

# Web Enabling Architectures For e-server iSeries

EP11

ITSO iSeries Technical Forum

Randy Ruhlow



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## Web Enabling Architectures for e-server iSeries Forum



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  - ▶ Customer Solution 2 - Mohawk Industries
  - ▶ Customer Solution 3 - Renaissance Cruises
- ▲ More About Custom Technology Center
- ▲ References

# Who Am I



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## ▲ Custom Technology Center

- ▶ US - Rochester 1996-2001
- ▶ EMEA - La Gaude, France 2001-present

## ▲ Provide Services for Architecting - Designing - Developing Custom Applications

- ▶ iSeries Business Partners
- ▶ iSeries Customers
- ▶ IBM Internal Customers

## ▲ Skilled in

- ▶ VisualAge Java
- ▶ WebSphere iSeries, NT
- ▶ Rational Rose Professional J edition
- ▶ UML
- ▶ C, C++
- ▶ Web enabling iSeries applications
- ▶ Integrating iSeries applications with new technologies

# General Architectures

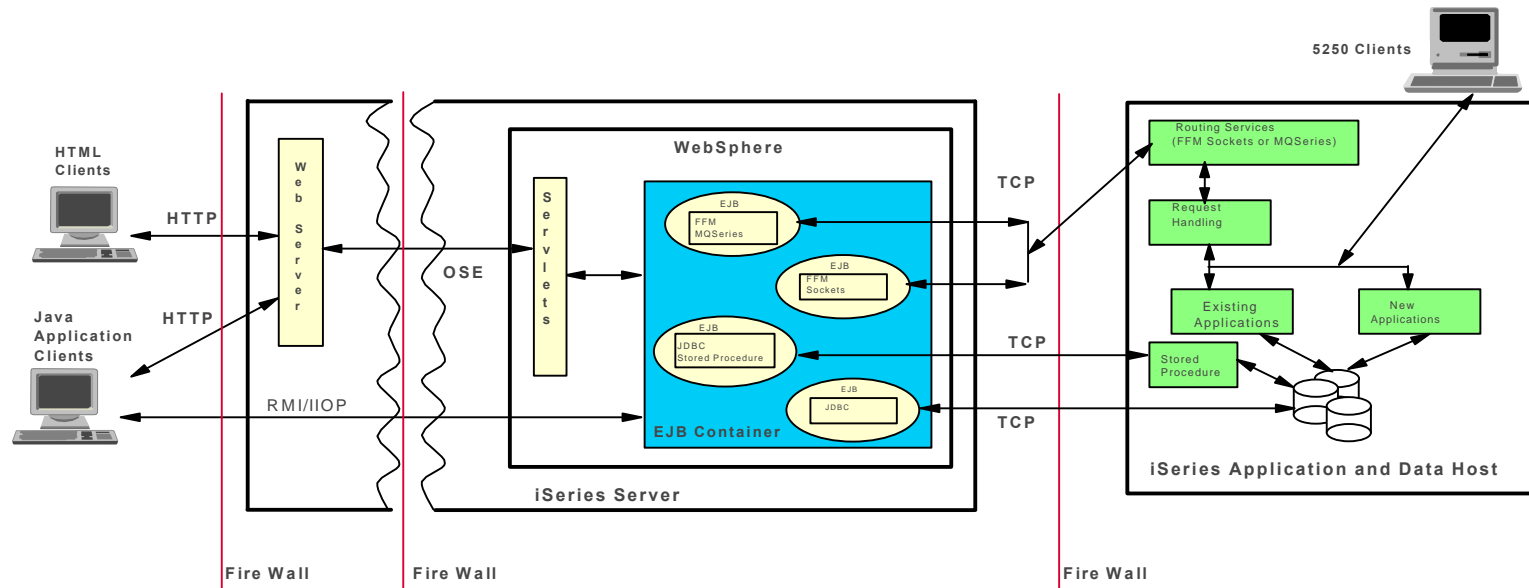


- ▲ All architectures developed for iSeries solutions in this presentation have been based on IBM's Application Framework for e-business. The Application Framework for e-business uses industry standards, to build platform independent applications for e-business.
- ▲ Many n-tier solutions have been developed for the iSeries where the client is web based, the application servers and host servers are iSeries based, and the host servers utilize existing data and applications. Some of these solutions are completely portable in that the application server code, written in Java does not utilize any iSeries specific technologies or APIs. The connectivity between application servers and host servers takes advantage of industry standards and cross platform technologies such as RMI, Sockets and MQSeries.
- ▲ However, some customers are less concerned about portability and still have the requirement to extend or leverage new or existing applications and data on iSeries systems to the web. For this type of customer set, the solutions, where necessary, extend the framework to take advantage of iSeries specific tools and technologies such as the AS/400 Toolbox for Java and FFM technology developed by CTC.

# General Architectures EJB Model



## iSeries Server Web / e-Business Enabling Model - EJBs



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## General Architectures EJB Model



### ▲ Logical 3+ Tier

- ▶ Web Client - HTML, XML
- ▶ Java Client
- ▶ Application Server - WebSphere Application Server
  - provides Enterprise Java Server for EJBs
  - provides Servlet environment
- ▶ Host server (data server) - iSeries servers

