Debian/GNU Linux Networking Basics of the Networking

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Károly Erdei — Debian/GNU Linux Networking



2 Ethernet

- **3** Internet Protocols
- 4 TCP
- 5 DHCP
- 6 Check Network

7 Connecting PCs



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Computer Networks Transmission Principles

Broadcasting networks

- one machine sends short messages (packet)
- Broadcasting: all other machines receive the package sent
- transmission medium shared by all network participants (hosts)
- Example: Radio, television, GSM, Ethernet

Point-to-point networks

- Multiple connections between individual pairs of machines
- Message from one machine to another
- Message must be routed from source to destination
- Example: Telephone system, Internet

Range of Computer Networks

Ranges

- PAN Personal Area Networks 1-10 m, (using Bluetooth units)
- LAN Local Area Network: Room (10 m), building (100 m), campus (1000 m)
- MAN Metropolitan Area Network: City (10 km) Metronet-Hgb
- WAN Wide Area Network: Country (100 km), continent (1000 km)
- Internetwork Combination or network of networks: Planet (10K km)

LAN

- Private network within building or complex of buildings
- Connection based on cables (hosts are attached via network cards)
- Transmission speed 0.1–1 Gbps
- Various topologies: Bus-based (Ethernet), Wireless (WLAN)

Network of Networks

Internetwork:

- Connects multiple WANs/LANs across the globe
- LANs/WANs connected to Internetworks by routers or gateways
- Each attached network may have different protocol
 - Protocol = language spoken by computers on network
- Any computer in any network can communicate with any other computer in any other network independently of physical network technologies
 - Communication based on higher level protocols

The Internet

- A worldwide internetwork that uses the TCP/IP protocol suite
- It is a packet switching network (data will be splitted in packets)

The Internet

Various groups of networks

- Backbones: large networks for connecting other networks (GEANT2)
- Regional networks: e.g. connecting universities (ACOnet)
- Commercial networks: privately owned for paying users (LIWEST)

Lot of services

- Application level: World Wide Web, eMail, file transfer, remote login
- Network level: connectionless packet delivery (UDP), reliable stream transport (TCP)

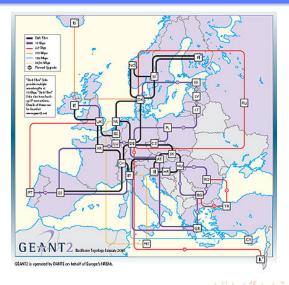
Today the Internet is a collection of commercial networks

Organisation of the Internet

Internet Architecture Board (IAB)

- Internet Engineering Task Force (IETF)
 - Decisions about protocols, procedures, conventions
- Request for Comments (RFCs)
 - Series of reports that defines the (history of) Internet protocols
- Internet Standards
 - Defines the official Internet protocols
 - References the RFCs that define a current standard
 - Update of standards: other RFCs will be referenced
- Examples of Internet Standards:
 - IP Internet Protocol: STD 5
 - TCP Transmission Control Protocol: STD 7
 - DNS Domain Name System: STD 13
 - SMTP Simple Mail Transfer Protocol: STD 10

GEANT2 - Pan-European Education/Research Network



Networks Ethernet Internet Protocols TCP DHCP Check Network Connecting PCs ACOnet - Austrian Academic Computer Network



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Ethernet The communications medium

Ethernet

- is a family of frame-based computer networking technologies for local area networks (LANs)
 - a data packet on the wire is called a frame
- uses the Media Access Control (MAC) address to identify nodes
- allows communication of computers over a shared coaxial cable or UTP acting as a broadcast transmission medium
- all generations of Ethernet share the same frame formats
 - the same interface for higher layers

Ethernet MAC addresses

MAC / physical / hardware Address

- each Ethernet station is given a single 48-bit unique MAC address
- is used both to specify the destination and the source of each data packet
- is six groups of two hexadecimal digits, separated by or :
 - first three octets identify the organization
 - arbitrary but unique next three octets assigned by the organisation
- is used/valid only in LAN (network segment)

