EXAMINING BASIC CHARACTERISTICS OF COMPUTING ENVIRONMENTS BASED ON THE X-COM METACOMPUTING SYSTEM

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Goals

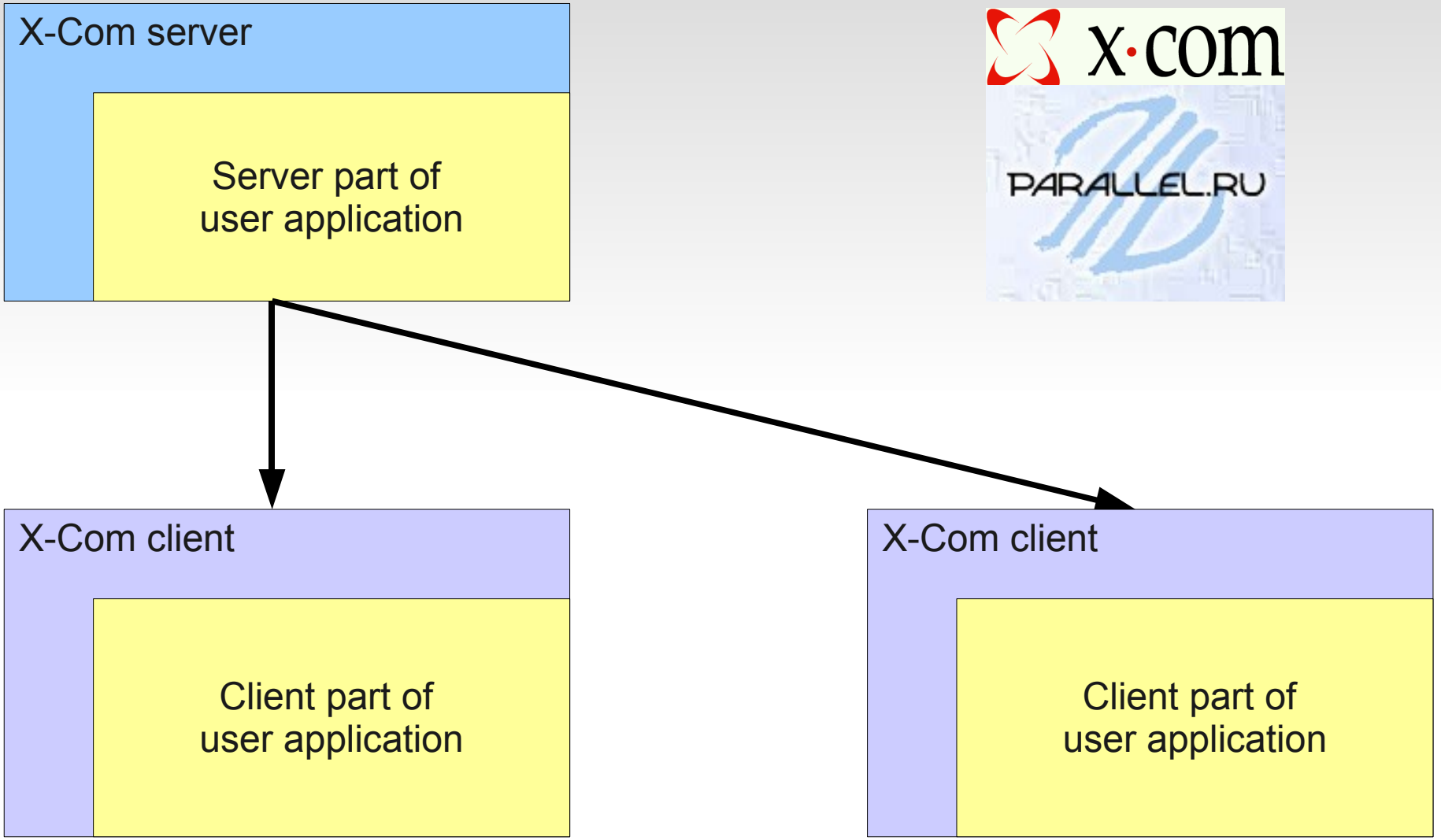
Goals:

