Administration of Operating Systems

SSH

Chapter 18

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SSH

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- *Secure Shell*
  - access remote systems
  - encrypting all traffic
  - host verification
- Uses public key encryption
- `ssh` client is installed by default on virtually every GNU/Linux systems
- `ssh` server can be installed using `sudo apt-get install openssh-server`
- `ssh` client for Windows
  - `putty`
- Protocol version 2

Tools

- `ssh`
  - remote shell
- `sshd`
  - server
- `scp`
  - file copy
- `sftp`
  - file transfer protocol
- `ssh-keygen`
  - private/public key generation
- `ssh-agent`
  - secure passphrase storage

Tools

- `ssh host`
- `ssh user@host`
- `exit`
- `ssh user@host command`
- `scp source user@host:destination`
- `scp user@host:source destination`
- `sudo /etc/init.d/ssh restart`
- `sudo /etc/init.d/ssh reload`
- `ssh-keygen -t rsa -f filename`

Basic Security

- Make sure users use secure passwords
  - this is *way* more important than all the rest
- Use public key based authentication
  - more about it later
- Disable remote login for `root`
  - limit users who have `ssh` access
- Chroot `sshd`
  - lock down users to their home directories
- Thwart `ssh` brute force attacks
- Change the default port 22
- Only use SSH protocol 2

Symmetric Encryption

- Alice and Bob both know the key
  - share secret knowledge
- The key is unknown to Eve
- Problem: how to distribute encryption keys?
  - ... securely ...
  - ... among peers who never interacted before...
  - ... and who can communicate only through a network which is inherently non-secure
- Historically, keys were agreed upon personally
  - meet once, then you can communicate
- Does not work well in the global Internet
  - can be done, but it’s quite inefficient

Establishing a Secret

- Alice sends Bob a number of unique puzzles
  - each puzzle has a name
  - there is *a lot* of them
- Bob chooses one at random
- Bob solves the chosen puzzle
- Bob sends Alice the solution
- Now, both Bob and Alice know the secret
  - name of the puzzle Bob has chosen
- Eve does not know the name
  - unless she solved *all* the puzzles
  - or can guess Bob's random choice

Asymmetric Encryption

- Requirements
  - public key for encryption E
  - private key for decryption D
  - $D(E(text)) = text$
  - it is difficult to deduce D knowing E
    - including high resistance to the “chosen plaintext” attack
  - sufficiently easy to generate E, D pair
- Everybody can encrypt message using E
- Only Alice can decrypt it using D
  - Bob sends encrypted message
  - Eve cannot decrypt it

~/.ssh/known_hosts

- Also `/etc/ssh/ssh_known_hosts`
- List of all known remote hosts
  - including their public keys
- Upon first connection, `ssh` cannot, by itself, verify the identity of the host
  - it should be done by the user
- Afterwards, *ssh* will be able to verify it is talking to the same remote system
  - and warn the user if something is wrong

Public Key Authentication

- Do not input password every time
  - authorise using asymmetric cryptography
- Generate a personal pair of keys
  - public & private
- Put public key on the server
  - this one does not need to be protected
- Keep private key safe
  - protected with a good passphrase
- Tell server that *everybody who knows this private key is considered trusted*
  - that's still better than password
- `ssh -i` & `ssh-agent`