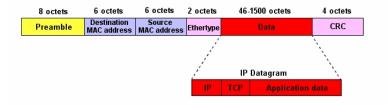
technologies which use MAC address

Ethernet, 802.11 wireless networks, Bluetooth

Special MAC addresses:

- broadcast address: ff:ff:ff:ff:ff:ff
 - packets sent to this address are received by all stations on the local network

Ethernet The frame structure



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Ethernet - MAC address How to find a local MAC addresses

Linux - command line with /sbin/ifconfig

```
uhu: ~> /sbin/ifconfig eth0
eth0 Link encap:Ethernet HWaddr 00:16:41:16:6D:5D
inet addr:192.168.1.115 Bcast:192.168.1.255 Mask:255.255.25
....
uhu: ~> /sbin/ifconfig eth1
eth1 Link encap:Ethernet HWaddr 00:16:6F:BA:3E:01
UP BROADCAST MULTICAST MTU:1500 Metric:1
```

. . . .

MS Windows - fastest way

in DOS Window by means of ipconfig /all

Linux - all units in the network segment

arp -a (only one line listed as example):

crutch.risc.uni-linz.ac.at (193.170.37.76) at 00:16:35:37:5C:EC [ether] on eth0

Ethernet - MAC address

How to find a local MAC addresses - Linux with gnome-nettool

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Devices Ping Netstat Traceroute Port Scan Lookup Finger Whois								
Network device: Ethernet Interface (eth0)								
IP Information								
	Protocol	IP Add	ress	Net	mask / Prefix	Broadcast		Scope
	IP∨4	193.1	70.37.80	255	.255.255.0	193.170.3	7.255	
	IPv6	fe80:::	213:20ff:fe75:	4402 64				Link
	terface Ir				Interface S			
	Hardware Multicast:	addres	s: 00:13:20:7 Fnabled	5:44:02	Transmitte		1.5 G	
	Multicast: MTU:		Enabled 1500		Transmitte Transmissi			400
	MIU: Link speed	4.	not availab		Received b		-	MID
	State:	<i>.</i>	Active	ne	Received p	·	2569	
	State:		Active		Reception		2569	/00
					Collisions:	cirors.	0	
					consions.		<u> </u>	
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Internet Protocols

Connectionless and Connection-oriented protocols

Connectionless protocol

- communication between two network point in which message can be sent without prior arrangement
- the transmitting device sending the message:
 - does not ensures first recipient is available and ready to receive data
 - simply sends the message to the recipient address
- often problems with transmission
- examples: IP, UDP, ICMP, IPX

Connection-oriented protocol

delivers a stream of data in the same order as it was sent

- first a communication section will be established
- data stream will be send by handshaking
- packet retransmission by error, data lost, etc.
- examples: TCP

4 - + -

phone call: user must dial first and get answer before transmitting

IP - The Internet Protocol

Features of IP

- A standard protocol (STD 5)
- No delivery guarantuees
 - Connection-less
 - Unreliable: packets may be lost, duplicated, reordered
 - Best-effort: however, we do our best to deliver a packet
 - packets oriented
- Data from an upper layer protocol is encapsulated inside one or more packets
- IP can be used over a heterogeneous network
 - Ethernet, ATM, FDDI, Wi-Fi, token ring, etc.
- Core functionality
 - defines IP addresses und subnetting
 - defines routing in the network

IP Addressing

RFC 1166: Internet Numbers

- An IP address is a 32 bit unsigned integer
 - \blacksquare There exist $2^{32}\approx 4$ billion IP addresses
- Representation in dotted decimal notation
 - X.X.X.X; Each X is a decimal number, a byte of the address
- Example: 128.10.2.30: 10000000 00001010 00000010 0011110

Some addresses are reserved for special purposes

- net.0: the "network" address (not a particular host) 193.170.37.0
- default gateway: an address in this network: 193.170.37.1
- broadcast address: net.255
- 0.0.0.0: "this" host
- 127.0.0.1: loopback (not sent across network, for testing local IP setup)

IP Datagram Structure

Version Header Type of Length Service			Datagram Length	
	IC)	Offset	
TTL		Upper Layer Protocol	Checksum	
Source IP Address Destination IP Address				
Data				