### ▲ Java Based Architecture

- ▶ EJB based

### ▲ Data Access

- ▶ Java Data Base Connectivity
- ▶ SQL
- ▶ Stored Procedures

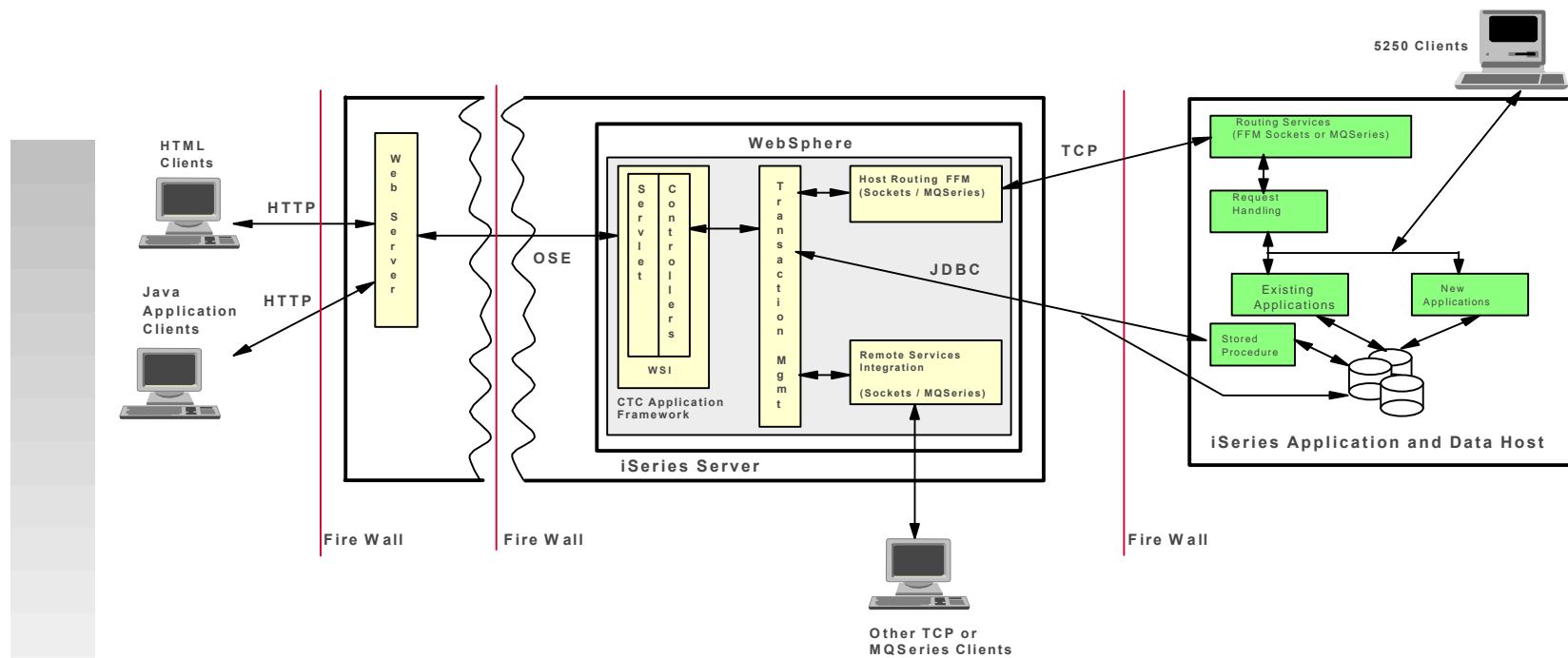
### ▲ Existing/New Application Access

- ▶ Socket - FFM technology
- ▶ MQ Series - not shown
- ▶ Stored Procedures - existing pgms converted

# General Architectures CTC Framework Model



## iSeries Server Web / e-Business Enabling Model - CTC Web Enablement Framework



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# General Architectures CTC Framework Model



## ▲ Logical 3+ Tier

- ▶ Web Client - HTML, XML
- ▶ Java Client
- ▶ Application Server - WebSphere Application Server
  - provides Servlet environment
- ▶ Host server (data server) - iSeries servers

## ▲ Existing/New Application Access

- ▶ Socket - FFM technology
- ▶ MQ Series - not shown
- ▶ Stored Procedures - existing pgms converted

## ▲ Java Based Architecture

- ▶ CTC Web Enablement Framework
  - pre-built components
  - Transaction Services
  - Presentation Services
  - Host Routing Services
  - Remote Integration Services

## ▲ Data Access

- ▶ Java Data Base Connectivity
- ▶ SQL
- ▶ Stored Procedures

## *Customer Solutions*



- ▲ Landsafe Credit - Java Server Application with Web and Electronic Data Interchange interfaces
- ▲ Mohawk Carpets - Java Servlet based with Web interfaces on an intranet
- ▲ Renaissance Cruises - Java Servlet intranet/internet based web application w/MQSeries

# *Landsafe Introduction*



- ▲ LandSafe Credit, Inc. division of Countrywide Credit Industries, Inc.
