

Ethernet / TCP-IP - Training Suite

01 - LWIP Introduction

LwIP Distribution protocols

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Application protocols

- SNMP,
- DNS client,
- DHCP client,

Transport protocols

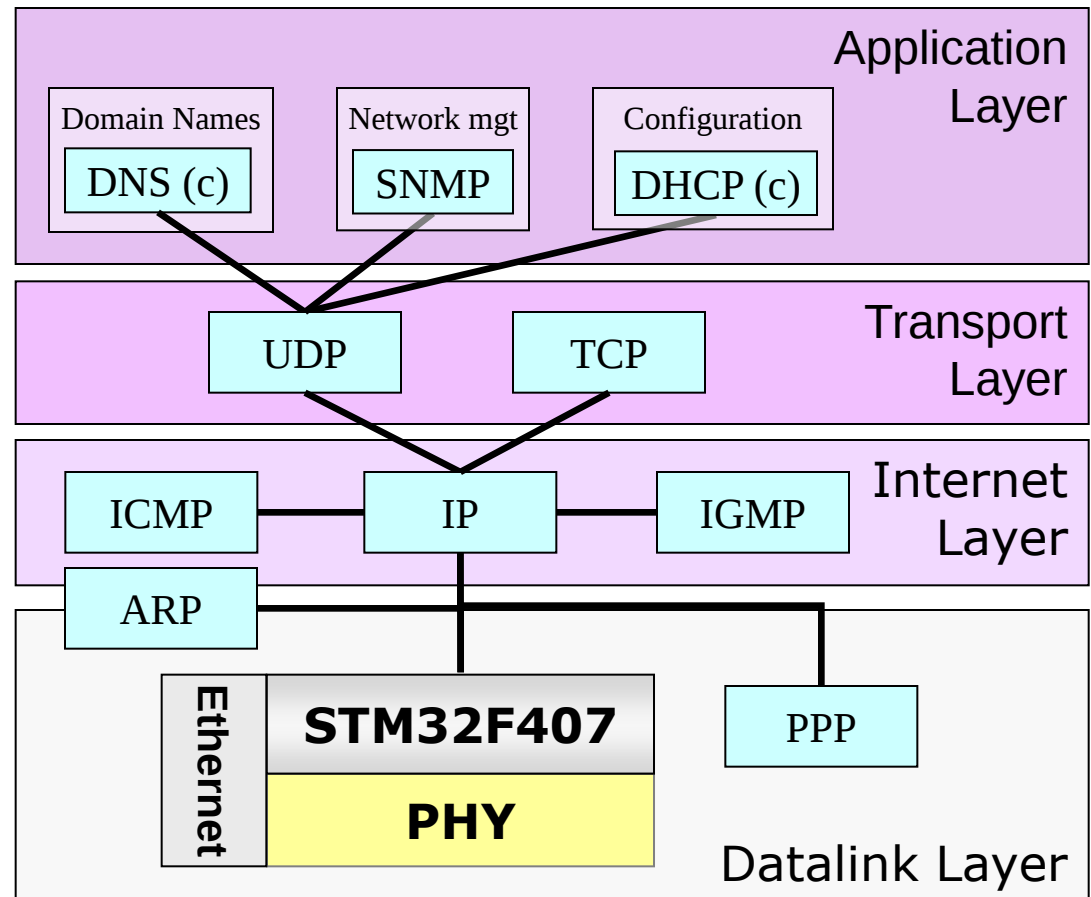
- UDP,
- TCP,

Internet Protocols

- ICMP,
- IGMP,

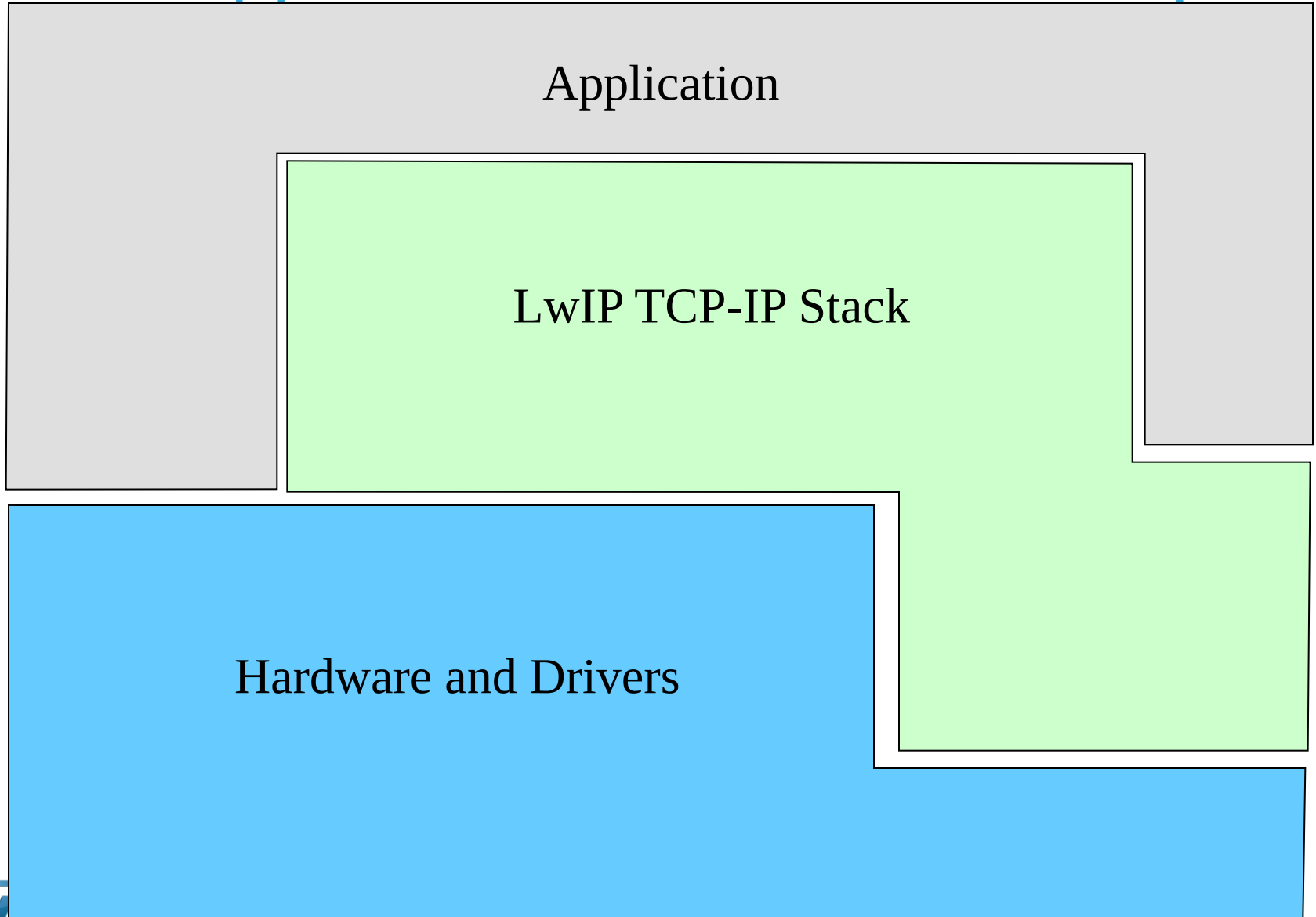
Datalink Protocols

- ARP,
- PPP



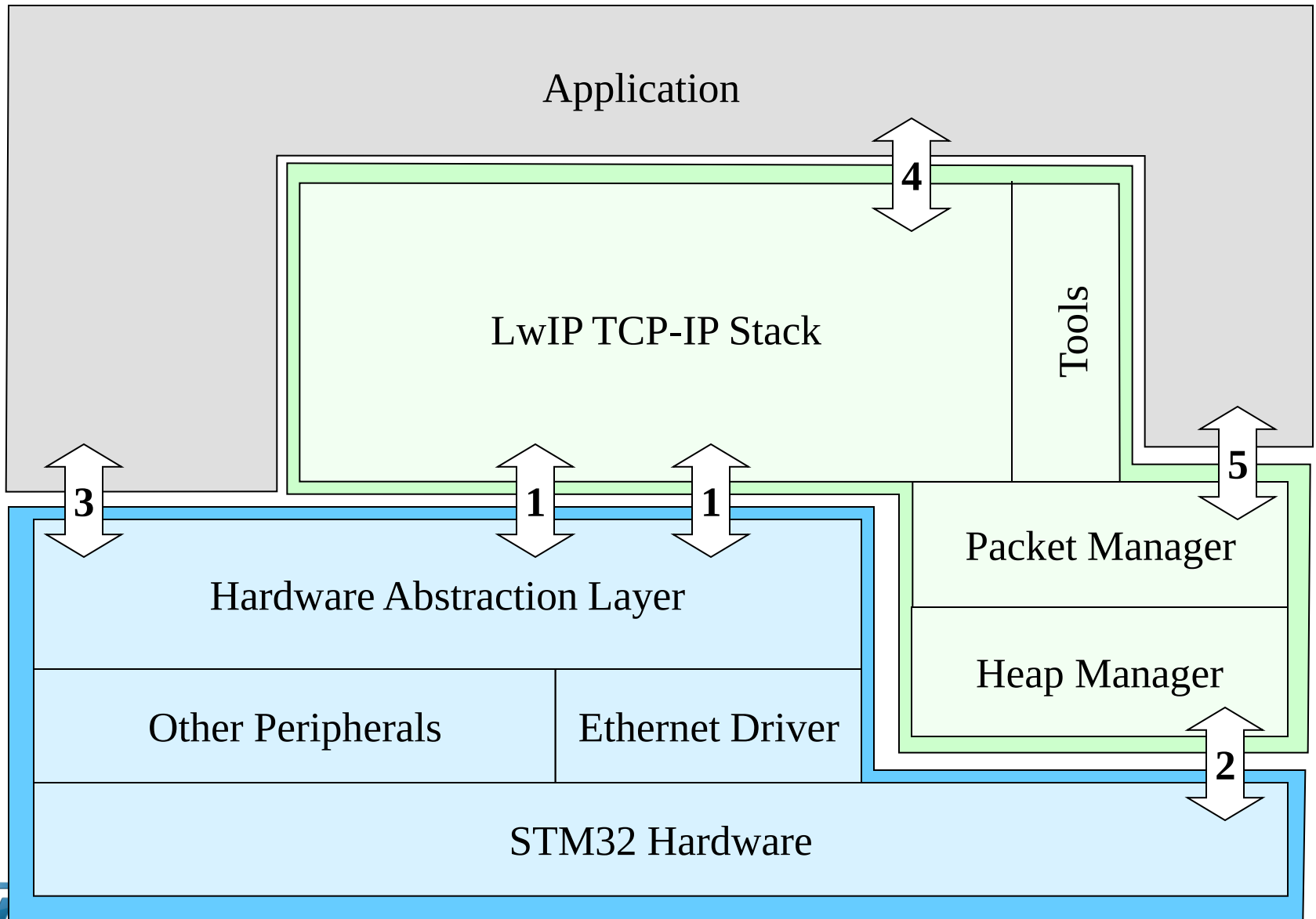
Application Architecture example

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Application Architecture example (details)

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Lwip add-on application

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Application	Solution
Webserver	Demo by ST
DHCP client	Demo by ST
TFTP client & server	Demo by ST
UDP echo client & server	Demo by ST
TCP echo client & server	Demo by ST
UDP simple client demo	Demo by ST Available on demand
UDP simple server demo	Demo by ST Available on demand
