

Infrastructure of Ubiquitous Computing

"Grid" Technology and Network Transparency

Grid, as well as ubiquitous computing, is an important concept and technology which supports future information society. Our life is already surrounded by numerous computers. However, what we need is not really a computer, but functions provided by a computer network or an information service which enables the user to predict the future. This would be realised through the collection of data from the web sites, road information etc., building a database with necessary information and easy data retrieval. As far as these functions are available, the shape or the location of the computer does not really matter.

In order to meet this requirement, AIST is proceeding with research to establish the Grid technology that ensures a certain quality of service regardless of by whom, where or when the request is made.

Ubiquitous computing and Grid technology

Through ubiquitous computing, the optimal service is sought to be provided to the user in consideration of time, location and the environment.

Ubiquitous computing and grid technology have common characteristics in terms of the transparency of information systems (computer, storage, network, sensors etc.). The function to provide information services, regardless of place (ubiquitous computing) and the features to access the computing capabilities and database wherever situated globally are complementary to each other.

Ninf Project

With the aim towards the establishment of the grid technology, AIST is currently promoting the Ninf Project with the Grid Research Center as its hub of the research. The objective of this project is to provide a function that enables a user to access other computers when his/her computer goes down, even without any particular computer skill. This mechanism is called "Grid-enabled Remote Procedure Call (Grid RPC).

Furthermore, by exploiting the local storage of computers distributed over the world-wide network, AIST focuses on the development of Grid Data Farm (Gfarm), the grid software to create a virtual computer with high capacity data storage architecture and peta-scale data intensive computing system. Users can retrieve the required data, accessing the virtual mass storage wherever they are. In order

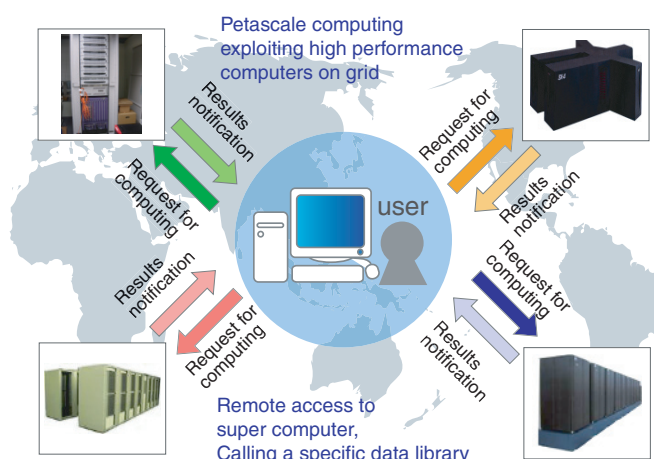
to utilize this system from all over the world, it is required to use the high-speed network efficiently. AIST achieved high speed data transfer at 741Mbps between Japan and the U. S. in November 2002.

Standards for integration of single function sensors

Grid technology has been developed based on general purpose computing systems. However, in ubiquitous computing societies, it is necessary to integrate a large number of single function sensors. This requires the standardization of interfaces and protocols to communicate between devices in a cooperation with an international standardization organization, such as Global Grid Forum (GGF). AIST is involved in the standardization activities and promotional events organized by GGF. The Institute has set up Grid Consortium Japan and been active in technology exchanges with industrial and academic sectors.



Large file
High speed data transfer at 741 Mbps was achieved between Japan and the U.S.



Grid-enabled Remote Procedure Call (Grid RPC)

Users can call computers on the world wide network.

Ubiquitous Computing

Multi-agent Architecture CONSORTS for Ubiquitous Computing Environment

A variety of research projects on ubiquitous computing are ongoing all over the world. There are, however, few examples that provide a total formulation of architecture to integrate the entire layers from communication network to end users. For ubiquitous information societies, we find it essential to build a multiagent architecture that allows several kinds of agents to function individually in ubiquitous computing environment. This is the fundamental concept of the research project to design and implement "CONSORTS."

The key concepts are as follows.

A prototype system of CONSORTS has been implemented for museum scenario where several kinds of users visit a museum and the CONSORTS service agents navigate the users and provide suitable information to them (Fig.1). The system uses FIPA-ACL based communication protocols and consists of spatio-temporal reasoner, personal agents, CONSORTS service agents, and device wrapper agents.

1. Grounding

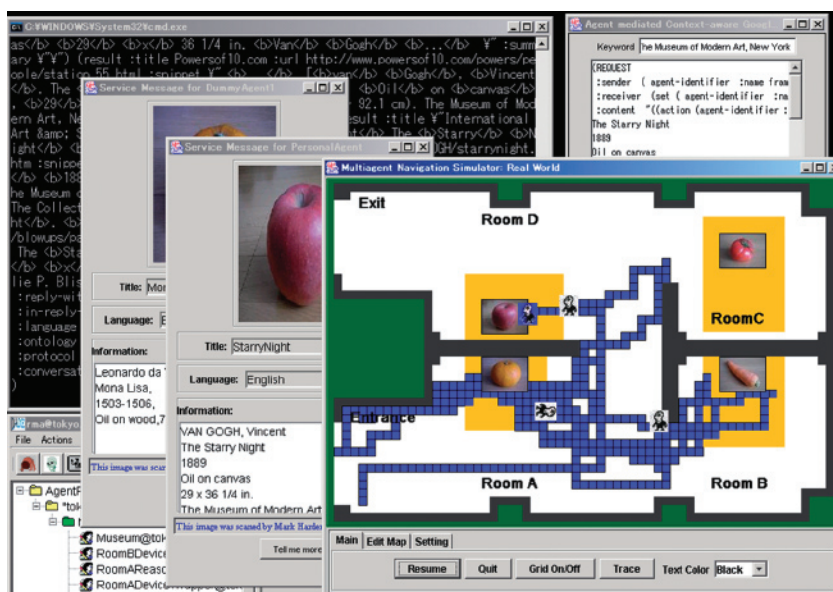
Information that is highly abstract "object" should be grounded in the real physical world by using sensory information.

2. Service Coordination

Physical and computational resources should be structured as agent framework where we can flexibly access information services.

3. Mass User Support

To support users as mass in order to realize innovative services that coordinate users' preference and plans. One of the service image is dynamic resource allocation, that is, coordination among users' behaviors in traffic system or appointment system for public services by spatio-temporal resource allocation.



CONSORTS Application Image – Museum Scenario.