MITSUBISHI ELECTRIC ITA
HORIZON SYSTEMS LABORATORY

TECHNOLOGY AT A GLANCE

CONCORDIA - - JAVA MOBILE AGENT TECHNOLOGY

Q: What is Concordia?
A: Concordia is a full-featured framework for the development and management of network-efficient mobile agent applications which extend to any device supporting Java. Concordia is written in Java and is portable to any platform running Java.

A Concordia System, at its simplest, is made up of a Java Virtual Machine (VM), a Concordia Server, and at least one mobile agent on 1 network node. Usually, the Concordia System will consist of multiple machines in a local or wide area network, each of which is running Java VMs, Concordia Servers, and mobile agents.

The Java VM can be on almost any machine; essentially, it is a standard environment available for most platforms.

The Concordia Server is a Java program which runs in the Java VM on machines in the network where mobile agents may need to travel. The Concordia Server is responsible for providing all Concordia functionality on a given machine. The Concordia Server manages the life cycle of the agent. It provides for agent creation and destruction, and provides an environment in which the mobile agent executes.

The mobile agent is a Java program. The Concordia Server manages the mobile agent, including the mobile agent's code, data, and movement. The mobile agent is a mobile component of the Application Program.

Q: What are Concordia mobile agents?
A: Concordia mobile agents are Java Objects. Concordia mobile agents are a powerful and fundamentally new way to program distributed applications. Mobile Agents overcome inherent limitations of client/server architecture. In a Concordia mobile agent solution, the flow of control actually moves around a network; unlike the request/response architecture of client/server. In effect, every node is a server and the agent (program) moves to the location where it may find the services it needs to run at each point in its execution. For example, a mobile agent can travel to multiple databases located at different nodes, search the database locally at each node, and then carry the results back to the user.

Q: What are Concordia's Components?

- The **Agent Manager** provides the communications infrastructure that allows for agents to travel. It abstracts the network interface so that agent programmers do not need network specifics or programming interfaces.

- The **Security Manager** protects resources and ensures the security and integrity of mobile agents and their data. Concordia security can be configured via a graphical user interface.

- The **Persistence Manager** maintains the state of mobile agents and objects in transit around the network. It makes it possible to restart mobile agents in the event of a server failure and restart.

- The **Inter-Agent Communication Manager** handles the registration, posting and notification of events to and from mobile agents. It provides for multicast events (send events to multiple recipients) and is distributed such that the sender and receiver of an event need not be on the same machine. Also, the Inter-Agent Communication Manager provides an infrastructure which allows the mobile agents to collaborate (i.e. synchronize and share data with each other).

- The **Queue Manager** is responsible for the scheduling and guaranteed delivery of mobile agents between Concordia servers. It provides for reliable transmission in an unreliable network.

- The **Directory Manager** provides a name service for applications and agents. It allows agents to find services in the network.

- The **Administration Manager** provides remote administration of Concordia. Only one Administration Manager is required in the Concordia System. The Administration Manager supports simultaneous, central administration of multiple servers. The Administration Manager has a user interface component which is its primary means of use.

- The **Agent Tool Library** is the set of development tools provided by Concordia. This includes all Concordia APIs (Administration APIs, Lightweight Agent Transport APIs, Service Bridge API, etc.) and agent classes needed to develop Concordia mobile agents.

Q: What are the main features of Concordia?
A: Following are some of the features provided by Concordia.

- Concordia employs existing **TCP/IP communications services**. Concordia does not impose a protocol or distributed computing service of its own.

- **Advanced management functions** allows thousands of mobile agents to run on a single workstation. Concordia administration can start, stop, suspend, and resume Concordia Servers; view, stop, suspend, and resume agents at a Concordia Server; create, modify, delete users and/or permissions; upgrade and install Concordia Servers, monitor Concordia Server performance, and manage the components.

- **Collaboration** provides a number of benefits, such as enabling parallel operation over multiple servers or multiple networks. Using collaboration, an application can divide a task into subtask, the subtask can be carried out in the most appropriate places. The results of these sub-tasks are then assembled by the collaboration framework. A decision is made based upon the results, which can be used to determine destination, action, or other appropriate behavior.

