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# Planning Distributed Computer Systems

## Open Cooperative Computing Architecture lets businesses solve problems that once were the province of proprietary mainframes.

**OCCA eases system evolution as a business grows, needs change and new technology becomes available.**

When mainframes were the only game in town, proprietary computer system architectures prevailed and one vendor's mainframe could not communicate easily with another's. But as technology exploded, businesses began making decisions based on data scattered throughout an enterprise and the concept of distributed computing was born. Why not network all the computers in an enterprise, distribute data among them, and retrieve it when and where it's needed? Thus, the functions of a mainframe were spread through a network of computers and data became available at any location on the network.

When distributed computing began to take shape, most existing computer systems were patchworks of incompatible mainframes, minicomputers, PCs and systems software. To make systems transparent for moving data end-to-end—despite diverse hardware, operating systems and applications—the industry agreed on many software standards.

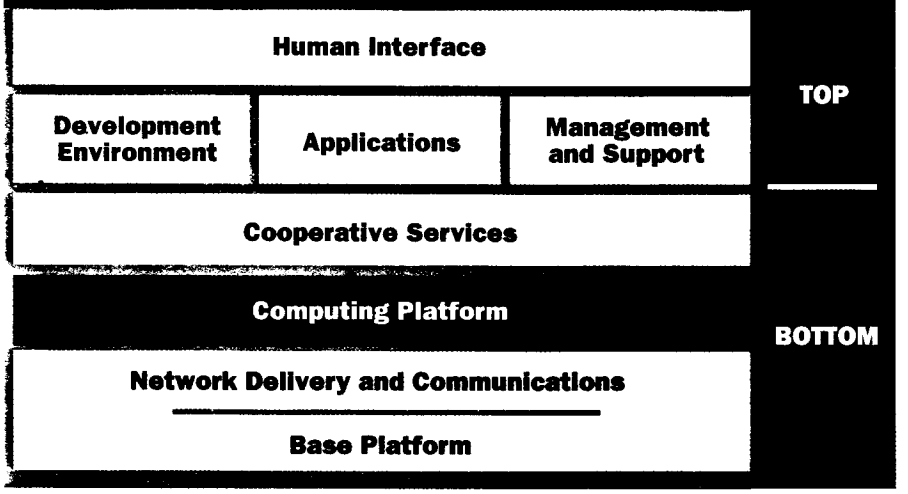
### ARCHITECTURE: KEY TO DISTRIBUTED COMPUTING

Open Cooperative Computing Architecture (OCCA) is AT&T Global Information Solution's standards-based system architecture. It enables an enterprise to solve problems with standard hardware and software that once required proprietary mainframes.

A system architecture provides the framework for solutions to technical questions of compatibility that arise during system development, integration and installation. OCCA takes into account the hardware and software standards the user must consider when

**FIGURE 1: OCCA MODEL**

**The seven Open, Cooperative Computing Architecture (OCCA) components are structured so that user-focused applications (top) generally use the services of the hardware and systems-software components (bottom). Layering isn't strict and, if required, software can use services in any component.**




developing distributed solutions that fill the various needs of the business—whether it's analyzing data, crunching numbers or sending e-mail. As an open-system architecture, OCCA ensures that the system will evolve easily as the business grows and its needs change, and as new technology becomes available.

Various disciplines are relevant to system architecture—systems engineering, software/hardware development, system integration, testing and support, and business marketing. An architecture development team may, in fact, comprise a roster of experts in those areas. The information in OCCA is extremely valuable to an architecture team for developing a distributed information-processing computing system tailored to the needs of the business.

### TARGETED TO BUSINESS NEEDS

Open cooperative computing, the theory underlying OCCA, envisions an information processing system dedicated to collecting, processing and accessing data in any form, at any time, any place and to managing the computing services that transform data into information to run the business. In constructing OCCA, AT&T Global Information Solutions has adhered to three principles basic to open cooperative computing:

☐ It must support the customer's business;

☐ It must show customers how to comprehensively implement a computing system centered on getting, moving and using data; and

☐ It must adhere to standards.

The OCCA details various hardware and software services, utilities and tools incorporated into a system so that users can interact with it comfortably and efficiently. It is actually a collection of seven components in two groups—user-focused-application components (the top four, Figure 1 ) and system software components (the bottom three). Industry standards are described for each component to provide the user with the widest selection of compatible hardware and software.

☐ The human interface services component for exchanging information between the user and the computer provides a consistent look, feel and response for user applications. Consistency leads to increased productivity for users because they perform often-used operations—file closing, for example—in the same way regardless of the application.

