

High Precision Performance Measurement of Network Device

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Needs for High Precision Network Device Measurement

Popularity of highly latency sensitive online services such as Online Games (e.g., FPS, RTS) and Online Communication services (e.g., Skype)

On going increase of Cloud Computing services and Data Center usage

Problems with Conventional Technology

- Software Testers
 - High variability
- Hardware Testers
 - Expensive
 - inflexible

Software's Imprecision

File Edit View Search Terminal Help

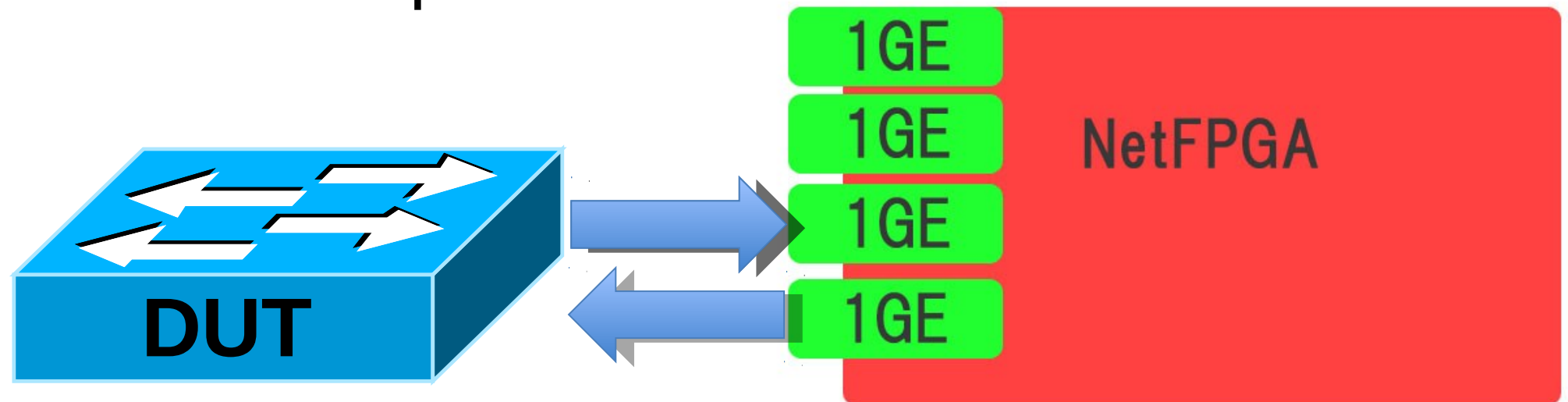
```
[bhangra@bhangra tmp]$ ping localhost
PING localhost (127.0.0.1) 56(84) bytes of data.
64 bytes from localhost (127.0.0.1): icmp_req=1 ttl=64 time=0.055 ms
64 bytes from localhost (127.0.0.1): icmp_req=2 ttl=64 time=0.057 ms
64 bytes from localhost (127.0.0.1): icmp_req=3 ttl=64 time=0.057 ms
64 bytes from localhost (127.0.0.1): icmp_req=4 ttl=64 time=0.060 ms
64 bytes from localhost (127.0.0.1): icmp_req=5 ttl=64 time=0.065 ms
64 bytes from localhost (127.0.0.1): icmp_req=6 ttl=64 time=0.057 ms
64 bytes from localhost (127.0.0.1): icmp_req=7 ttl=64 time=0.043 ms
64 bytes from localhost (127.0.0.1): icmp_req=8 ttl=64 time=0.053 ms
64 bytes from localhost (127.0.0.1): icmp_req=9 ttl=64 time=0.051 ms
64 bytes from localhost (127.0.0.1): icmp_req=10 ttl=64 time=0.044 ms
64 bytes from localhost (127.0.0.1): icmp_req=11 ttl=64 time=0.069 ms
64 bytes from localhost (127.0.0.1): icmp_req=12 ttl=64 time=0.061 ms
64 bytes from localhost (127.0.0.1): icmp_req=13 ttl=64 time=0.056 ms
64 bytes from localhost (127.0.0.1): icmp_req=14 ttl=64 time=0.055 ms
64 bytes from localhost (127.0.0.1): icmp_req=15 ttl=64 time=0.048 ms
64 bytes from localhost (127.0.0.1): icmp_req=16 ttl=64 time=0.048 ms
^C
```

Overview

Implement high precision network device tester

Test the implementation's precision

Measure performance of L3 switch.



