

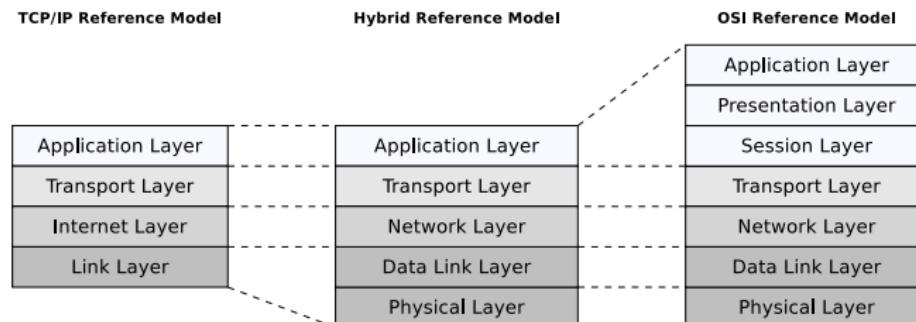
## Network Components (Solution)

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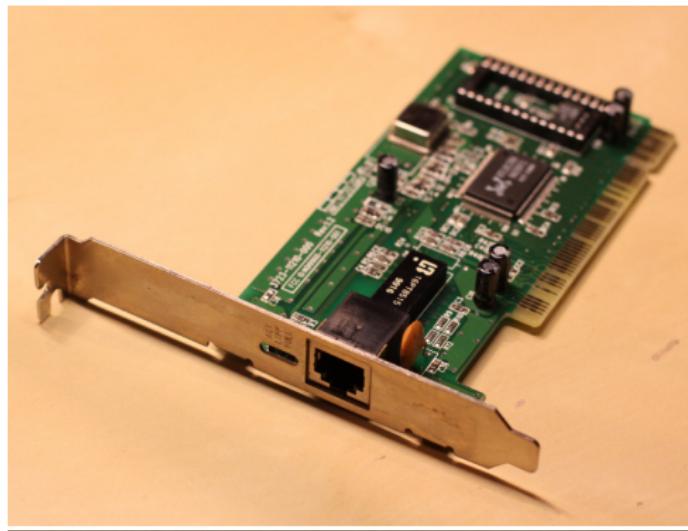
# Task

- The slides of this slide set contain photos of various network components
- Try to assign the network components to the layers in the hybrid reference model



- A horizontal row of 40 small circles, starting with a solid black circle on the left and followed by 39 hollow circles.

## Component 1





# PCI Network Interface Card with Realtek Chipset

- PCI network interface card (approx. 2000) for 10/100 MBit Ethernet

## Layers in the hybrid reference model: 1-2

5	The functions of layers 3-5 in the hybrid reference model are implemented by the operating system of the computer in which the PCI network card is installed
4	
3	
2	The device has a MAC address
1	Connector for Ethernet 10BASE-T and 100BASE-TX (Fast Ethernet)

Interesting details: 3 LEDs at the slot cover

- ACK (= Action): Data is sent or received
- Link: A network cable is connected
- Full (= Full-Duplex): Sending and receiving at the same time is possible



## Component 2





# 3Com 10/100 LAN CardBus PC Card 3CXFE575CT

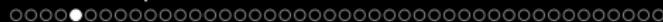
- PCMCIA network card (approx. 2000) for 10/100 MBit Ethernet

### Layers in the hybrid reference model: 1-2

5	The functions of layers 3-5 in the hybrid reference model are implemented by the operating system of the computer in which the PCMCIA network card is installed
4	
3	
2	The device has a MAC address (but not to be seen on the photos!)
1	Connector for Ethernet 10BASE-T and 100BASE-TX (Fast Ethernet)

## Attention!

- The photos do not show the MAC address, but only a serial number
  - The amount of characters matches a MAC address, but the serial number contains characters which are not allowed in hexadecimal notation!



