

The Electronic InfoMall — HPCN Enabling Industry and Commerce

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Abstract. We describe our InfoMall technology transfer program — a partnership of over sixty commercial, academic and federal organisations working together on HPCN technology development as well as HPCN-enabled business activities. We discuss a selection of some of the project activities being undertaken by InfoMall members and focus on an “Electronic InfoMall” activity in collaboration with the US Air Force to exploit high performance computing (HPC) systems and software shared between collaborating members of a virtual organisation. This system is built around the World Wide Web - a protocol developed in Europe for the exchange of multimedia hypertext. We have demonstrated how HPC systems can be linked together using this mechanism, to provide networked services such as Video on Demand and Simulation on Demand. More information on InfoMall is available on the World Wide Web at <http://www.infomall.org/>.

1 The InfoMall Process

Technology is developing rapidly and it is no longer possible for a single, static, hierarchically structured organization to possess all the right knowledge to make the best use of technology. The full knowledge base to do this can only come from **virtual organizations**. This is especially true of the rapidly growing field of High Performance Computing and Communications³ technology. The InfoMall process is a mechanism for enabling technology transfer by building virtual organizations whose members can interact and exchange multimedia information rapidly using HPCN technology which is already widely available.

The InfoMall process works by networking together participants. *Scientists and engineers* working together on a project but at geographically separate locations can exchange technical information in the form of documents; diagrams;

** Submitted to HPCN 1995

³ known as High Performance Computing and Networking (HPCN) in Europe.

software; photographs; videos; audio sounds and speech. Teams working in overlapping but distinct areas can choose to make available certain information to each other and prevent duplication of effort. *Line managers* can review technical work-in-progress rapidly by accessing the technical information placed on line by the technical staff and can adjust cost estimates and schedules accordingly. *Program managers* can review material in-progress across several projects and programs and identify synergistic opportunities. *Favored customers or end-users* can be given access to early software products, or on-line catalogs of product information. Mechanisms exist for customers to order products directly via the network and also to provide feedback in the form of carefully controlled questionnaires and product evaluation sheets. *Ordinary customers* can also make requirements specifications directly available to the product development teams and both parties can exchange information rapidly to come to a correct, achievable, agreed specification. *Production teams* can receive technical information accurately and rapidly from the **product development teams** thus avoiding costly delays and errors. *Strategic planners* can review material across all programs and sites that are part of the InfoMall and can decide what areas of work to promote in the future on the basis of up-to-date information on what is available and what feedback is being returned. *Marketing Managers* can make product information available not only to existing participants of their InfoMall network but through the main InfoMall USA (see section 2) to a potential market covering the nation and indeed the world. Mechanisms exist to advertise products and carry out market research very cost effectively compared with traditional means.

The participants are thus **empowered** by the InfoMall process. The InfoMall people-networking process can be enabled by building an Electronic InfoMall based on technology integration servers (TIS). These are networked repositories of *integrated* information which can be in the form of: multimedia “encyclopedia” review articles; on-line glossaries and acronym explanation lists; technology data-sheets; on-line “normal” documents; on-line videos; on-line software including modeling and simulations-on-demand; on-line software product demonstrations. There are many other forms of information that can also be included. This process of enabling people using technology is shown in figure 1.

2 How is NPAC using the InfoMall process?

InfoMall was initiated at the Northeast Parallel Architectures Center (NPAC) of Syracuse University to manage the technology transfer process associated with HPC technology. The metaphor of a **shopping mall** is used to illustrate the various people and organizational networking transaction activities that are necessary for successful technology transfer.

