

Control software for the COMbo Ethernet Tester and its integration into the Netopeer configuration system

Master's thesis

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Outline of Presentation

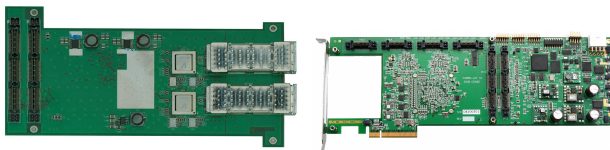
- 1 About the COMET Project
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About the COMET Project

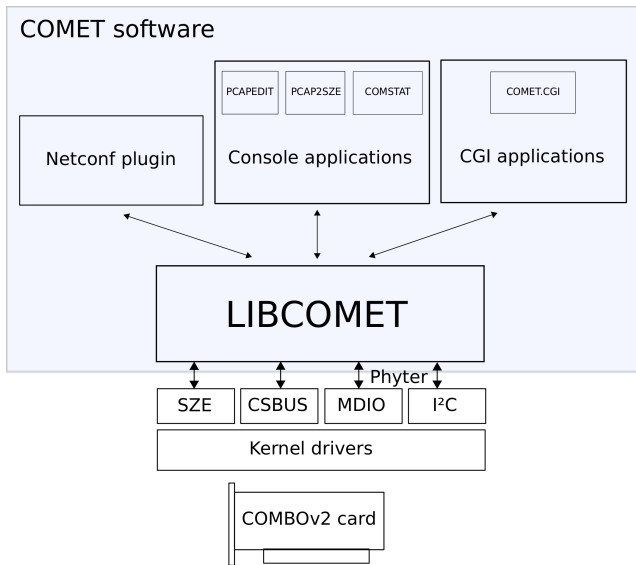
- COMET = COMbo Ethernet Tester
- Idea came from CESNET, z.s.p.o.
- My supervisor – RNDr. Radek Krejčí

What COMET is?

- Ethernet tester built on “Programmable hardware” – COMBOv2 card



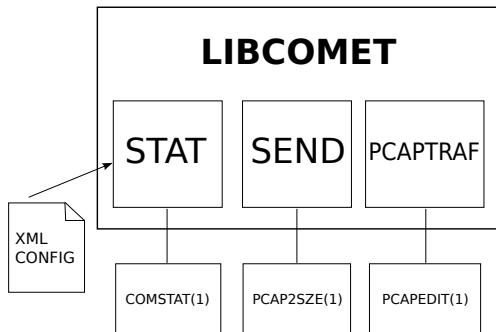
COMET Architecture



My part was the COMET software design and implementation.

Software Architecture

Software part uses the *libcomet* library.



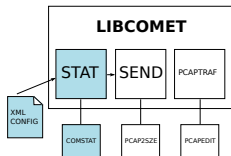
STAT reading information about device state and incoming traffic,

SEND sending stored traffic at given speed,

PCAPTRAF manipulation with PCAP files.

STAT Module

Used in *comstat(1)* console application.



This module:

- is based on XML configuration file,
- reads information from hardware,
- writes data into hardware,
- computes values according to simple equations,
- presents values to user.

SEND Module

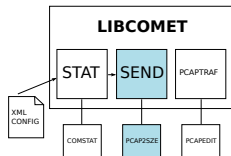
Used in *pcap2size(1)* console application.

This module:

- is used for sending stored network traffic,
- has many options for timestamp specification,
- allows to repeat packets.

Basic modes of transmission:

- 1 full-speed,
- 2 user-speed,
- 3 interval-based.



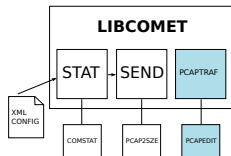
PCAPTRAF Module

Used in *pcapedit(1)* console application.

This module is used for manipulation with a content of PCAP file.

Some operations:

- load/save PCAP file,
- make a copy of frame,
- remove a frame,
- ...



