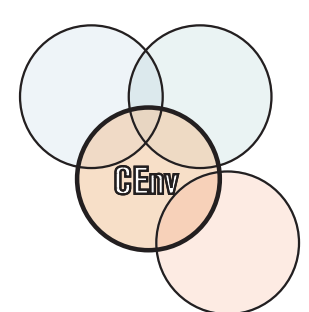




# Distributed Computing & Systems

Department of Computing Science



## Collaborative Environments (CEnv)

A *distributed collaborative environment* enables multiple users, physically located at different places, to access and modify shared objects in real-time. Shared objects are distributed resources whose state can change over time. The idea behind collaborative environments is to deliver a sense of "being there interacting with you".

Building a collaborative environment implies the challenge of providing *consistency* between the view of the users on the one hand and allowing the system to **perform** well and **scale** on the other.



### Research Perspectives

- Cross-fertilization with the research area of process synchronization to address consistency issues.
- Lessons from real-life: gossiping for information propagation and group organization.
- New methods for (virtual) object realization and sharing, using distributed algorithms and data structures.

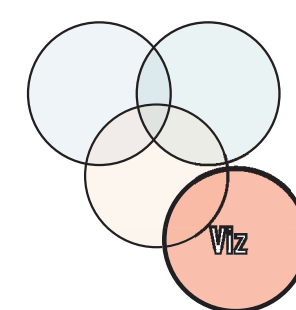
### Consistency and Shared Objects

A consistency model gives a contract that specifies how shared objects are modified. The definition of shared objects themselves are in our interest since different properties of objects determine how and whether users can become aware of local changes. Group communication is a basic supporting mechanism to dynamically update the set of group members as well as efficiently inform users about changes in the system.

### Applications

Collaborative environments have many exciting applications that may help humans to work, play and socialize together despite geographical barriers. Below are some examples of such applications:

- Computer-Supported Cooperative Work (CSCW) - Collaborative environments can be used to build shared workspaces that allow multiple users to work together on various tasks, thus forming virtual work teams potentially spanning the entire globe. We are planning to use the 3Dwm system for this purpose.
- Virtual Meetings - Humans are social animals, and have a deep need for social contact. Collaborative environments can help people meet loved ones despite being far away, and can also be used for business-oriented virtual conferencing.
- Simulation and Entertainment - Today's computer gamers are increasingly turning to massively multi-player on-line environments, and this trend is also evident in the simulation industry, where it is often desirable to let people train together in a shared simulation environment.
- Steering and Monitoring of Distributed Systems



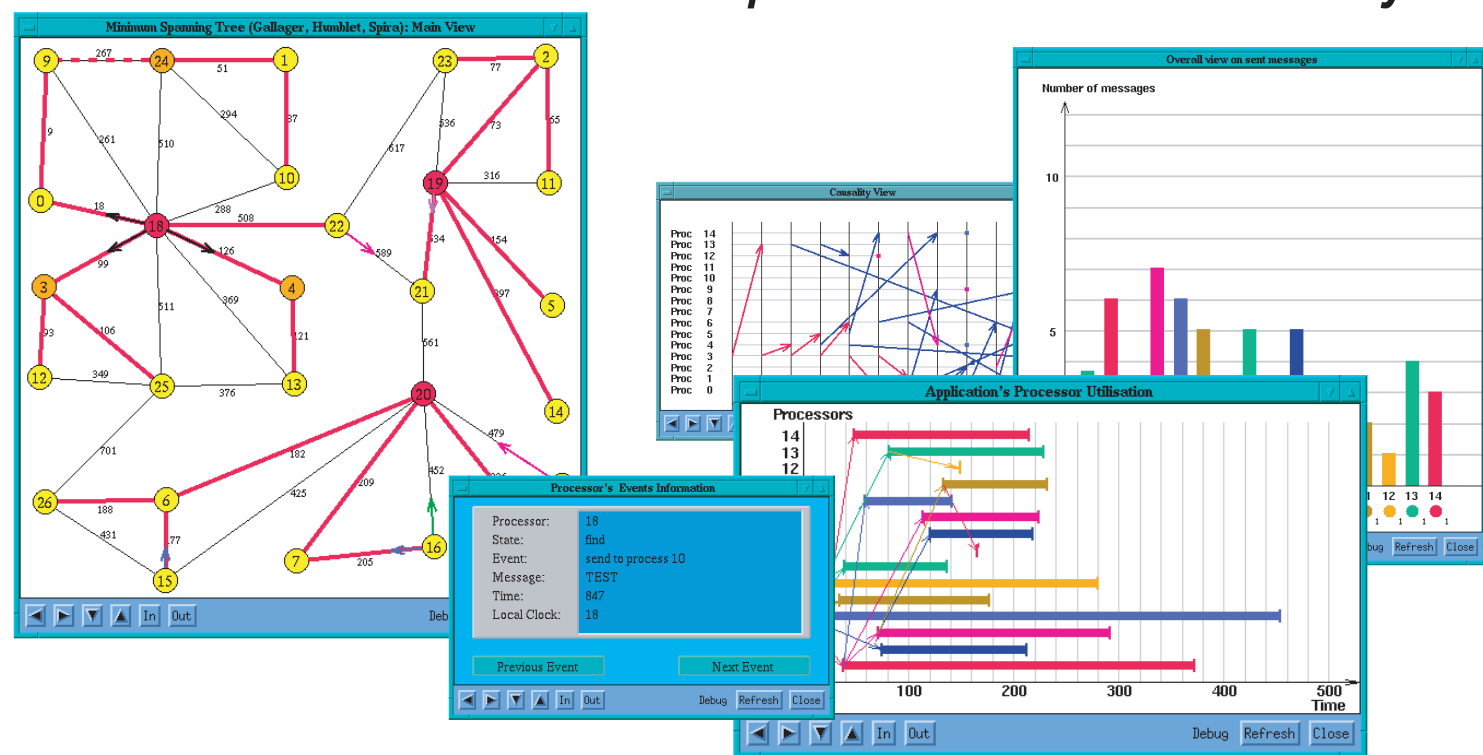
## Visualization (Viz)

