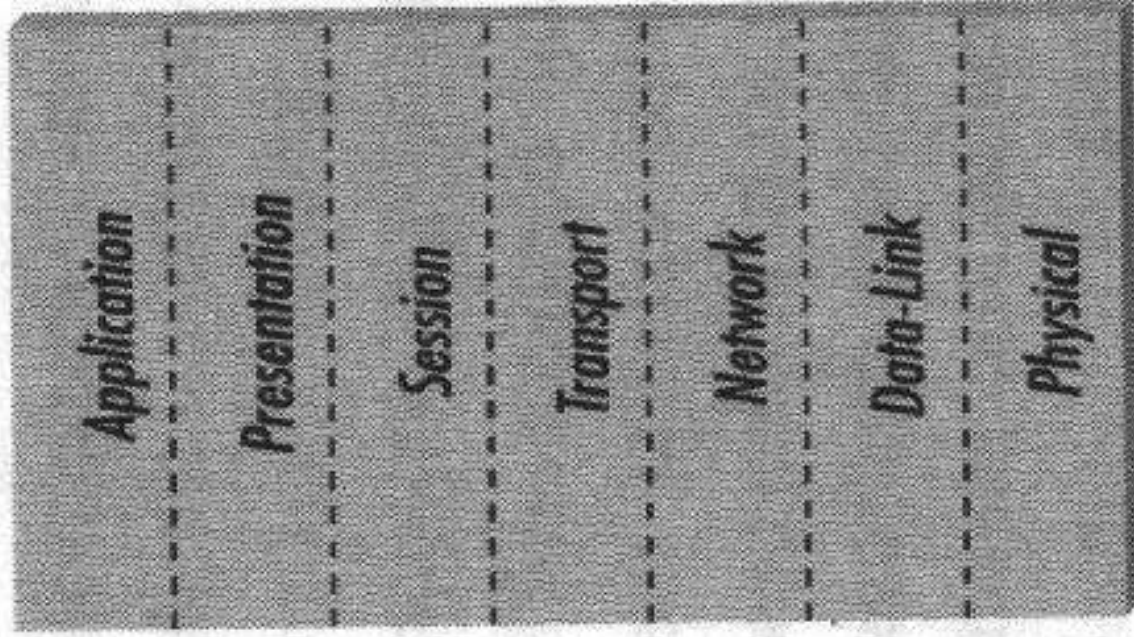
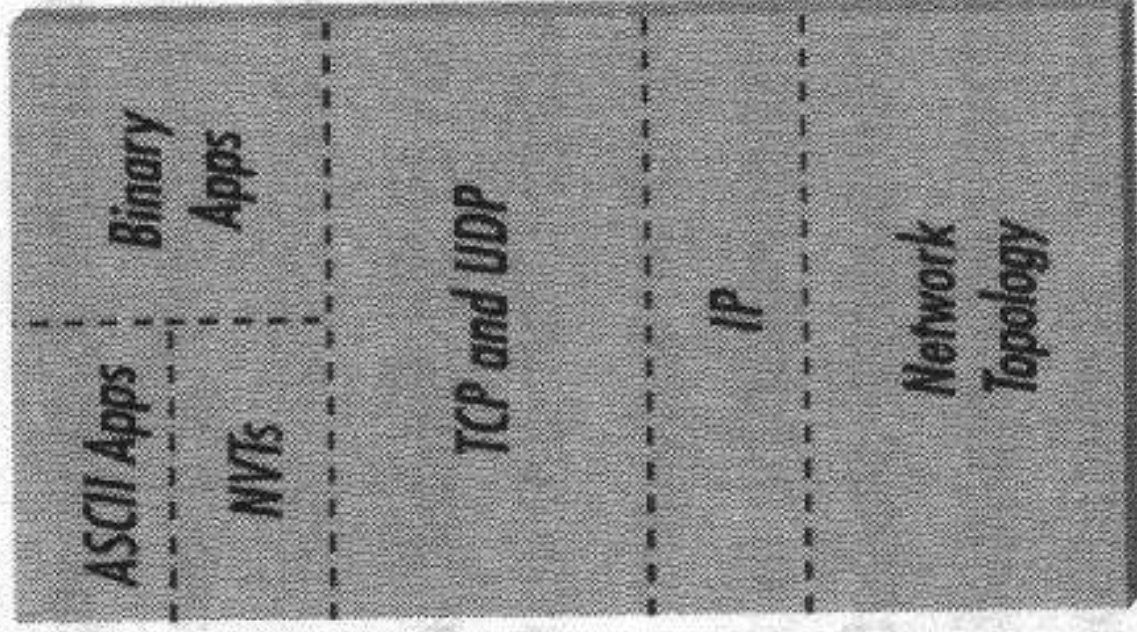


