Nizhni Novgorod State University

HPC Competency Center Based on Microsoft Technologies

ParaLab

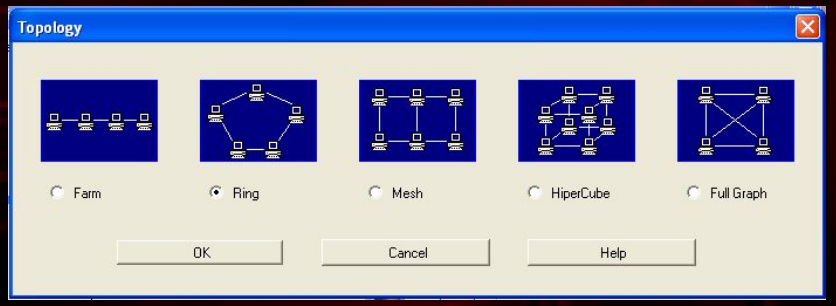
A Visual Way to the World of Parallel Computations

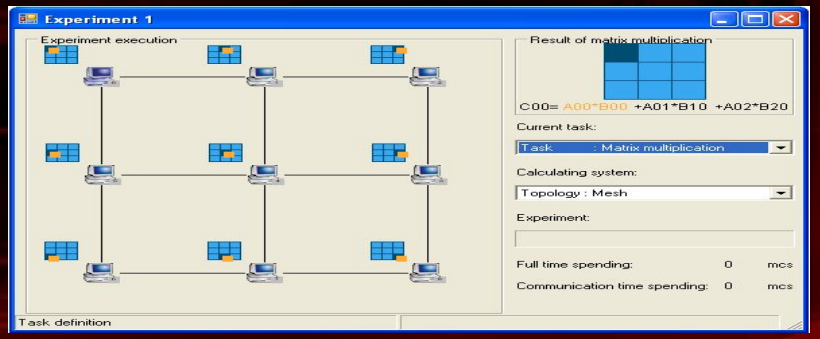
ParaLab Objective

- Intensive use of research and education software systems for modeling computations on various multiprocessor systems and visualization of parallel computation processes:
  - The system **Parallel Laboratory** (**ParaLab**) – the software system for studying and investigations parallel methods for solving time-consuming problems

ParaLab Overview…

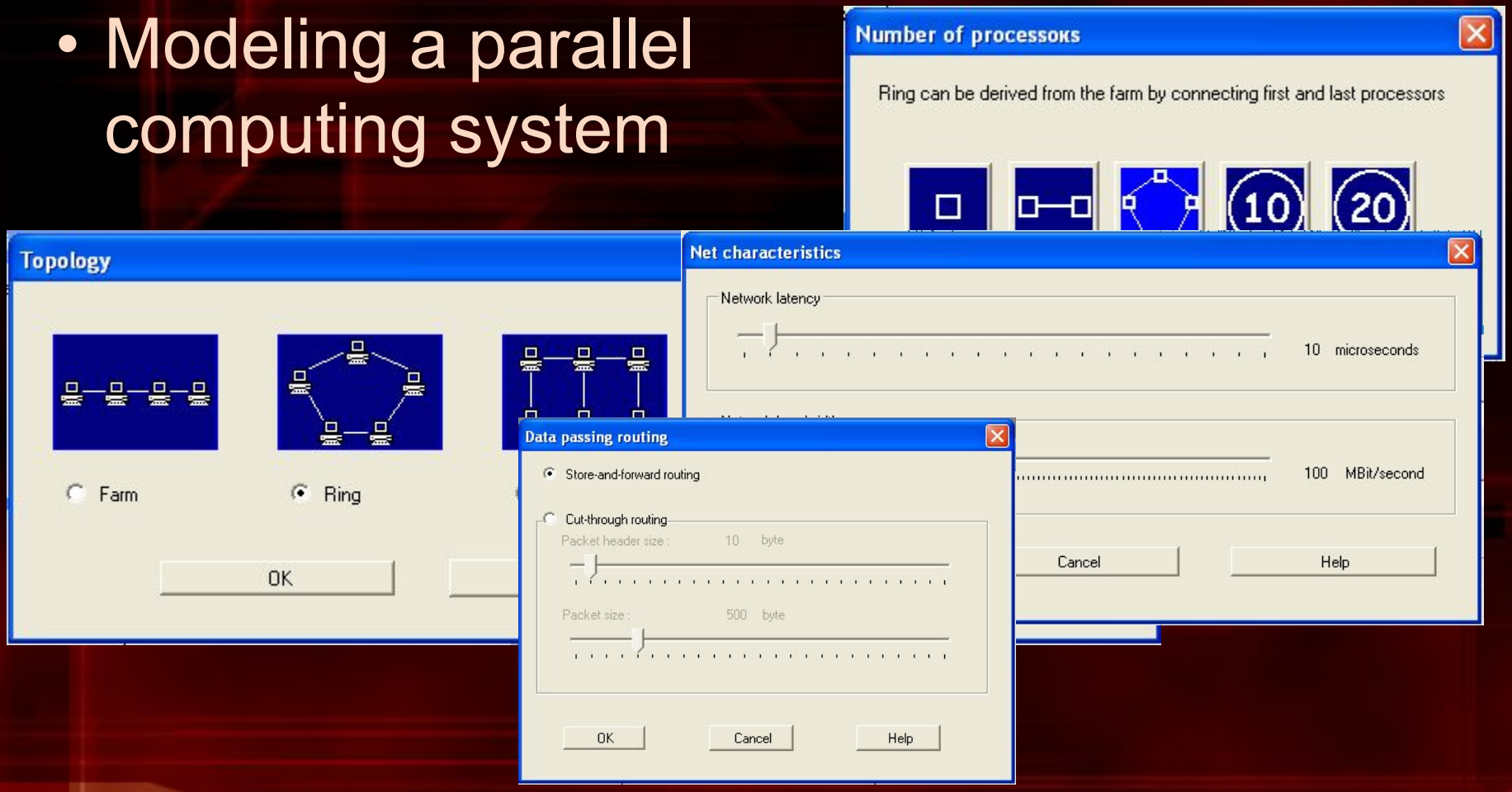
- Modeling a parallel computing system
- Choosing a studied problem and a method to solve it
- Carrying out computational experiments with visualization of parallel calculations
- Information gathering and analyzing the results (“experiment log")
- Data archiving





