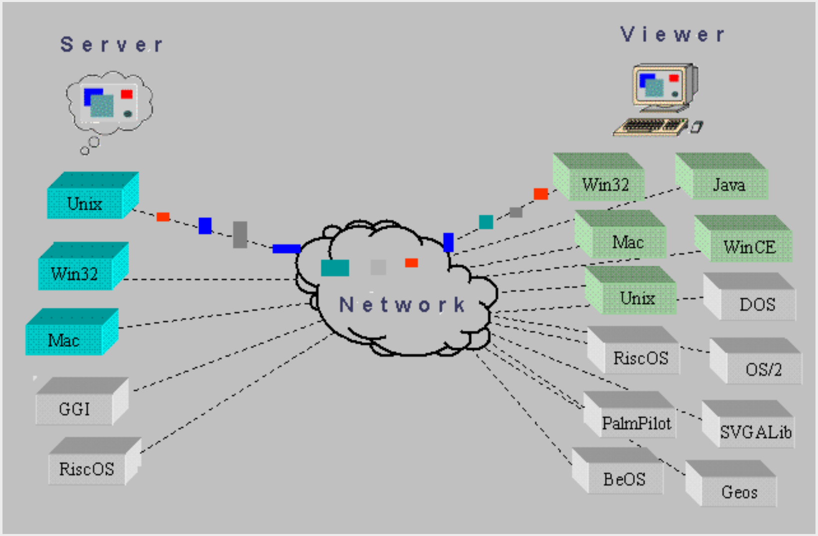


OpenSSH Authentication

Enter passphrase for .ssh/id_dsa:

## Agenda

## Real VNC (Virtual Network Console)



## VNC - Virtual Network Computing

### Basic Features

**VNC**

- is a Client-Server architecture based on the RFB protocol
- is a graphical desktop sharing system
  - without the need of X on the client side
- transmits the keyboard and mouse events from one computer to another
- relays the graphical screen updates back in the other direction
- is not a secure protocol
  - passwords are not sent in plain-text
  - crack could be successful if both the encryption key and encoded password are sniffed from a network
- always use VNC through an SSH tunnel !

**VNC is a free platform-independent application !**

## VNC - Virtual Network Computing
Basic terminology

### Framebuffer (FB)

- is a video output device that drives a video display from a memory buffer containing a complete frame of data
- the information in the buffer consists of color values for every pixel on the screen
- total memory required for the FB depends on the resolution, and on the color depth
- a FB device driver was created for X11: XF86 FBDev as standard part of XFree86
- FBDev is basic driver in X, without using the features of the GPU

## VNC - Virtual Network Computing

RFB Protocol

### Remote Framebuffer (RFB) protocol

- is a simple protocol for remote access to graphical user interfaces
- it works at the framebuffer level, it is applicable to all windowing systems and applications, including X11, Windows and Macintosh.
- to the basic features a lot of extensions added
  - file transfers
  - more sophisticated compression
  - security techniques
- seamless cross-compatibility
  - between the many different VNC client and server implementations
- clients and servers negotiate using
  - the best RFB version
  - most appropriate compression and security options

### RealVNC, Ltd.

- continues development of VNC and to maintain the RFB protocol

## VNC - Virtual Network Computing
VNC Server

### VNC Server features

- does not have a physical display! (does not bind to a display)
- consists of two servers on Linux/Unix OS
  - Framebuffer Server: to communicate remotely with the VNC client
  - X Server: to communicate locally with the X-clients, presenting itself as a real X-Server
  - the X-server part fills up the framebuffer with the output from the X-clients
  - the FB-server part transfers the content of the FB to VNC-client(s)
- the session information will be kept in the server side
  - if you disconnect from the VNC server it will not close the session
  - Disconnecting from VNC server behaves like locking the session and switching off the monitor
- you have explicitly kill the VNC server after your work !