☐ The development environment component outlines ways to develop software that merges the changing demands for business efficiency with the opportunities offered by changing technology. For example, users can define the business to the computing environment using a business modeling tool in the development environment. Later, a database mining tool can use the definition to extract meaningful information from marketing databases.

☐ The applications component automates business processes, helping customers to organize, communicate and control their business activities. A marketing analysis application can extract information from anywhere in the enterprise to determine buying trends, which could lead to increased revenues from existing customers.

☐ The management and support component describes architecture, applications, functions and services that operations and support personnel need for managing the system. If, for instance, a communications link to a remote site fails, the management software signals the event to the user for corrective action.

☐ The cooperative services component gives software programs access to common services and resources anywhere in the system. To the user, the resource appears to reside in the application program. For example, a database of marketing information may be distributed through many locations. Database access services allow users to treat them as a single, locally-resident database.

☐ The network delivery and communications services component gives a software program access to remote resources but makes the communications protocols and technologies involved transparent to the user. A procedure in an application may actually reside on a remote machine, for example. If that machine overloads or fails, the procedure, can be moved to another machine without the application being aware of it.

☐ The base platform component contains the operating system, hardware platforms and peripherals. This component, together with network delivery and communications services, form the OCCA cooperative computing platform.

### MIDDLEWARE AND OPEN ARCHITECTURE

Middleware is the name of the software that runs between an application program and lower-level system resources that the application calls on to perform its functions. In OCCA, the cooperative services and network delivery/communications services contain the middleware.

Middleware may be designed to access information and other resources

**OCCA, described in books available from AT&T Global Information Solutions, will help you plan distributed systems that will meet future needs.**

**FIGURE 2: COOPERATIVE SERVICES**

**Cooperative services allow an application to access data and high-level software services throughout the enterprise. These services may move and/or transform data as necessary, transparently to the application.**

| Information Services | Collaboration Services | Application Services |
|---|---|---|
| • Native Data Access<br>- File & Print<br>- Relational<br>- Object<br>• Information Access<br>• Information Brokerage<br>• Cognitive<br>• Real-Time Transaction Processing | SYNCHRONOUS<br>• Video Conferencing<br>• Telemedia<br>• Data Conferencing<br>• Virtual Meeting<br><br>ASYNCHRONOUS<br>• Electronic Mail<br>• Electronic Data Interchange<br>• Workflow<br>• Deferred Transaction Processing | • Application Control<br>• Multimedia<br>• Script Execution<br>• Object Support |

for the application while insulating it from the details of getting and transmitting data. Thus, middleware makes applications easier to write. Middleware also may reformat data to fit the application's needs, isolating the applications from inevitable changes in the computing environment and making it more stable when changes occur. Many current distributed applications contain proprietary middleware for exchanging conventional data only between elements of the application itself.

However, proprietary middleware from different vendors may be incompatible, a situation that often generates problems of integration, flexibility, scalability, usability, reliability and performance. For example, a marketing research application and an on-line transaction processing application may need to share multiple databases, a difficult process if the applications do not use the same middleware.

As middleware becomes standards-based, the problem will become less complex. This will make it easier to implement new applications, integrate off the shelf software and protect the system from change. Future standards-based middleware must support integration of new technologies such as voice, video, audio and images in the application. And it must support these technologies without disturbing the existing system's operation.

Standards-based distributed database systems, messaging systems and transaction systems are becoming widely available. New concepts like information mining, multimedia communications, realtime group collaboration and virtual meeting room systems represent the latest challenges to open, distributed systems.

### THE OUTLOOK FOR OCCA

Business computer systems, from the mainframe to the early days of distributed computing, had simple goals: To reduce costs or to increase productivity. As computer technology began to put the power of mainframes on people's desks, computers were seen as the means to re-engineer a business.

Today, as companies seek to differentiate themselves in highly competitive and commoditized markets, their goal is to establish strong, enduring relationships with customers. These relationships are based on knowledge of customer needs and expectations, and improved service in response to them. AT&T's business strategy is to provide information technology solutions that help customers better understand and serve their customers. Potential benefits of these solutions include increased revenue, increased market share, and greater profitability. Here are a few examples of how AT&T customers are using systems to strengthen and grow their businesses.