- Increasing usage efficiency of computing resources
  - Determining bottlenecks in a computing environment
  - Optimizing user applications

Methods:

- Examining base characteristics of a computing environment based on the X-Com system and user application behaviour

X-Com System Architecture



Examined Characteristics

- Server hardware usage: CPU, Mem, Network, HDD
- Latency and bandwidth of connection between client and server (network + client + server)
- Efficiency values of the X-Com server (worktime, overhead part, portion requests vs answers)

Testing Methods

- Test task imitates real computational tasks behavior
- Performing a series of experiments with variable test task parameters like: client computing time, data sizes, read/write on disk
- Evaluating server hardware load and server log files analysis
- Determining bottlenecks for different parameters of user application

Potential Bottlenecks in the Computing Environment

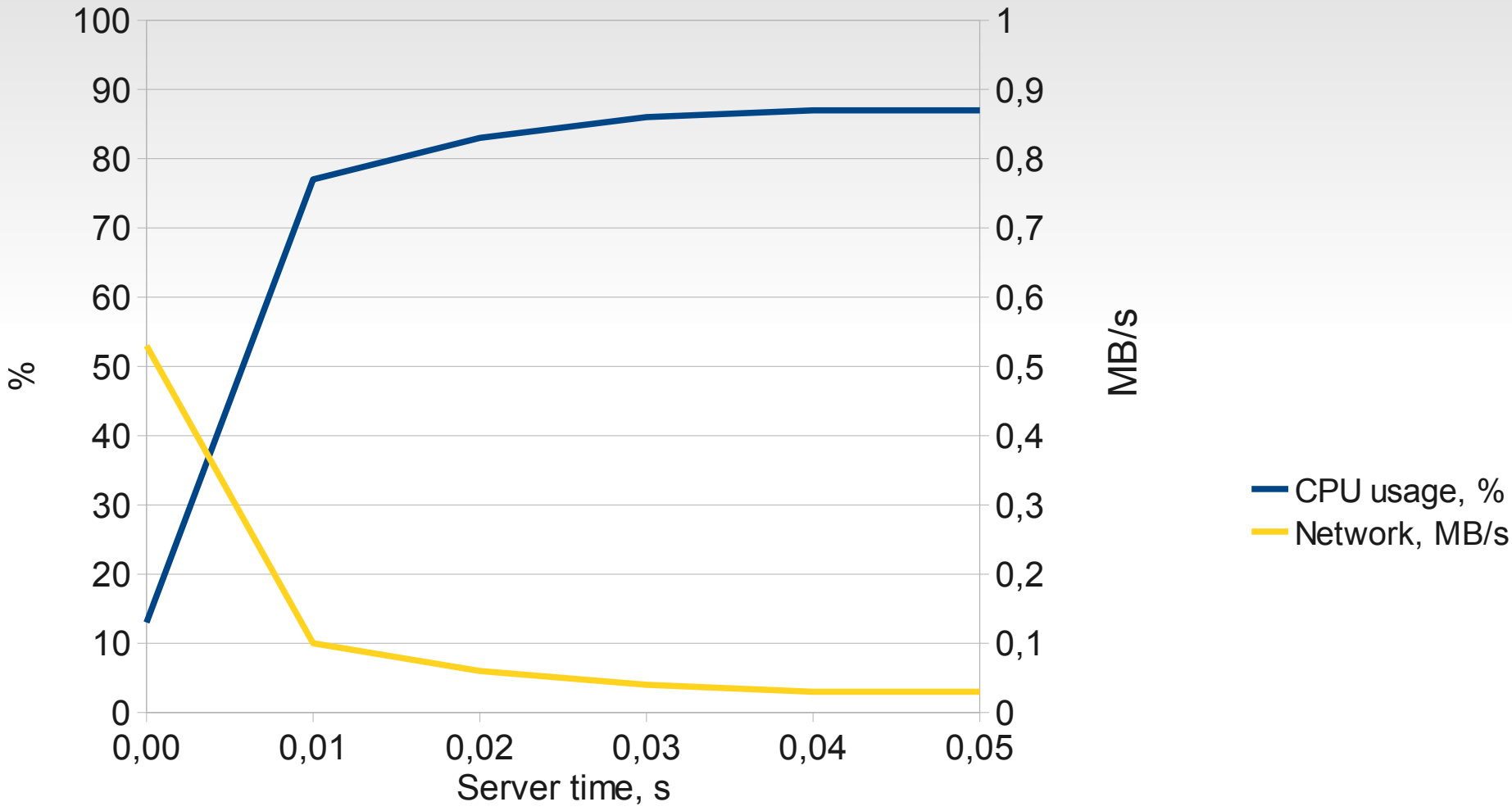
- CPU, memory, network, disk usage by server part of user application
- Latency and bandwidth of commection between server and clients
- Processing a large number of simultaneous requests
- Determining scalability limits of computing environment