ParaLab Overview…

- Modeling a parallel computing system

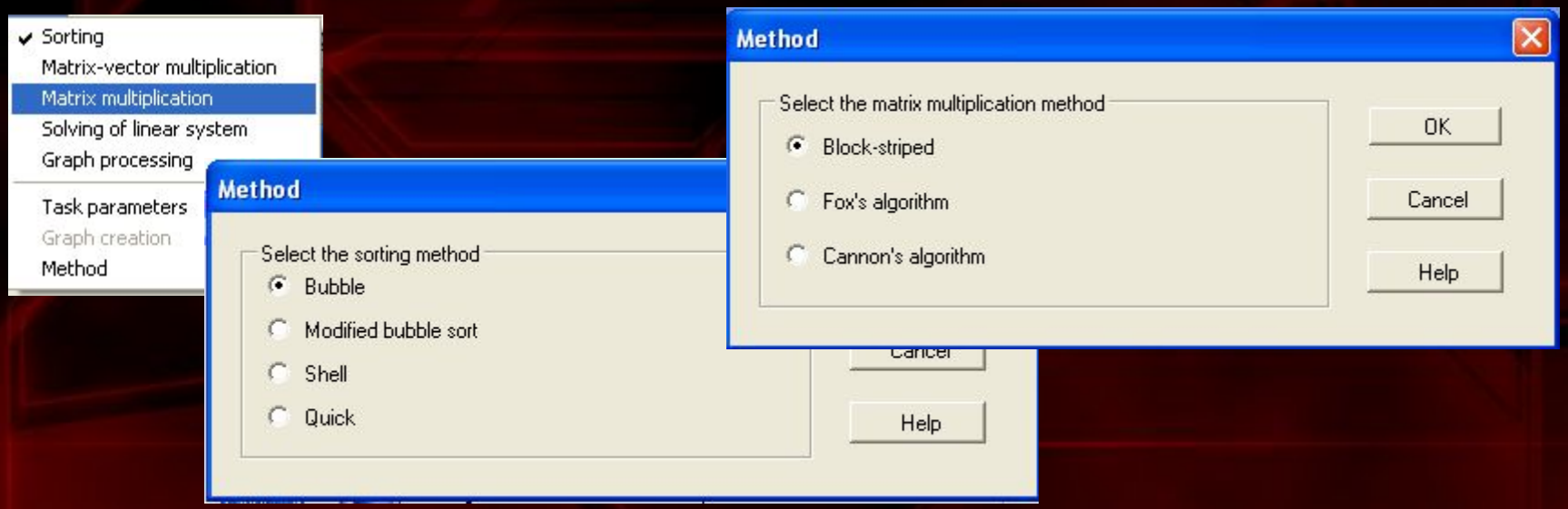


ParaLab Overview…

- Choosing a studied problem and a method to solve it…
  - Sorting,
  - Matrix calculations,
  - Systems of linear equations,
  - Graph processing,
  - Optimization,
  - Solving differential equations in partial derivatives

