German National Research Center for Information Technology
Research Institute for Computer Architecture and Software Technology

A Parallel Programming Environment for Clusters of Workstations

SNOW

Prof. Dr. Wolfgang Schröder−Preikschat

GMD−FIRST

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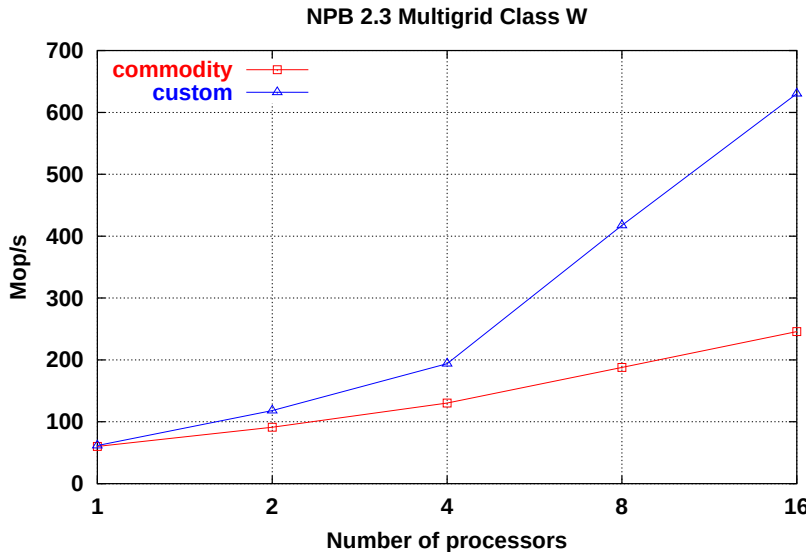
Outline

- Motivation
- Goals
- Overview
- Partners and respective tasks
- Schedule
- Budget
- Summary

Motivation (1)

- Parallel computing performance revisited
  - a case study: commodity vs. Custom software



- Clusters are still far behind MPPs

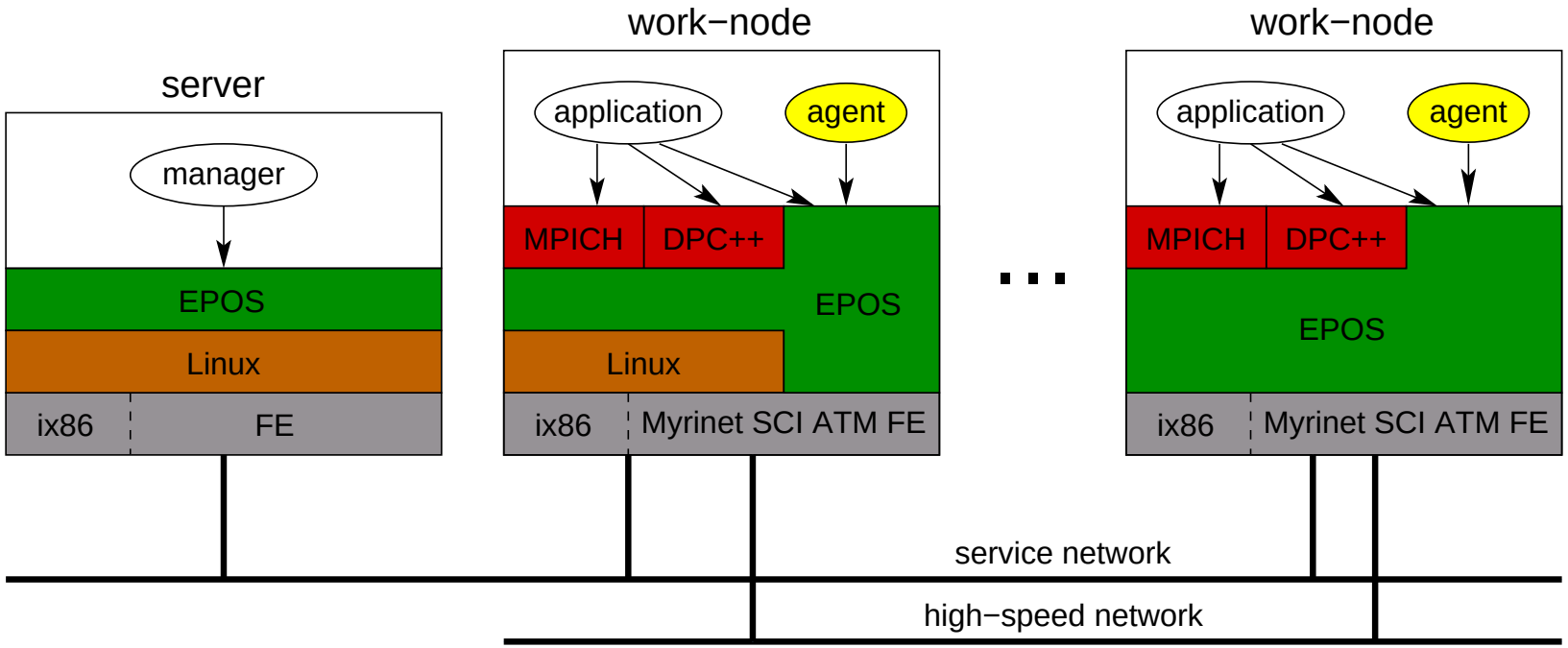
Motivation (2)