TCP simple server demo	Demo by ST Available on demand
TCP client demo with DNS	Demo by ST Available on demand
SNMP client	Please refer to http://savannah.nongnu.org/projects/lwip/
SMTP client	
NetBIOS nameserver	
Ping (board => PC)	

TCP/IP solutions (1/2)

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Provider	Solutionname	Model	Cost	Availability		
				F107	F2	F4
CMX	CMX-TCP/IP,CMX-MicroNet, CMX-INet	Source	License	Y	Y	Y
EUROS	TCP/IP stack	Binaries	License	Y	Y	Y
ExpressLogic	NetX and NetX Duo IPv4/IPv6	Source	License	Y	Y	Y
eCosCentric	SecureSockets, SecureShell	Source	License	Y	Y	Y
eForce	uNet3	Source	License	Y	Y	Y
GreenHills	μ-velOSityTCP/IPv4/v6	Source	License	Y	Y	N1
HCC	MISRA HCC-TCP/IPv4/v6	Source	License	Y	Y	Y
Interniche	NicheLite	Source	Free	Y	Y	Y
Interniche	NicheStack	Source	License	Y	Y	Y
Interniche	embTCP v4/v6	Binaries	License	N	Y	Y
Keil/ARM	MDK-ARM TCPNET	Source	License	Y	Y	Y
SICS	LwIP	Opensource(BSD)	Free	Y2	Y2	Y2