NETCONF Support

Done by Netopeer plug-in implementation.

- NETCONF — network configuration protocol (RFC6241)
- Netopeer — implementation of NETCONF protocol
- YANG — configuration modeling language (RFC6020)

For COMET:

- Created data configuration model in YANG;
- COMET has new RPC operations (send-traffic, reset-counter, reset-modules);
- Implementation of Netopeer plug-in.

Testing and Verification

- ❶ Tests of software part:
 - ▶ static program analysis – Stanse,
 - ▶ dynamic program analysis – Valgrind;
- ❷ Tests of Netopeer plug-in;
- ❸ Tests of the whole COMET device
 - ▶ tested with the Spirent Ethernet tester (verified sent and received data).

Installation of the COMET Software

The COMET software is packed in the *libcomet* and *comet* RPM packages.

Makes installation and boot of COMET easy:

```
[root@localhost]# yum install libcomet comet  
[root@localhost]# comet-boot.sh start
```

Screenshots of GUI

Statistics module		
Total packet count (received + discarded)	5019	
Received frames (not discarded)	5019	
Discarded frames	0	
Buffer overflow	0	
CRC error	0	
Bad MAC address	0	
Packets over MTU counter	0	
Packets below MTU counter	0	
MIN packet size	64	
MAX packet size	98	
MIN packet delay (B)	10	
MAX packet delay (B)	141467531342	
Number of packets in sum of sizes	5019	
Sum of sizes	453866	
Read to read delay (clocks)	860165969	
Average packet size	90	
Histogram of sizes		
0 - 63	0	
64 - 127	 5019	
128 - 191	0	

List of sections

PCS Reset	● (off)
PCS system loopback G	● (on)
PCS Low power	● (off)
PCS Fault(s)	● (up)
PCS RX link status	● (up)
PCS Low power ability	✓ Supported
PCS TX fault(s)	● (up)
PCS RX fault(s)	● (up)
10GBASE-R RX Link status	● (up)
PCS PRBS31 pattern test capability	✓ Capable
High BER	Normal
PCS Block lock	🔒 PCS block locked
BER counter	0
Errored block counter	0
Seed A (57:48)	0x0 Set
Seed A (47:32)	0x0 Set
Seed A (31:16)	0x0 Set
Seed A (15:0)	0x0 Set
Seed B (57:48)	0x0 Set
Seed B (47:32)	0x0 Set
Seed B (31:16)	0x0 Set

Histogram of delays

0 - 1us	5
1us - 1.2us	0
1.2us - 1.5us	0
1.5us - 1.9us	0
1.9us - 3.8us	60000009
3.8us - 7.8us	0
7.8us - 15us	12000009
15us - 31.2us	0
31.2us - 62us	0
62us - 125us	1500009
125us - 250us	0
250us - 500us	300009
500us - 1ms	0
1ms - 2ms	0
2ms - 3ms	48009
3ms - others	0

832 - 895 0

896 - 959 0

960 - 1023 0

1024 - others 0

[Enable size histogram](#) ● (on)

[RAR size histogram](#) ● (off)

Histogram of IFG

<0 - 8)B 0

<8 - 12)B 950

<12 - 15)B 117

<15 - 19)B 1459

<19 - 24)B 41

<24 - 30)B 0

<30 - 37)B 0

<37 - 45)B 0

<45 - 54)B 0

<54 - 64)B 0

<64 - 75)B 0

<75 - 87)B 0

<87 - 100)B 0

<100 - 125)B 0

<125 - 157)B 0

<157 - others)B 2451

[Enable IFG histogram](#) ● (on)

[RAR IFG histogram](#) ● (off)

Conclusion

The work I have done:

- COMET software architecture design,
- designed configuration file structure,
- COMET library implemented,
- console application and GUI implemented,
- NETCONF support,
- RPM packages,
- static and dynamic source codes analysis.