- Commodity hardware matches custom hardware
  - a conclusion that is not true for software
- Commodity software
  - is interactive, web−based, multi−{user,tasks,...}
  - is more distributed and less parallel
- Custom software
  - is delivering high performance and low latencies
  - is dedicated to parallel computing
- Clusters call for custom software

Goals

- Developing an application−oriented environment
  - management tools
  - programming language
  - run−time support system
  - standard interfaces (POSIX, MPI)
- Validated by selected parallel appliations
  - computational fluid dynamics
  - control of complex industrial processes
- Bringing cluster performance closer to MPP

Overview


server
manager
EPOS
Linux
ix86
FE
work−node
application
agent
MPICH
DPC++
EPOS
Linux
ix86
Myrinet SCI ATM FE
work−node
application
agent
MPICH
DPC++
EPOS
ix86
Myrinet SCI ATM FE
service network
high−speed network

Partners

- Germany
  - Academia
    - GMD−FIRST
  - Industry
    - Genias GmbH
- Brasil
  - Academia
    - UFRGS−II, UFSC−INE, USP−LSI
  - Industry
    - ALTUS Ltda

GMD−FIRST

- Tasks
  - run−time support system
  - reuse of EPOS components
  - configuration tools
- Head
  - Prof. Dr. Wolfgang Schröder−Preikschat
- Expertise
  - **PEACE** parallel operating system
  - **PURE** embedded operating system
  - **Myrinet** cluster

GENIAS GmbH

- Tasks
  - CFD package port and adaptation
  - Performance analysis and validation
- Head
  - Dr. Hans−Georg Paap
- Expertise
  - **Codine** cluster manager
  - Commercial parallel **applications**

UFRGS−II

- Tasks
  - DPC++ port and adaptation
  - Parallel run−time library
- Head
  - Prof. Dr. Philippe O. A. Navaux
- Expertise
  - Parallel programming **languages**
  - **Myrinet** and **SCI** clusters

UFSC−INE

- Tasks
  - Run−time support system
  - Reuse of EPOS components
  - POSIX adaptation layer
- Head
  - Prof. Antônio Augusto M. Fröhlich
- Expertise
  - **Nó*//*** multicomputer
  - **Aboelha** operating system

