Grid Technology in TORGA.net Context

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German Abstract

Dieser Beitrag gibt einen allgemeinen Überblick über die Access-Grid-Technologie mit Hinweisen auf ihre technischen Aspekte und einer kurzen Beschreibung der Architektur eines Access Grid Node. Er stellt die Unterschiede zwischen der Access-Grid-Technologie und anderen herkömmlichen Technologien für Videokonferenzen dar und zeigt einige der Gründe auf, weshalb sich das TORGA.net-Konsortium für diese Technologie zur Durchführung von Videokonferenzen zwischen der Universität von Minho im Norden Portugals und der Universität von Vigo im spanischen Galizien entschieden hat.

Introduction

The TORGA.net - Trans Portugal Galicia Network - project is funded by Interreg III-A Community Initiative, Galicia North of Portugal Subprogramme involving the following partners: University of Vigo and Centro de Supercomputación de Galicia (CESGA) from Spain and University of Minho and Centro de Computação Gráfica (CCG) from Portugal. Its main objective is to build an efficient communication platform between the research and innovation communities of the South of Galicia and the North of Portugal, in order to encourage the collaboration between them and simplify the economic and social integration of this bordering zone. In practical terms, this project involves the installation of several Access Grid rooms. The Access Grid is an ensemble of resources including multimedia large-format displays, presentation and interactive environments, and interfaces to Grid middleware and visualization environments.

These resources are used to support group-to-group interactions across the Grid. For example, the Access Grid is used for large-scale distributed meetings, collaborative work sessions, seminars, lectures, tutorials, and training. Therefore, the Access Grid technology differs from desktop-to-desktop tools that focus on individual communication.

Access Grid technology

A Grid is a set of hardware and software resources distributed over the Internet that provide services accessible through a set of protocols and open interfaces (resource management, remote process management, communication libraries, security, monitoring support, etc) organized by well defined proceedings and good practices. The virtual organizations that interconnect through a Grid are responsible for their own security and resource management policies. This means that the technology used to build a Grid is complementary to other technologies enabling the use of distributed resources from the intranet of those organizations.

The need to use resources already available in the systems connected to the Internet and to simplify their usage created an opportunity for a new information technology known as Grid. The idea for this new tech-

Figure 1: Access Grid room in university of Minho (Braga)

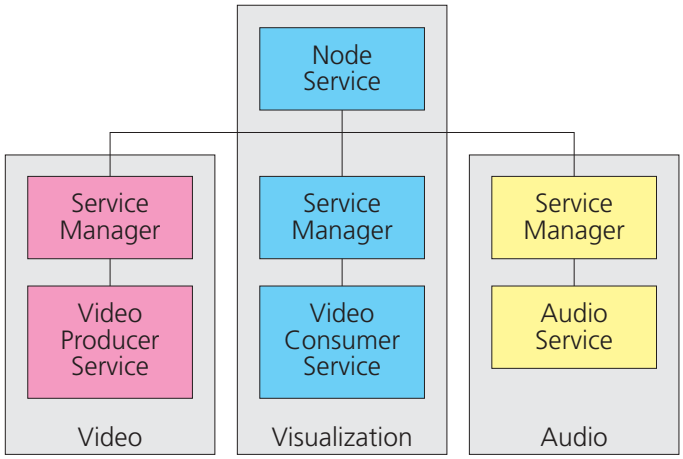

Figure 2: Structure of an Access Grid Node

nology is to offer access to various resources geographically dispersed, such as supercomputers, clusters, storage, information sources, tools, etc. Therefore, the distributed systems can be used as a single virtual system by various applications.

A Grid system is defined by the dependency in a centralized control, for being based on open standards and for providing quality of service. As such, the objective of the Grid technology is to bind resources of distinct administration domains, respecting the policies and internal management tools of those domains.

Access Grid is a framework of hardware and software resources over multicast networks with middleware interfaces, used to make human interaction and collaboration between local and remote spaces easier.

Each Access Grid Node connects to other nodes, creating a flexible Collaborative Virtual Environment that makes possible for multiple users located in different physical locations to communicate and collaborate as if they were working in the same room.

In an Access Grid Node, audio, video and data create environments that make other participant nodes feel like they were working in the same physical space.

In order to create this environment some aspects must be taken into account, like the room space, equipment layout and the construction and configuration of the Access Grid Node.

An Access Grid Node is composed of four components:

– Audio System,
– Video System,
– Visualization System, and
– Network

Access Grid vs. Conventional Videoconferences

What are the advantages of an Access Grid Videoconference System? What are the differences between Access Grid and conventional videoconferencing technology? Table 1 presents a comparison made between a videoconference taking place in an Access Grid Node versus a videoconference in a conventional room.