- ▲ Based in the Los Angeles area of California USA
- ▲ Provides Credit reports to Countrywide branch offices and other lending institutions
- ▲ Known for providing revolutionary processes in the mortgage lending industry
- ▲ Developed the Merged Credit Report concept

## *Landsafe Technologies and Tools Employed*



▲ Java

▲ IBM HTTP Server

▲ VisualAge for Java

▲ Sockets

▲ HTML, JavaScript

▲ Java DataBase Connectivity (JDBC)

▲ ILE C for CGI program

▲ IBM DB2 Universal Database

# *Landsafe Current Process*



▲ When an initial request for a credit report was made, the information was entered into the Landsafe CCRS system which communicated via ASC X12 Electronic Data Interchange standard to a third party vendor who submitted the requests to Equifax, Experian and Trans Union credit bureaus. The credit information received from the credit bureaus was collected and manually merged together. The final report delivered to Landsafe was more thoroughly scrubbed and sent to the requester. The requests and responses were sent and received over socket connections. This process could take two to five days, sometimes longer if there was a problem with any of the credit history data.

## ▲ X12 Message Standards Used:

- ▶ Mortgage Credit Report Transaction Set 200
- ▶ Application Advice Transaction Set 824
- ▶ Mortgage Credit Report Order Transaction Set 833
- ▶ Text Message Transaction Set 864

▲ At each stage of processing, the data had to be stored before and after any manipulation for close auditing and legal purposes.

