Shared Rapid File System on Ethernet

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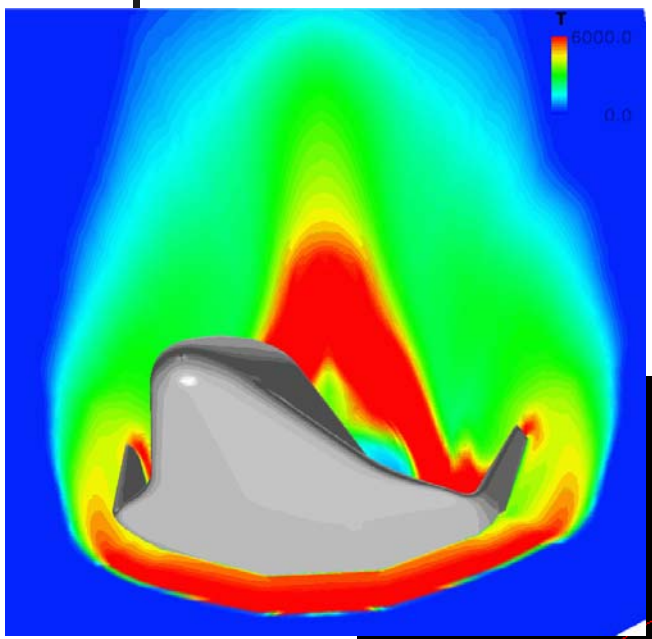
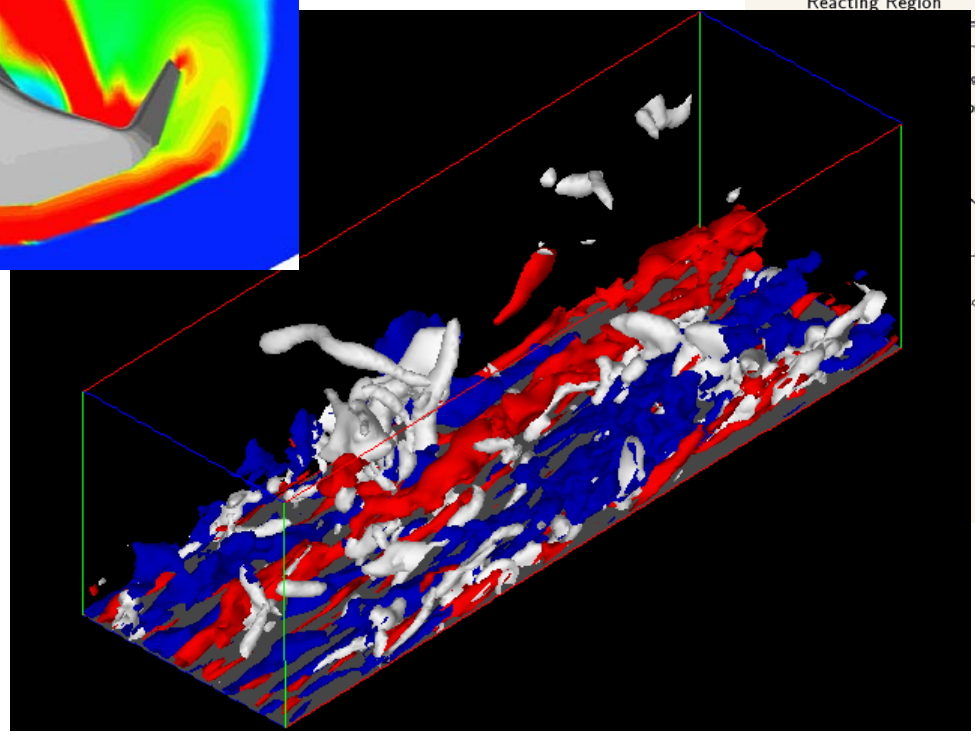
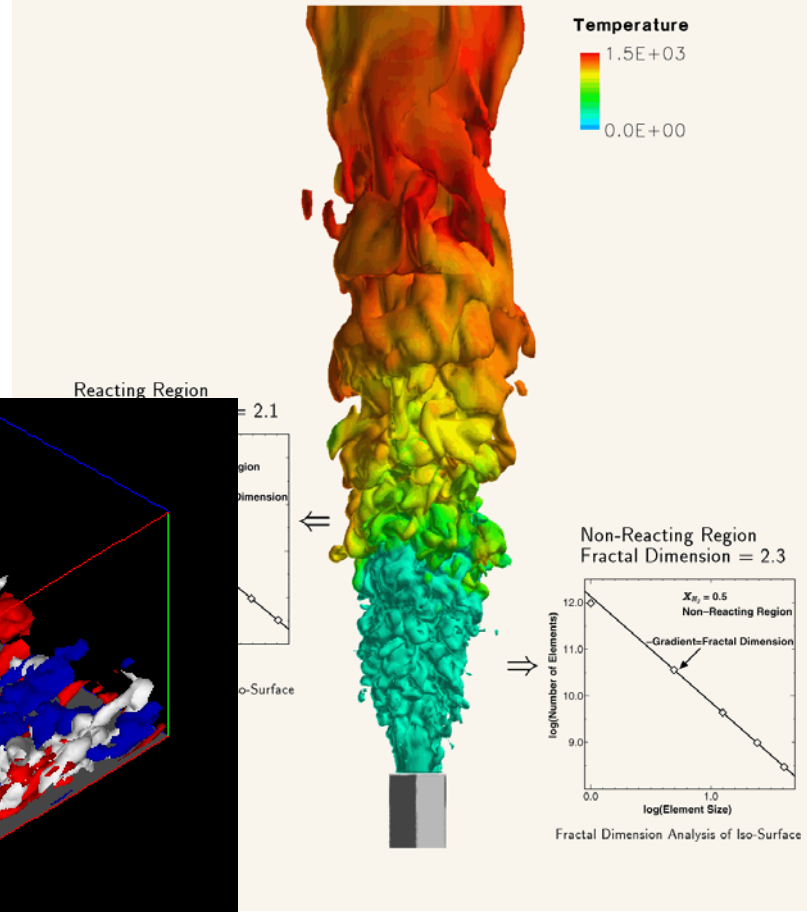
Our Main Application –Computational Fluid Dynamics-