## Component 3





## Nintendo Wii LAN-Adapter RVL-015

- USB network card (approx. 2000) for 10/100 MBit Ethernet

## Layers in the hybrid reference model: 1-2

5	The functions of layers 3-5 in the hybrid reference model are implemented by the operating system of the computer with which the USB network adapter is connected to
2	The device has a MAC address
1	Connector for Ethernet 10BASE-T and 100BASE-TX (Fast Ethernet)



## Component 4



PCMCIA-WLAN-Karte GL242201-OT

- No-name PCMCIA card (approx. 2002)

## Layers in the hybrid reference model: 1-2

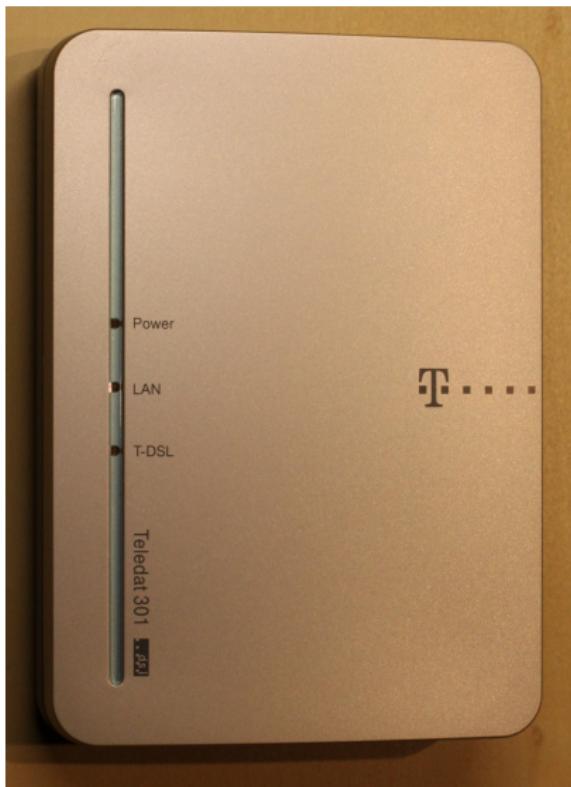
5	The functions of layers 3-5 in the hybrid reference model are implemented by the operating system of the computer in which the PCMCIA network card is installed
4	
3	
2	The device has a MAC address
1	Supports WLAN according to standard 802.11b

## Interesting details

- The hardware is identical with D-Link DWL-650+
  - The adapter also provides 22 Mbit/s at 40 MHz channel width via a proprietary (vendor-dependent) standard



## Component 5



## Teledat 301 DSL Modem

- External DSL modem

### Layers in the hybrid reference model: 1-2

5	—
4	—
3	No logical network address
2	The device has a MAC address
1	Connectors for Ethernet 100BASE-TX and DSL splitter



# Component 6



Siemens - Google Chrome  
Siemens | 192.168.1.100/html/CurrentStatus.html

# SIEMENS

## WLAN Bridge

Current Status

Current Status

Device IP Information		WLAN 802.11b /g Status	
MAC Address	» 00:1d:6a:38:61:7e	ESSID	» ALICE-WLAN
Get IP From	» Manual	Channel	» 11
IP Address	» 192.168.1.100	Rate	» Auto
Subnet Mask	» 255.255.255.0	Security Level	» Open System
Default Gateway	» 192.168.1.1	/Encryption Enabled	

## Siemens WLAN Bridge W-011 (approx. 2006)

- Integrates one(!) network device that is connected via Ethernet interface into a WLAN (⇒ WLAN client)

### Layers in the hybrid reference model: 1-5

- |   |  |
|---|--|
| 5 | SSH server, Telnet server, HTTP server, SNMP client,...    |
| 4 | Ports for configuration via SSH, Telnet, Web interface,... |
| 3 | IP address and netmask are assigned                        |
| 2 | The device has a MAC address                               |
| 1 | Connector for Ethernet 100BASE-TX and WLAN interface       |

### Interessante Details

- Accepts only one MAC address at the Ethernet interface ⇒ not a full-fledged bridge but only a WLAN client
- The hardware is identical to D-Link DWL2100AP, but the firmware is „crippled“



# Component 7



# Netgear Dual Speed Hub DS108

- Hub = Multiport Repeater (approx. 2000)
- Forwards incoming signals to all ports

## Layers in the hybrid reference model: 1

5	—
4	—
3	No logical network address
2	No physical network address
1	Connectors for Ethernet 10BASE-T and 100BASE-TX