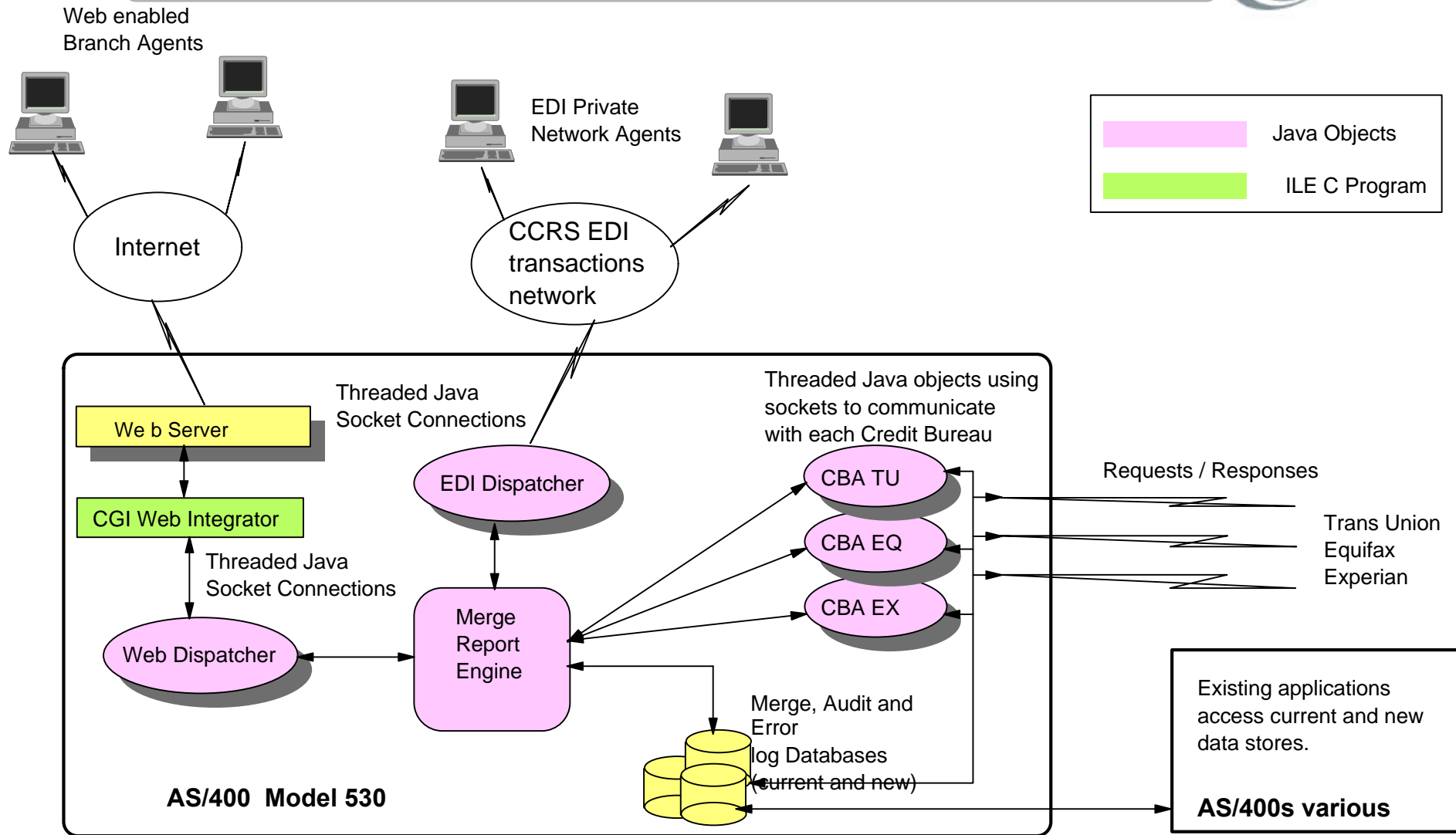
▲ Data Centric processing. Data is the core asset of Landsafe.

# *Landsafe Business Requirements*



- ▲ Eliminate Third Party processing of data
- ▲ Automate the manual merging and scrubbing of data
- ▲ Create a highly accurate and efficient Merged Credit Report
  - ▶ Current process is error prone and highly inefficient
- ▲ Create a web user interface for accessibility to branches from the Internet
- ▲ Create Data Mining capabilities from information collected
- ▲ Continue Electronic Data Interchange interface into the application
- ▲ Provide 24/7 365 days availability
- ▲ Create a foundation for future web applications and pervasive computing devices
- ▲ C++ or Java based
  - ▶ RPG skills hard to find