Speed & Capacity Requirements

---------- I/O samples on CFD ----------

Sample 1) Creating animation

Sample 2) Three dimensional wing simulation

Sample 3) Complete airplane simulation

Sample 4) Huge turbulence computation with real-time visualization

Sample 5) DNS of turbulence with restart of computation

Sample 6) DNS of combustion

Sample 7) Job swap

Requirement

- Huge turbulence computation with real-time visualization -

1) Send physical variables to 3D-visualization system at once.
2) Grid points : a = 1024 x 1024 x 1024 [dots]
3) Information quantity per grid : b = 5 [variables/dot]
4) Length of variable : c = 8 [Bytes/variable]
5) Calculation time : d = 500 [hours]
6) Time calculation steps : e = 1.2 x 10^6 [steps]
7) Visualization frequency : f = @ 100 time calc. steps
8) Number of visualization : g = 1000

Requirement

- Huge turbulence computation with real-time visualization –(cont.)

x : I/O Speed
y : Storage Capacity

$$x = (a \times b \times c) / (\frac{d}{e} \times f)$$

$$= (10243 \times 5 \times 8) / (\frac{500*60*60}{1.2 \times 106} \times 100)$$

$$\fallingdotseq 273 \text{ [MByte/sec.]}$$

$$y = a \times b \times c \times g$$

$$= 10243 \times 5 \times 8 \times 1000$$

$$\fallingdotseq 39.1 \text{ [TByte]}$$

Speed & Capacity Requirements

	Sample1: Animation	Sample4: Turbulence with Visualization	Sample7: Job swap
I/O speed requirement [Byte/sec.]	26.4M	273M	1.55G
Capacity requirement [Byte]	15.4G	39.1T	1T

Capacity Requirements

Unit : GByte/case

	Sample2: 3D-wing	Sample3: Complete airplane	Sample5: DNS of turbulence	Sample6: DNS of combustion
Grid data	0.18	1.8	26	26
Restart data	0.42	4.2	34	170
Analysis data	0.48	4.8	38	86
Subtotal	1.1	11	98	282
Animation analysis data	---	---	1100	1100

Condition

- Data
  is too large to copy.
- Each client
  has only Ethernet interface.
- Server
  is centralized.