MentorEmbedded	Nucleus Network	Source	License	Y	Y	Y

TCP/IP solutions (2/2)

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Provider	Solutionname	Model	Cost	Availability		
				F107	F2	F4
Micrium	μC/TCP-IP	Source	License	Y	Y	Y
MicroDigital	smxNS and smxNS6(DualIPv6/v4)	Source	License	Y	Y	Y
OryxEmb.	CycloneTCP	Open source (GPL2) or source	Free or License	Y	Y	Y
Quadros	RTXCQuadnet	Source	License	Y	Y	Y
Rowebots	Unison TCP-IP/v4-v6	Source	License	Y	Y	Y
SEGGER	embOS/IP	Source	License	Y	Y	N1
SICS	Contiki/uIP6	Open source(BSD)	Free	N	N	N1

Provider	Solutionname	Model	Cost	Availability		
				F107	F2	F4
OryxEmb.	CycloneSSL	Open source(GPL2) or Source	Free or license	Y	Y	Y
PolarSSL	PolarSSL	Open source(GPL2) or Source	Free or license	Y2	Y2	Y2
yaSSL	CyaSSL	Open source(GPL2) or Source	Free or license	N	Y	Y

1. Available on customer request. Please contact supplier

2. A port to STM32 was implemented by ST

TCP/IP solutions details (1/2)