RCC MSU Processor Polygon

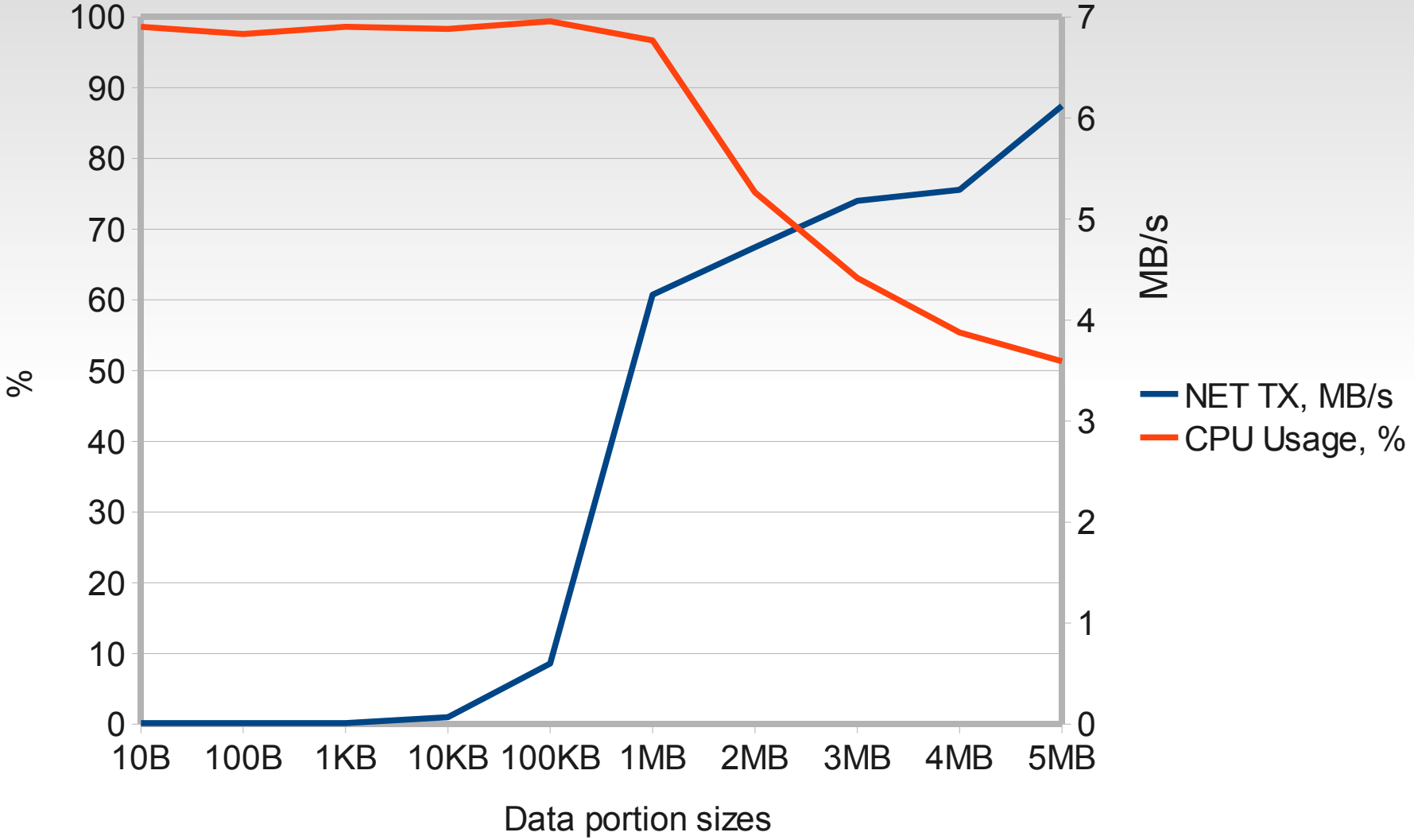
Node	Processors	Frequency	Memory
Woodcrest4	2 x GenuineIntel Intel(R) Xeon(R) CPU 5150	2.66 GHz	4 GB
Woodcrest7	4 x GenuineIntel Intel(R) Xeon(R) CPU 5130	2 GHz	8 GB
Opteron1	2 x AuthenticAMD AMD Opteron(tm) Processor 244	1,8 GHz	2 GB
Opteron2	2 x AuthenticAMD AMD Opteron(tm) Processor 244	1,8 GHz	2 GB
Opteron3	2 x AuthenticAMD Dual Core AMD Opteron(tm) Processor 280	2,4 GHz	4 GB
Opteron4	2 x AuthenticAMD Dual Core AMD Opteron(tm) Processor 265	1,8 GHz	4 GB
Opteron5	AuthenticAMD Dual Core AMD Opteron(tm) Processor 265	1,8 GHz	2 GB