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Routers and Gateways Features

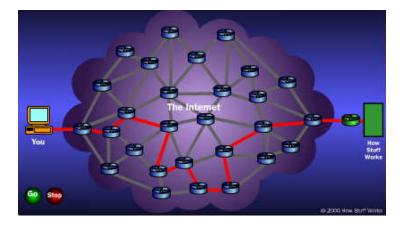
Router: a networking device

- a computer whose software and hardware are usually tailored to the tasks of routing and forwarding packets
- transfers packets only across networks using similar protocols
- contains a specialized operating system (e.g. Cisco's IOS)
- has multiple network connections
- Types of routers
 - small units (DSL router) ISPs big multiprocessor unit

Gateway

- a networking device that converts protocols among networks
- accepts a packet formatted for one protocol (AppleTalk) and converts it to a packet formatted to another protocol (TPC/IP)
- Default gateway

Routers, packets A route of a packet in the Internet



Private Networks - Private IP Addresses

The addresses, which can be used by everyone

Private Internet Addresses

RFC 1918: address allocation for private Internets

- May be used internally in any organization
- routers have to discard any packets with a private IP address in the IP header
- gives security for private networks they are not available from the Internet

Examples

- private class A network: 10.0.0.0 10.255.255.255
 - Huge address range for communication within an organization
- Home network: 192.168.0.0 192.168.255.255
 - Cable/DSL router: 192.168.1.1

Internet Protocol - ICMP based applications

Ping and Traceroute

ping

```
simplest version: ping hostname
```

PING kernel.risc.uni-linz.ac.at (193.170.37.225) 56(84) bytes of da 64 bytes from kernel.risc.uni-linz.ac.at (193.170.37.225): icmp_seq=1 ttl=245 time=25.0 ms 64 bytes from kernel.risc.uni-linz.ac.at (193.170.37.225): icmp_seq=2 ttl=245 time=26.3 ms --- kernel.risc.uni-linz.ac.at ping statistics ---2 packets transmitted, 2 received, 0% packet loss, time 999ms rtt min/avg/max/mdev = 25.021/25.705/26.389/0.684 ms

traceroute

- simplest version: traceroute hostname
- try it yourself this command

Internet Protocol - ICMP based applications

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had	es:sysadmin(3>	
hade	es:sysadmin(3>	
hade	es:sysadmin(3> traceroute www.bme.hu	
trad	ceroute to www.bme.hu (152.66.115.35), 30 hops max, 40 byte packets	
1	net37-gtw (193.170.37.1) 0.479 ms 2.601 ms 0.439 ms	
2	jkuc3hb1.edvz.uni-linz.ac.at (140.78.222.1) 0.480 ms 0.474 ms 0.490 ms	
3	jkuc6bb1.edvz.uni-linz.ac.at (140.78.200.140) 0.594 ms 0.568 ms 0.576 ms	
4	Linz.ACO.net (193.171.22.25) 0.816 ms 0.738 ms 0.599 ms	
5	linz2.aco.net (193.171.15.10) 1.076 ms 0.991 ms 0.980 ms	
6	wien21.aco.net (193.171.15.5) 4.465 ms 4.418 ms 4.432 ms	
7	aconet.rt1.vie.at.geant2.net (62.40.124.1) 8.908 ms 4.411 ms 4.444 ms	
8	so-3-0-0.rt1.bud.hu.geant2.net (62.40.112.14) 9.237 ms 9.201 ms 9.181 ms	
9	hungarnet-gw.rt1.bud.hu.geant2.net (62.40.124.102) 9.445 ms 9.331 ms 9.347	ms
10	c6513-tengbeth13-3.vh.hbone.hu (195.111.97.242) 181.798 ms 219.094 ms 9.36	56 n
11	sup720-tengbeth2-1.bme.hbone.hu (195.111.97.102) 9.434 ms 9.405 ms 9.403 m	ns
12	tge8-1.taz.bme.hu (152.66.0.125) 9.438 ms 9.381 ms 9.419 ms	
13	torpapa.eik.bme.hu (152.66.115.35) 9.319 ms 9.303 ms 9.294 ms	
hade	es:sysadmin!4>	