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Provider	Solutionname	Details
CMX	CMX-TCP/IP	PPP, PPPoE, ARP, IGMP, ICMP, IPv4, UDP, TCP, DHCP(cs), DNS, FTP(cs), IMAP4, NAT, POP3(c), SMTP, SNMP, SNTP, Telnet(s), SSL/TLS, TFTP(c), HTTP(s)
CMX	CMX-MicroNet	PPP, ARP, IGMP, ICMP, IPv4, UDP, TCP, DHCP(c), DNS, FTP(cs), POP3(c), SMTP, SNMP, SNTP, Telnet(s), SSL/TLS, TFTP, HTTP(s)
EUROS	TCP/IP stack	PPP, PPPoE, ARP, IGMP, ICMP, IPv4, IPv6, IPSec/IKE, UDP, TCP, DNS, DHCP(cs), FTP(cs), NAT, POP3(c), SMTP, SNMP, SNTP, Telnet(s), SSL/TLS, TFTP, HTTP(cs)
ExpressLogic	NetX and NetX Duo IPv4/IPv6	PPP, ARP, IGMP, ICMP, IPv4, IPv6, IPSec/IKE, UDP, TCP, DNS, DHCP(c), FTP(cs), NAT, POP3(c), SMTP, SNMP, SNTP, Telnet(s), TFTP, HTTP(s)
eCosCentric	SecureSockets	SSH2
eCosCentric	SecureShell	SSL/TLS
eForce	μNet3	PPP, ARP, IGMP, ICMP, IPv4, IPv6, UDP, TCP, DNS, DHCP(c), FTP(s), SSL/TLS
HCC	MISRA HCC-TCP/IP v4/v6	ARP, ICMP, IPv4, IPv6, UDP, TCP, DNS, DHCP(c), FTP(s), SMTP, TFTP(s), HTTP(s)
GreenHills	μ-velOSity TCP/IPv4/v6	ARP, ICMP, IGMP, IPv4, IPv6, IPv4/6, UDP, TCP, DNS, DHCP(c),
Interniche	NicheLite	ARP, ICMP, IPv4, UDP, TCP, DNS, DHCP(c), FTP(s), Telnet(s), TFTP
Interniche	NicheStack	SLIP, PPP, PPPoE, ARP, IGMP, ICMP, IPv4, IPv6, IPSec/IKE, UDP, TCP, DNS, DHCP(cs), FTP(cs), NAT, POP3(c), SMTP, SNMP, SNTP, Telnet(s), SSL/TLS, TFTP, HTTP(s), RTP/RTCP, SSH
Interniche	emb TCPv4/v6	ARP, TCP/IPv4, IPv4/v6 HTTP, FTPTelnetICMP, UDP, TCP, DNS, DHCP
Keil/ARM	MDK-ARM TCPNET	SLIP, PPP, ARP, IPv4, ICMP, UDP, TCP, DNS, DHCP(c), FTP(s), SMTP, SNMP, Telnet(s), TFTP(s), HTTP(s)
SICS	LwIP	PPP, ARP, ICMP, IPv4, UDP, TCP, DHCP(c), DNS(c), SNMP(c), SMTP(c)
MentorEmbedded	Nucleus Kernel	PPP, PPPoE, ARP, IGMP, ICMP, IPv4, IPv6, IPSec/IKE, UDP, TCP, DHCP(c), FTP(cs), NAT, SNMP, SNTP, Telnet(cs), SSL/TLS, TFTP(cs), HTTP(cs)

TCP/IP solutions details (2/2)

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Provider	Solutionname	Details
Micrium	μ C/TCP-IP(and μ C/SSL)	ARP,ICMP,IPv4,UDP,TCP,DNS,DHCP(c),FTP(cs),SMTP,POP3(c),SNTP,Telnet(s),SSL/TLS,TFTP,HTTP(s)
MicroDigital	smxNS and smxNS6(DualIPv6/v4)	SLIP,PPP,PPPoE,ARP,IGMP,ICMP,IPv4,IPv6,IPv4/6,UDP,TCP,DNS,mDNS,DHCP(cs),FTP(cs),NAT,POP3(c),SMTP,SNMP,SNTP,Telnet(s),SSL/TLS,TFTP,HTTP(cs),RTP/RTCP,SSH
OryxEmb.	CycloneTCP	ARP,IPv4,ICMP,IGMP,IPv6,ICMPv6,MLD,NDP,SLAAC,UDP,TCP,DNS,DHCP(c),DHCPv6(c),SMTP(c),FTP(cs),HTTP(s)
Quadros	RTXCQuadnet	PPP,PPPoE,ARP,IGMP,ICMP,IPv4,IPv6,IPSec/IKE,UDP,TCP,DNS,DHCP(cs),FTP(cs),NAT,POP3(c),SMTP,SNMP,SNTP,Telnet(s),SSL/TLS,TFTP,HTTP(cs),UPnP, Prioritized Packets Handling
Rowebots	Unison TCP-IP/v4-v6	PPP,ARP,ICMP,IGMP,IPv4,IPv6,IPv4/6,6LoWPan,IPSec,UDP,TCP,DNS,DHCP(cs),SMTP(c),SNMP,Telnet(s),TFTP(cs),HTTP(cs),NAT
SEGGER	embOS/IP	PPP,PPPoE,ARP,ICMP,IGMP,IPv4,UDP,TCP,DNS,DHCP(c),FTP(cs),SMTP(c),Telnet(s),TFTP(cs),HTTP(s)
SICS	Contiki/uIP6	IPv6,6LoWPAN

For recently solutions, please refer to

[http://www.st.com/st-web-](http://www.st.com/st-web-ui/static/active/en/resource/sales_and_marketing/presentation/product_presentation/stm32-stm8_embedded_software_solutions.pdf)

[ui/static/active/en/resource/sales_and_marketing/presentation/product_presentation/stm32-stm8_embedded_software_solutions.pdf](http://www.st.com/st-web-ui/static/active/en/resource/sales_and_marketing/presentation/product_presentation/stm32-stm8_embedded_software_solutions.pdf)

- WireShark is
 - a network monitoring tool
 - It uses WinPcap that interfaces directly with the Network card
- Wireshark allows you to
 - See all the packets sent or received by the PC
 - Filter the packets to display only the relevant information.
 - The packets content is formatted for easy reading
 - This Software cannot send any data

Wireshark : how to use it

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- Select the network interface you want to monitor