- X-Com server on dedicated machine
- 4 cores (Xeon)
- 4 GB memory
- Ethernet network

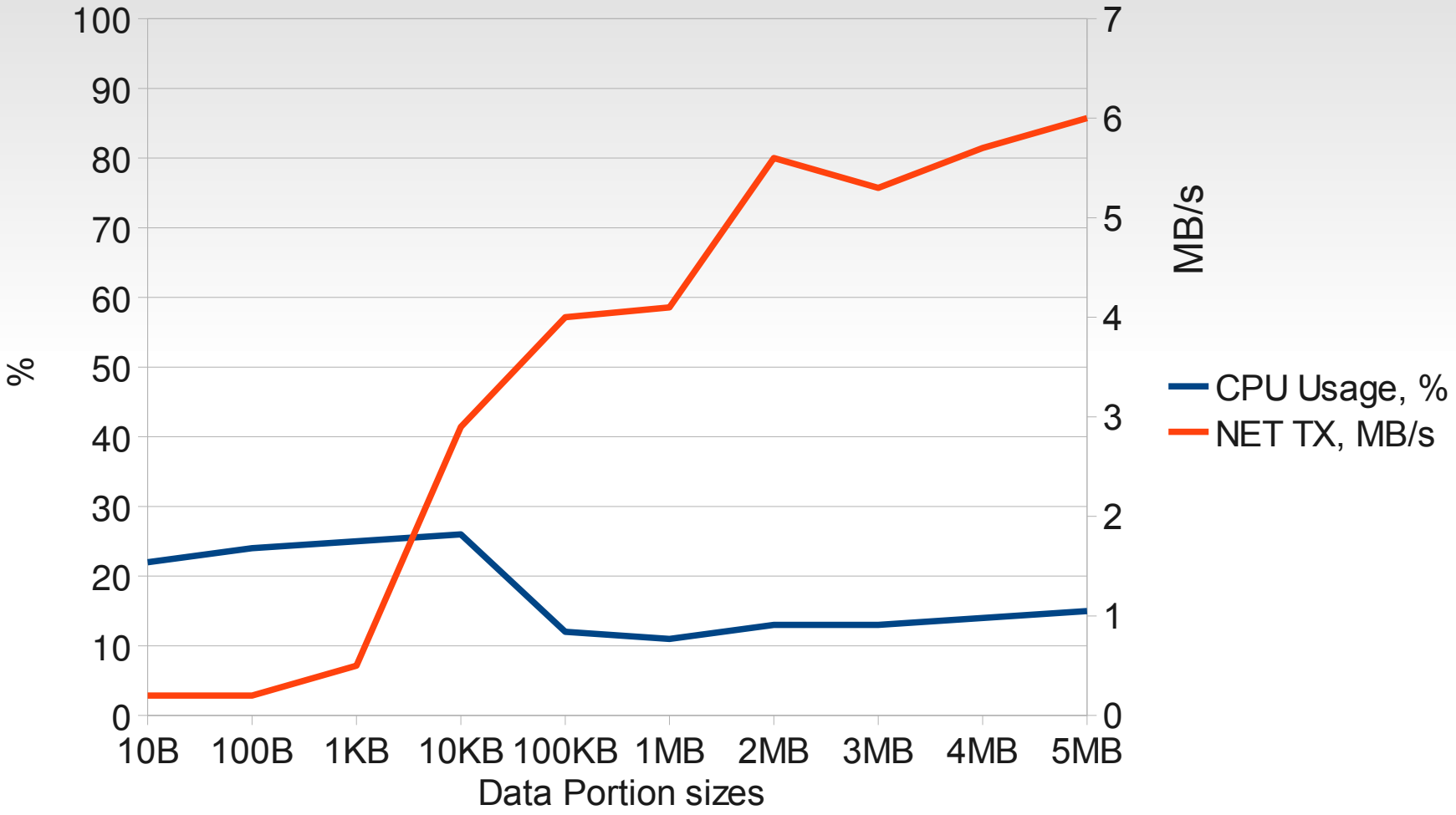
User application server part work time



Data Portion Size with Hard Server Part