## VNC - Virtual Network Computing

### VNC Server II

#### VNC Server features

- by default uses TCP ports 5900 through 5906
  - each port corresponds to a separate screen (:0 to :6)
- uses ports 5800 through 5806 for java connections
  - allowing clients to interact through a Java-enabled web browser
- Xvnc is the Unix VNC server, it is based on standard X server
- any number of Xvnc server can be started (resources!)
- more clients can connect to the same server
- VNC need more/high bandwidth because of tranferring screenshots
  - the session and switching off the monitor

## VNC - Virtual Network Computing
VNC Server starting

### Starting the VNC server

- log in by ssh to a RISC computer
- start the VNC server by the command:

```
vncserver -geometry 1024x768 -depth 24
```

- You will see something similar in the screen (it just ask a session password at the first run):

```
You will require a password to access your desktops.

Password:
Verify:

New 'X' desktop is srvname:2

Starting applications specified in /etc/X11/Xsession
Log file is /home/yourusername/.vnc/srvname:1.log
```

## VNC - Virtual Network Computing

VNC server and client starting

### Starting Server

- You have to memorize the server name and the screen number - after the computer name (in this case it is ":1")
  - The port number will be 5901 (5900+screen number)
- You have to shutdown the VNC server, after you do not need it:

```
vncserver -kill :1
```

### Starting the VNC Client

- create an ssh tunnel: (IMPORTANT Update,s.next slide)

```
ssh -f -l username -N -L 9999:srvname:5901 srvname
```

- start the VNC client

```
xvncviewer localhost::9999
```

- Security Risk
  - your password can be stolen using xvncclient without ssh tunnel !
  - hacker get full access to your home directory

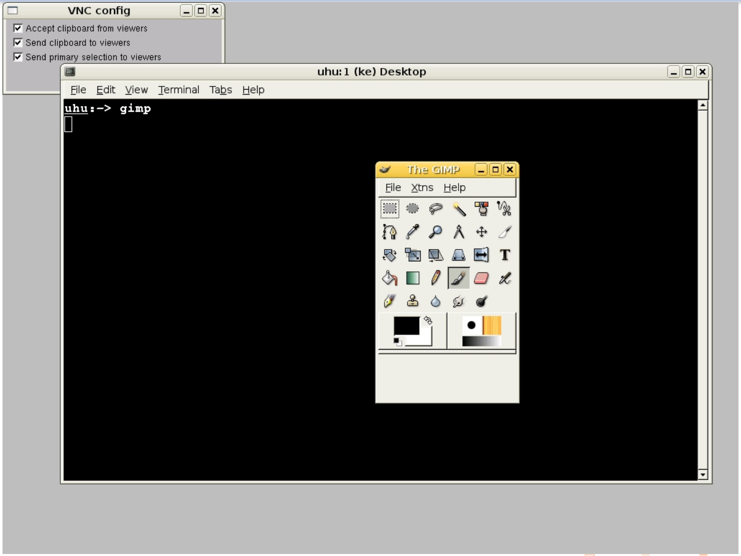
## VNC - Virtual Network Computing
VNC server and client starting NEW SLIDE

### Configuration of the `vncserver` changed at RISC

- this slide has been added on Dec 23, 2008.
- on Dec 9, 2008. the following feature has been added to the configuration of the vncservers at RISC -localhost
  - this means, that the vncserver accepts connections only from localhost (127.0.0.1)
  - with other words: you MUST use ssh tunnel to the host where the vncserver is running (otherwise you'll get error: connection refused).
- because of this change you have the use the form of the ssh tunnel:
  - `ssh -f -l username -N -L 9999:localhost:5901 srvname`
- example: assumed, you started the vncserver on the computer speedy.risc.uni-linz.ac.at, you need the follwoing ssh-tunnel:
  - `ssh -f -l username -N -L 9999:localhost:5901 speedy.risc.uni-linz.ac.at`
  - localhost will be replaced by 127.0.0.1, and this is the IP from which the vncserver accepts connections.

## VNC - Virtual Network Computing

### VNC Client - xnvcviewer - standard xterm


VNC config

☑ Accept clipboard from viewers
☑ Send clipboard to viewers
☑ Send primary selection to viewers

