General considerations and test methods

Evaluation of low latency protocol performance regarding use in selected topologies and error cases

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Why performance evaluation?

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- **Key factor is performance**
- **Calculation of performance** requires deep inspection of traffic in general
- Convergent networks allows no traffic restrictions!
- ***Methods identified to combine traffic***
  - *No integration*
  - *Time Aware Shaper (TDMA type)*
  - *Minimize impact to high performance traffic*
- **Special topology constrains in automation**
  - Line structures at low level reduce cabling
  - Ring structures for redundancy

Evaluation stategies

- Building real components and run the test

Pro	Cons
Real life (100% coverage)	**Very difficult to set up**
Integration of different systems	Time consuming

- Simulation of the components

Pro	Cons
Setup in a medium time frame	**Mostly no real solution test**
Good analytical tools	No combination with real systems

- Virtualization concept (several components@one HW)

Pro	Cons
Setup in a short time frame	**Not real time**
Scalable solution	Model of low latency
Mixed infrastructure	

The VM „ISIS“ way…

- 3 virtualization systems **VirtualBox**, Vmware, Parallels
  - decision based on networking capabilities=>VirtualBox
- Using of a standard application implementation
  - Shall be selected
- **Cloning concept** for efficient handling of huge configuration
  - Create a template („snapshot“) of a „virtual node“
  - Produce copies of this clone with a distinct identity (i.e. specific addresses, names, communication profile)
  - The clones share the same code with a different database
  - The clones communication ports are connected to a virtual channel (using xtended existing model) or a later on a NIC

