

- 65 - Routing - Gateway

- **Network decisions on routing paths**

- Set extra IP addr. of Ethernet card using YaST or `ifconfig`
 - `ifconfig eth0[:x] <IP addr> netmask <netm> up`

- **Routing principle: ***** Kernel table *******

- Setting-up the routing:
 - via yast Control Zentrum -->
 - System/Sysconfig-Editor/network/Base/IP/IP_FORWARD=yes
 - or in `/etc/sysconfig/sysctl` file. Parameter: `IP_FORWARD=yes`
 - via `echo 1 > /proc/sys/net/ipv4/ip_forward`

- **Kernel Routing table:**

- view it with
 - `/sbin/route -n`
 - `/bin/netstat -rn`
- Local networks destinations are automatically forwarded

- **Gateway principle**

- Setting default gateway via:
 - yast2 Module/Netzwerk-Basis/Konfiguration der Netzwerkkarte/
Bereits konfigurierte Geräte(Bearbeiten)/
Bearbeiten/Routing/Standard Gateway
 - `route add default gw <known GW addr.>`
Note: the default gateway is automatically put at the end of the routing table.

- **Adding routes to the routing table:**

- Local routing (for locally programmed address on ethernet cards)
 - `route add -net <Net. addr> netmask <Netmask> dev <device>`
- Remote routing (for specific networks or hosts behind gateways)
 - `route add -net <Net. addr.> netmask <Netmask> gw <known Gateway addr> dev <device>`
 - `route add -host <Host addr.> netmask <Netmask> gw <known Gateway addr> dev <device>`

- **Deleting a route from the routing table:**

- `route del <Net Addr. or Host addr.>`
Note: this will delete only one route: the first found in route table even if the same exist with other parameters later in the list.
- To delete more specific route specify more parameters

- **Setting the permanent routing table in `/etc/sysconfig/network/routes`**

Destination	Gateway(gw)	Netmask	Device(dev)
192.168.10.0	0.0.0.0	255.255.255.0	eth0
192.168.11.0	0.0.0.0	255.255.255.0	eth1
192.168.12.0	192.168.11.190	255.255.255.0	eth1
192.168.0.1	0.0.0.0	255.255.255.255	ipp0
default	192.168.0.1		

- **Where is the initial routing set-up?**

- `/etc/sysconfig/network/ifroute-eth0` or
`/etc/sysconfig/network/routes`
Destination Gateway Netmask [Device]

- **Routing diagnostics programs**

- `ifconfig`
- `netstat -nr`
- `route -n`
- `iptraf`
- `traceroute ip` `xtraceroute` program
- `xmtr` (in `mtr-gtk` package) - (traceroute program)
- `ping ipNr`
- `fping ipNr1 ipNr2 ipNr3`

- **Dynamic routing**

- Routing protocols:
 - Interior protocols: (for Autonomous networks)
 - **Hello** Delay decision oriented protocol
 - **IS-IS** Intermediate System to Intermediate System protocol for between large ISP. Based on Shortest Path First
 - **RIP** Routing Information Protocol. Broadcasts RIP Updates between Gateways. Minimal hops oriented protocol
 - **OSPF** Open Shortest Path First protocol. For TCP/IP large networks and better than RIP
 - Exterior Routing Protocols
 - **EGP** Exterior Gateway protocol. Based on a centrally controlled connection between Autonomous Networks. No more popular because of fast growing of autonomous networks.
 - **BGP** Border Gateway Protocol. Mostly used in Internet. Uses Inter Domain Routing Protocol. Uses the domains architecture and a central Routing Arbiters(RA) to decide for shortest routes. Includes also bilateral negotiated routing information between ISPs as alternative routing.
- Routing Information Protocol (RIP) for UNIX/Linux
 - `routed` daemon provides this Protocol
 - `routed -q` (quiet-listens only) for Hosts that are not Gateways(routers)
 - `routed` For gateways
 - Uses `/etc/gateways` to get the list of default gateways to start with. Mostly for distant gateways.
 - `/etc/gateways` format:


```
net(or host) <net addr., 0.0.0.0 if default> gateway <gw. addr>
metric <No. of hops> active(or passive)
```

 - active is for gateways that provides RIP updates. They will be deleted from routing tables if no RIP updates are received within 180 sec (gateways send RIP updates every 30 sec.)
 - passive is for gateways that don't provide RIP updates and therefore this route will never be deleted and considered static route. Use passive default routing gateways with care. Better use active default gateway.

- **Shortcomings of RIP(version 1)**
 - Longest RIP route is limited to 15 hops.
 - Long time to determine that a specific route is no longer valid
 - Do not route between different IP addressing classes.
 - Small danger of routing loops creation
- **RIP Version 2** is improving the situation a bit
 - Allows for Netmask defined Network sizes (no more Class oriented restrictions)
 - Shorter detection of dead routes.
 - Still good only for limited size networks eg. large LAN (max 15 hops)
- Multi Protocol capable Daemon : **gated**
 - Capable to provide RIP, RIPv2, OSPF, and BGP
 - See page 187 of OReilly TCP/IP network administration.

Routing exercises:

- Set-up 2 extra IP Numbers for the eth0 using `ifconfig.....`
 - Make each student row a separate network
 - Have one student per row set himself as gateway to the laptop via the teacher
 - Set the `ip_forward` to 1
 - `echo 1 > /proc/sys/net/ipv4/ip_forward`
 - To do it permanently with `yast`
 - `IP_FORWARD=yes`
 - Check the route with `ping`
 - Check the route with `traceroute`

Command to constantly check the accessibility of a host:

```
xterm -e watch "ping -w2 -c1 192.168.10.1 &>/dev/null \
                && echo '192.168.10.1 - OK' \
                || echo '192.168.10.1'"
```