Wireshark : ICMP Echo Requests & Replies

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Broadcom NetXtreme Gigabit Ethernet Driver: Capturing - Wireshark

Filter: `ip.host==192.168.1.2`

No.	Time	Source	Destination	Protocol	Info
552	152.634085	192.168.1.3	192.168.1.2	ICMP	Echo (ping) request
553	152.634208	192.168.1.2	192.168.1.3	ICMP	Echo (ping) reply
558	153.623773	192.168.1.3	192.168.1.2	ICMP	Echo (ping) request
559	153.623923	192.168.1.2	192.168.1.3	ICMP	Echo (ping) reply
562	154.639831	192.168.1.3	192.168.1.2	ICMP	Echo (ping) request
563	154.639968	192.168.1.2	192.168.1.3	ICMP	Echo (ping) reply
569	155.655550	192.168.1.3	192.168.1.2	ICMP	Echo (ping) request
570	155.655688	192.168.1.2	192.168.1.3	ICMP	Echo (ping) reply

Source :
- ICMP requests sent by the PC (192.168.1.3)
- ICMP Replies sent by the Target board (192.168.1.2)

Destination :
- ICMP requests sent to the Target board (192.168.1.2)
- ICMP Replies sent to the PC (192.168.1.3)

Protocol type :
PING is using ICMP

PING Requests & Replies

Frame 552 (74 bytes on wire, 74 bytes captured)
Ethernet II, Src: Foxconn_2b:e7:a0 (00:15:58:2b:e7:a0), Dst: 00:00:00_00:00:01 (00:00:00:00:00:01)
Internet Protocol, Src: 192.168.1.3 (192.168.1.3), Dst: 192.168.1.2 (192.168.1.2)
Internet Control Message Protocol

Raw data of the selected frame

Details of the selected Frame

```
0000 00 00 00 00 00 01 00 15 58 2b e7 a0 08 00 45 00 ..... X+.
0010 00 3c 14 f0 00 00 80 01 a2 7b c0 a8 01 03 c0 a8 .<..... .{.
0020 01 02 08 00 e6 5b 03 00 64 00 61 62 63 64 65 66 .....[. d.a
0030 67 68 69 6a 6b 6c 6d 6e 6f 70 71 72 73 74 75 76 ghijklmn opq
0040 77 61 62 63 64 65 66 67 68 69 wabcdefg hi
```