### Interesting details

- Collision indicator
- Switch for setting port 8 to be an uplink port



## Component 8





# Creatix Modem

- Analog „narrowband“ modem (approx. 1996) for telephone lines

## Layers in the hybrid reference model: 1-2

5	—
4	—
3	No logical network address
2	Uses the Point-to-Point Protocol (PPP) to establish, maintain, and terminate point-to-point connections. No physical network address
1	Modulates digital information to be transmitted onto a carrier frequency in the high-frequency range. Demodulates received signals

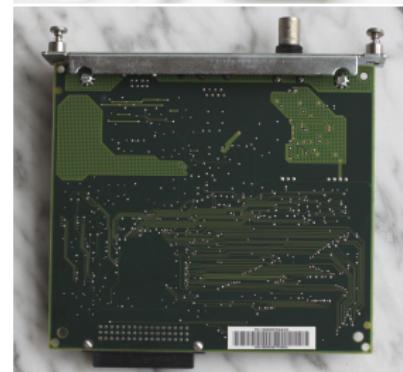


```
# telnet 10.0.0.5
Trying 10.0.0.5...
Connected to 10.0.0.5
Escape character is '^]'.

HP JetDirect

Please type "?" for HELP, or "/" for current settings

> /
==JetDirect Telnet Configuration==
Firmware Rev.      : A.08.49
MAC Address        : 08:00:09:7f:56:63
Config By          : USER SPECIFIED
IP Address         : 10.0.0.5
Subnet Mask        : 255.255.255.0
Default Gateway   : 10.0.0.1
Syslog Server     : Not Specified
Idle Timeout       : 90 Seconds
Set Cmnty Name    : Not Specified
Host Name          : LASERJET
DHCP Config        : Disabled
```



# HP JetDirect J2552B Print Server

- Print server (approx. 1996) for HP LaserJet printers

## Layers in the hybrid reference model: 1-5

5	Configuration is possible via Telnet, among other things. Newer print servers also include SSH server, SNMP client and/or a web interface (HTTP server), automatic network configuration is possible via DHCP client
4	Uses TCP port 9100 as default entry point to the printer
3	IP address and netmask are assigned
2	The device has a MAC address
1	Connectors for Ethernet 10BASE2, 10BASE-T and Apple LocalTalk



## Component 10





## TP-Link TL-SG108 8-Port Gigabit Switch

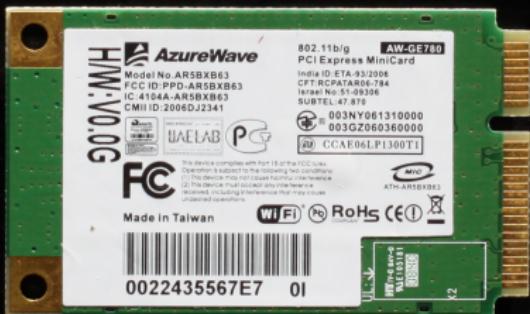
- Layer 2-Switch = Multiport Bridge (2014)
  - Learning Bridge
  - Unmanaged Switch  $\Rightarrow$  no configuration options
  - 2 MB buffer

## Layers in the hybrid reference model: 1-2

5	—
4	—
3	No logical network address
2	Connects different physical networks. Learning Bridge $\Rightarrow$ learns which MAC addresses are connected to which port. No physical network address
1	Connectors for Ethernet 10BASE-T, 100BASE-TX and 1000BASE-T



# Component 11



0022435567E7



## AzureWave AW-GE780

- Mini PCIe WLAN card (2007)
- Such cards are often installed in laptops or so-called „all-in-one“ computers (e.g. Apple iMac)
- The card provides two U.FL connectors (from Hirose Electric) for connecting WLAN antennas

### Layers in the hybrid reference model: 1-2

5	The functions of layers 3-5 in the hybrid reference model are implemented by the operating system of the computer in which the Mini PCIe WLAN card is installed
4	
3	
2	The device has a MAC address
1	Supports WLAN according to standard 802.11b and 802.11g