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TCP - Transmission Control Protocol

Transport layer services

- Connection oriented
 - for data delivery first a connection must be established
- Same Order Delivery
 - data will arrive in the same order it has been sent
- Reliable data transmission
 - retransmit corrupted packages; error detection code, packet acknowledgement
- Byte orientation: not packages, but stream of byte sent
- Introducing the term port
 - port addresses multiple entities on the same location

TCP - Ports

The problem of the applications on a host to communicate

- more programs run on a computer
 - sendmail, webserver, name server, ftp-, pop server, etc.
- the computer has one unique IP address
- how to deal with the application, how to differ them
- introducing ports is the solution
 - analogy: postal address as IP address; appartement number or name is the port number

Ports

to each services in the Internet/Computer a port is assigned

- ports are identified by the port number
- see in Linux the /etc/services file for numbers/services allocation
- port number is a part of TCP packets header
- a program implement a service
 - the program LISTEN on the port for a communication

	Internet Protocols TCP	DHCP Check Networ	k Connecting PCs
	Ports t in /etc/services		
ftp-data ftp ssh telnet smtp whois	20/tcp 21/tcp 22/tcp 23/tcp 25/tcp 43/tcp	mail nicname	# SSH Remote Login Prot
domain domain finger	53/tcp 53/udp 79/tcp	AT OF ALLO	<pre># name-domain server</pre>
WWW WWW	80/tcp 80/udp	http	# WorldWideWeb HTTP # HyperText Transfer Pr
pop3 imap2 https https ftps	110/tcp 143/tcp 443/tcp 443/udp 990/tcp	pop-3 imap	<pre># POP version 3 # Interim Mail Access P # http protocol over TL</pre>
telnets imaps pop3s	990/tcp 992/tcp 993/tcp 995/tcp	4	# Telnet over SSL # IMAP over SSL , # POP-3 over, SSL

TCP - Transmission Control Protocol Example: Sending email per smtp port (1)

```
hu: ~> telnet bullfinch 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/Debian-3
Mon, 3 Nov 2008 15:19:26 +0100; (No UCE/UBE) logging access from: i
uhu37.risc.uni-linz.ac.at(OK)-ke@uhu37.risc.uni-linz.ac.at [193.170.37.
helo ich-bin-s
250 bullfinch.risc.uni-linz.ac.at Hello ke@uhu37.risc.uni-linz.ac.at
[193.170.37.115], pleased to meet you
mail from: k.erdei@risc.uni-linz.ac.at
250 2.1.0 k.erdei@risc.uni-linz.ac.at... Sender ok
rcpt to: karoly.erdei@jku.at
250 2.1.5 karoly.erdei@jku.at... Recipient ok
```

TCP - Transmission Control Protocol Example: Sending email per smtp port (2)

```
data
354 Enter mail, end with "." on a line by itself
this is an email sent by telnet 25 command from the laptop to the mail
server bullfinch.risc... demonstrating how smtp works
.
250 2.0.0 mA3EJQr4014077 Message accepted for delivery
quit
221 2.0.0 bullfinch.risc.uni-linz.ac.at closing connection
Connection closed by foreign host.
uhu:~>
```

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TCP - Transmission Control Protocol Example: Downloading file from the WWW server

Telnet to port 80 on the Web server

hades:www!11> telnet www 80
Trying 193.170.37.138...
Connected to crow.risc.uni-linz.ac.at.
Escape character is '^]'.
GET http://www/proba.txt

Hello! This is a test file. To get it per port access with telnet. It succeeded to get this file per port access from the web server. Great!