ParaLab Overview…

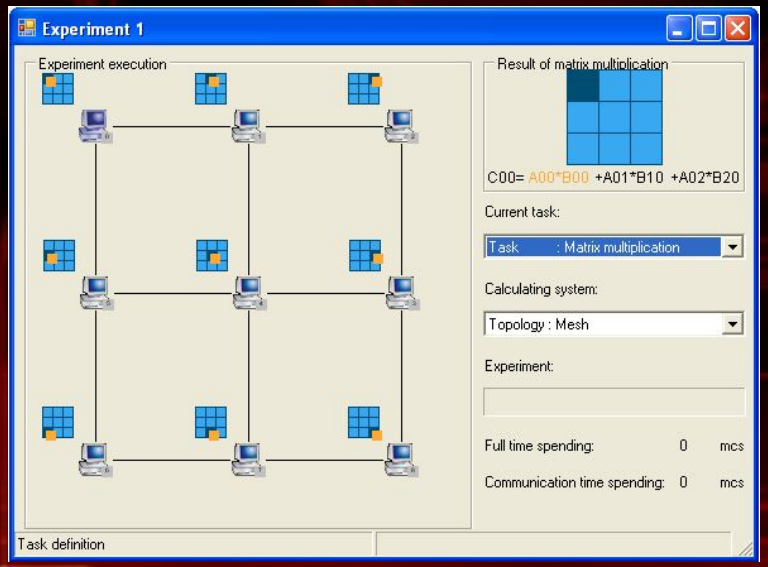
- Choosing a studied problem and a method to solve it…