Data Portion Size with Light Server Part

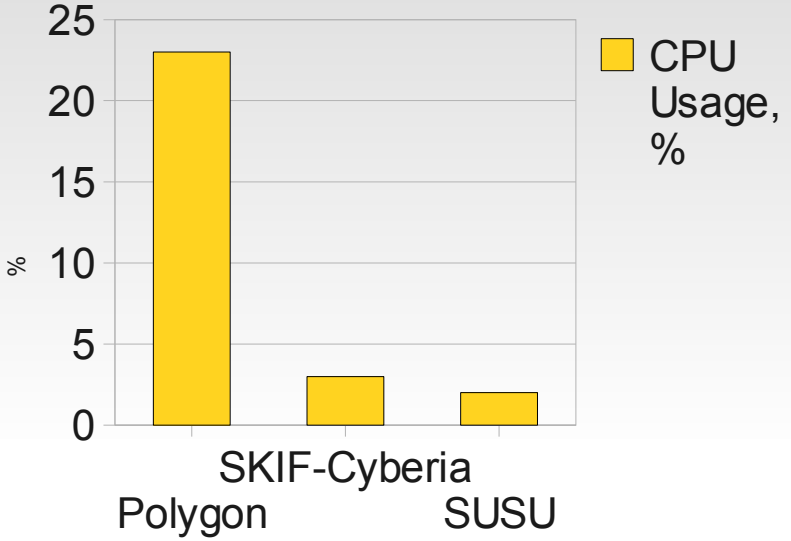


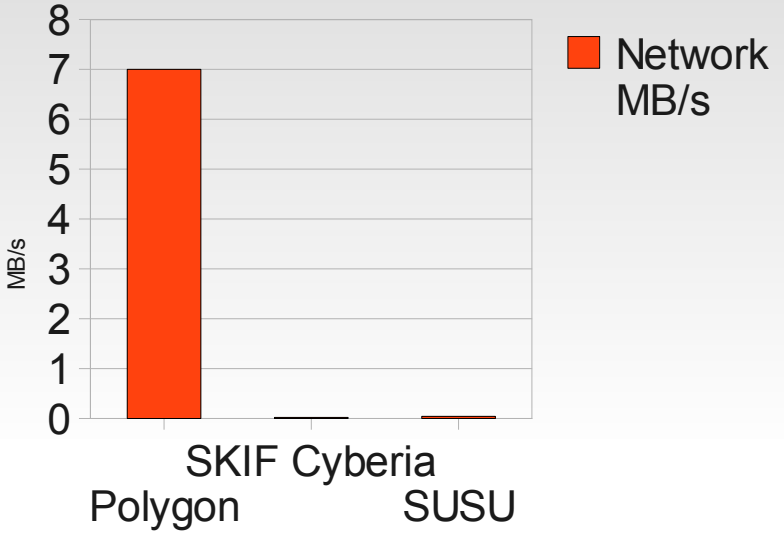
Conclusions

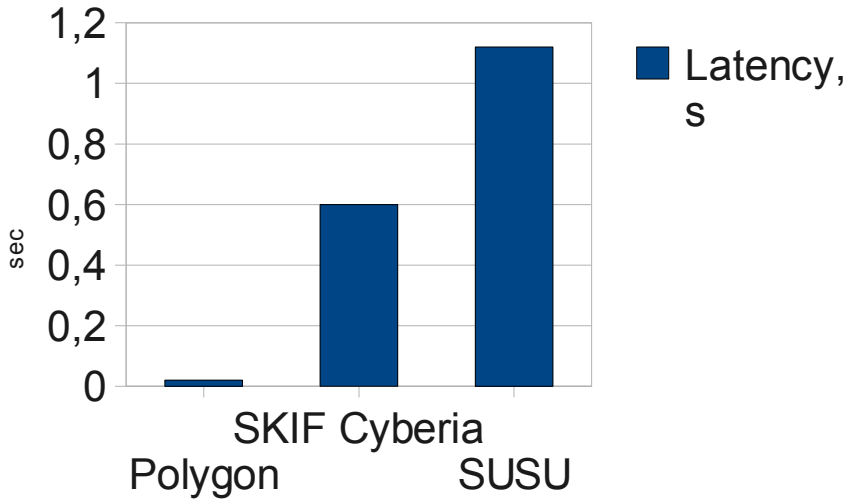
- With hard server part server processor is the main bottleneck
- Large data portions (over 2 MB) overload network
- In simple cases we have not enough nodes to load server

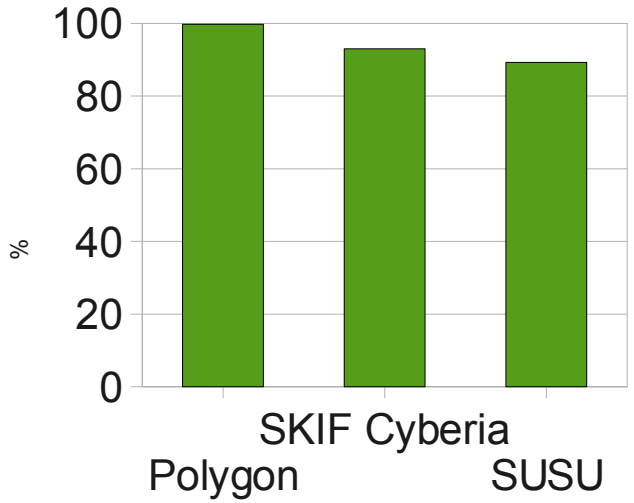
- Disk caching prevents harming performance when reading and writing large files