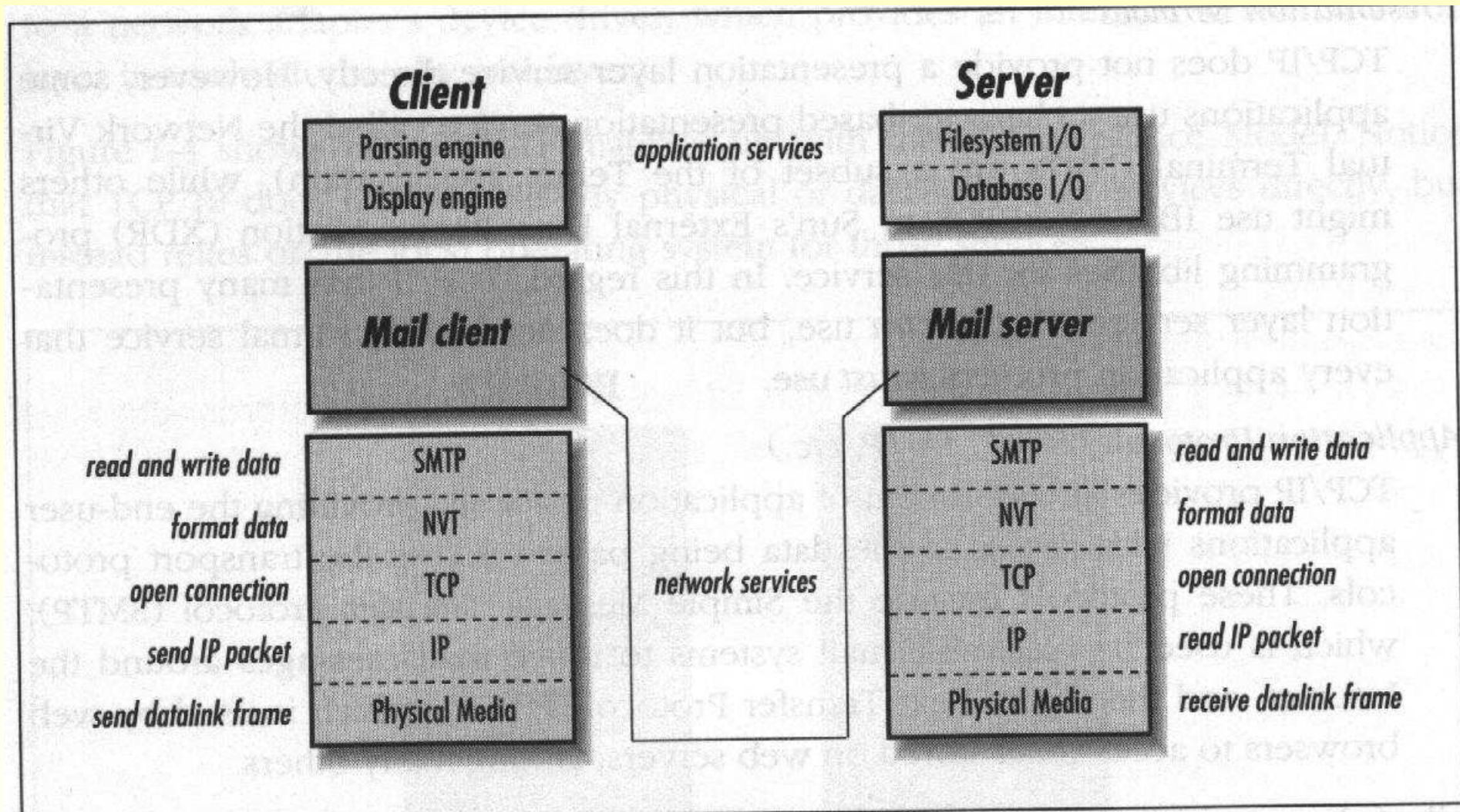
OSI MODEL



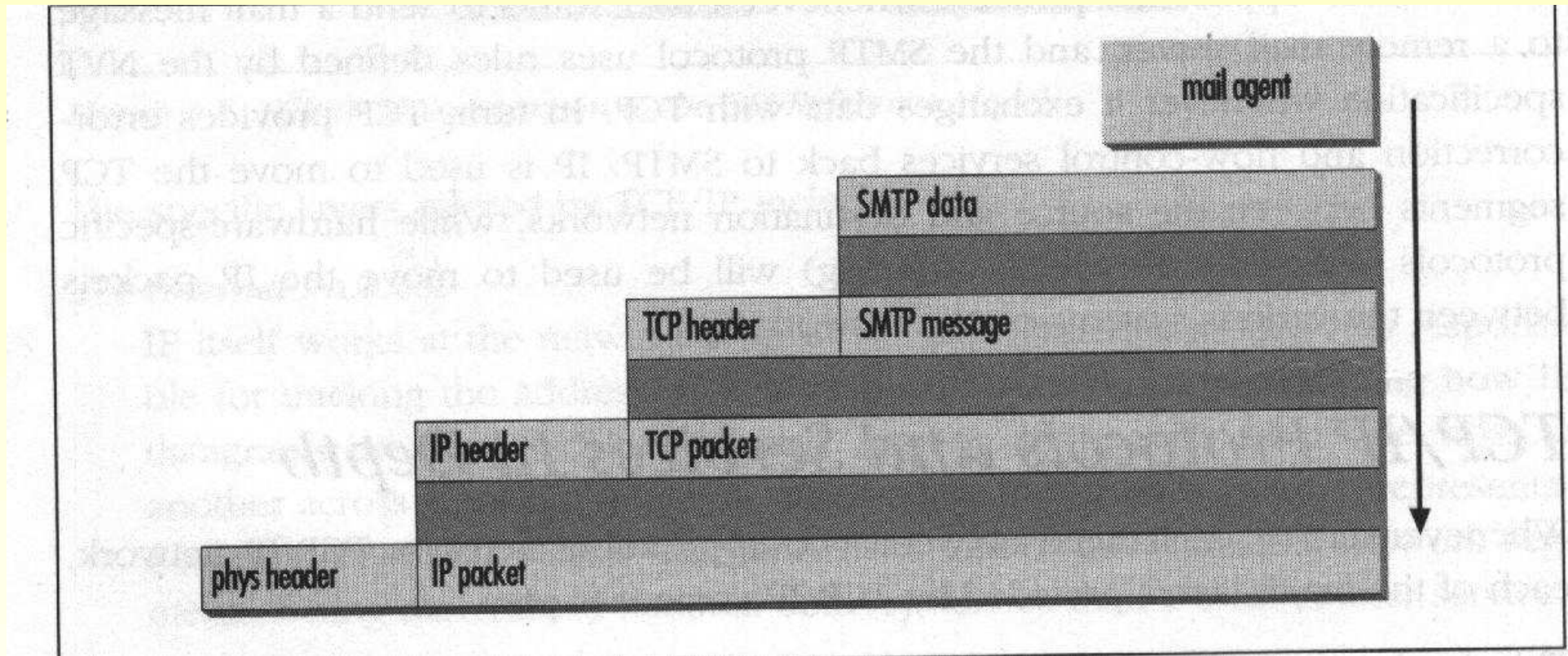
TCP/IP



Consequences for Software



Consequences for the Data Format



Data Link Layer (Topologies)

Star

Ring

Bus

Tree

Mesh

Data Link Layer (Technologies)

Ethernet

Wireless LAN

Token Ring

Fiber Distributed Data Interface (FDDI)

Novell IPX

ATM (Internet backbones)

Ethernet

Invented 1973 Robert Metcalfe (Xerox)

Paper 1976 Ethernet: Distributed Packet-Switching For Local Computer Networks.