Connection closed by foreign host. hades:www!12>

TCP Datagram Structure

Source Port	Destination Port			
Sequence Number				
Acknowledgement Number				
Flags	Receiver Window Size			
Checksum	Urgent Data			
Options				
Data				

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DHCP - Dynamic Host Control Protocol

Client - Server application

DHCP Client - Server communication flow

- DHCP is used to obtain parameters necessary for IP networking
- client: broadcasts a DHCPDISCOVER request
 - Asks for a DHCP server on the network segment
 - Asks for a lease and for an IP address
 - Lease: the length of time for the allocation is valid
- server: sends a DHCPOFFER message
 - Checks if the MAC of client is registered
 - Marks an IP from the spool
- client: broadcasts a DHCPREQUEST on the network
 - The IP of the server is in the packet
- server: sends the client the data
 - Reservers the IP for the time of the lease
 - Other servers delete the mark for the IP

DHCP - Dynamic Host Control Protocol

DHCP server

- has a pool of IP addresses
- manages other network parameters for networking by client
 - options are widely configurable
- checks the MAC of the client, if configured
- lease time is configurable (max;min)

Client requests periodically

- Client has to request again before lease time is over
 - a new IP or request the same IP
- By booting must suspend other processes
 - without IP no network connection

DHCP server is implemented in Home/DSL/Cable routers

DHCP - Dynamic Host Control Protocol

Assigned data by DHCP server at RISC

- Network configurations parameter at RISC
 - IP Address
 - Lease
 - Domain Name (risc.uni-linz.ac.at)
 - Default Gateway address (193.170.38.1)
 - Name server IP address (193.170.37.225)
 - Name server IP address (193.170.37.224)
 - WINS servers (phoebe.risc.uni-linz.ac.at)
 - WINS servers (samba-dc1.risc.uni-linz.ac.at)
 - NTP servers (time.risc.uni-linz.ac.at)
 - SMTP server (mail.risc.uni-linz.ac.at)
 - POP server (pop.risc.uni-linz.ac.at)

NAT - Network Address Translation

How NAT works

general definition

- a technique that hides an entire address space, usually consisting of private network addresses (RFC 1918), behind a single IP address in another, (often) public address space.
- implemented in a router connected to private/public network
 - uses translation tables to map/remap the addresses
 - translation table are created by the outgoing requests
 - rewrites the outgoing IP packets as sent from the router
 - Assigns to each connection a different source port
- NAT introduces complications in communication, performance
 - it has to rewrite checksum, reassemble packets, fragment them again, etc.
- The NAT box the Internet router
 - for SOHO Network (Small Office Home Office)
 - Cable/DSL router: a firewall is always integrated



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Checking Network Connections

gnome-nettool, devices

•	🖉 Nı	etwor	k Tools - De	vices <	<@prometheu	i>)		×
To	ol <u>E</u> dit <u>H</u>	lelp							
De	vices Ping	Net	stat Tracerou	e Port	Scan Lookup	Finger Who	ois		
N	etwork dev	rice:	#	Etherne	t Interface (eth0)		<u>%</u> Configure	
IF) Informa	tion							
	Protocol	IP Ad	dress	1	Netmask / Prefix	Broadcast		Scope	
	IPv4	193.1	.70.37.80	:	255.255.255.0	193.170.3	7.255	,	
	IPv6	fe80:	:213:20ff:fe75	4402 6	54			Link	
	I								
Ir	iterface li				Interface S				
			ss: 00:13:20:	/5:44:0			1.5 G		
	Multicast:		Enabled			d packets:		400	
	MTU:		1500			on errors:	-		
	Link speed	:	not availa	ole	Received b	·	893.2		
	State:		Active		Received p	ackets:	2569	788	
					Reception	errors:	0		
					Collisions:		0		
									4
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Checking Network Connections

gnome-nettool, ping, LAN

		🗿 Network Too	ils - P	ing ⊲	@prometheus>			
Ī	ool <u>E</u> d	it <u>H</u> elp						
D	Devices Ping Netstat Traceroute Port Scan Lookup Finger Whois							
	Network address: compute							
	Send:	⊙ Or	ly 5	*	requests 🔿 Unlir	nited requests		
							Ping 🖉	
	Bytes	Source	Sea	Time	Units			
	64	193.170.37.220	1					
	64	193.170.37.220	2	0.288	ms			
	64	193.170.37.220	3	0.210	ms			
	64	193.170.37.220	4	0.391	ms			
	64	193.170.37.220	5	0.307	ms			
			istics		nsmission Statis			
		num: 0.21 ms			ackets transmitted			
		age: 1.54 ms			ackets received:	5		
	Maxir	mum: 4.01 ms		Pa	ackets loss:	0%		