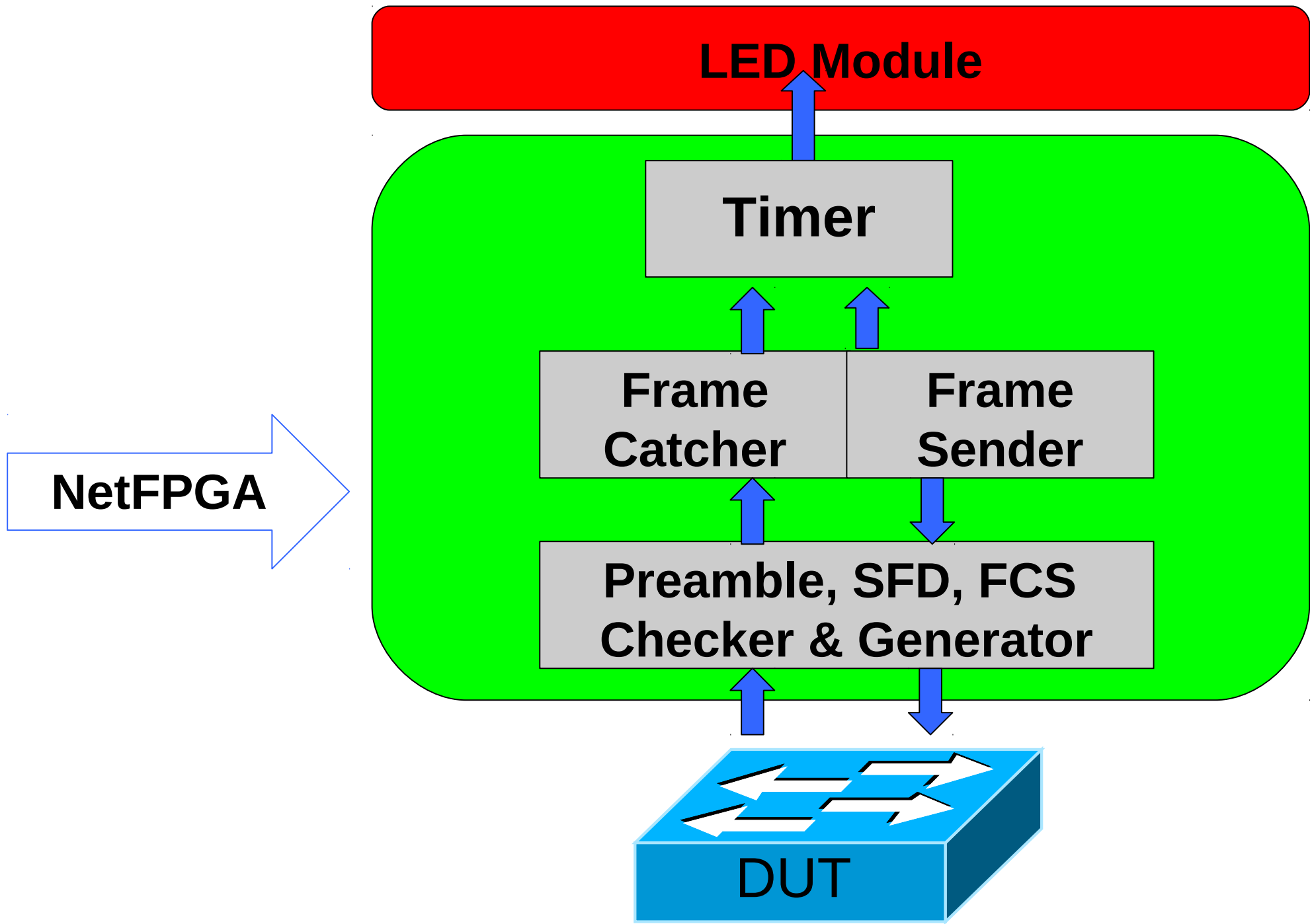
NetFPGA

PCI card with 4 gigabit Ethernet(GE) interface, PHY, SRAM, DRAM, etc.

It is designed to operate on 125MHz clock, rate at which 1 byte is sent on GE.