Use Case 70 µs „slot“ time

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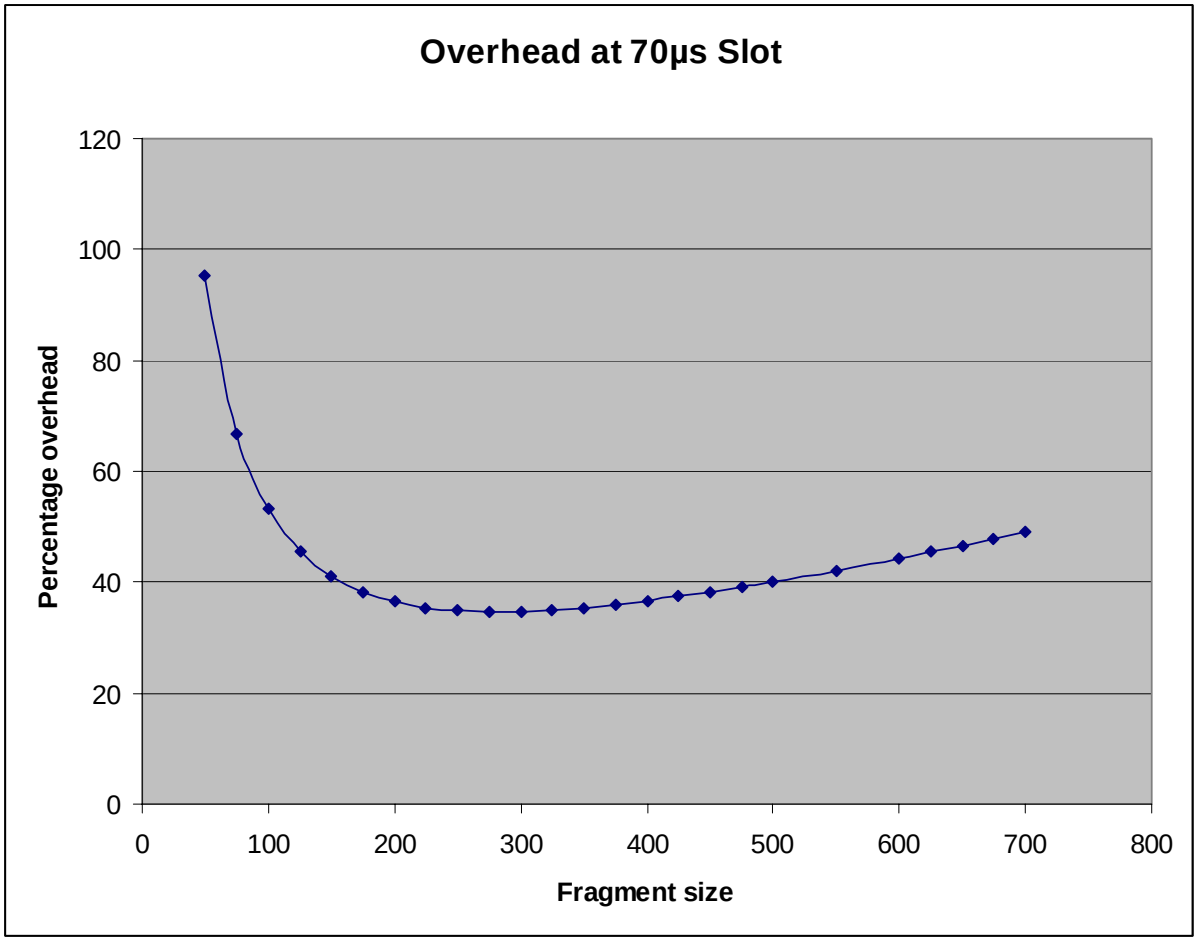
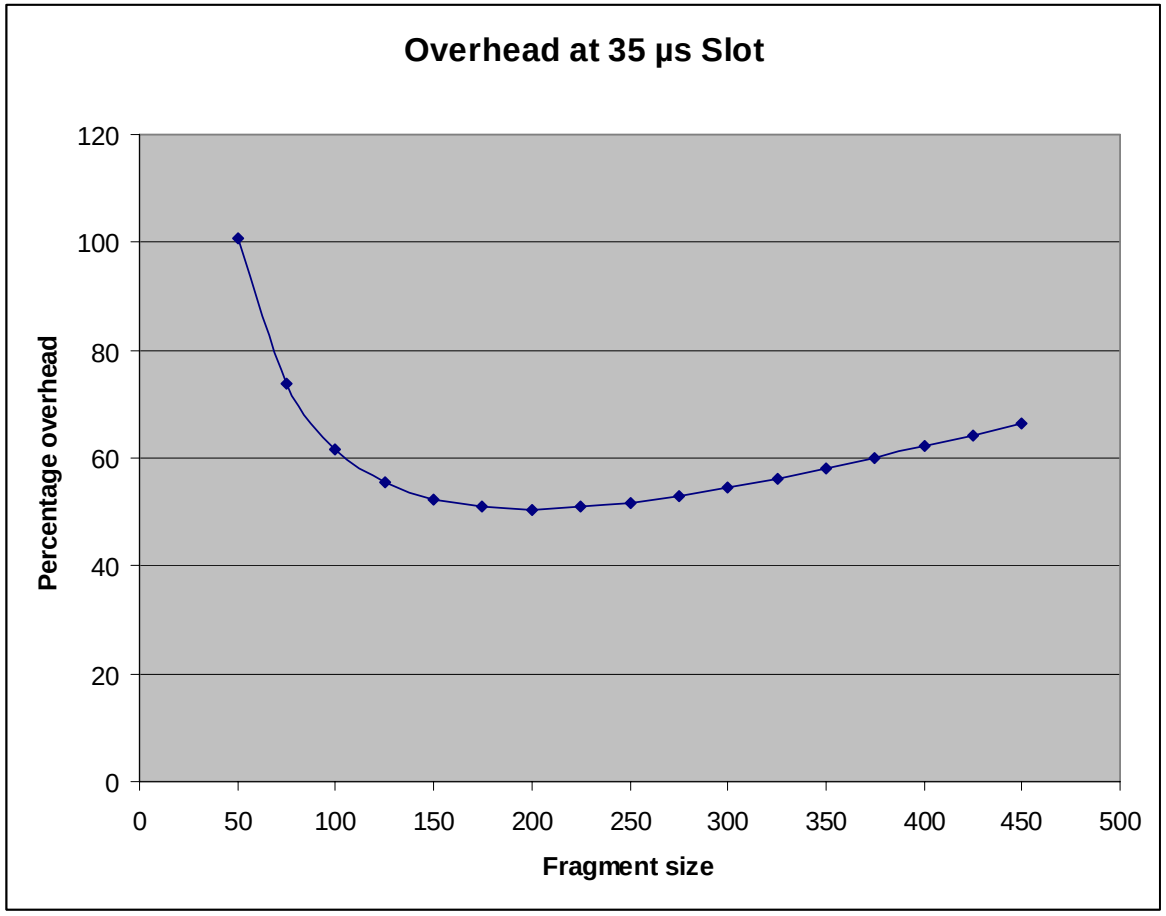
„All time“ split