☐ Leveraging information. A major retailer has created an on-line network that includes all its widespread stores and its suppliers. By collecting and processing daily sales data from its stores, the retailer can identify and monitor customer buying patterns, coordinate product mix and develop display and pricing strategies. The

**Middleware is software that runs between an application program and lower-level system resources.**

### MIDDLEWARE

There are three main classes of middleware:

☐ Core distributed computing services;

☐ Information middleware, which supports transaction processing and information gathering and analysis, and

☐ Evolving collaboration services, which allow workgroup, whole enterprise and global levels of information sharing and collaboration.

To support new technologies like multimedia, all three areas must be enhanced. The resulting middleware will allow it to handle new multimedia interactive operations providing ever better customer-focused solutions. OCCA, the information architecture model, and other OCCA-related information is a solid foundation from which today's open distributed systems can evolve into new services and new solutions.

That foundation offers two major benefits to customers: It will protect their current system investments while, at the same time, accommodating the infusion of new technology at a rate that keeps pace with business needs.

suppliers actively participate in inventory management and, therefore, know when to prepare products for delivery and when to deliver them.

☐ Empowering the enterprise. A Midwestern bank is building an integrated delivery system so that customer-service representatives at all branches can access a common customer information file. It contains up-to-the-minute customer financial information and bank product information. The bank can respond to a customer's specific needs by connecting its product experts with the customer via interactive video call centers.

☐ Re-engineering the business. A major insurance company is replacing outdated assembly line procedures with automated workflow operations. A major result: employees can now collaborate and share data throughout the organization. Productivity is enhanced as well, and the new systems provide top-notch customer service.

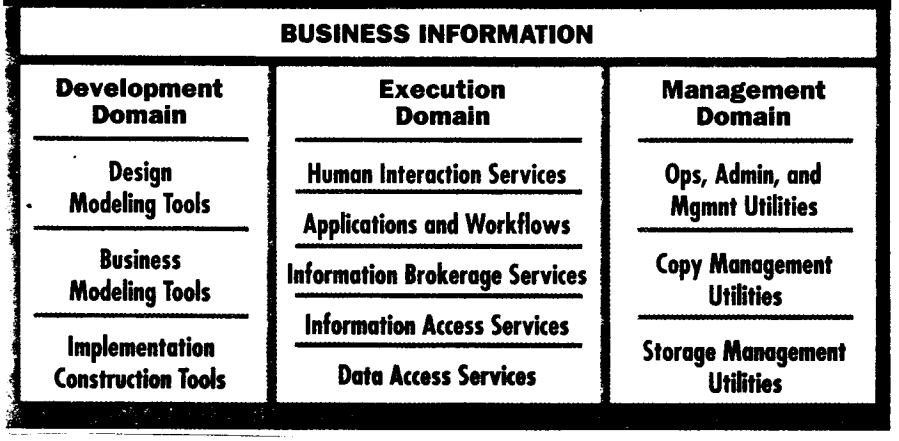
AT&T is now developing an information architecture model based on OCCA, which will emphasize the critical role of middleware. The model will provide customers with the basis for planning, designing and specifying a distributed information processing system. In addition, it is an incremental architecture; that is, it is compatible with components of the existing system technology while being open to the systematic integration of new technology.

Together, OCCA and the information architecture model will define the middleware services for distributed computing. Architecture for collaborative services, the melding of communications and computing, also is under development.

Virtual meeting services, for example, will allow the computing communications environment to facilitate meetings among many people. The system will set up the call, synchronize video and audio transmission and store meeting information. It will also maintain connections, allowing people to join a meeting, leave it and rejoin it at any time without disrupting the meeting in any way.

**FIGURE 3: INFORMATION ARCHITECTURE MODEL**

**This model describes the information processing technology required to develop, access and manage enterprise data. The four primary areas are the business information directory and the development, execution and management domains.**




## THE OCCA INFORMATION ARCHITECTURE MODEL

The information architecture model, which describes the information processing technology needed to develop, access and manage enterprise data, has four areas: (See Figure 3.)

☐ The business information directory provides storage and access facilities for enterprise directory data. Essentially it includes name, location, and a description of the components of the computing environment. All enterprise locations have access to the information business directory.

☐ The development domain provides tools for modeling, designing and building customer information systems. Tools include business, process and data modeling and application construction tools. The goal of the development domain is to transform the business model into software that automates the business processes revolving around customer information systems.

☐ The execution domain provides an operation run-time environment that contains services for human interaction, information access and data access. These services enable applications and workflows to transparently access heterogeneous systems, databases and file systems.

☐ The management domain provides utilities for operations, administration and management of the elements in the information architecture components. It includes copy management utilities to manage data movement between distribution points in the enterprise from any operational system.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