• Established in 1968
• 40,000 Students (8,000 graduate students)
• 3,000 Teachers (Professors, Associate Professors and Assistant Professors)
• 2,500 Students in Computer Science
CAOS Department

- 3 Professors
- 10 Associate Professors
- 1 Post Doc
- 23 Research Assistant (Graduate Students)

CAOS Research Activities

- Parallel Applications
- Support Tools for Parallel Programming
- Management of Parallel and Distributed Systems
- Computer Architecture: Processors and Networks
Computer Architecture: Processors and Networks

- Advanced Processors Design (Branch Prediction and Adaptive Cache)
- Interconnection Networks
Management of Parallel and Distributed Systems

- Low Cost Parallel Machine
- Performance Modelling and Prediction of Multiclusters
- Grid Resource Management
• Parallel Programming Models
• Automatic Performance Evaluation and Dynamic Tuning
• Reliability (Fault Tolerant)
Parallel Applications

- Event Driven Parallel and Distributed Simulation
- Simulation of Forest Fire Propagation
- Video on Demand
Grid Resource Management: CrossBroker

• Grid Resource Management
  – Automatic
  – Transparent
  – Reliable

• Supporting new applications:
  – Interactive
  – Workflows
  – Parallel
Simulation of Forest Fire Propagation

- \(S^2F^2M\) (Statistical System for Forest Fire Management) is a statistical method that improves the prediction of fire propagation by focusing on the imprecision of the input data.

- \(S^2F^2M\) looks for a behavior pattern of the forest fire, independently of the parameters values.

- \(S^2F^2M\) presents an option to the resolution of the problem by means of the use of multiple cases instead of doing a prediction from only one parameters set.
Simulation of Forest Fire Propagation

– Example

Scenarios number = 4

Worker 1

Worker 2

Worker 3

Worker 4

probability

S²F²M
Simulation of Forest Fire Propagation

- In real experiments, the terrain is divided into dedicated plots with regular shape and dimensions separated by firewalls to limit fire spread and to keep it inside desired boundaries in each burn.
Dynamic Tuning

- Dynamic automatic tuning of parallel/distributed applications
MATE: Monitoring, Analysis and Tuning Environment

- Application Controller - AC
- Dynamic Monitoring Library - DMLib
- Analyzer

Diagram: Three machines (Machine 1, Machine 2, Machine 3) interconnected through AC and DMLib components. Events are exchanged between tasks and machines.
MATE: Monitoring, Analysis and Tuning Environment

Analyzer
- Carries out the application performance analysis
- Detects problems “on the fly” and requests changes

- Application Controller - AC
- Dynamic Monitoring Library - DMLib
- Analyzer
MATE: Monitoring, Analysis and Tuning Environment

**Application Controller (AC)**
- Controls the execution of the application
- Has a Monitor module to manage instrumentation via DynInst and gather execution information
- Has a Tuner module to perform tuning via DynInst
MATE: Monitoring, Analysis and Tuning Environment

Dynamic Monitoring Library (DMLib)
- Facilitates the instrumentation and data collection
- Responsible for registration of events

- Application Controller - AC
- Dynamic Monitoring Library - DMLib
- Analyzer
MATE: Monitoring, Analysis and Tuning Environment

– **Automatic Performance Analysis on the fly**
  - Find bottlenecks among events applying performance model
  - Find solutions that overcome bottlenecks
– Analyzer is provided with an application knowledge about performance problems
– Information related to one problem is called a tuning technique
– A tuning technique describes a complete performance optimization scenario
MATE: Monitoring, Analysis and Tuning Environment

- Each tuning technique is implemented in MATE as a “tunlet”, a C/C++ library dynamically loaded to the Analyzer process.

  - **measure points** – *what* events are needed
  - **performance model** – *how* to determine the behavior and possible solutions
  - **tuning actions/points/synchronization** – *what* to change, *where*, *when*
Universitat Autònoma de Barcelona

University Autonoma of Barcelona (UAB)