Foundation of 3com 1979: Ethernet products of 3com, DEC, Intel and Xerox

Broadcast medium (one sender, others are recipients)

Ethernet: Collisions

Carrier sense multiple access / Collision Detection

random wait time

double interval if collision detected

physical address = MAC addr = hardware addr = Ethernet
addr

48 Bit \rightsquigarrow 12 hex numbers

for example 00:20:ED:B2:43:79

network interface

UNIX command: ifconfig

Data Link Layer (Devices)

Repeater

Hub

Bridge

Switch

Data Link Layer (Bridge)

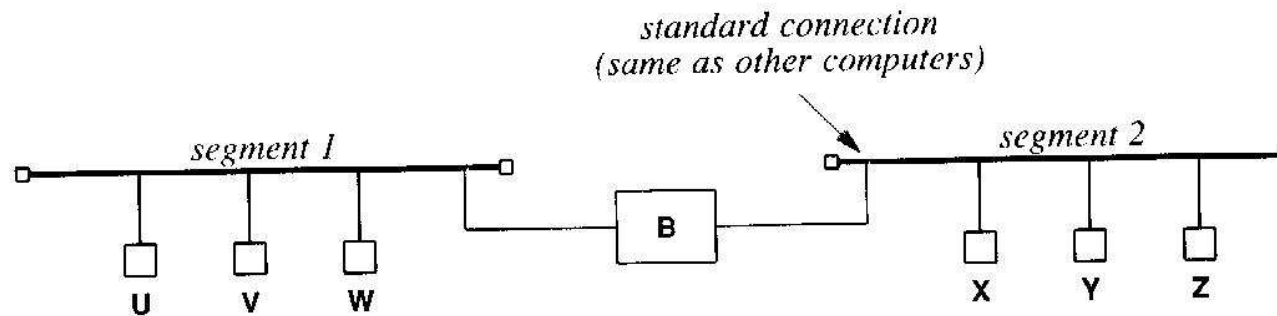


Figure 10.4 Six computers connected to a pair of bridged LAN segments. The bridge, which uses the same type of connection as a computer, always sends and receives complete frames.

Event	Segment 1 List	Segment 2 List
Bridge boots	-	-
U sends to V	U	-
V sends to U	U, V	-
Z broadcasts	U, V	Z
Y sends to V	U, V	Z, Y
Y sends to X	U, V	Z, Y
X sends to W	U, V	Z, Y, X
W sends to Z	U, V, W	Z, Y, X

Data Link Layer (Switch)