Checking Network Connections

gnome-nettool, ping, remote

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<u>T</u> ool <u>E</u> di	it <u>H</u> elp							
Devices	Devices Ping Netstat Traceroute Port Scan Lookup Finger Whois							
Network	k address: www.i	univie.	ac.at					
Send:	,	_			nlimited requests			
Sena:	• or	ily Ip	•	requests 00	niimited requests			
						A Ping		
Bytes	Source	Seq	Time	Units				
64	131.130.1.78	1	4.16	ms				
64	131.130.1.78	2	4.13	ms				
64	131.130.1.78	3	4.18	ms				
64	131.130.1.78	4	4.12	ms				
64	131.130.1.78	5	4.09	ms				
Pound	Trip Time Stat	istics	Trai	emission Sta	tistics			
	num: 4.09 ms	istics		ackets transmit				
	age: 4.14 ms		Pa	ackets received	: 5			
Maxin	num: 4.18 ms		Pa	ackets loss:	0%			
						//		

Checking Network Connections

gnome-nettool, traceroute

0 (<mark>≥ Network Tools - Traceroute</mark> < dit <u>H</u> elp	@prometheus>				
Devices Ping Netstat Traceroute Port Scan Lookup Finger Whois Network address: www.bme.hu						
1	net37-gtw	193.170.37.1	0.453	0.429		
2	jkuc3hb1.edvz.uni-linz.ac.at	140.78.222.1	0.498	0.503		
3	jkuc6bb1.edvz.uni-linz.ac.at	140.78.200.140	0.632	0.575		
4	Linz.ACO.net	193.171.22.25	0.586	0.575		
5	linz2.aco.net	193.171.15.10	1.064	1.005		
6	wien21.aco.net	193.171.15.5	4.477	4.430		
7	aconet.rt1.vie.at.geant2.net	62.40.124.1	4.446	5.584		
8	so-3-0-0.rt1.bud.hu.geant2.net	62.40.112.14	41.474	9.231		
9	hungarnet-gw.rt1.bud.hu.geant2.net	62.40.124.102	9.410	9.422		
10	c6513-tengbeth13-3.vh.hbone.hu	195.111.97.242	9.468	9.454		
11	sup720-tengbeth2-1.bme.hbone.hu	195.111.97.102	9.501	9.439		
12	tge8-1.taz.bme.hu	152.66.0.125	9.441	9.417		
	torpapa.eik.bme.hu	152.66.115.35	9.348	9.303		

Network Connections - Routing

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Devi	Devices Ping Netstat Traceroute Port Scan Lookup Finger Whois					
Dis	play: 💿 Routing Table	Information				
	O Active Networ	k Services				
	 Multicast Infor 	mation				
					Interstat 🥔	
De	estination	Gateway	Netmask	Interface		
19	3.170.37.0	0.0.0	255.255.255.0	eth0		
0.	0.0.0	193.170.37.1	0.0.0.0	eth0		
fe	B0::		64	eth0		
::1			128	lo		
fe	80::213:20ff:fe75:4402		128	lo		
ffC	10::	::	8	eth0		

Network Connections - Active Services

Protocol IP Source Port/Service State tcp 0.0.0.0 512 LISTEN tcp 0.0.0.0 513 LISTEN tcp 0.0.0.0 513 LISTEN tcp 0.0.0.0 513 LISTEN tcp 0.0.0.0 513 LISTEN tcp 0.0.0.0 514 LISTEN tcp 0.0.0.0 513 LISTEN tcp 0.0.0.0 514 LISTEN tcp 0.0.0.0 514 LISTEN tcp 0.0.0.0 514 LISTEN tcp 0.0.0.0 57253 LISTEN tcp 0.0.0.0 587 LISTEN tcp 193.170.37.80 427 LISTEN tcp 127.0.0.1 427 LISTEN Totten		Network Tools -	Netstat ≺@p	rometheus>	
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Network Connections - Active Services

