The VIOLA testbed is an integrated testbed for applications and advanced network services, organised as a consortium with partners from industry, research laboratories, universities and the DFN (Deutsches Forschungsnetz) association in the region of North-Rhine-Westphalia with an extension to Bavaria.

Major goals are the test of different signalling mechanisms in an heterogeneous environment of routers and switches and the development of a user-driven dynamical bandwidth allocation. The results will give input for the stepwise implementation of the XWIN, the next generation research network in Germany.

![Network Topology Diagram](image)

Figure 1: Network topology.

In addition to network allocation and development of the needed new network technologies, the improved properties should be tested and demonstrated by applications with very high communication requirements. The TechniSim project within VIOLA deals with the distributed simulation of complex technological systems and combines two of such applications.

**Keywords:** high performance computing, grid computing, optical network, technical applications

**Contact:** voigt@cassandre
Simulation of industrial crystal growth processes:

In cooperation with Fraunhofer-Institute for Algorithms and Scientific Computing (SCAI) the crystal growth process will be simulated in a quality which has not been possible so far. Heat transfer by conduction, convection and radiation in complex geometries with changing boundaries and free interfaces are calculated in a real three dimensional model. To be able to handle the complexity of such a simulation, the different aspects are computed on distributed clusters, which have to exchange their results using volume and surface coupling mechanisms. The coupling will be realized via OpenFOAM between AMDIS and FLUENT. The commercial CFD-software FLUENT is used to simulate turbulent melt convection together with heat conduction in crucible, melt and crystal. AMDIS, on the other hand, is responsible for efficient computation of heat radiation and conduction in the furnace as well as for defect dynamics in the crystal.

Simulation of biosensors:

Today, diverse biosensors that are able to detect least quantities of organic molecules are being developed very intensively. The layout of such sensors can be designed with the help of precise mathematical simulations that involve large systems of coupled partial differential equations. Thereby, piezoelectrical and piezoelectric equations in the solid state and flow equations in the liquid state are combined. Because of a small wavelength, the computational effort for such coupled simulations is very high in 3d. The compute grid of VIOLA enables three dimensional calculations, which may give new hints for parameter and geometry optimisation. The idea of distributed computations consists of the decomposition of the coupled governing PDE system, say, in subsystems describing solid and liquid parts of the structure. The subsystems are being solved on separate clusters as the fitting of the pressures and velocities on the liquid/solid interface occurs through minimization of a residual with a descent gradient search in which the gradients are computed through solving of adjoint equations on distributed clusters. The method will be implemented in FlexiEs.

Supported by BMBF grant 01AK605K.