- The **Service Bridge** allows a developer to add services to a Concordia Server. Service Bridges may be managed remotely via the Concordia Administration Manager. For example, you can provide access to an application-specific service so the service does not need to travel with the mobile agent . The Service Bridge also provides a way out of the Virtual Machine to the outside world.

- **Persistence and Queuing** provides for automatic retries of agent transmission and queue storage recovery in case of server and/or network failures. These 2 features also provides for load balancing when machines in a network provide different response time and the order of execution is important.

- The **Itinerary** specifies where a mobile agent travels. It provides a method to allow destinations to be added or removed either by the application, mobile agent or the Concordia Administration.

- **Service Naming** is a name service for applications and agents. In an environment where information is dynamic (i.e. the internet), this provides an easy way to establish a list of locations where services reside.

- The **Concordia Security Structure** unlike most agent systems provides security based on the rights of the user of the applications - not the permissions given by the developer of the application. This provides for more control of which files, databases, resources, etc., are available to a specific end user. In addition , the security system protects resources from access by unauthorized mobile agents and protects mobile agents from being tampered with by unauthorized users.

- The **Lightweight Agent Transporter API** allows the developer to embed within a client application the ability to receive, execute, and launch Concordia Agents. The application can receive notifications from the mobile agent and can directly interact with mobile agent.

- **Encryption** is not technically a part of the Security Manager - - we provide you with an option: Concordia can provide Encryption as a security measure or the developer can plug in their own encryption scheme.

Q: How Can Concordia Benefit My Application?
A: Concordia mobile agents can be used to develop new applications, as well as, to enhance existing applications and frameworks. Mobile agents can support off-line processing and disconnected operation. By using Concordia, the applications can be developed without special knowledge of underlying network communications. Concordia both hides the details from the programmer and user, as well as allows the mobile agent to adapt to its environment and administration. Concordia mobile agents provide security and reliability without requiring the programmer to write additional code.

Listed below is a sample of application functions and categories that can profit from implementing Concordia mobile agents.

- Applications that access multiple databases/sites in dynamic environment(i.e. locations and addresses of services/information is continually changing)
- Enabling legacy applications that need to be accessible to mobile workers (i.e. provide inventory information or Contact information to a mobile sales force)
- Integrate with distributed objects e.g. CORBA (i.e. providing Business-Business interfaces for Electronic Commerce)
- Enabling Applications to accept a query, process that query without active interface with the user, and then provide notification to the user when completed (i.e. Disconnected Computing)
- Enable applications with network latency issues to process data locally on the network and report the results (i.e. wireless communication to client devices with small footprints)

- To provide Cross platform operability (i.e. applications that need to access/deliver information via a combination of laptops, PDAs, smartphones, windows, Macs, Email, Voicemail, Pager, or FAX)
- To monitor Network nodes and report results or take action without continue polling (i.e. Network Monitoring Applications)

Q: What Business Opportunities does Concordia provide?
A: Among the many opportunities Concordia mobile agent technology provides are the following 3 opportunities sought by every business venture.