Implementation

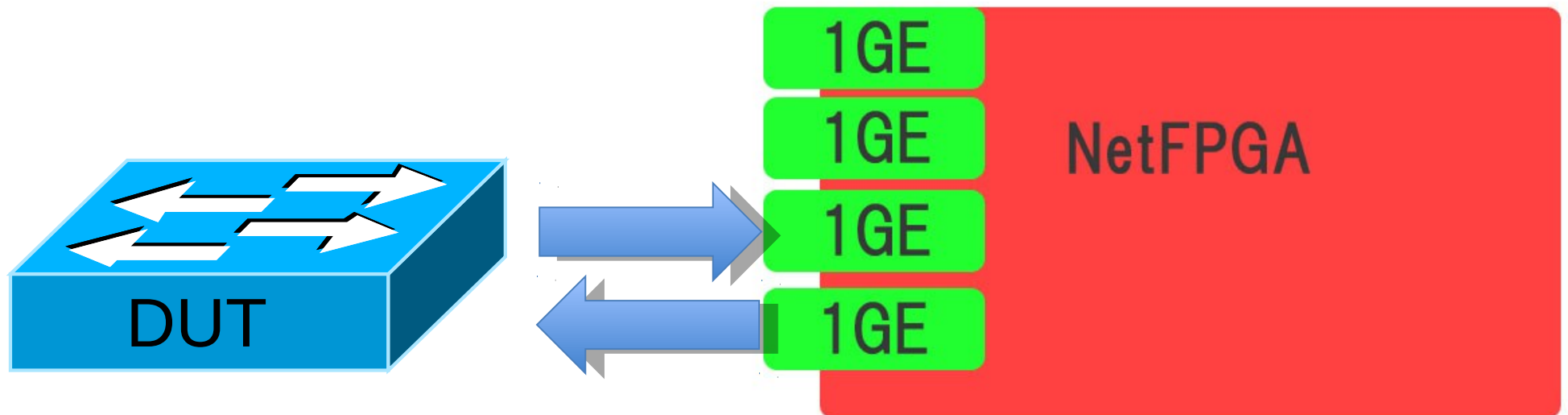


Measurement

Connect implementation with DUT

3 Frame Length: 64 and 1518bytes, jumbo frame

Test internal latency of the DUT and rate at which Ethernet frames are dropped



Current State

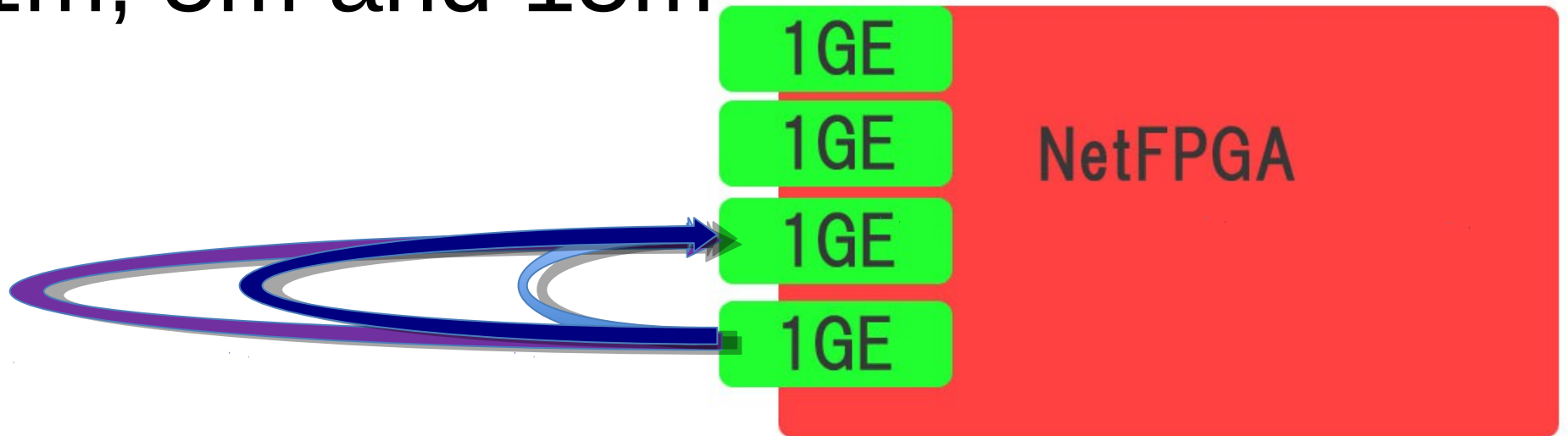
- Incorporated modules that generates Preamble, SFD and CRC
- Calibration was carried on 1m, 5m, 15m long UTP cable
- some bugs and deviance with data were spotted