## Component 12

```
$ telnet 192.0.0.192
Trying 192.0.0.192...
Connected to 192.0.0.192.
Escape character is '^]'.
```

HP JetDirect

```
Please type "?" for HELP, or "/" for current settings
> /
```

====JetDirect Telnet Configuration=====

```
Firmware Rev.      : F.08.20
MAC Address        : 00:30:6e:fc:97:c8
Config By         : Default IP
```

```
IP Address        : 192.0.0.192
Subnet Mask       : Not Specified
Default Gateway   : 192.0.0.192
Syslog Server     : Not Specified
Idle Timeout      : 90 Seconds
Set Cmnty Name    : Not Specified
Host Name         : Not Specified
```

```
DHCP Config       : Enabled
Passwd            : Disabled
IPX/SPX           : Enabled
DLC/LLC           : Enabled
Banner page       : Enabled
```

S/N:SG421BB4AA  
AD:00306EFC97C8



## HP JetDirect J3258B Print Server 170X

- Print server (approx. 1999) for HP LaserJet printers

### Layers in the hybrid reference model: 1-5

5	Configuration is possible via Telnet, automatic network configuration is possible via DHCP client
4	Uses TCP port 23 for Telnet
3	IP address and netmask are assigned
2	The device has a MAC address
1	Connector for 10BASE-T



## Component 13





# CentreCOM 210TS Twisted Pair Transceiver

- This transceiver is so compact that it can be connected directly to the network interface of a workstation (e.g. Sun SPARCstation). An AUI cable is not necessary

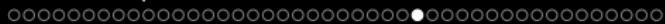
## Layers in the hybrid reference model: 1

5	—
4	—
3	—
2	—
1	Physical connection to the transmission medium of a 10BASE-T Ethernet network



## Component 14





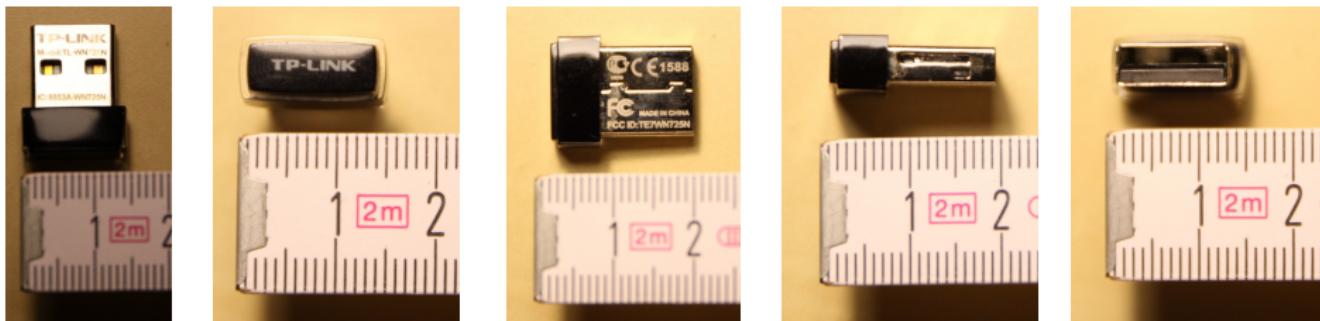
# Linksys WRT54GL Wireless Router with 4-Port Switch

- Router with one WAN port, integrated 4-port Switch and wireless Access Point

## Layers in the hybrid reference model: 1-5

- |   |   |
|---|---|
| 5 | HTTP server, DHCP server,...                          |
| 4 | Ports for configuration via web interface,...         |
| 3 | IP address and netmask are assigned                   |
| 2 | The device has a MAC address                          |
| 1 | Connection for Ethernet 100BASE-TX and WLAN interface |

# Component 15



```
[221411.207865] usb 1-2: USB disconnect, device number 90
[221703.999606] usb 1-1: USB disconnect, device number 91
[221732.387524] usb 1-1: new high-speed USB device number 92 using xhci_hcd
[221732.528114] usb 1-1: New USB device found, idVendor=0bda, idProduct=8179
[221732.528118] usb 1-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[221732.528121] usb 1-1: Product: 802.11n NIC
[221732.528123] usb 1-1: Manufacturer: Realtek
[221732.528126] usb 1-1: SerialNumber: 00E04C0001
[221733.120663] r8188eu: module is from the staging directory, the quality is unknown, you have been warned.
[221733.124373] Chip Version Info: CHIP_8188E_Normal_Chip_TSMC_A_CUT_1T1R_RomVer(0)
[221733.150775] usbcore: registered new interface driver r8188eu
[221733.152618] r8188eu 1-1:1.0 wlx6466b31c4fbc: renamed from wlan0
[221733.177891] IPv6: ADDRCONF(NETDEV_UP): wlx6466b31c4fbc: link is not ready
[221733.178917] r8188eu 1-1:1.0: firmware: direct-loading firmware rtlwifi/rtl1818eufw.bin
[221733.544034] MAC Address = 64:66:b3:1c:4f:bc
```