NPAC manages the **InfoMall USA** program with over 60 member organisations. This includes major organisations such as IBM, Kodak, Martin Marietta, Niagara Mohawk, Booz, Allen & Hamilton, Dun & Bradstreet, NYNEX, Rome Laboratory, MADIC(A multi disciplinary consortium of aerospace corpo-

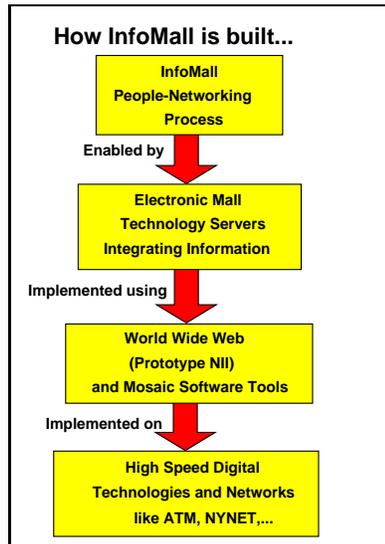


Fig. 1. The InfoMall process enables people using technology, and provides a prototype for services on the National Information Infrastructure (NII) which will become the Global Information Infrastructure (GII)

rations) and the Center for Research on Parallel Computation as well as many small businesses local to New York State. The resulting stream of technological and business related information pouring through NPAC has proved an excellent means of promoting technology transfer statewide and indeed nationally. NPAC is now expanding the InfoMall process outside the USA with corporations in Europe and Africa interested in joining InfoMall.

InfoMall projects make use of HPCC to deliver the required performance for data creation (simulation), data access or data analysis (processing). The Internet provides scope for meta-computing[1] on a grand scale with HPCC systems accessible through the standardized interface of the World Wide Web hypertext transfer [7] protocol (see section 3 below). For example, an on-line database service might also require use of parallel search algorithms and high speed networking facilities. This may then become part of a larger set of technologies and services offered by an integration company, which has expertise in bringing new technologies into the marketplace. InfoMall provides “one-stop shopping” for the necessary technologies, technical and business support, and market opportunities resources.

InfoMall projects under present development include: financial option pricing in the stock market (NPAC, IBM and various Wall Street Firms) environmental modeling (in collaboration with IBM). These are essentially “Simulation On Demand” projects. Information Access projects include: electronic access to photo image libraries (Kodak), fraud detection in health care payments (Booz, Allen & Hamilton, The Federal Bureau of Investigation); collabora-

tive cardiology and heart surgery (Veterans Administration Hospital, NYNEX); combining electronic entertainment with education (Abrams Gentile Entertainment); parallel database development for Dun & Bradstreet; city planning work with WorldView; Travel planning information with TravelVenture; and semantic interpretation for intelligent document retrieval systems with TextWise. Recently completed projects include electromagnetic simulation (Syracuse Research Corporation)[1] and electric power transmission simulation (Niagara-Mohawk Power Corporation).

3 What HPCC technology makes InfoMall work?

The InfoMall process of networking people is enabled by Technology Integration Servers which are on-line repositories for integrated information. These technology servers are implemented using HPCC software, as described below. These software tools are implemented on HPCC hardware in the form of high speed digital networks such as ATM-based networks such as NYNET.⁴ HPCC technology such as data caching can improve the transaction speed of such systems.

The most widely used and standardized multimedia information exchange software at present is the Mosaic package from NCSA, which implements protocols defined under the internationally adopted World Wide Web (WWW) system which originated from the High Energy Physics community in CERN, Switzerland. The Mosaic software has been implemented on Macintosh microcomputers, IBM compatible PCs and a wide range of workstations. Mosaic itself is a “viewer” for the hypertext information which is exchanged between participants across the Internet. The WWW protocols determine how a user can embed hypertextual links connecting information components in hypertext documents, with these documents residing on disk space on servers all around the world.

The WWW system allows for exchange of:

- text in many standardized formats such as PostScript; plain ASCII; LaTeX; TeX as well as the widely adopted hypertext markup language (HTML) itself, with which existing information components can be linked.
- photographs stored digitally in a range of standard formats.
- video sequences or movies.
- audio or speech.
- almost any item of software can be set up to be run on the target server system. This allows demonstration software to be made available, where the hypertext server may itself be a client of another HPCC system.