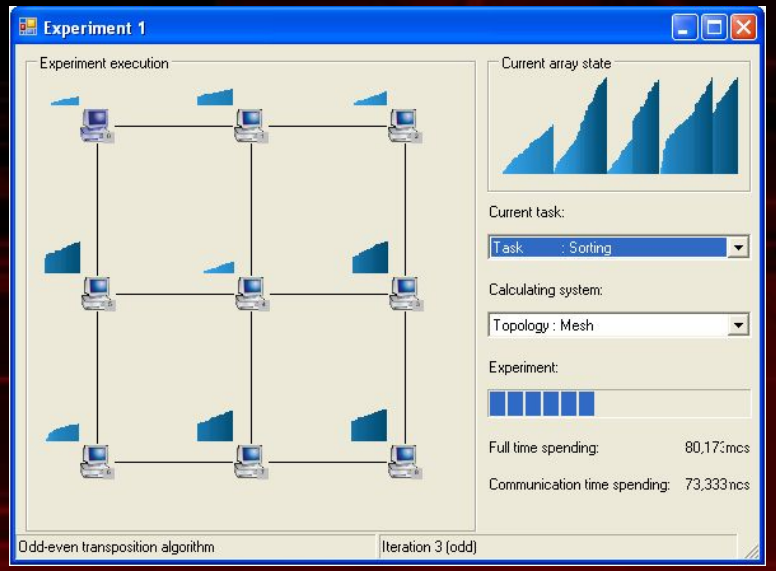
ParaLab Overview…

- Computational experiments and visualization of parallel calculations

Matrix computations

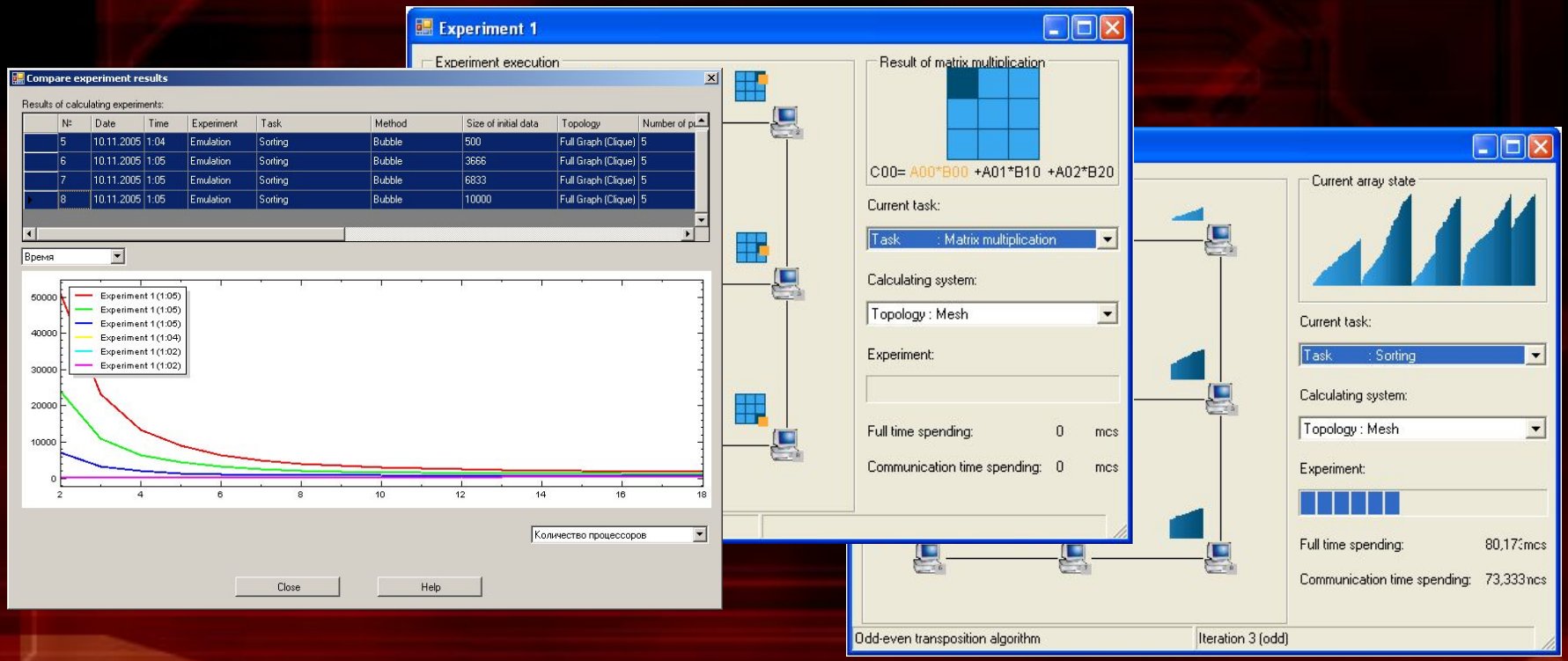


Sorting



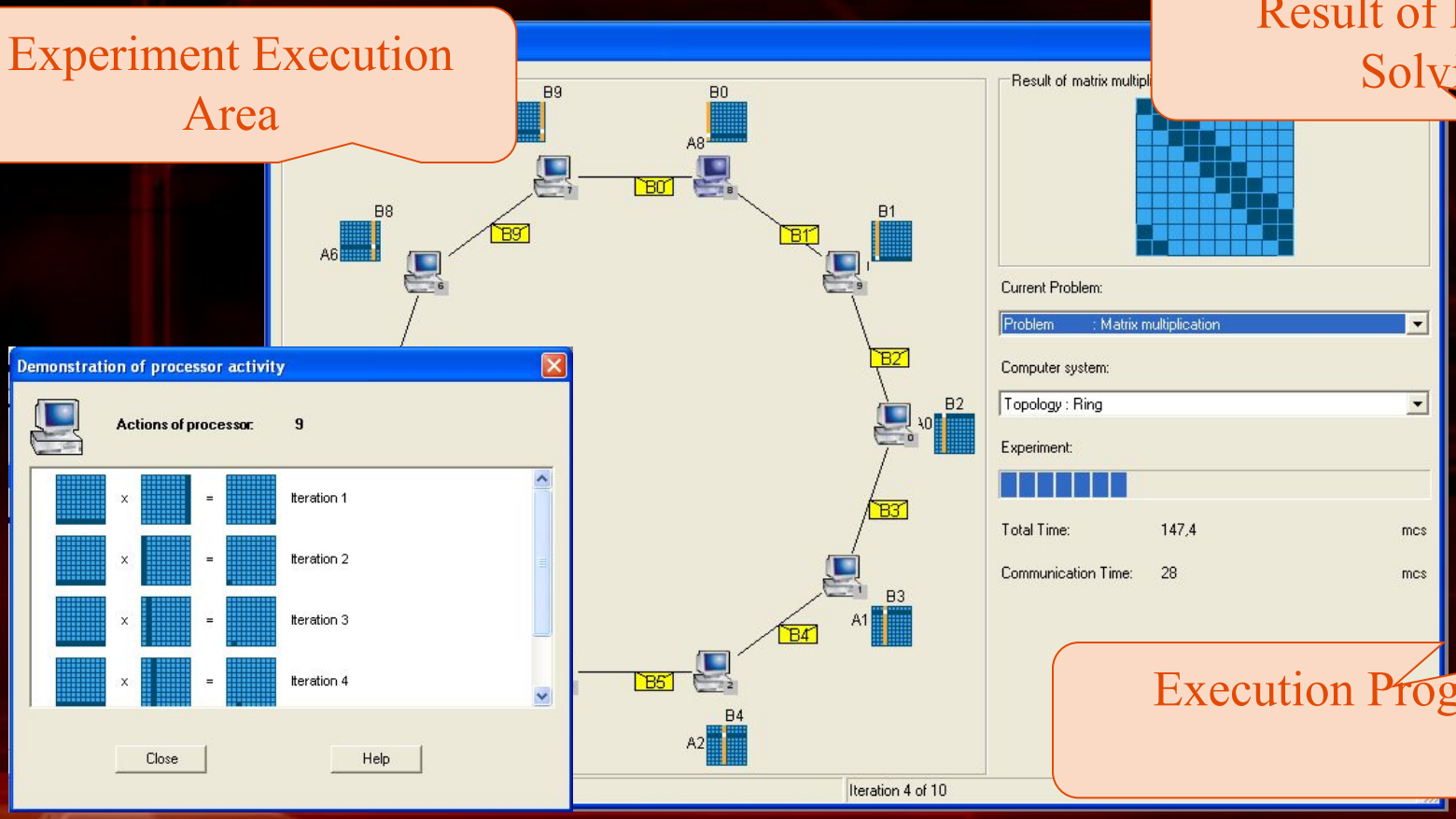
ParaLab Overview…