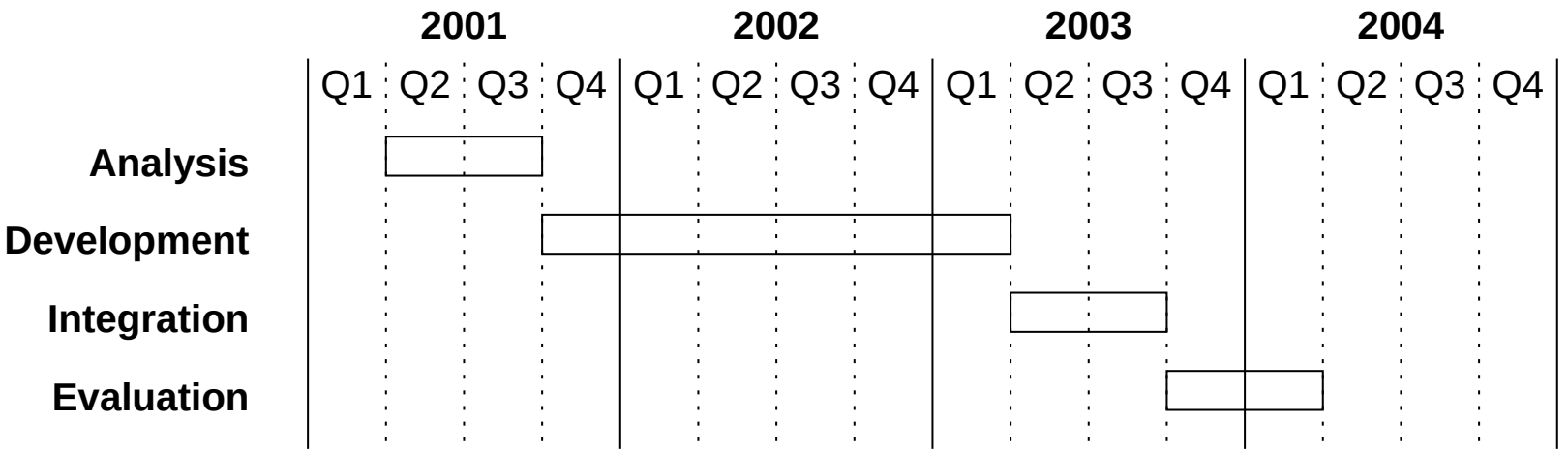
USP−LSI

- Tasks
  - Cluster management tools
  - MPI adaptation layer
- Head
  - Prof. Dr. Sérgio Takeo Kofuji
- Expertise
  - **SPADE** scalable parallel architecture
  - **Myrinet** and **ATM** clusters