Technical Targets

- File Share over IP-network, especially the Internet
- Guarantee a data coherency under a file-sharing environment
- High-speed without TCP/IP tuning

- Unified user administration
- Security (Working with firewall, Encryption, Intrusion protection)

Present Targets

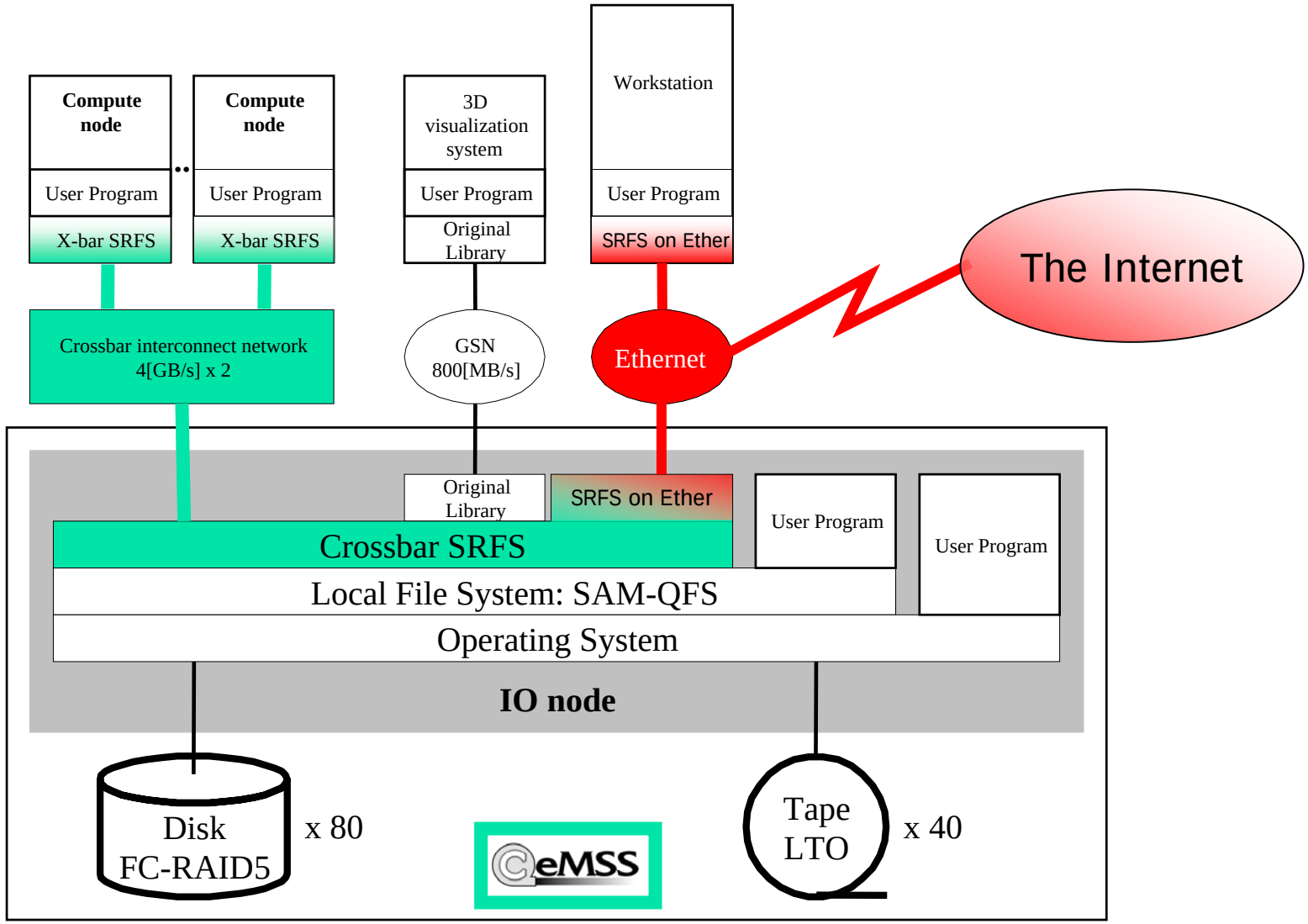
Future Targets

Design Overview of SRFS on Ethernet