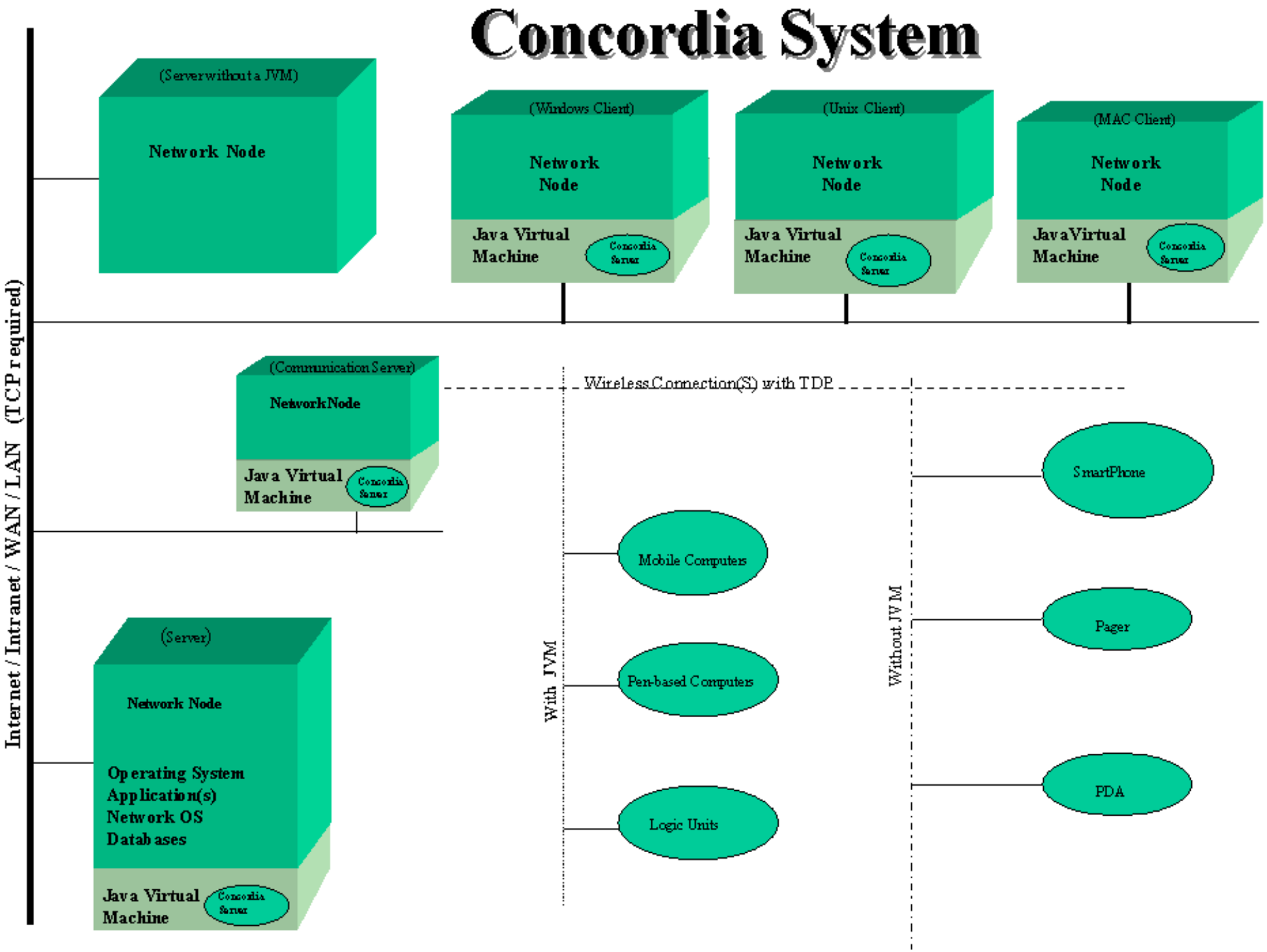
- Extend the lifecycle of existing applications and products by providing new capabilities (i.e. Internet/Intranet Access, Mobile Computing Features, Disconnected Computing Capabilities, etc.)
- Decrease the cost of development, time to market, and support for new applications that would be developed using client/server architecture in the past.
- New revenue source by providing mobile agent enabled solutions without investments in expensive and scarce resources (i.e. developers with mobile agent experience, non-standard development tools).

We hope this quick glance helps to position Concordia to you clearly. If you have other questions, please contact us at (408) 523-6843.