uhu:1 (ke) Desktop

```
uhu:-> gimp
```

## VNC - Virtual Network Computing
Xvncserver configuration

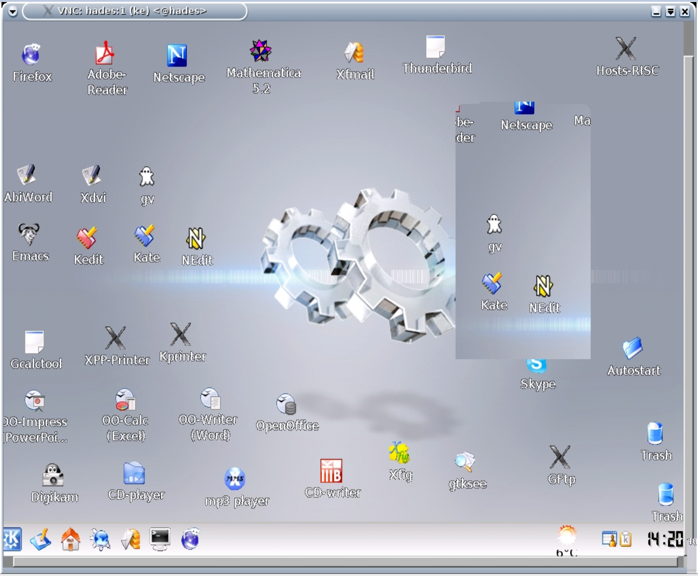
### How to start KDE session

- configuration directory: ~/.vnc
  - password: passwd; session startup: xstartup

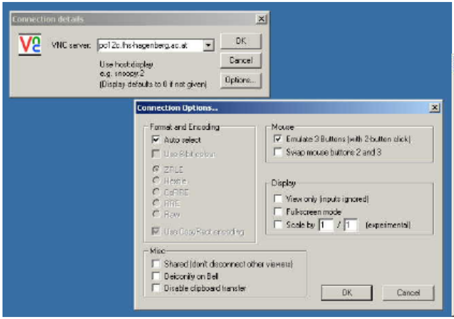
```
#!/bin/sh
# Uncomment the following two lines for normal desktop:
# unset SESSION_MANAGER
# exec /etc/X11/xinit/xinitrc
[ -x /etc/vnc/xstartup ] && exec /etc/vnc/xstartup
[ -r $HOME/.Xresources ] && xrdb $HOME/.Xresources

# xsetroot -solid grey
# vncconfig -iconic &
# x-terminal-emulator -geometry 80x24+10+10 -ls -title "$VNCDES
## metacity window manager will be started:
# x-window-manager &
## to start a kde session uncomment the line below and add star
#  x-session-manager &
startkde &
```

## VNC - Virtual Network Computing

### VNC Client - xnvcviewer - with KDE



## Real VNC


Connection details

VNC server: pc12c.fhs-hagenberg.ac.at

Use host:display
e.g. snoopy:2
(Display defaults to 0 if not given)

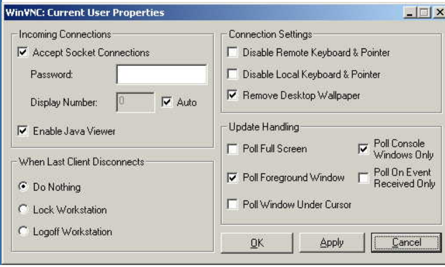
Connection Options...

Format and Encoding
- [✓] Auto select
- [ ] Use 8-bit colour
- (●) ZRLE
- ( ) Hextile
- ( ) CoRRE
- ( ) RRE
- ( ) Raw
- [✓] Use CopyRect encoding

Mouse
- [✓] Emulate 3 Buttons (with 2-button click)
- [ ] Swap mouse buttons 2 and 3

Display
- [ ] View only (inputs ignored)
- [ ] Full-screen mode
- [ ] Scale by 1 / 1 (experimental)

Misc
- [ ] Shared (don't disconnect other viewers)
- [ ] Deiconify on Bell
- [ ] Disable clipboard transfer


WinVNC: Current User Properties

Incoming Connections
- [✓] Accept Socket Connections
- Password:
- Display Number: 0 [✓] Auto
- [✓] Enable Java Viewer

When Last Client Disconnects
- (●) Do Nothing
- ( ) Lock Workstation
- ( ) Logoff Workstation

Connection Settings
- [ ] Disable Remote Keyboard & Pointer
- [ ] Disable Local Keyboard & Pointer
- [✓] Remove Desktop Wallpaper

Update Handling
- [ ] Poll Full Screen
- [✓] Poll Console Windows Only
- [✓] Poll Foreground Window
- [ ] Poll On Event Received Only
- [ ] Poll Window Under Cursor