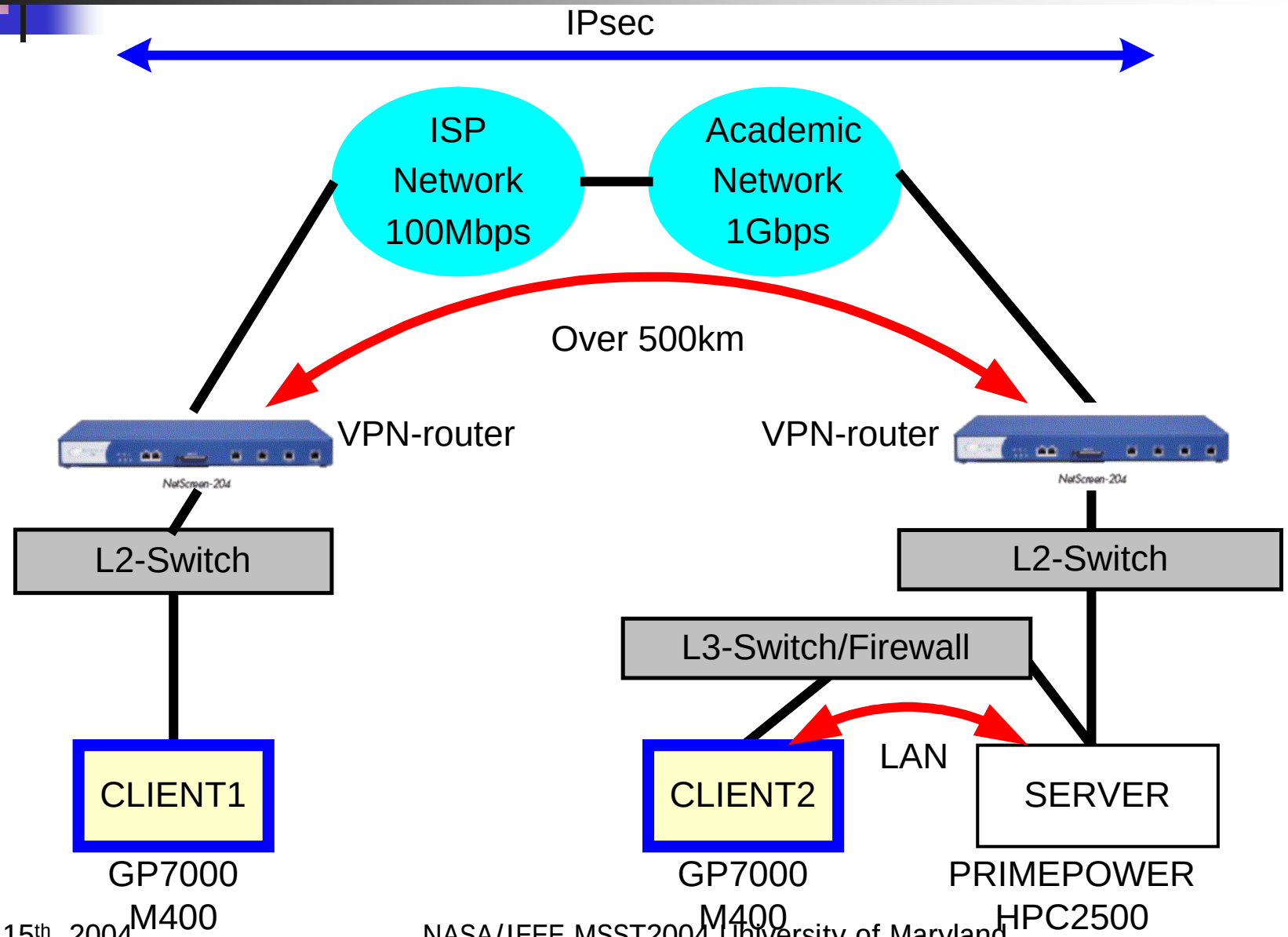
- Add an Ethernet interface to communication control module. (Original interface is Crossbar-network)
- Automatic TCP/IP stripe and protocol switch (TCP/UDP)
- Data coherency control under a file-sharing environment

(There is nothing to do to guarantee a data coherency, because *SRFS* already has had data coherency control function.)