Calibration

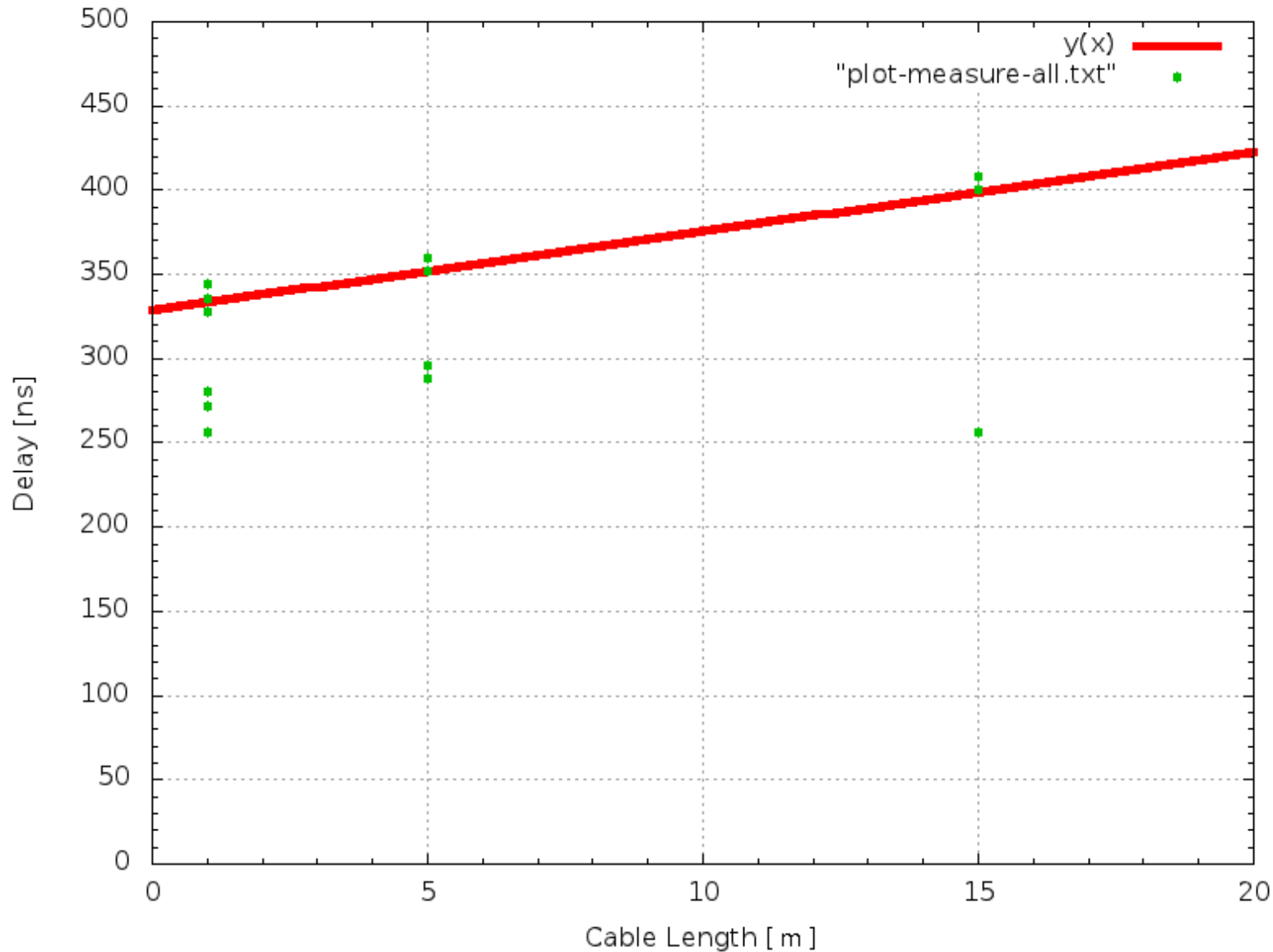
1. Measure internal latency of implementation and test the precision
2. Check the implementation's accuracy