- Information gathering and analyzing the results (“experiment log")



ParaLab Overview…

- Carrying out an experiment…



ParaLab Overview…

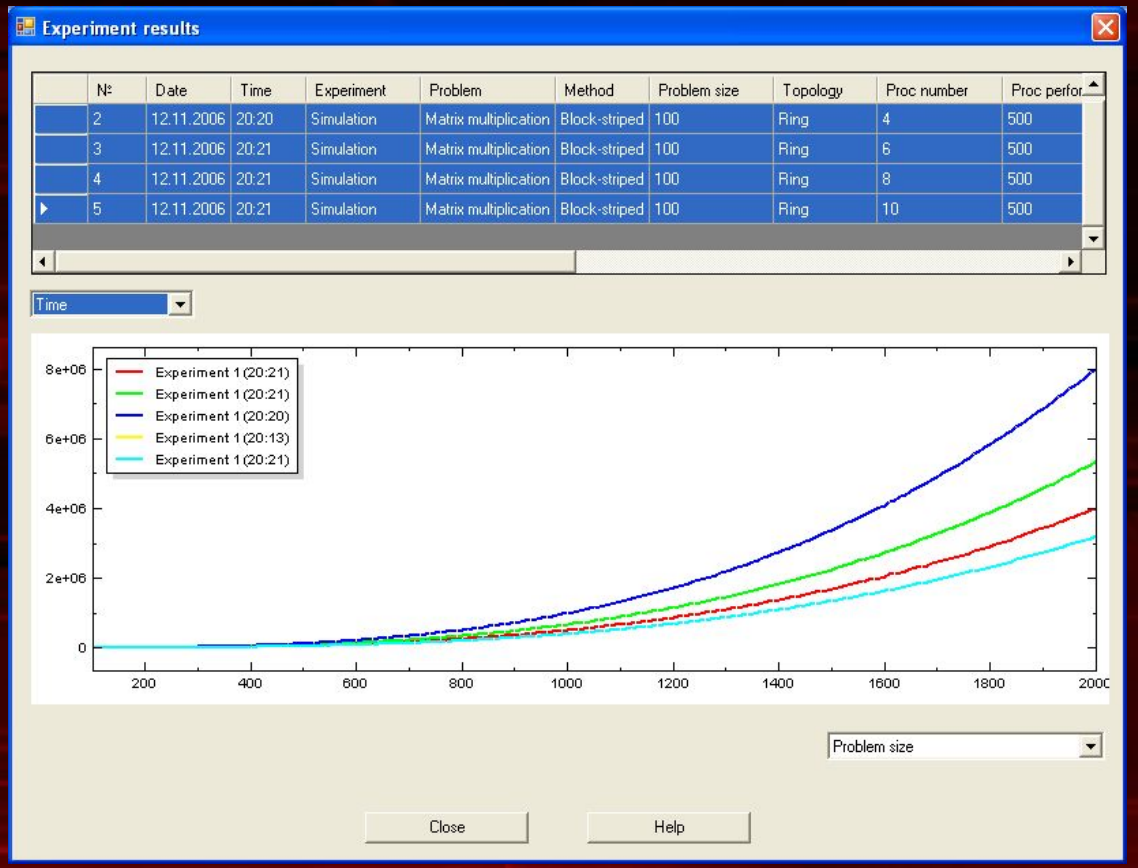
- Carrying out an experiment:
  - Simulation mode,
  - Remote access to a cluster