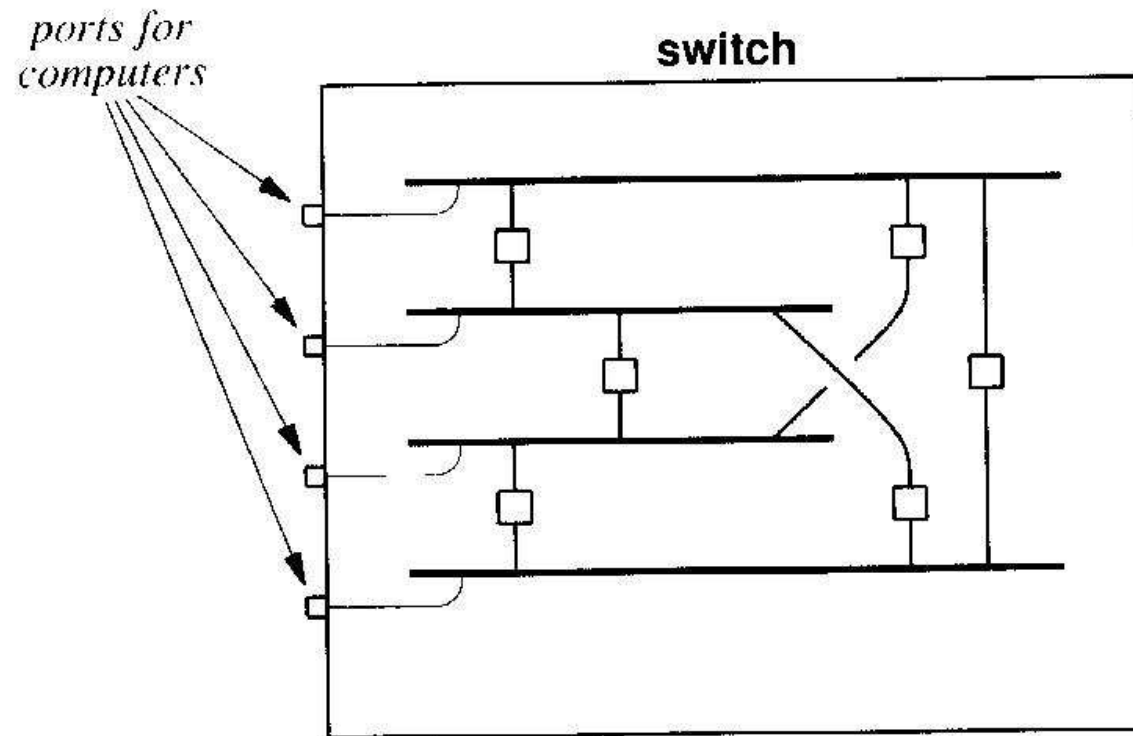


Figure 10.10 The concept underlying a switched LAN. Electronic circuits in the switch provide each computer with the illusion of a separate LAN segment connected to other segments by bridges.

Frame Format

Ethernet data entity is called frame

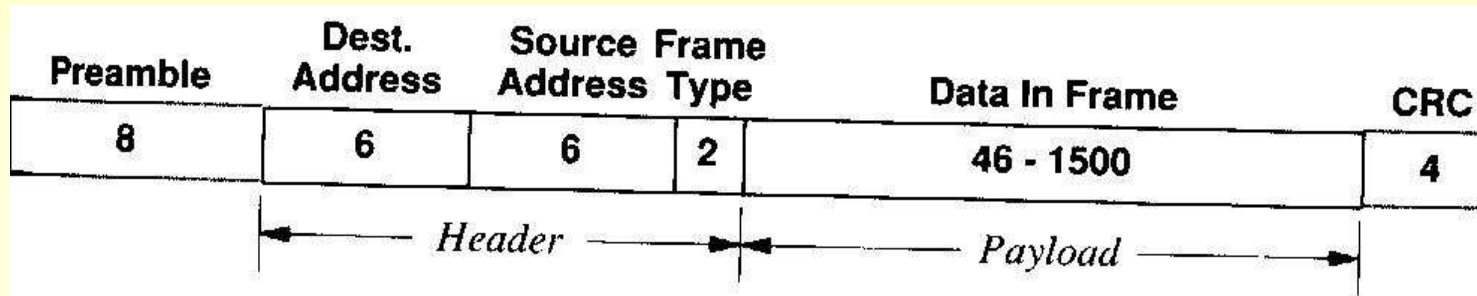


Figure 8.3 Illustration of the frame format used with Ethernet. The number in each field gives the size of the field measured in 8-bit octets.

max data size: 1500 octets

Frame Types:

- IP 0x0800
- ARP 0x0806

Cut-Through-Switching

destination address is first field

allows switching as soon first bytes of frame arrive

storing frame/packet to determine outgoing port is called

store-and-forward switching

Linux ifconfig

eth0

Link encap:Ethernet HWaddr 00:20:ED:B2:43:79

inet addr:192.168.1.2 Bcast:192.168.1.255 Mask:255.255.255

inet6 addr: fe80::220:edff:feb2:4379/10 Scope:Link

UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1

RX packets:1024 errors:0 dropped:0 overruns:0 frame:0

TX packets:1289 errors:0 dropped:0 overruns:0 carrier:0

collisions:0 txqueuelen:100

RX bytes:185615 (181.2 Kb) TX bytes:129850 (126.8 Kb)

Interrupt:5 Base address:0x1000

Solaris ifconfig -a

```
stl-s-stud.htw-saarland.de
```

```
ge0: flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,IPv4>  
      mtu 1500 index 1 inet 134.96.216.204 netmask ffffffff00  
      broadcast 134.96.216.255
```

OpenBSD ifconfig

```
isl-s-02.htw-saarland.de
```

```
$ ifconfig r10
```

```
r10: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu  
    address: 00:20:ed:5f:03:3b  
    media: Ethernet autoselect (100baseTX full-duplex)  
    status: active  
    inet 134.96.216.92 netmask 0xffffffff broadcast 134.  
    inet6 fe80::220:edff:fe5f:33b%r10 prefixlen 64 scope
```

FreeBSD ifconfig

```
isl-c-02.htw-saarland.de
```

```
$ ifconfig r10
```

```
r10: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu
    options=8<VLAN_MTU>
    inet6 fe80::220:edff:fe5e:fb81%r10 prefixlen 64 scope
    inet 134.96.216.82 netmask 0xffffffff broadcast 134.
    ether 00:20:ed:5e:fb:81
    media: Ethernet autoselect (100baseTX <full-duplex>)
    status: active
```