C:\WINDOWS\system32\cmd.exe

```
Reply from 192.168.1.2: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

- Xcap is
 - A windows packet generator & sender tool through a specified interfaces on you computer.
- What you can do through this tool:
 - create a packet by a packet creating wizard
 - send the packet you created
 - create ipv4&ipv6 fragments, you can create a long packet(can not exceed 16K bytes)
 - browse the packet by WireShark

Xcap: How to use it (Please refer to help)

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The screenshot shows the Xcap Ethernet configuration interface. On the left is a tree view of the configuration hierarchy. The main area is titled 'Ethernet' and contains several configuration sections. Annotations with blue lines point to specific parts of the interface:

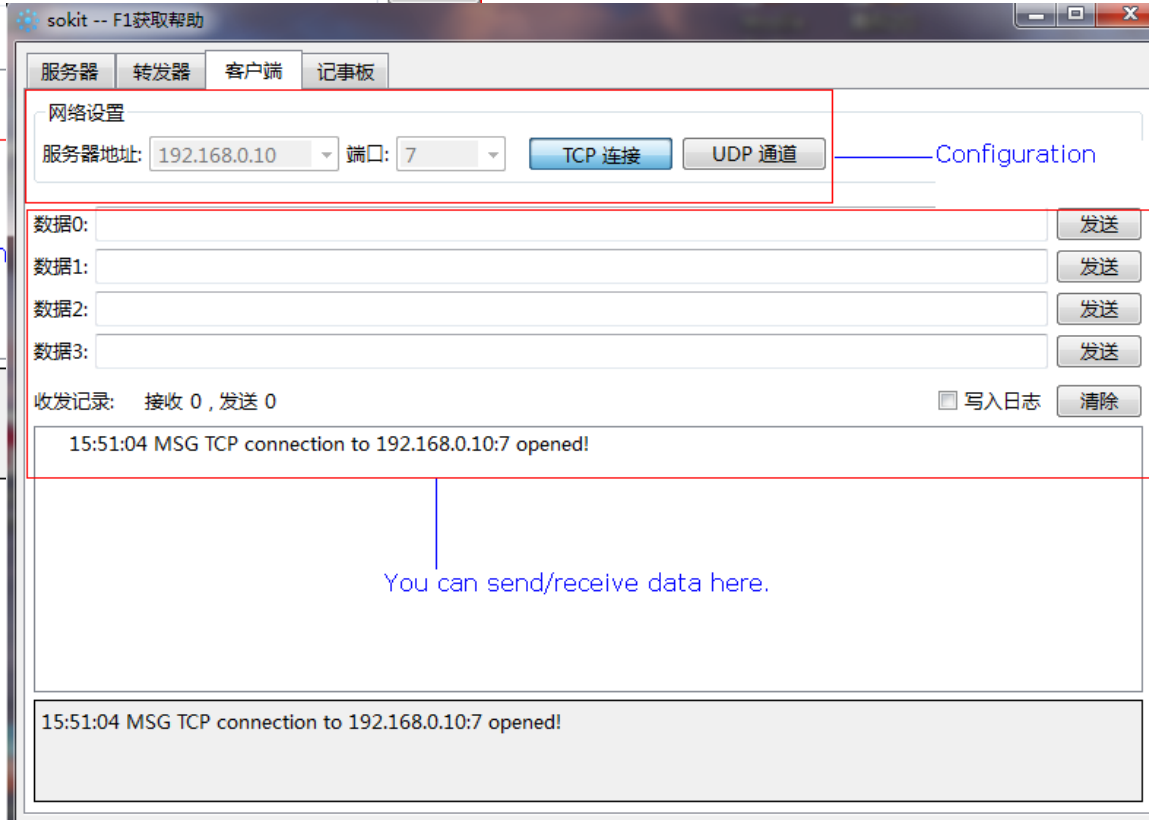
- Data link layer configuration:** Points to the MAC configuration section, which includes fields for Destination MAC (02:00:00:00:00:00), Source MAC (00:00:00:00:00:00), and their respective Actions (Fixed), Num (1), and Loop (0).
- Net interface:** Points to the '接口2 - [Broadcom 440x 10]' entry in the left tree view, which shows parameters like IP address (192.168.0.11), MAC address (fe80::2c16:e174:9817), and Link Type (EN10MB).
- Next layer configuration: IP (Select Type:IPv4):** Points to the 'Type' section at the bottom, where 'EthernetII' is selected and the 'Type' dropdown is set to '0x0800 (IPv4)'.

The bottom of the window features a navigation bar with buttons: '<< 上一步', '下一步 >>', '保存', '关闭', and '查看'.