1. Assumes TAS
2. Splitting overhead same range as Ethernet
3. Use standard traffic according to internet recording
4. „Slot“ means the average time between RT-traffic bursts

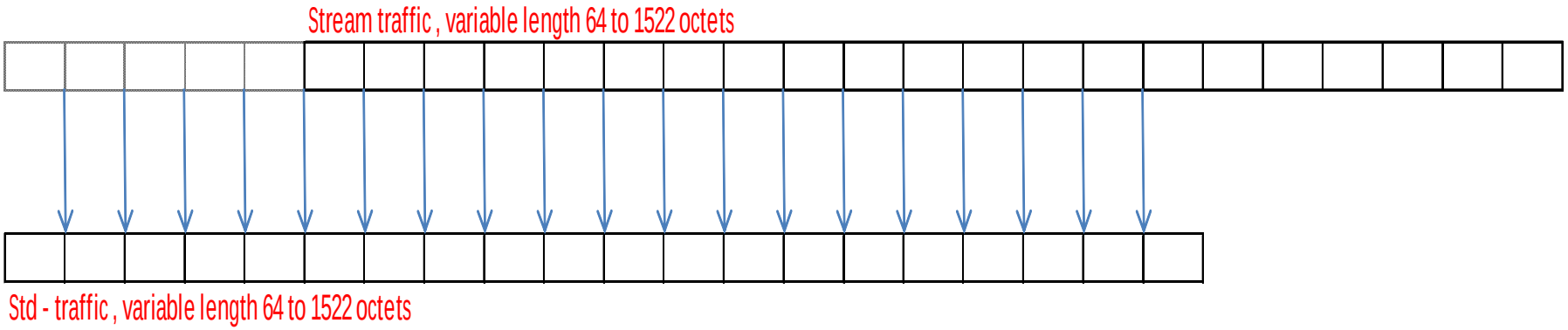


Slot time reduction = more overhead



Testing of interference

Problem Statement



- There are up to 1522 potential places for an action
- The interference is up to 1522 octets
- Some distinct use cases (e.g. multiple splits)
- 2316484 cases have to be taken into account basically
- Apply sending of multiple high priority frames in sequence
- Error situations

More Critical: Error Cases

- Two fragments+ corrupted due to link error cases
- Lifetime of fragments
- Header fields corrupted
- and so on ……

➔**But is there a difference in the testing if placed in different sublayers?**

➔**Even in the PHY there is an interference if 2 channels used**

Further Work

- Test with dynamic split up procedures
- New test scenarios (meshed rings, …)
- More investigation about (transient) errors
  (the setup as it is ignores this)
- Improve result display methods
- Use other implementations

and more if you have any wishes …

Summary

- Method a feasible way to evaluate protocols
- Scales in a non linear way with the number and size of the data
- Can handle the topologies requested (lines, rings, multiple rings)
- Further performance evaluation and understanding needed