Many tools are available to link hypertext to existing databases, to allow interaction with other users and to integrate the information components with other software packages on the users’ host computer systems. There are many documents available to explain and discuss the Mosaic[8], the World Wide Web[7]

⁴ NYNEX’s high speed network, part of which already connects Rome Lab., and NPAC at Syracuse University.

and the other software components mentioned above. At present virtually all this software is available free on the Internet (see for example the National Software Exchange [6]).

It is interesting to note that although the WWW mechanism originated in Europe, it has taken the superb networking infrastructure of the Internet enabled in the USA by ARPA and DARPA investment to make this system viable for exchanging the large amounts of information needed for true multimedia interaction. Similar levels of investment by the European Union may be necessary if Europe is to remain competitive in Information Technology.

4 A Demonstration Electronic InfoMall

It is not possible to convey the full power on the on-line information delivery system built for this project in a static paper document. A demonstration Electronic InfoMall was constructed as a guide to the US Air Force's Rome Laboratory with hypertext links provided to complementary resources available elsewhere on the Internet [3],[5], illustrating the inter-relationships between the various components of the project work, Rome Laboratory itself, InfoMall, industry, academia, the federal Government and other assets on the World Wide Web. Central to the project were a number of consultant experts, in various HPC technology, from whom we sought advice. The distinguished group of consultants[3] provided expert advice on the three technological focus areas of: *Distributed Computing*, *Broadband Networking* and *Software Engineering*.

5 Conclusions

The information applications we demonstrated to the US Air Force involved the exchange of hypertextual data consisting of text (in various formats, static images in various formats, video sequences in MPEG format, and "clickable" image maps. Recent work indicates a number of other technologically innovative information delivery and access possibilities. A number of organizations, including the US Air Force, already have proprietary database systems which offer the facility for searching, database-joining and other manipulations. We have demonstrated that proprietary database systems using the industry standard Structured Query Language (SQL) can be interfaced with the Mosaic/WWW system. In particular we are able to interface to Oracle (including a parallel version), Sybase and other proprietary database systems. The implications for networked access to existing data using the existing infrastructure of UNIX/Macintosh and IBM compatible PC's within InfoMall organisations are potentially attractive. The integrity of existing database systems can be maintained by employing the secure (password protection) features of the system.

SQL proprietary database systems today generally store and manipulate textual data, but another possibility is to build database systems consisting of multimedia information items. This is currently an active research area.

We are working with our partners in the virtual research organization “Center for Research on Parallel Computation” to investigate possibilities of “data mining” of publicly posted information systems on the Internet. This has the attractive possibility of being able to ask for the most up to date information on a subject from organizations and experts around the whole world. We are investigating how the potential flood of information that could result from such a query can be organized to provide a manageable response. Another project with our partners in the CRPC involves a National Software Exchange of HPCC software and information. This is available on the World Wide Web [6], and embodies many of the ideas we have used for our InfoMall servers.

We believe the exploitation of the World Wide Web technology to interconnect HPCC systems together through the Electronic InfoMall process will be a powerful lever for further development of a HPCC software industry as well as stimulating many HPCC-enabled industries.

6 Acknowledgments

It is a pleasure to thank Marina Chen, Peter Christy, Paul Coddington, James Cowie, Sam DiNitto, Jack Dongarra, Ira Goldstein, John Graniero, Scott Gregory, Robert Jacobson, Walter Johnston, Carl Kesselman, Adam Kolawa, John Latta, Don Leskiw, Roman Markowski, Paul Messina, Richard Metzger, Peter Mills, Paul Nielsen, Janusz Niemiec, Jan Prins, John Reif, Richard Schantz, William Scherlis, Donald Spector and Shar Zand who provided either technical advice and expert opinion on the technological areas used as exemplars or other material used in the project for the US Air Force.

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8. <http://www.ncsa.uiuc.edu/> The National Center for Super-computing Applications (NCSA) Web Server, giving information on the World Wide Web and software to exploit it.