# TP-LINK TL-WN725N

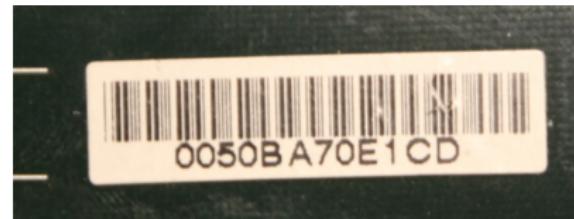
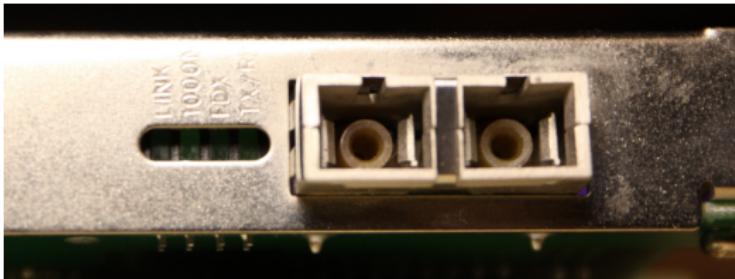
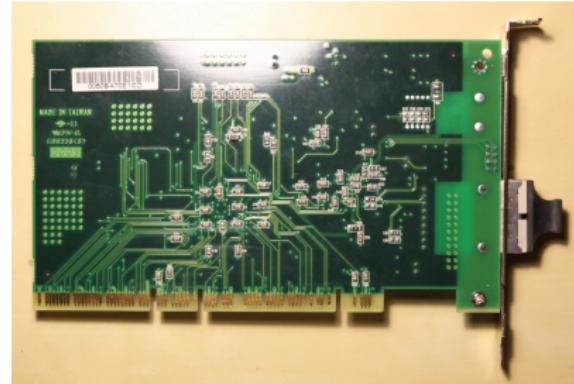
- Nano WLAN USB adapter

## Layers in the hybrid reference model: 1-2

5	The functions of layers 3-5 in the hybrid reference model are implemented by the operating system of the computer with which the USB network adapter is connected to
4	
3	
2	The device has a MAC address
1	Supports WLAN according to standard 802.11b, 802.11g and 802.11n



## Component 16



# PCI Network Interface Card D-Link DGE-500SX

- PCI network interface card (approx. 1999) for 1 GBit Ethernet via fiber optic cable
- Transmission medium: multimode optical fiber with 850 nm wavelength (full duplex)

## Layers in the hybrid reference model: 1-2

5	The functions of layers 3-5 in the hybrid reference model are implemented by the operating system of the computer in which the PCI network interface card is installed
4	
3	
2	The device has a MAC address
1	Connector for Ethernet 1000BASE-SX



## Component 17



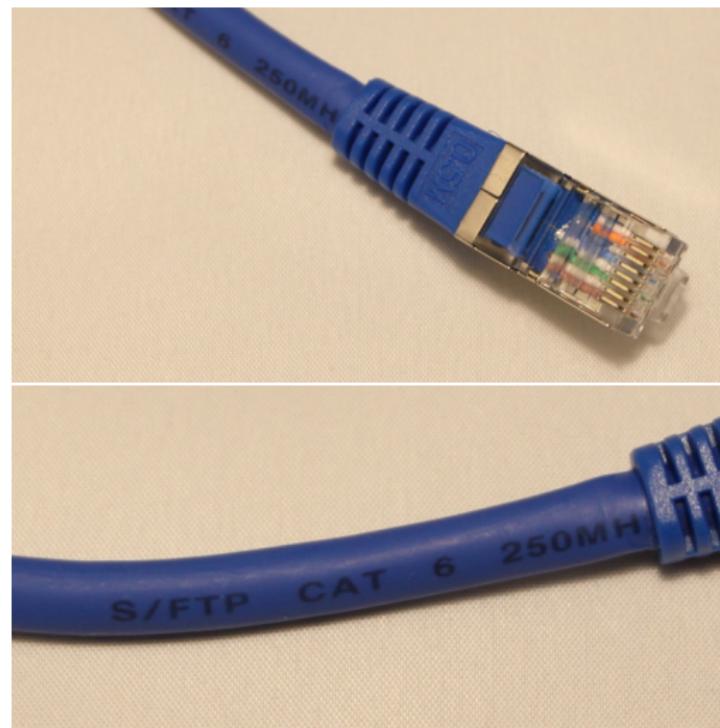
# INTERLAN NT1000 IEEE 802.3 Ethernet Transceiver