- What does this software do:
 - Allow to send/receive UDP data
 - Allow to send/receive TCP data (TCP client)
 - Allow to listen for incoming TCP connection, send/receive TCP data (TCP server)

sokit: How to use it

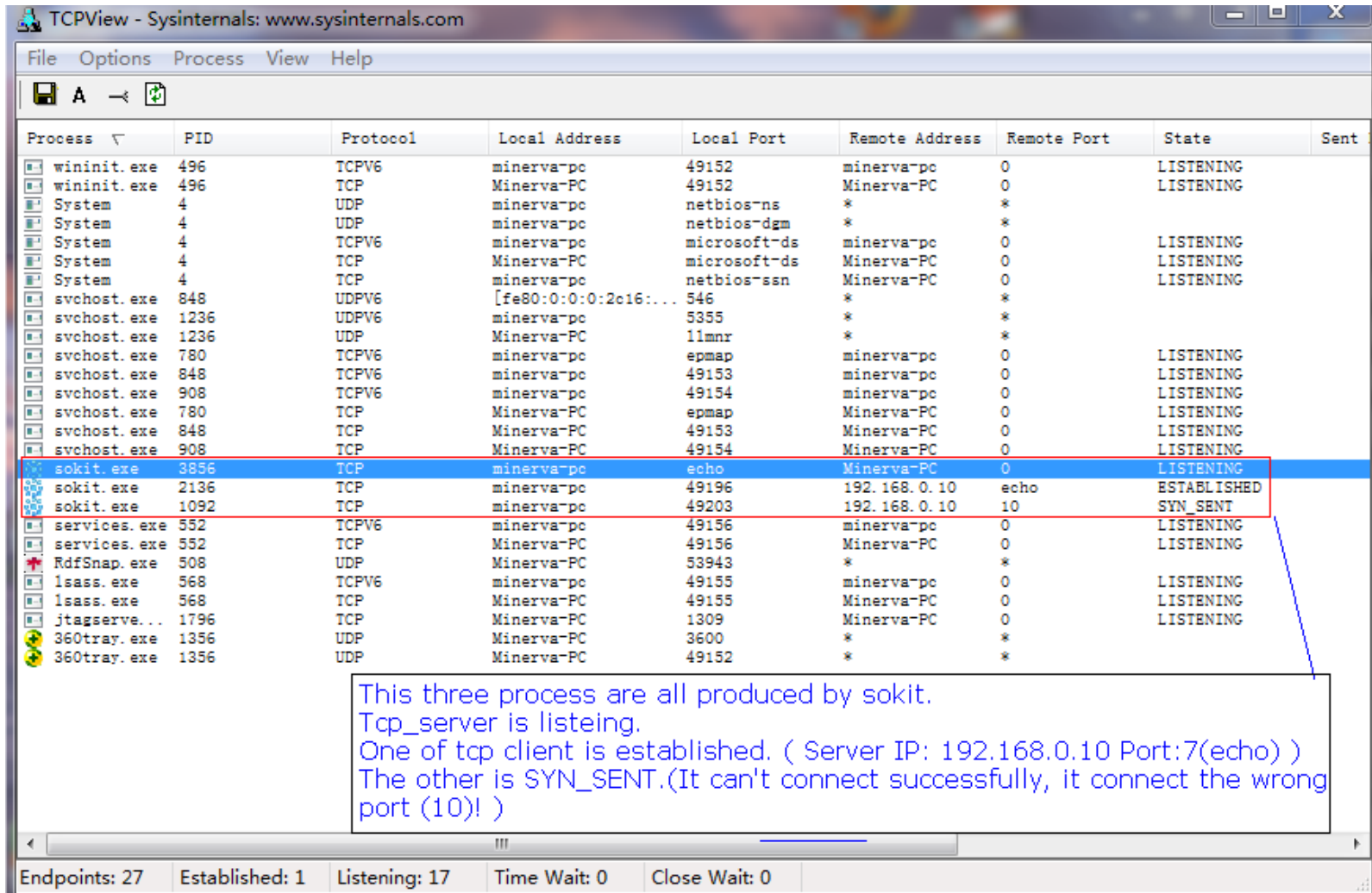
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- TCPView is
 - a Windows program that will show you detailed listings of all TCP and UDP endpoints on your system
 - including the local and remote addresses and **state of TCP connections**.

TCPView: How to use it

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TCPView - Sysinternals: www.sysinternals.com

File Options Process View Help

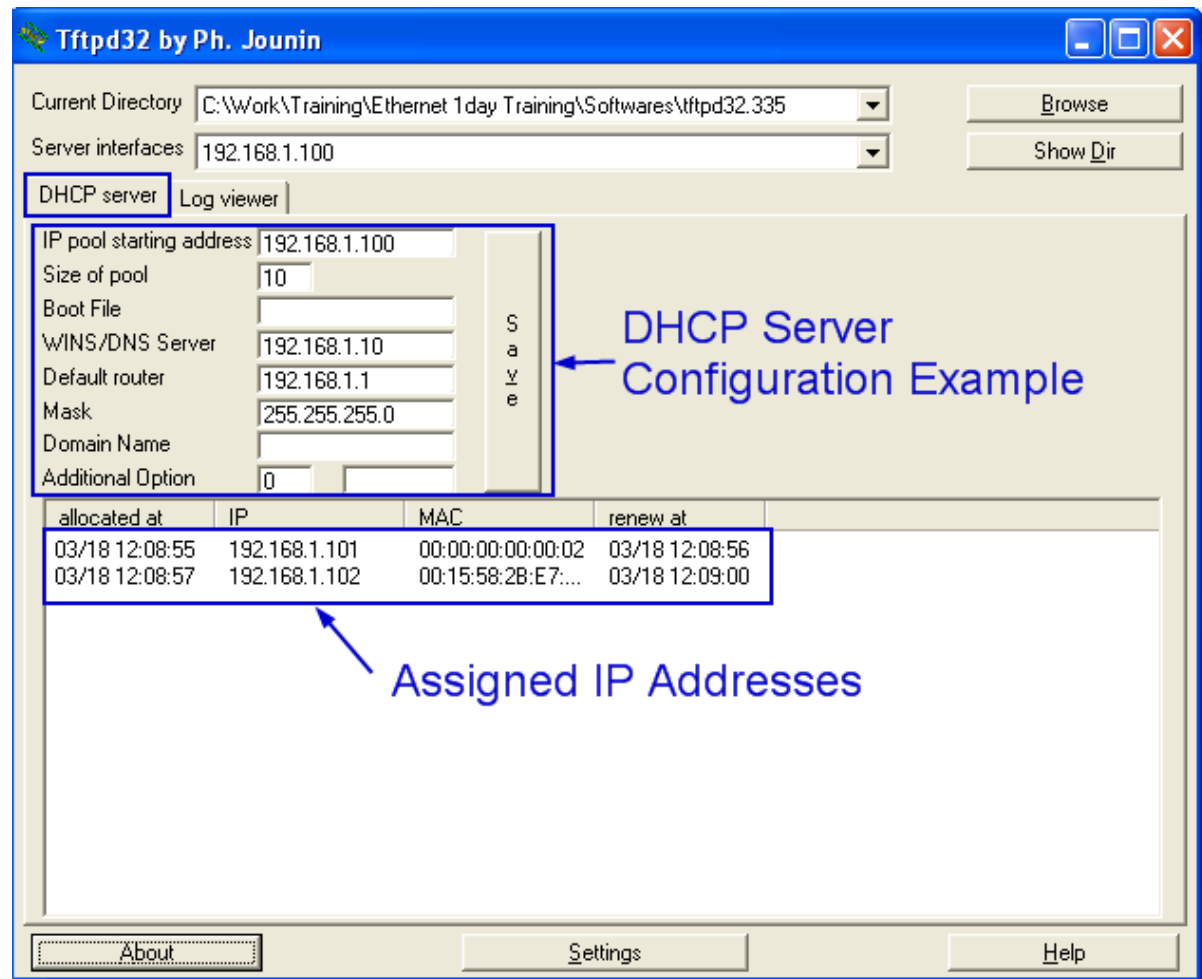
Process	PID	Protocol	Local Address	Local Port	Remote Address	Remote Port	State	Sent
wininit.exe	496	TCPV6	minerva-pc	49152	minerva-pc	0	LISTENING	
wininit.exe	496	TCP	Minerva-PC	49152	Minerva-PC	0	LISTENING	
System	4	UDP	minerva-pc	netbios-ns	*	*		
System	4	UDP	minerva-pc	netbios-dgm	*	*		
System	4	TCPV6	minerva-pc	microsoft-ds	minerva-pc	0	LISTENING	
System	4	TCP	Minerva-PC	microsoft-ds	Minerva-PC	0	LISTENING	
System	4	TCP	minerva-pc	netbios-ssn	Minerva-PC	0	LISTENING	
svchost.exe	848	UDPV6	[fe80:0:0:0:2c16:...	546	*	*		
svchost.exe	1236	UDPV6	minerva-pc	5355	*	*		
svchost.exe	1236	UDP	Minerva-PC	11mnr	*	*		
svchost.exe	780	TCPV6	minerva-pc	epmap	minerva-pc	0	LISTENING	
svchost.exe	848	TCPV6	minerva-pc	49153	minerva-pc	0	LISTENING	
svchost.exe	908	TCPV6	minerva-pc	49154	minerva-pc	0	LISTENING	
svchost.exe	780	TCP	Minerva-PC	epmap	Minerva-PC	0	LISTENING	