Distributed Computing Environment









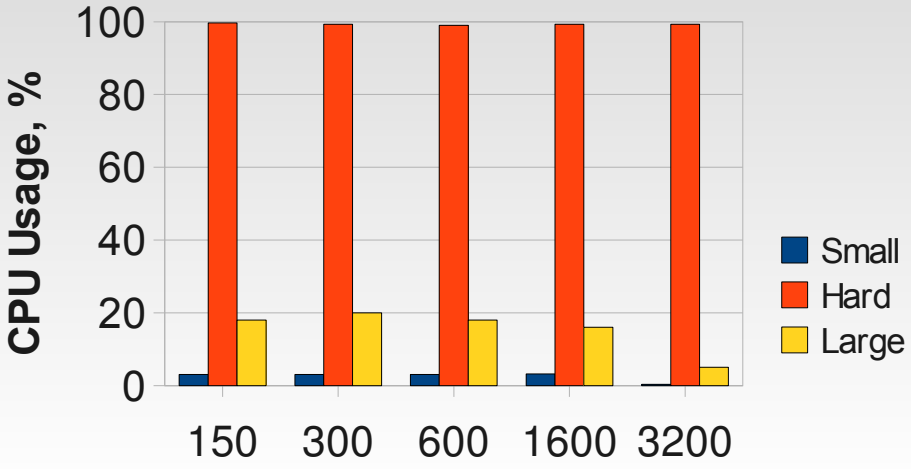
Eff-cy

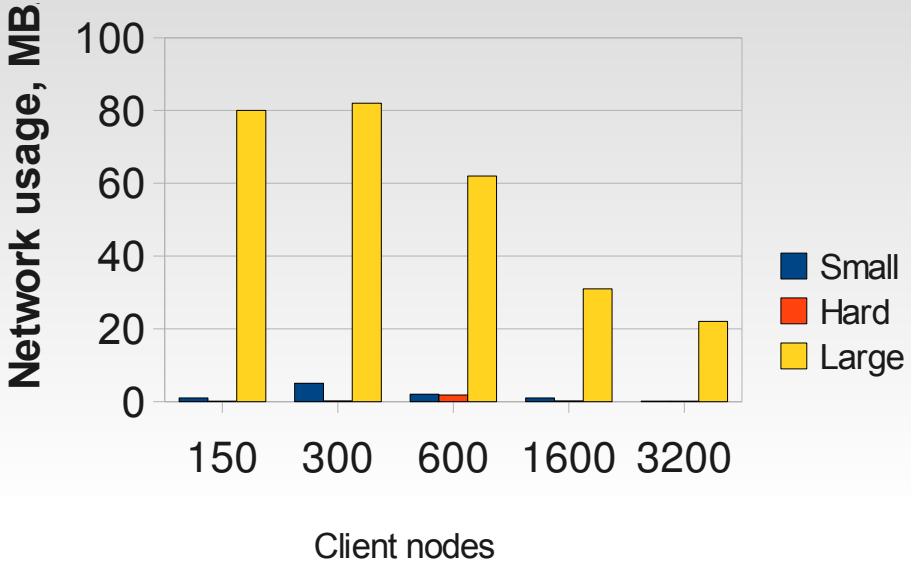
* Tcli/(Tcli+Tover)
** on 10 sec portions

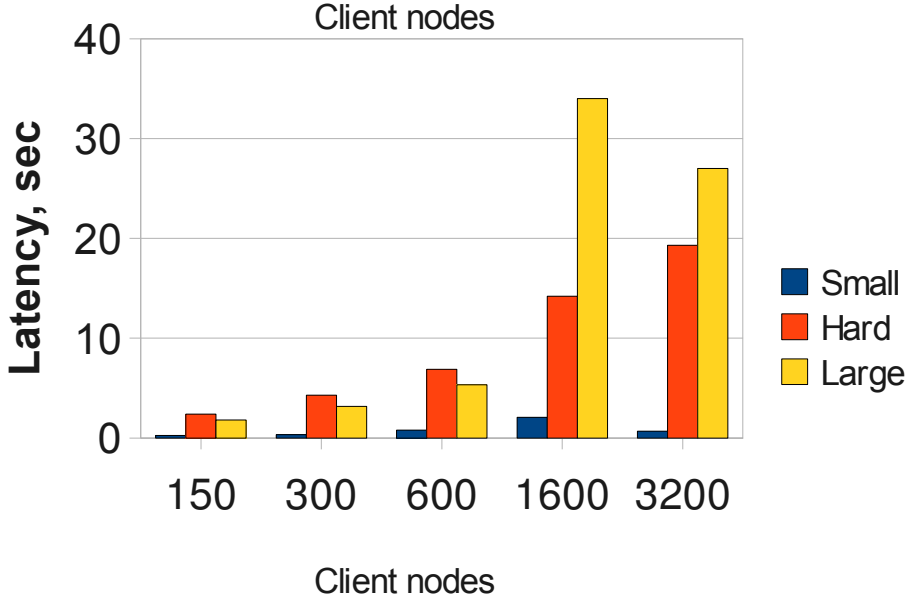
Conclusions

- Significantly bigger latency
- Lesser server load
- Overhead is too big for small and short data portions