- This transceiver is connected to the network interface of a workstation (e.g. Sun SPARCstation) using an AUI cable

## Layers in the hybrid reference model: 1

5	—
4	—
3	—
2	—
1	Physical connection to the shared transmission medium of a 10BASE5 Ethernet network

## Component 18





# CAT-6 Twisted Pair Ethernet Cable

- Screened Foiled Twisted Pair (S/FTP)
  - Pair shielding = aluminum foil shielding
  - Cable shielding = braided shielding
- 8P8C connector (RJ45)

**Layers in the hybrid reference model: 1**

5	—
4	—
3	—
2	—
1	Transmission medium for Ethernet networks up to a maximum of 10GBASE-T (55 m)



## Component 19



# HP Jetdirect 615n Print Server

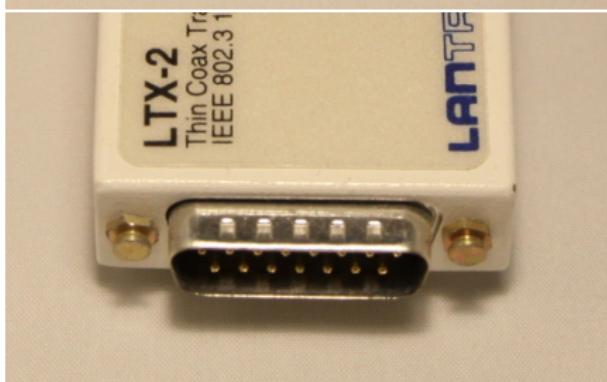
- Print server ( approx. 2004) for HP LaserJet printers
- Source: <http://h10032.www1.hp.com/ctg/Manual/c00190293>

## Layers in the hybrid reference model: 1-5

5	Configuration is possible via Telnet and web interface (HTTP server), among others. SNMP client included. Network configuration is possible via DHCP client
4	Uses TCP port 9100 as default entry point to the printer, web server uses ports 80 and 443, telnet server uses port 23
3	IP address and netmask are assigned
2	The device has a MAC address
1	Connection for Ethernet 10BASE-T



## Component 20



# LANTRONIX LTX-2 Thin Coax Transceiver

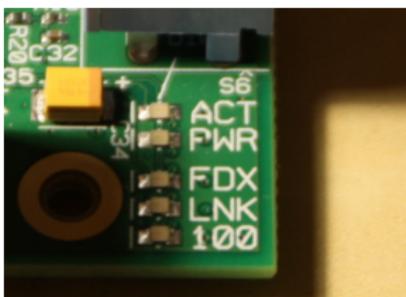
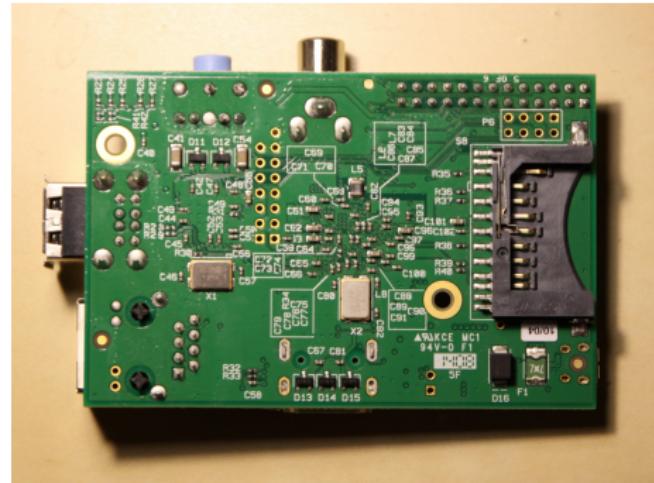
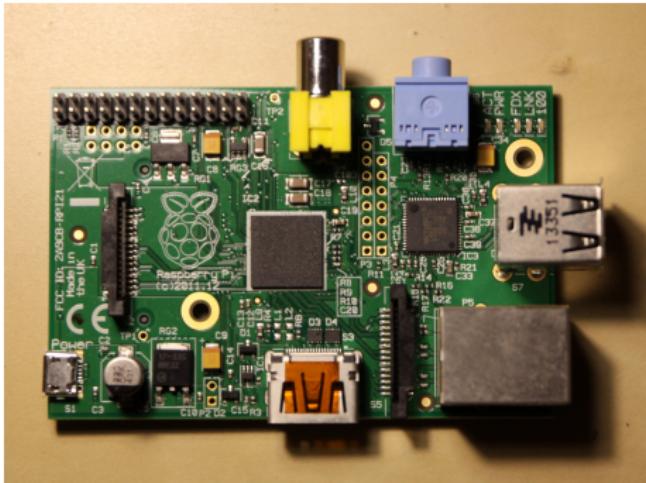
- This transceiver is so compact that it can be connected directly to the network interface of a workstation (e.g. Sun SPARCstation). An AUI cable is not necessary
  - Source: <https://www.artisantg.com/info/ATGboo2v.pdf>