X11 Window System

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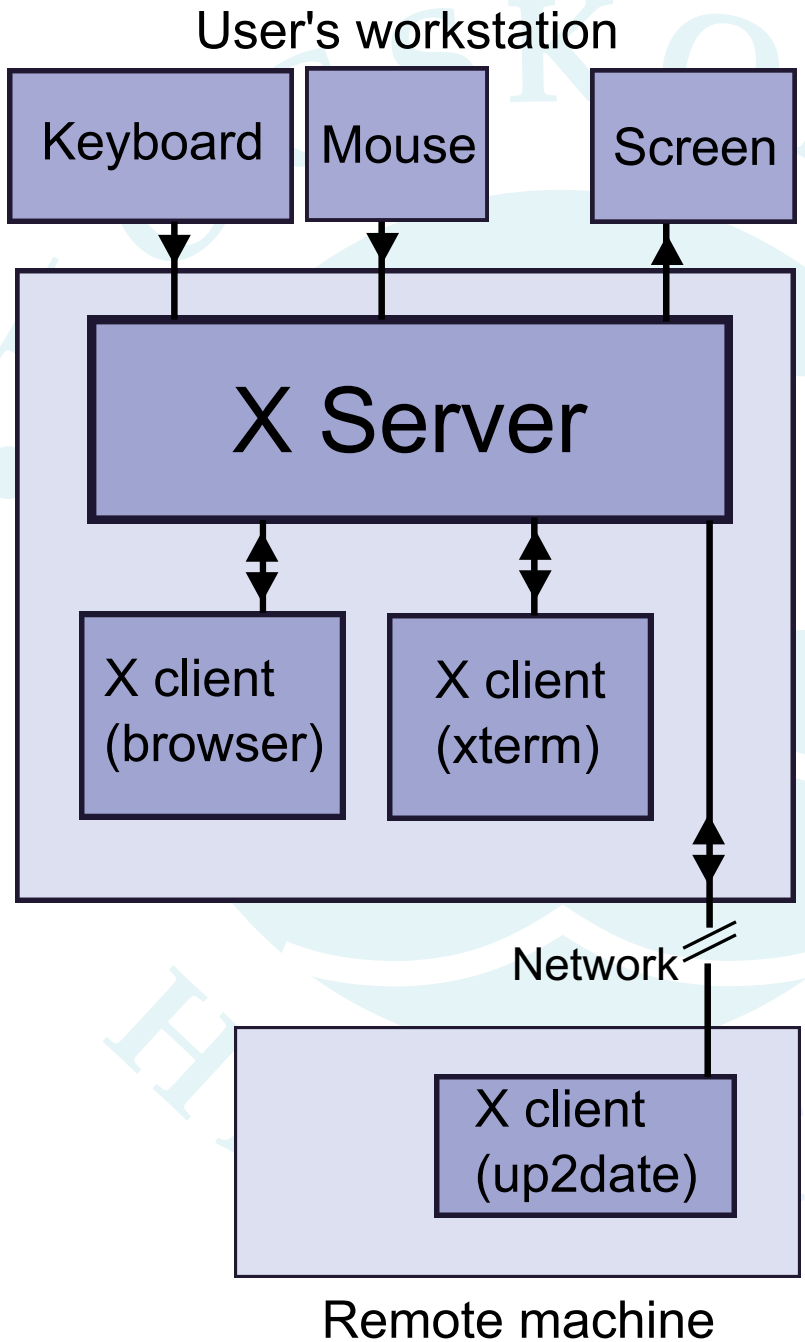

X11 Forwarding

- GUI environment used by GNU/Linux systems
  - architecture independent & network aware
  - using client-server model
- X11 forwarding allows remote system to display GUI objects on user's local machine
  - encrypting all traffic
  - *X server* needs to be running on local machine
- `sshd` acts as *X server* on remote host
  - GUI applications connect to it
  - traffic is tunnelled over encrypted connection
- `ssh` acts as GUI client
  - displaying GUI objects of remote applications

Port Forwarding

- Similar mechanism can be used for forwarding arbitrary traffic
- Most commonly used for securing otherwise unencrypted protocols
  - POP3, SMTP, IRC, ...
- Local port forwarding
  - connections to local machine are transparently forwarded to the remote system
- Remote port forwarding
  - connections to remote machine are transparently forwarded to the local system

Configuration

- AllowUsers & DenyUsers
  - AllowGroups & DenyGroups
- PasswordAuthentication
- PermitEmptyPasswords
- PermitRootLogin
- AllowAgentForwarding
- AllowTcpForwarding
- ListenAddress & Port
- Protocol
- ChrootDirectory
- Match User

Questions?