svchost.exe	848	TCP	Minerva-PC	49153	Minerva-PC	0	LISTENING	
svchost.exe	908	TCP	Minerva-PC	49154	Minerva-PC	0	LISTENING	
sokit.exe	3856	TCP	minerva-pc	echo	Minerva-PC	0	LISTENING	
sokit.exe	2136	TCP	minerva-pc	49196	192.168.0.10	echo	ESTABLISHED	
sokit.exe	1092	TCP	minerva-pc	49203	192.168.0.10	10	SYN_SENT	
services.exe	552	TCPV6	minerva-pc	49156	minerva-pc	0	LISTENING	
services.exe	552	TCP	Minerva-PC	49156	Minerva-PC	0	LISTENING	
RdfSnap.exe	508	UDP	Minerva-PC	53943	*	*		
lsass.exe	568	TCPV6	minerva-pc	49155	minerva-pc	0	LISTENING	
lsass.exe	568	TCP	Minerva-PC	49155	Minerva-PC	0	LISTENING	
jtagserve...	1796	TCP	Minerva-PC	1309	Minerva-PC	0	LISTENING	
360tray.exe	1356	UDP	Minerva-PC	3600	*	*		
360tray.exe	1356	UDP	Minerva-PC	49152	*	*		

Endpoints: 27 Established: 1 Listening: 17 Time Wait: 0 Close Wait: 0

This three process are all produced by sokit.
Tcp_server is listeing.
One of tcp client is established. (Server IP: 192.168.0.10 Port:7(echo))
The other is SYN_SENT.(It can't connect successfully, it connect the wrong port (10))

Features

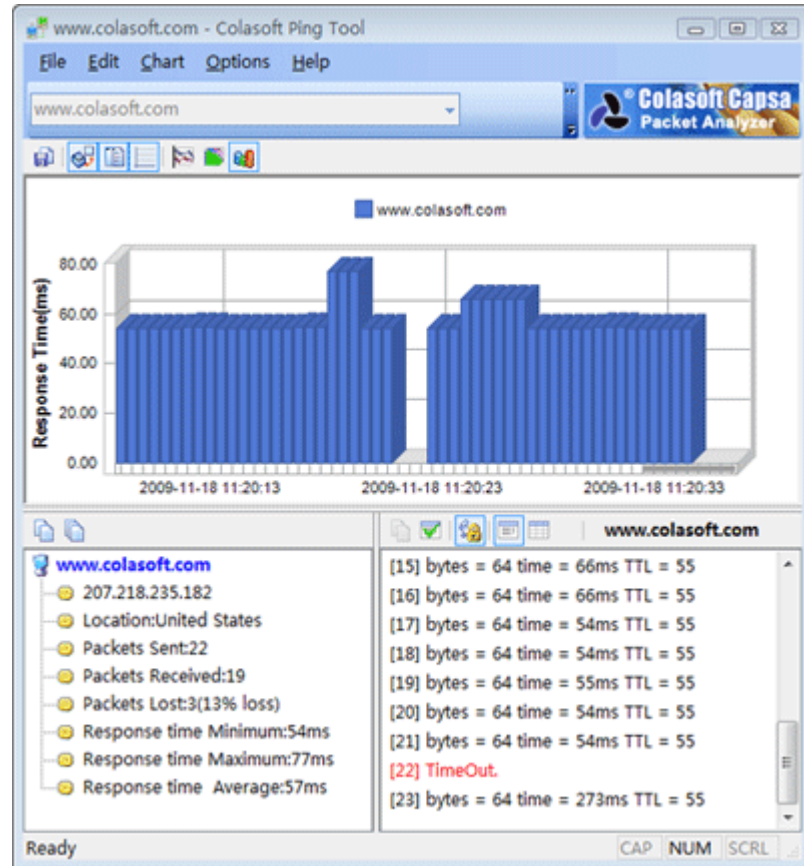
- DHCP Server
- TFTP Server
- TFTP Client
- SNTP Server
- Syslog Server
- DNS Server



Useful tools: Colasoft Ping Tool

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- Features
 - Graphic window
 - Ping – Summary
 - Ping - Details



Useful tools: (Need License)

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- Ping Tester
- TCP Viewer
- And so on...



Ethernet / TCP-IP - Training Suite

01 - LWIP Introduction

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