## Layers in the hybrid reference model: 1

5	—
4	—
3	—
2	—
1	Physical connection to the shared transmission medium of a 10BASE2 Ethernet



## Component 21



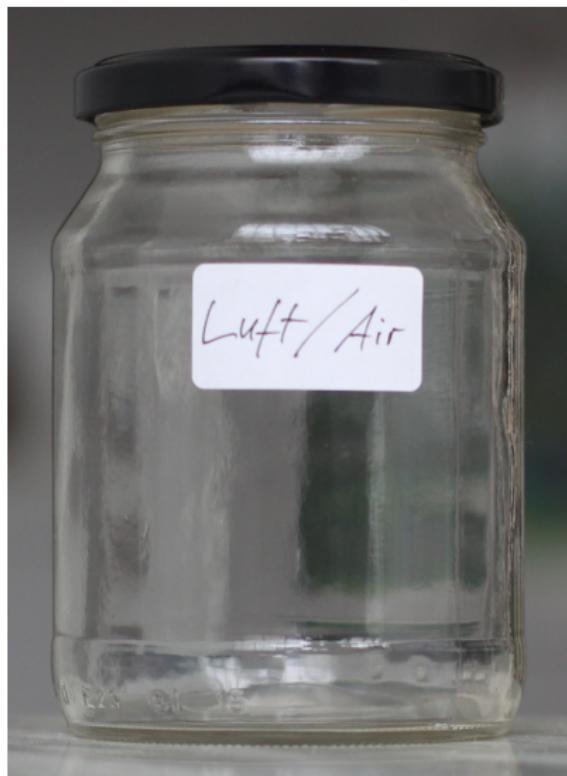
# Raspberry Pi 1B single board computer (2014)

- A terminal device
- Full computer with 700 MHz ARMv6 CPU, 512 MB RAM, SD card slot for mass storage Interface for 10/100 MBit Ethernet

## Layers in the hybrid reference model: 1-5

- |   |  |
|---|--|
| 5 | Any network services can be installed            |
| 4 | Ports depend on the deployed network services... |
| 3 | IP address and netmask are assigned              |
| 2 | The device has a MAC address                     |
| 1 | Connection for Ethernet 100BASE-TX               |

## Component 22



- Components of dry air:
    - Nitrogen ( $N_2$ )
    - Oxygen ( $O_2$ )
    - Argon ( $Ar$ )
    - Carbon dioxide ( $CO_2$ )
    - Neon ( $Ne$ )
    - Helium ( $He$ )
    - Methane ( $CH_4$ )
    - Krypton ( $Kr$ )
    - Hydrogen ( $H_2$ )
    - ...

# Glass filled with air

## Layers in the hybrid reference model: 1

5	—
4	—
3	—
2	—
1	Transmission medium for wireless networks (e.g. WLAN or Bluetooth) or for direct connections via laser Bridge