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	() Multicast Informat	ion		
					<i>⊎</i> Netstat
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1	cp	0.0.0	113	LISTEN	
1	cp	0.0.0.0	787	LISTEN	
1	ср	0.0.0.0	21	LISTEN	
1	ср	0.0.0	22	LISTEN	
1	ср	127.0.0.1	35990	LISTEN	
1	ср	0.0.0	23	LISTEN	
1	cp	0.0.0	631	LISTEN	
1	cp	0.0.0	43032	LISTEN	
1	cp	0.0.0	952	LISTEN	
1	ср	0.0.0.0	632	LISTEN	
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Network Connections - Active Services

	Network Tools - N	leisiai ≺@p	rometheus>	
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Protocol	IP Source	Port/Service	State	-
udp	0.0.0.0	719		
udp	0.0.0.0	10080		
udp	0.0.0.0	5353		
udp	0.0.0.0	111		
udp	0.0.0.0	631		
udp	0.0.0.0	46841		
udp	193.170.37.80	123		
udp	127.0.0.1	123		
udp	0.0.0.0	123		
udp	0.0.0	767		

Network Connections - portscan

gnome-nettool, local

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ť		open												
		open												
	23	open	telnet											
	25	open	smtp											
	79	open	finger											
	111	open	sunrpc											
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Network Connections- portscan

gnome-nettool, remote

•	🛛 Ne	iwork Tools - Port Scan <@prometheus>	
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			an Scan
Port	State	Service	
21	open	ftp	
22	open	ssh	
25	open	smtp	
80	open	www	
110	open	рорЗ	
443	open	https	
3306	open	mysql	
		4	

1 Networks

2 Ethernet

- 3 Internet Protocols
- 4 TCP

5 DHCP

6 Check Network

7 Connecting PCs

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Connecting Computers to the Network General remarks

Connecting automatically by DHCP

- the most confortable solution
 - if DHCP server is available for the domain, for the LAN segment
 - if the DHCP server is not restricted to known hosts
 - the hardware address (MAC address) of ethernet/wireless interface needed for access

Connecting manually with fixed IP address

- this solution always works (local help (IP) needed)
- needs more knowledge about the OS, configuration files, etc.
- the only possibility if no DCHP server available

Connecting Computers to the Network Using DHCP

Linux Configuration with network-admin

		👻 🥂 Interface	properties 📃 🗙
🔍 🥂 Network settings		Connection	
Location:	[▼]	Interface name: et	th0
Connections General DNS Hosts		✓ Enable this conr	nection
Wireless connection	<u>R</u> roperties	Connection setting	s
Ethernet connection	🔈 Activate	C <u>o</u> nfiguration:	DHCP 🔽
The interface eth0 is active	🛛 Deactivate	IP address:	192.168.1.115
Modem connection The interface ppp0 is not configured		<u>S</u> ubnet mask:	255.255.255.0
Default gateway device: eth0 🗸		<u>G</u> ateway address:	192.168.1.1
Melp X	<u>Cancel</u>	🔯 <u>H</u> elp	X Cancel

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Connecting Computers to the Network by DHCP for MS Windows

	nternet Protocol (TCP/IP) Properties ?
cal Area Connection Properties	General Alternate Configuration
General Connect using:	You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for
Intel(R) PR0/100 VE Network Connection	the appropriate IP settings. Obtain an IP address automatically
Configure	Use the following IP address:
Components checked are used by this connection:	IP address:
B. Client for Microsoft Networks B. File and Printer Sharing for Microsoft Networks	Subnet mask:
Internet Protocol (TCP/IP)	Default gateway:
	 Obtain DNS server address automatically
Install Uninstall Properties	────────────────────────────────────
Description	Preferred DNS server:
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.	Alternate DNS server:
Show icon in taskbar when connected	Advanced
OK Cancel	OK Canc

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Connecting Computers to the Network