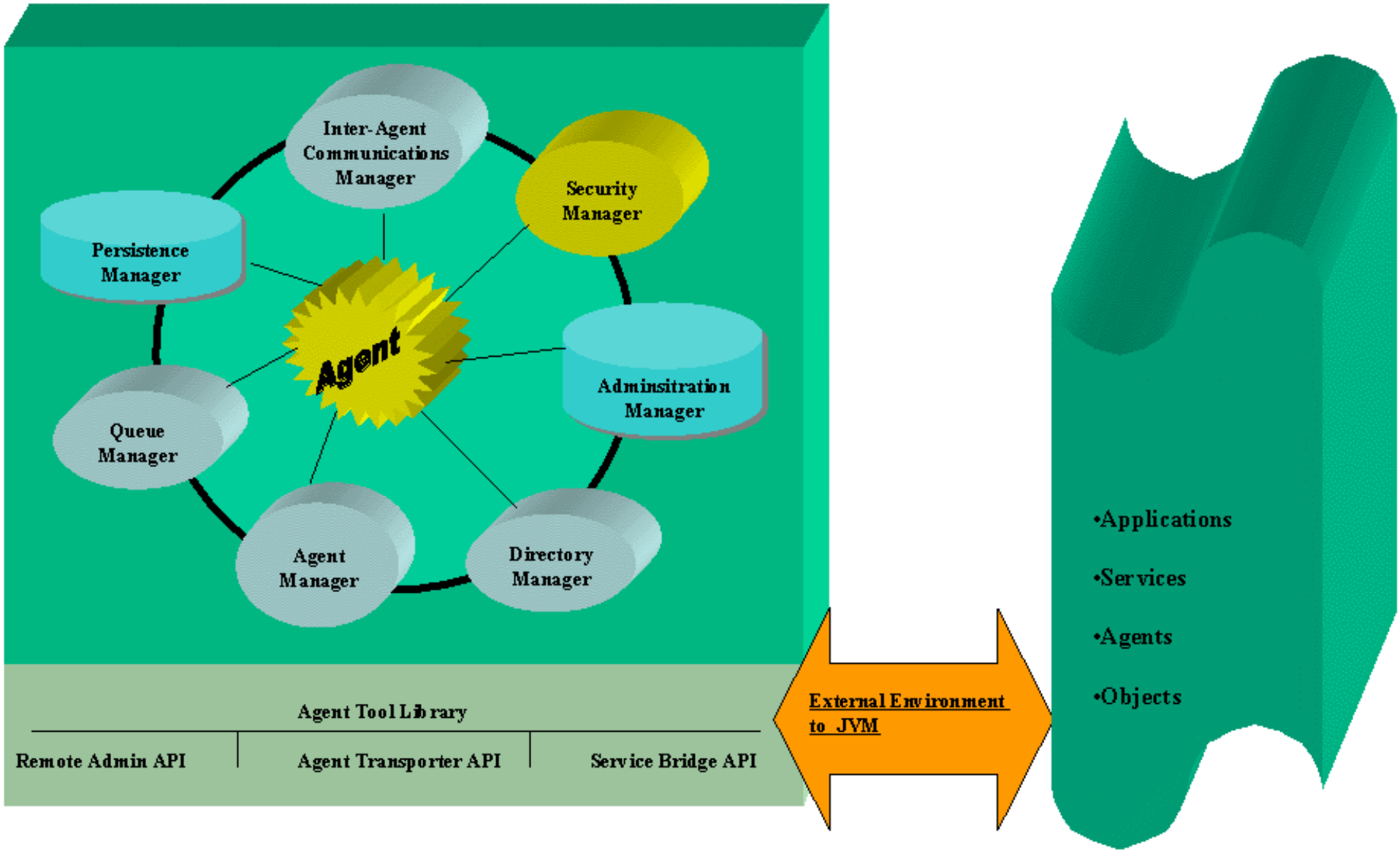
Or, visit our website: **http://www.meitca.com/HSL/Projects/Concordia/.**

To obtain :

- Whitepapers, Conference Papers , Data sheet, Contact Information
- A Free 30 Day Evaluation Kit (Available 10/30)
- License Information and Purchase Instructions (Available 10/30)
- List of Concordia Business Partners, Press Releases and Application Scenarios (Available 10/30)


Concordia System
(Server without a JVM)
Network Node
(Windows Client)
Network Node
Java Virtual Machine
Concordia Server
(Unix Client)
Network Node
Java Virtual Machine
Concordia Server
(MAC Client)
Network Node
Java Virtual Machine
Concordia Server
Internet / Intranet / WAN / LAN (TCP required)
(Communication Server)
Network Node
Java Virtual Machine
Concordia Server
Wireless Connection(S) with TDP
With JVM
Mobile Computers
Pen-based Computers
Logic Units
Without JVM
SmartPhone
Pager
PDA
(Server)
Network Node
Operating System
Application(s)
Network OS
Databases
Java Virtual Machine
Concordia Server

Concordia Server



Concordia Mobile Agent

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Application Code

Provided by Application Developer

Data

Associated with the Concordia Mobile Agent & the Application

JAVA Code and Classes

Provides interface to the Concordia Server