ParaLab Overview

- Information gathering and analyzing the results

"Experiment Log"

Graphs of Performance Metrics (Time, Speedup,…)

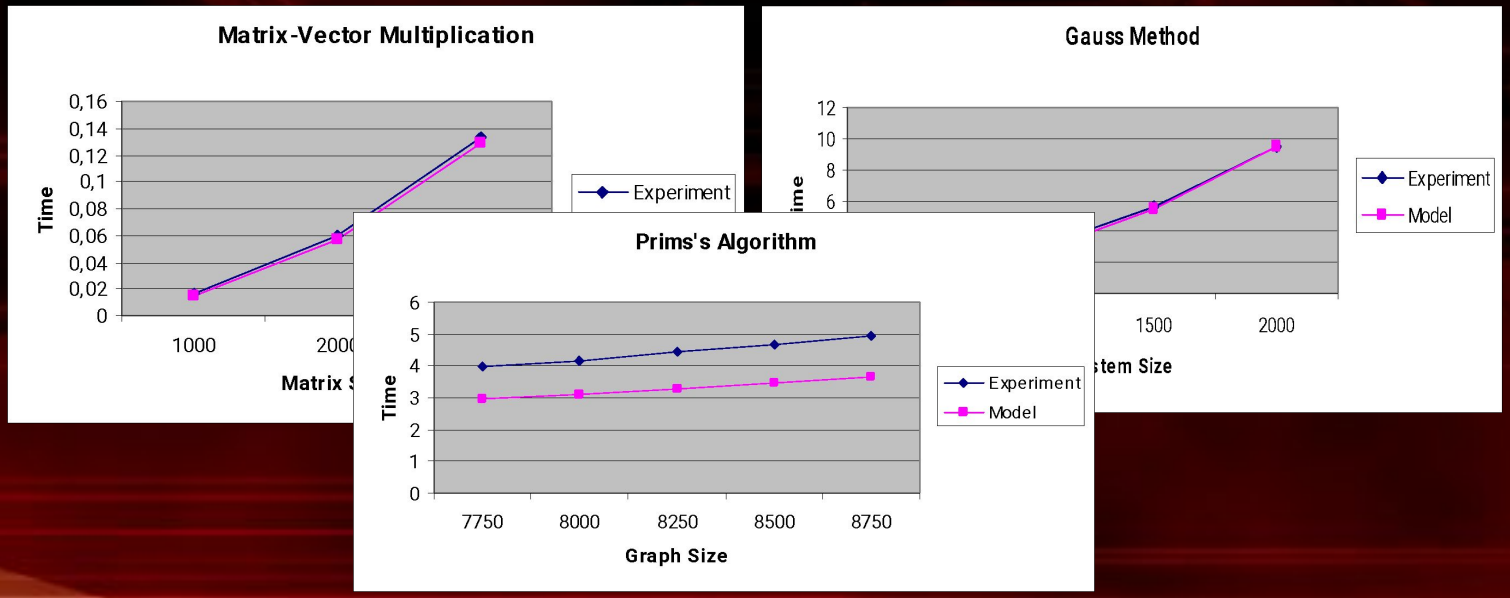


Estimation of Parallel Algorithm Execution Time:

- Hockney's model and its generalizations

$$T(comm) = l \cdot \left(\alpha + \frac{m}{\beta} \right)$$

- Results



ParaLab Requirements:

- Microsoft .NET, C#
- Microsoft Compute Cluster Server 2003

ParaLab may be useful for both novices, who are just starting to learn parallel computing, and experts in this perspective sphere of strategic computer technology

Take advantage of ParaLab and the world of parallel computing will become more evident to you!

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