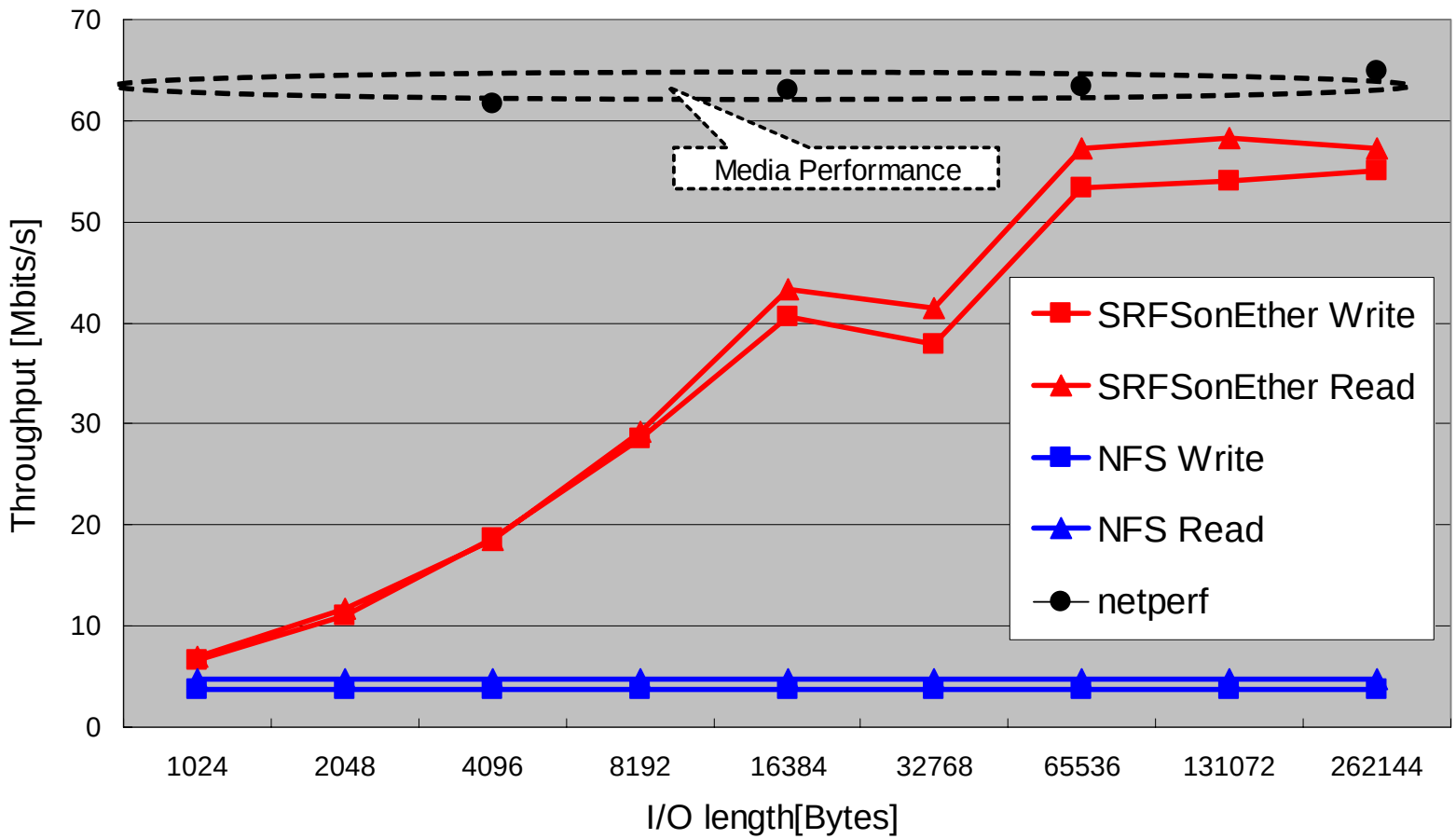
Design Overview of SRFS on Ethernet (Cont.)