Scalability Examining



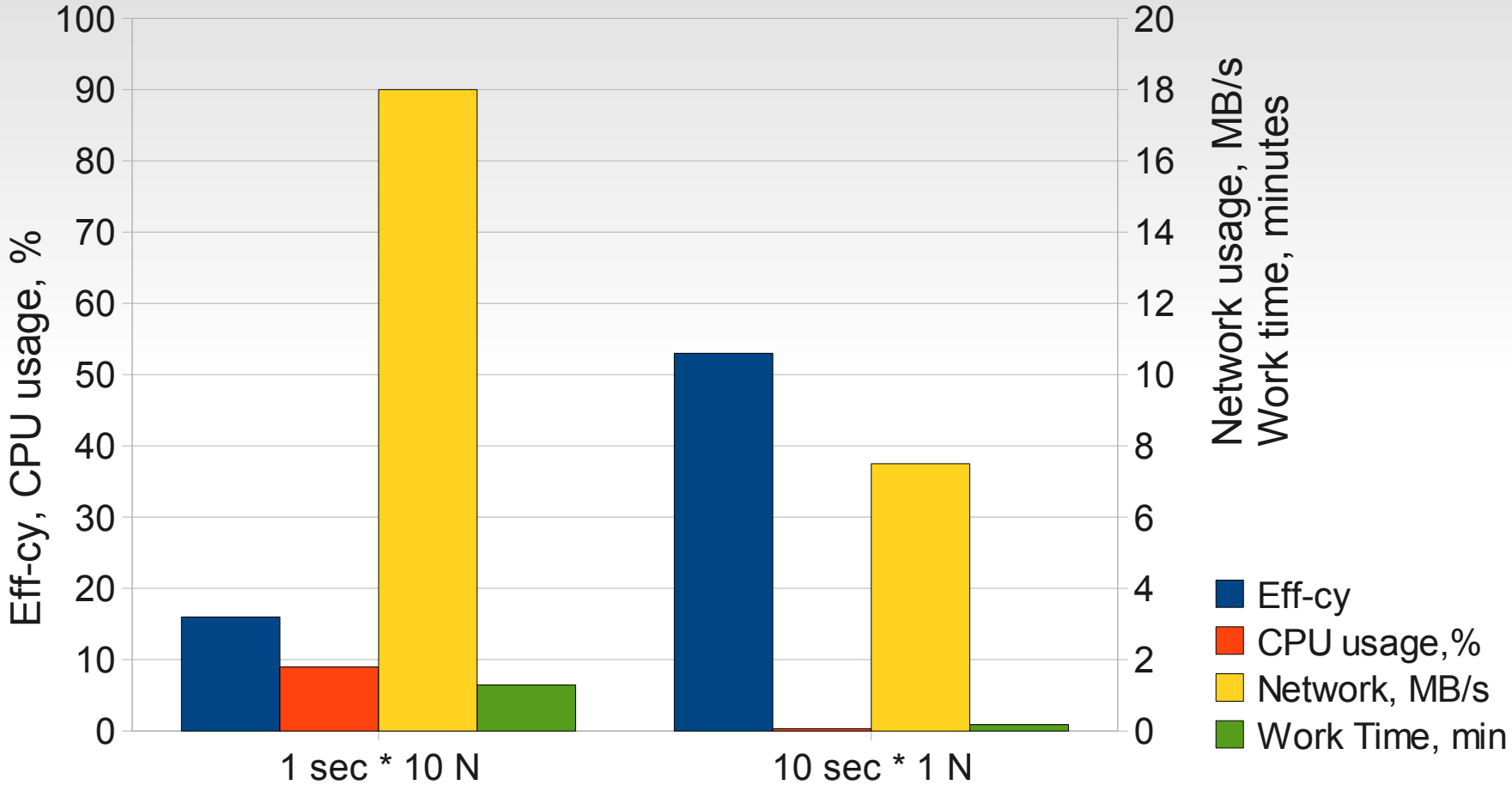




3200 nodes at SKIF-MSU

	Small	Hard	Large
Tcli	0	0	0
Tsrv	0	0,01	0
Data	100B	100B	1MB

Combining Data Portions



Conclusions

- In large environment with hard server part the main bottlenect is also processor on server
- With large number of simultaneous requests network communicating hardware is a serious bottleneck.

- If you have small portions, it is very effective to combine several small portions in a large one.

Summary

- Proposed method allows to determine bottleneck of computing environments based on the X-Com system
- It is possible to give recommendation on optimization of user applications

Working with Real User Applications

- Examining accuracy of real user application task simulation
- Applying this methods to the optimization of user applications

- **We are open for collaborating!**

Questions?

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