## Demonstration VNC client

Now make a short demonstration

how VNC works through a tunnel

## Agenda

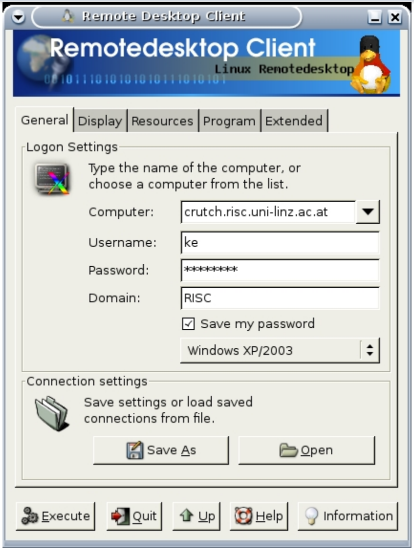
## Remote Desktop Protocol
Microsoft Windows

### Windows NT/2000: Terminal Services extension

- Remote Desktop Protocol (RDP) developed in the mid 1990's by Microsoft
  - RDP client computer (Windows/Unix) opens a remote desktop session on a Windows NT/2000 server with terminal services extension
  - In client window, user sees another desktop running on the server
  - Introduced by Windows NT Terminal Server Edition
  - Installed at RISC in 1999 for MS Office Compatibility goals
  - The first MS Windows Multiuser OS !
- Windows XP:
  - Provides builtin RDP service functionality
- Windows 2003 Server: successor of NT/2000 Terminal Server Editon

## GRDesktop - Configuration

Gnu RDP Client



Logon Settings

Type the name of the computer, or choose a computer from the list.

Computer: crutch.risc.uni-linz.ac.at

Username: ke

Password: *********

Domain: RISC

☑ Save my password

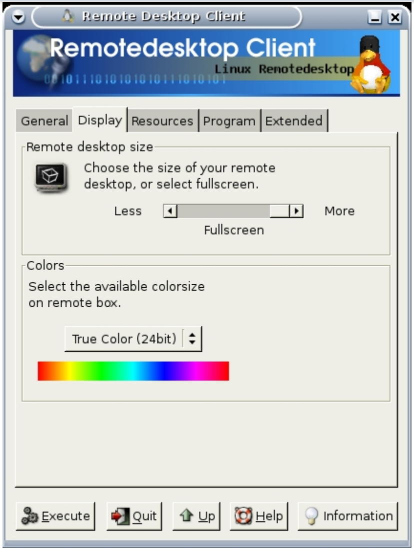
Windows XP/2003

Connection settings

Save settings or load saved connections from file.

## GRDesktop - Configuration

Gnu RDP Client



Remote Desktop Client

Remotedesktop Client

Linux Renotedesktop

General | Display | Resources | Program | Extended

Remote desktop size

Choose the size of your remote desktop, or select fullscreen.

Less — More

Fullscreen

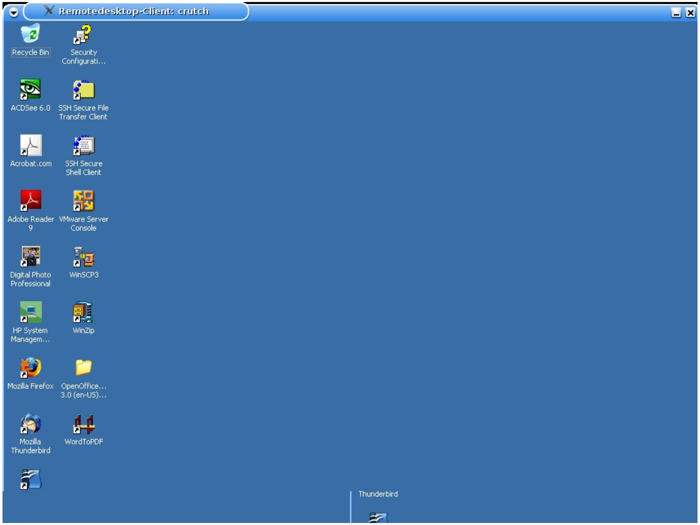
Colors

Select the available colorsize on remote box.

True Color (24bit)

## GRDesktop

### Main screen



## End of Remote Services, Desktops

Thanks for your attention !