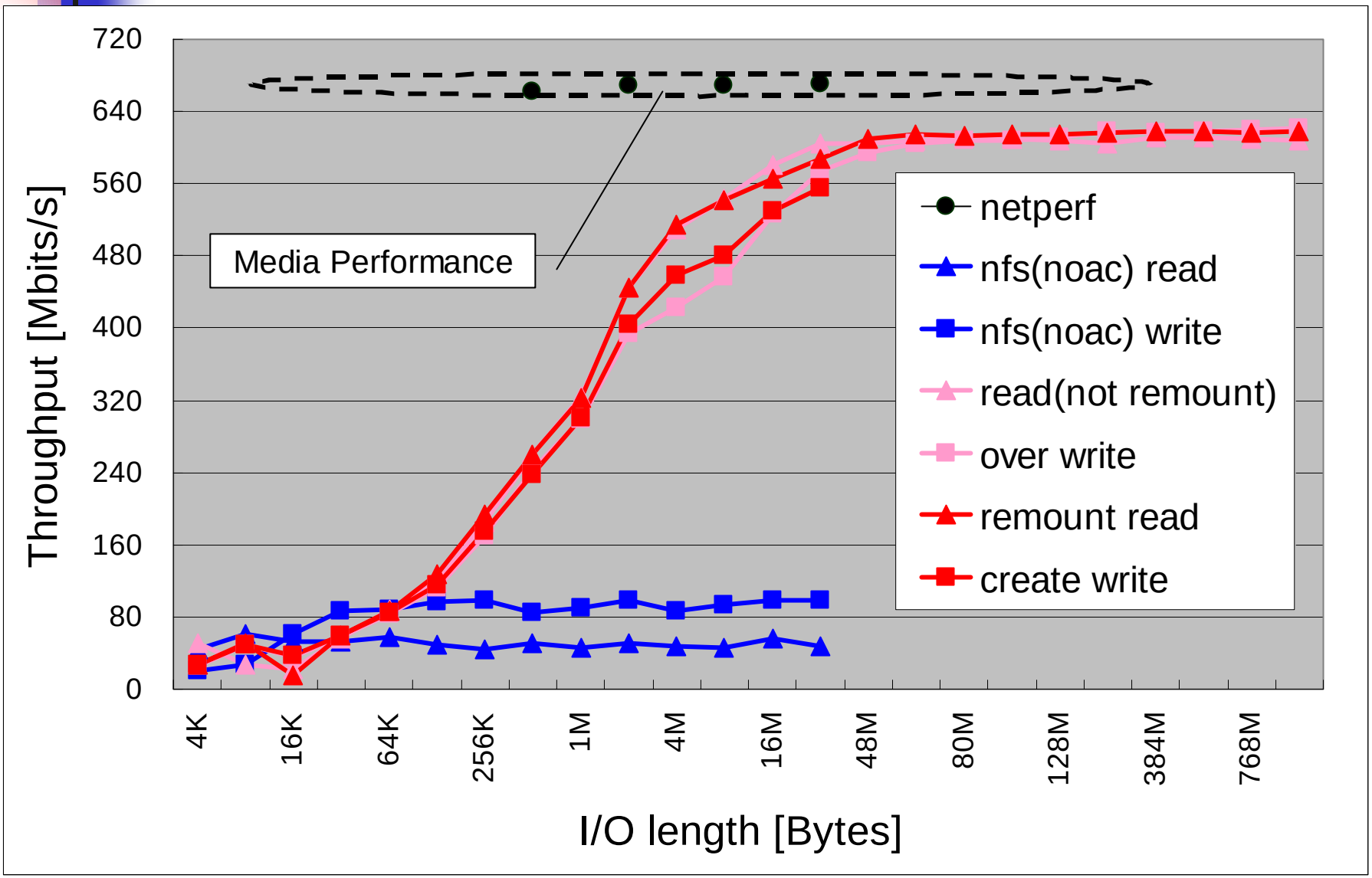
Benchmark Environment (100Mbps-WAN)