Using fixed IP addresses

Linux Configuration with network-admin

		👻 🦪 Interface properties 💦 🗙		
• 🔄 Metwork settings		Connection		
Location:	n: [▼		Interface name: eth0	
Connections General DNS Hosts		✓ Enable this conn	ection	
Wireless connection	<u>g</u> Properties	Connection setting	s	
Ethernet connection The interface eth0 is active	Activate	Configuration:	Static IP address 🔻	
Modem connection		IP address:	192.168.1.115	
The interface ppp0 is not configured		<u>S</u> ubnet mask:	255.255.255.0	
		<u>G</u> ateway address:	192.168.1.1	
Default gateway device: eth0	<u>Cancel</u>	🔯 <u>H</u> elp	K CancelOK	

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Connecting Computers to the Network

The Name Server

Configuration in Linux with network-admin

 All Network settings 	
Location: liwest	· ·
Connections General DNS Hosts	
DNS Servers	
212.33.55.5	db <u>A</u> dd
212.33.32.160	
	Delete
Search Domains	
mta.liwest.at	⊕ <u>A</u> dd
	Delete
🔯 <u>H</u> elp	💥 Cancel 🥔 OK
- Teih	

Connecting Computers to the Network by static IP for MS Windows

General	Internet Protocol (TCP/IP) Properties	? >
Connect using:	General	
Intel(R) PR0/100 VE Network Connection	You can get IP settings assigned automatically if your network suppor this capability. Otherwise, you need to ask your network administrator the appropriate IP settings.	
Components checked are used by this connection:	CC	
 Client for Microsoft Networks Eile and Printer Sharing for Microsoft Networks 	IP address: 10 . 41 . 0 . 130	
Internet Protocol (TCP/IP)	Subnet mask: 255 . 255 . 255 . 0	
	Default gateway: 10 : 41 : 0 . 254	
Install Uninstall Properties	C Obtain DNS server address automatically	
Description	Use the following DNS server addresses:	
Transmission Control Protocol/Internet Protocol. The default	Preferred DNS server. 10 . 40 . 0 . 1	
wide area network protocol that provides communication across diverse interconnected networks.	Alternate DNS server: 10 . 20 . 30 . 1	
Show icon in taskbar when connected	Advance	d
OK Can	ICEE OK CA	ancel

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Connecting Computers to the Network

Linux computer with Fixed IP addresses

Manual (command line) solution

- Changing the appropriate files
- Files responsible for connection:
 - /etc/network/interfaces
 - /etc/hosts
 - /etc/resolv.conf
- Other files for the host configuration
 - /etc/hostname
- File /etc/hosts
 - 127.0.0.1 localhost
 - 193.170.37.225

kernel.risc.uni-linz.ac.at kernel

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- File /etc/hostname
 - kernel

Connecting Computers to the Network By fixed IP address

File /etc/network/interfaces for fixed IP address

This file describes the network interfaces available on your system # and how to activate them. For more information, see interfaces(5). # The loopback network interface auto lo iface lo inet loopback

The primary network interface
allow-hotplug eth0
auto eth0
iface eth0 inet static

address 193.170.37.115 netmask 255.255.255.0 broadcast 193.170.37.255 network 193.170.37.0 gateway 193.170.37.1

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Connecting Computers to the Network Using DHCP

File /etc/network/interfaces

This file describes the network interfaces available on your system # and how to activate them. For more information, see interfaces(5). # The loopback network interface auto lo iface lo inet loopback

The primary network interface
allow-hotplug eth0
auto eth0
iface eth0 inet dhcp

Linux Configuration, on Command line

- change the /etc/network/interfaces file
- stop and start the interface: ifdown eth0; ifup eth0
- you will see the messages in the command line from ifup command

Connecting Computers to the Network Using DHCP

File /etc/resolv.conf

 for fixed IP configuration it consist the nameservers and domain name

search risc.uni-linz.ac.at
nameserver 193.170.37.224
nameserver 193.170.37.222
nameserver 193.170.37.138

- for DHCP connection it will be created by DHCP
- the contents is the same as above

Networks Ethernet Internet Protocols TCP DHCP Check Network Connecting PCs End of Network Basics

Thanks for your attention !