MUNI FI

PV198 - Ethernet

One-chip Controllers

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Intro

- Switch the branch to *Week_12*!
- Discussion of HW11

ISO/OSI model

ISO/OSI layers with some protocol examples:

Layer	Protocols
7. Application	HTTP, SMTP, DNS
6. Presentation	FTP, SSH
5. Session	
4. Transport	TCP, UDP
3. Network	IP, ICMP
2. Data	MAC
1. Physical	Physical structure

IPv4 header

Table 50-6. IPv4 header format

31 30 29 28	27 26 25 24	23 22 21 20	19 18 17 16	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
Version	IHL	TOS		Length			
Fragment ID				Flags	Fragment offset		
TTL		Protocol		Header checksum			
Source address							
Destination address							
Options							

Source: K66 Sub-Family Reference Manual

UDP header

Table 50-11. UDP header format

31 30 29 28	27 26 25 24	23 22 21 20	19 18 17 16	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
Source port				Destination port			
Length				Checksum			

Source: K66 Sub-Family Reference Manual

FRDM-K66F Ethernet

- 10/100 Mbps Ethernet MAC (ENET)
- Compliant with the IEEE802.3-2002 standard
- Hardware acceleration block to optimize the performance of network controllers providing TCP/IP, UDP, and ICMP protocol services
- CRC-32 checking / CRC-32 generation
- Programmable MAC address

FRDM-K66F Ethernet

We will use lightweight IP stack *lwIP* in our embedded application.

Application	Lightweight IP stack
Presentation	Lightweight IP stack
Session	Lightweight IP stack
Transport	Lightweight IP stack
Network	Lightweight IP stack
Data	10/100 Mbps Ethernet MAC, ENET driver
Physical	Micrel 32-pin Ethernet PHY

lwIP

- Lightweight IP stack
- Specification
- Small independent implementation of the TCP/IP protocol suite – used in embedded
- Features: IP, ICMP, UDP, TCP, DNS, DHCP, and more

Seminar task – Overwiew

- The application sends a message to a database
- Download it from study materials
- It uses UDP packets to send data to InfluxDB
- Data are shown with Grafana
  - `http://lavinia.fi.muni.cz:3000/`
  - Login: onechip:onechip
  - Goto: *Student Dashboard*
- InfluxDB: `udp://lavinia.fi.muni.cz:8089/`
- When you successfully send a message, it will be visible on the dashboard.

Seminar task – Template

- Initialization of pins, clocks, peripherals and lwIP already implemented.
- Based on UDP echo
  - When the board receives an UDP packet, it sends the packet back to the sender.
- Uses predefined static IP address.

Seminar task – Source Code

- `main`:
  - Initialize pins, clocks, peripherals, lwIP
  - Send udp packet – your task to implement
  - Loop: Receive packets

Seminar task – Task

1. Define your unique IP address (192.168.50.x).
2. Implement function `udp_send_data` in `udpecho_raw.c`.

Extra task

Handle received packet – send the packet back to the sender.

Voluntary homework

Send meaningful data to the database.
E.g.:

- Data from sensor (temperature, pressure, accelerometer, ...)
- Logging information (button pressed, ...)
- You have to use `address.h`

This homework is voluntary, you won't get points for it. You can ask your teacher for feedback for it.

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