In a traditional videoconference session we have a peer-to-peer topology in which every peer establishes a connection with every other peer in the conference that usually resumes to one. This is mandatory with unicast networks, while in an Access Grid session, since it is based on a multicast network, one node (peer) broadcasts video, audio and data stream(s) only once and every other node (peer) receives that stream, repeated as many as it wants, only limited by its own bandwidth. This means that the Access Grid technology is scalable in terms of the number of participants in a particular session.

The possibility to share resources and applications is another important issue compared to other technologies. Some technologies allow at the most the sharing of a virtual board in which the participants can write and make simple drawings. However, with Access Grid, the participants can share applications like web browsers, slide show presentations, etc. More, the resources of each node can be shared and used by applications as a single virtual system.

Access Grid Node: Software Architecture

The Access Grid infrastructure has the following components (figure 3):

– *Venue Server*: is where virtual rooms are created, modified and removed using a tool called »venue management tool«.

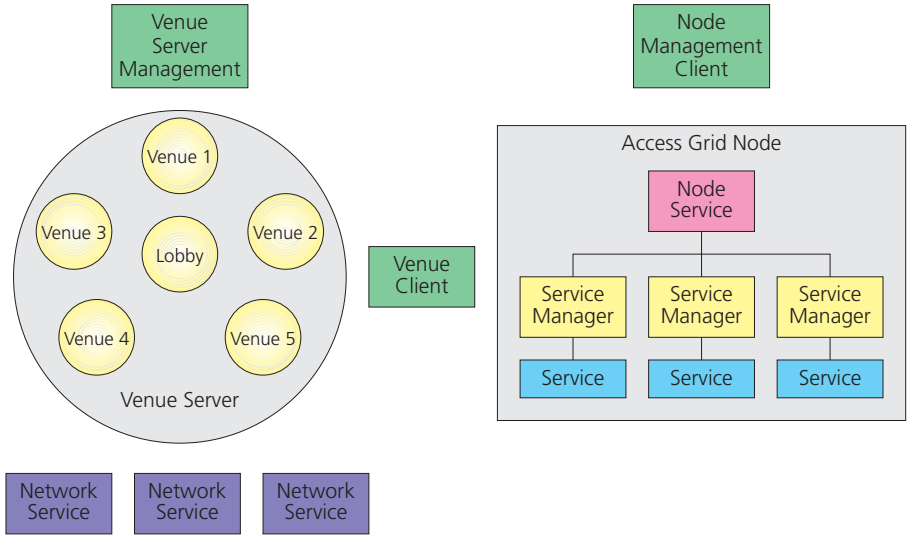

Figure 3: Client-server structure in virtual rooms

Videoconference Access Grid: Characteristics	Conventional Videoconference: Characteristics
Requires Broadband Networks (Internet2, GÉANT)	Require conventional networks: Internet, RDSI, ADSL
Multicast networks	Unicast networks
Multiple open source software resources	
Require multiple hardware resources	Require few hardware resources
Multiple audio/video streaming	
Projection of high quality image	Image of variable quality and small dimensions
Complex collaborative virtual spaces	Simple collaborative virtual spaces
Great interactivity	Poor interactivity

Table 1: Comparison between Access Grid and conventional videoconferences

Therefore, the Venue Server connects different Access Grid Nodes.

– *Venue Client*: software that serves as a connection between the node and the virtual class room (»virtual venue«)
  Allows:
  - To share data,
  - To share applications, such as Remote PowerPoint Presentation Tool, Whiteboard, GridFTP, distributed Web Browser, distributed Chat Room, shared Bookmarks, Voting Tool, Question & Answer Tool, etc.
– *Virtual Venue*: cooperative virtual space.
– *Node*: collection of hardware and software resources.

As seen in Figure 2, the Node Service connects to the Service Manager in each machine. The Node Service exposes to the outside the resources of each machine of the Node. Therefore, the components are:

– Node Service: central point of contact in a node.
– Service Manager: manager that controls the services in each machine. There is one for each PC to control the service execution.
– Service: include the hardware and software resources needed to provide a certain service (such as audio and video streaming).

The functionalities of each Node are determined by the services installed.

Conclusion

The experience provided by the Access Grid technology is very different from the traditional videoconferencing systems. In the domain of rich and interactive remote collaborations, Access Grid has an excellent performance when compared to other technologies.

Another feature that makes Access Grid stand up over other systems is its scalability; a session can be established between several nodes, each with the possibility to see the others; events with up to 100 participant nodes have already taken place using Access Grid technology. This is possible because Access Grid is based on multicast networks, meaning that one node has only one outgoing audio/video stream that flows over the multicast network to every other participant node.

Summarizing, the Access Grid technology offers the following capabilities:

– high-quality multichannel digital video and audio
– prototypic large-format display
– integrated presentation technologies (PowerPoint slides, mpeg movies, shared OpenGL windows)
– prototypic recording capabilities
– integration with Globus for basic services (directories, security, network resource management)
– macroscreen management
– integration of local desktops into the Grid
– multiple session capability

Points of Contact

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