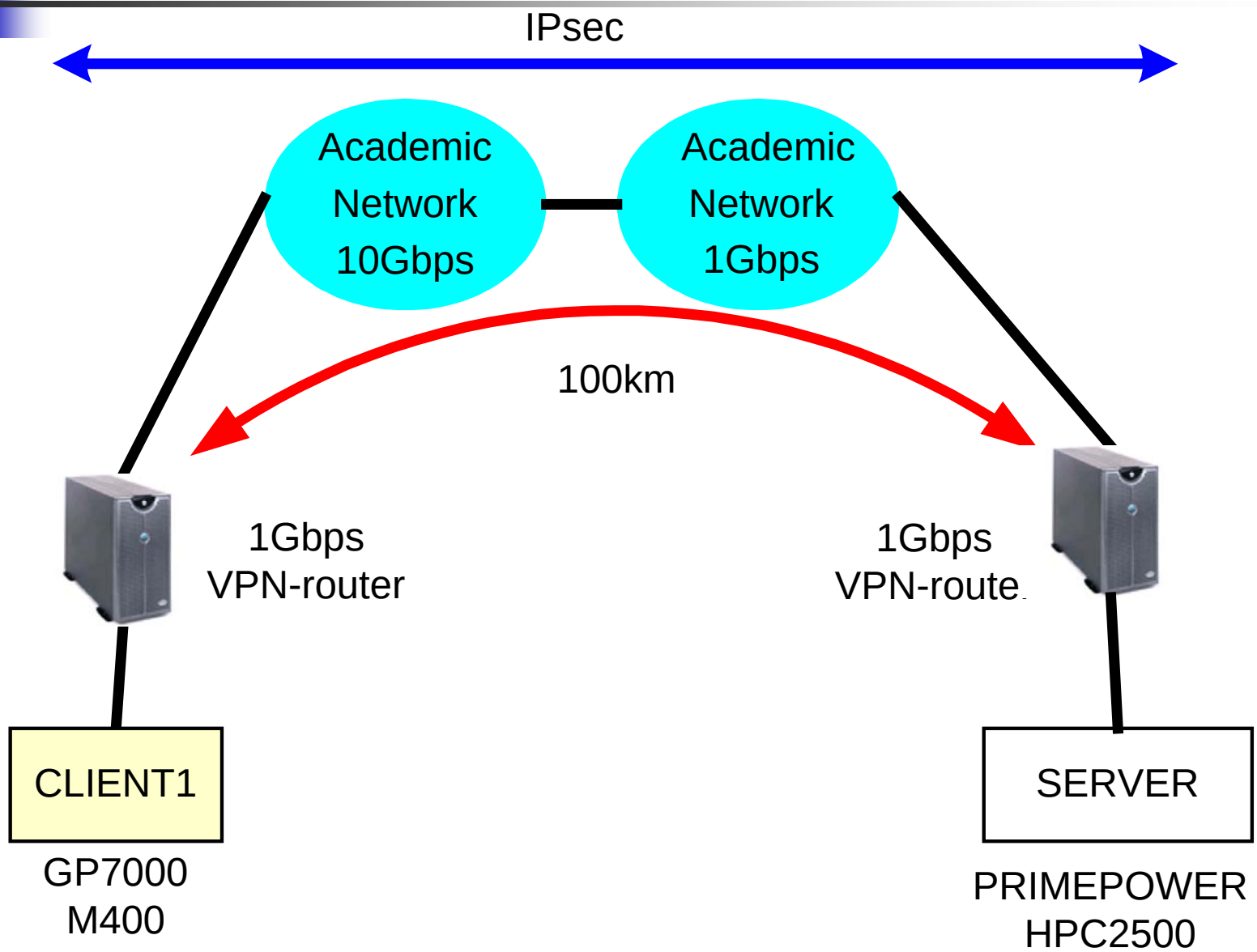
Benchmark Result (100Mbps-WAN)



Benchmark Result (GbE-LAN)



Benchmark Environment (GbE-WAN)



Summary

- File Share over IP-network
  - Added Ethernet communication control module
- Data coherency under a file-sharing
  - Guaranteed by original Crossbar-SRFS
- High-speed without TCP/IP tuning
  - 8 stripes data stream
  - Switch to UDP when I/O length is small
  - 55 [Mbps] on 100Mbps-WAN
  - 610 [Mbps] on GbE-LAN

Future Works

- User Authentication
  - Multi-Organization Authentication
    - GSI?
    - Original Authentication Mechanism?
- Security(Firewall friendly)
  - Reduce Port Number
  - Fixed Port Number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