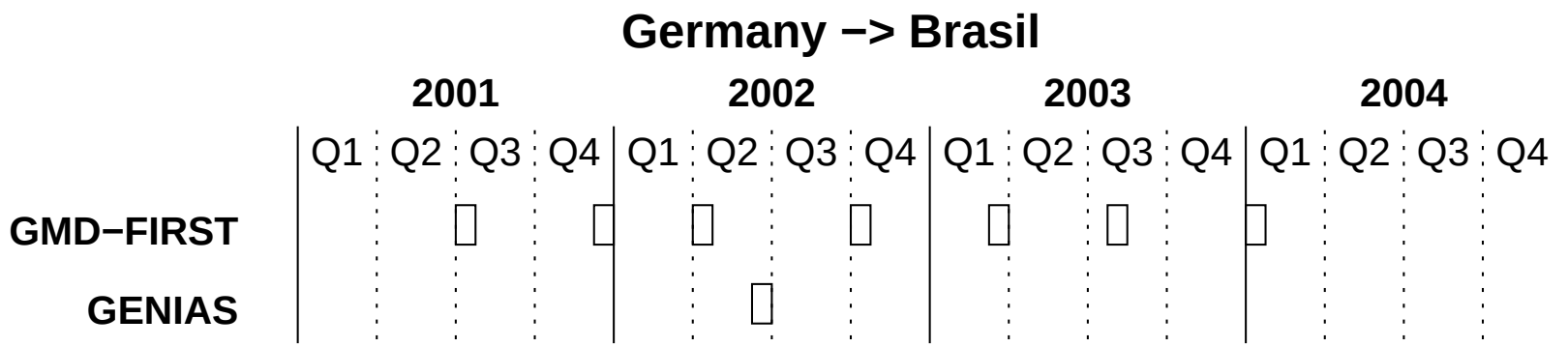
ALTUS

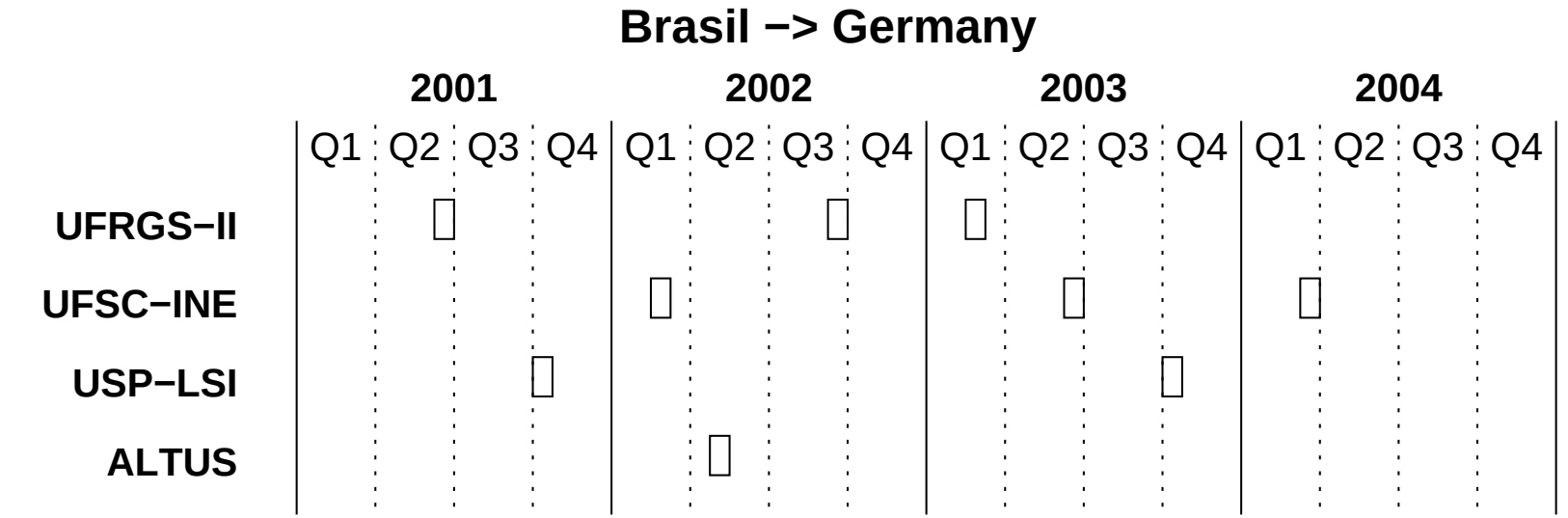
- Tasks
  - Industrial control applications
  - Performance analysis and validation
- Head
  - Eng. Luiz Francisco Gerbase
- Expertise
  - **Industry automation**
  - Brazilian market **leader**

Time Table


2001
2002
2003
2004
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
Analysis
Development
Integration
Evaluation

Travel Plan


Germany −> Brasil
2001
2002
2003
2004
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
GMD−FIRST
GENIAS


Brasil −> Germany
2001
2002
2003
2004
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
UFRGS−II
UFSC−INE
USP−LSI
ALTUS

Summary

- High−performance computing is an every growing field
- Cluster computing is the cost−effective alternative
- Parallel computing is a strategic field
  - dominated by the USA and Japan regarding MPP
  - still open for cluster−based solutions
- Brasil and Germany have competence in the field
  - strategic alliance makes both major players
- Let’s enjoy SNOW in the sunshine...