### LYDIAN

Distributed algorithms involve a large amount of data describing local state information and complex interactions between elements. It is often very difficult to understand their control flow and performance behaviour only from standard descriptions.

LYDIAN -- an extensible animation environment for distributed algorithms -- is a result of our effort in finding visualisation methods to help understanding distributed protocols. By creating own experiments users can perceive a whole execution by choosing from several 2D and 3D animations illuminating various aspects of each protocol. Recent efforts focus on offering support for collaborative learning and providing possibilities for monitoring and steering distributed system applications.

<http://www.cs.chalmers.se/~lydian>

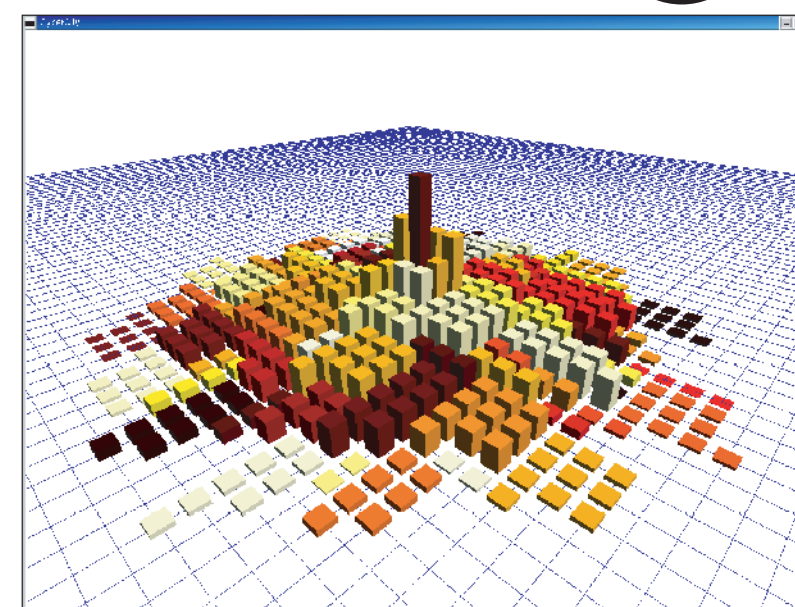


### Information Visualization

The Information Age is producing upwards of 1 exabyte (1 million terabytes) of data annually worldwide, 99.997% of which is only available in digital form.

Most of this digital data is abstract information which lacks a straightforward representation that makes sense to human users. Clearly, there is a need for a way to structure this deluge of data so that we can begin to understand it.

The field of information visualization combines aspects of human-computer interaction (HCI), computer graphics, and visualization to create visual mappings for this kind of abstract data in order to help users recognize patterns and trends and extract information from it.



### Research Perspectives

- Exploit visual ways to enhance capabilities in
- distributed algorithms understanding and analysis
  - human-computer-interaction by means of special environments for information visualization
  - perception of general concepts such as causal relations and tree hierarchies.

### 3Dwm: Three-Dimensional Workspace Manager

The 3Dwm system was designed to remedy the problems of conventional 2D interfaces by harnessing modern computing technology, and focuses on making the user interface more natural, flexible, and efficient through the use of 3D computer graphics. 3Dwm is an experimental application platform for programs with a three-dimensional user interface. Here, applications are not made up of a bunch of buttons, windows, and menus presented on a flat screen and controlled by a mouse and a keyboard, but are rather 3D volumes in space with a natural interaction approach based on common human movement patterns and brought to life on high-end 3D platforms, such as Virtual Reality equipment and wearable computers.

<http://www.3dwm.org>



## Group Presentation



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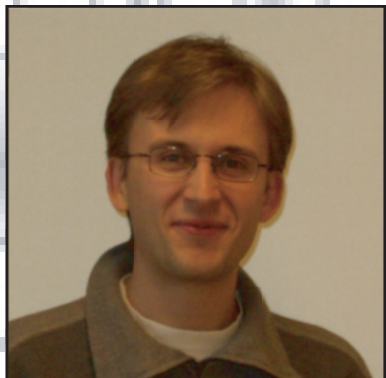
Inter-process communication, synchronization, task mapping in parallel systems.



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Packet scheduling, OS support for non-blocking synchronization.



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