Calibration

Calibration was carried on with UTP cables 3 different length: 1m, 5m and 15m



Data from Calibration



$$y(x) = 4.68343 \text{ ns/m} * x\text{m} + 328.645\text{ns}$$

Correlation Coefficient: 0.772340901

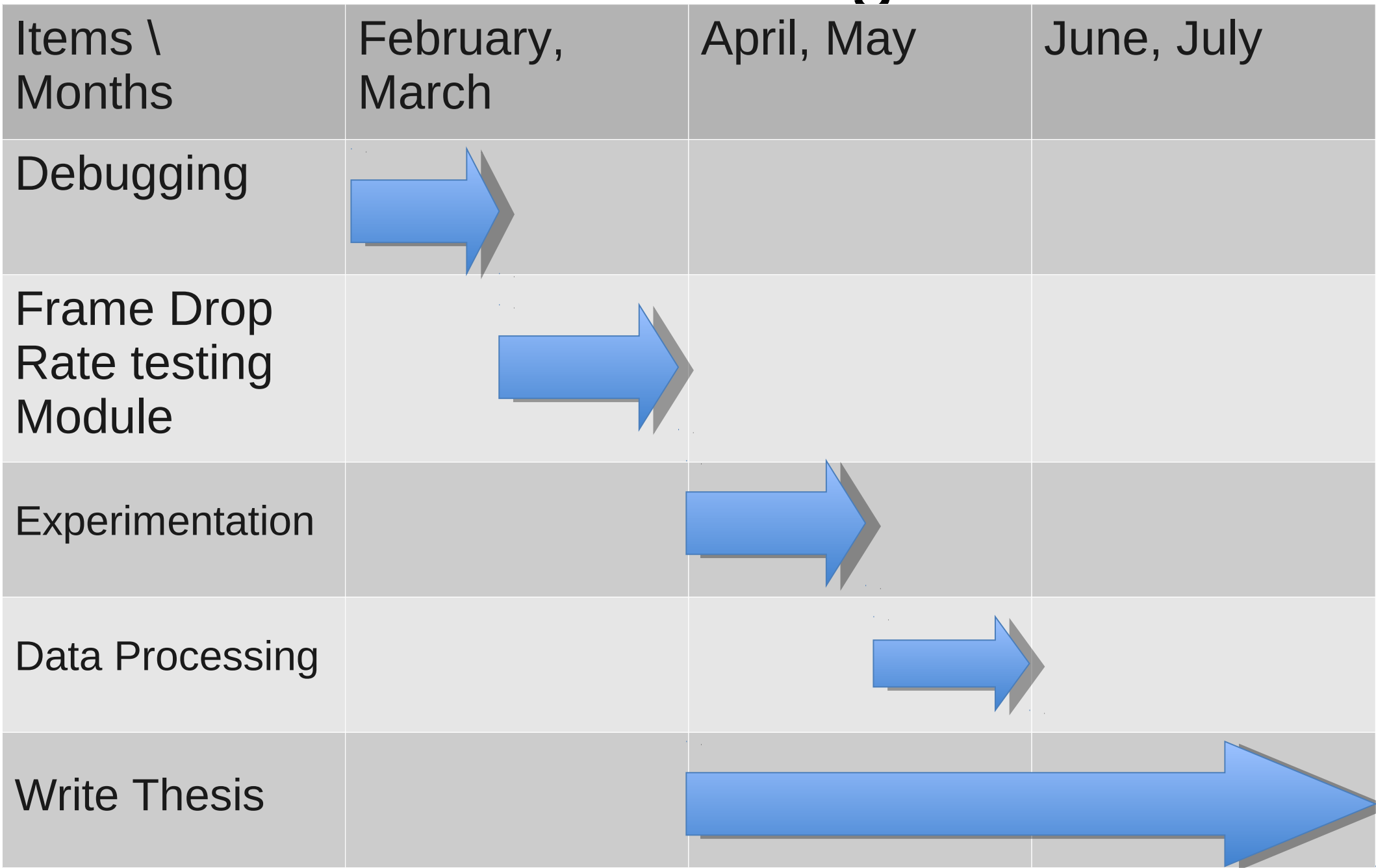
Insight to the result of Calibration

Existence of some erroneous data spotted

Correlation of delay measured with length of UTP cables

Speed of the electrical signal on UTP cable was found out to be 213518724 m/s which is about 71% of the speed of light vacuum

Scheduling



Summary

Aim:

- Implement high precision network device tester with FPGA
- measure network devices' performance

Progress:

- Incorporated Preamble and CRC module
- Calibration was carried on and led to discovery of some bugs