# Landsafe Solution: Simple Application Diagram

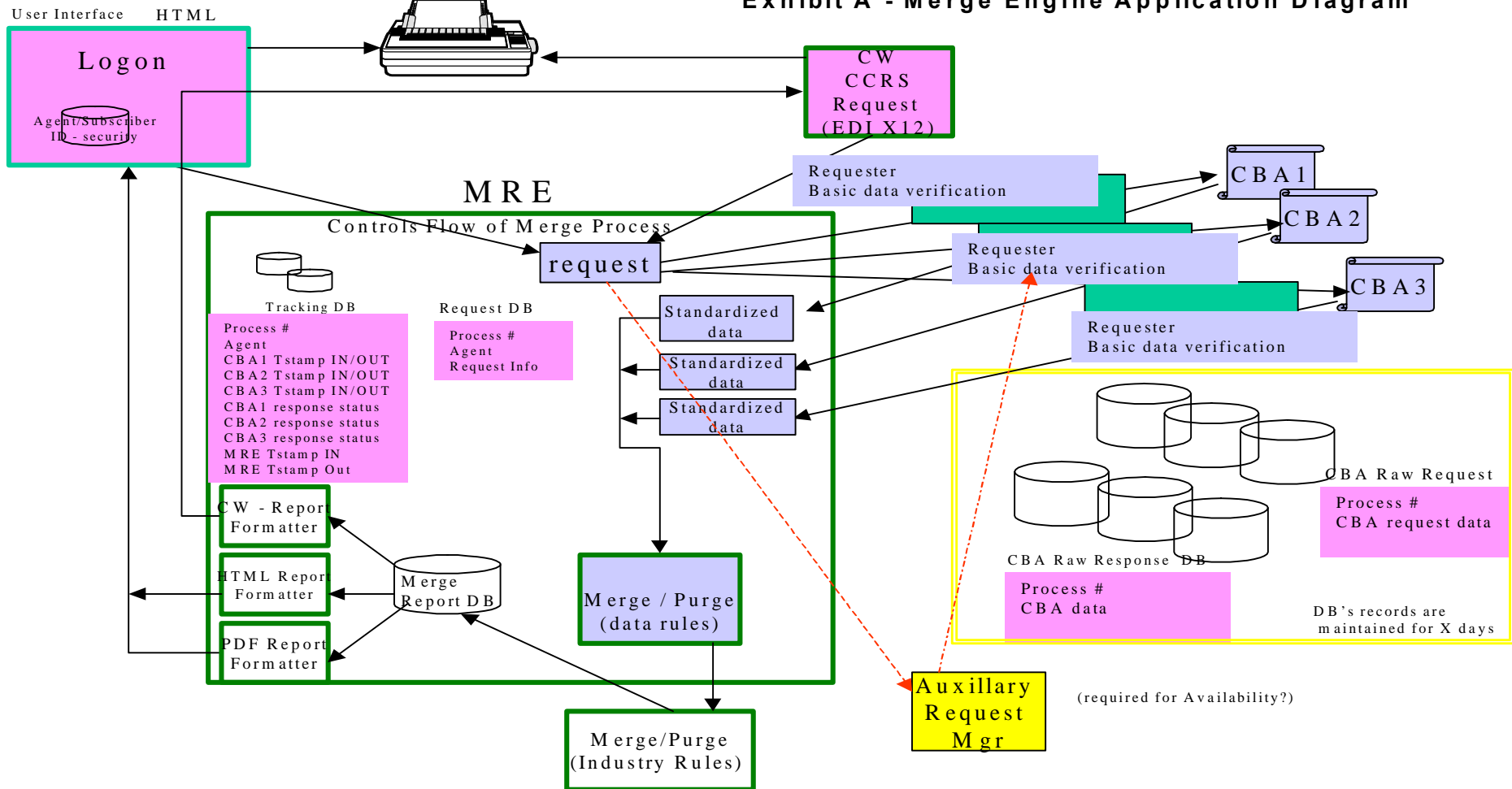


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# Landsafe Solution: Detail Application Diagram



Exhibit A - Merge Engine Application Diagram



# Landsafe Summary



- ▲ Incorporated Data Mirroring and Dual sites for 24/7 365 days
- ▲ Development effort took 6 months
- ▲ One ILE C - CGI program
  - ▶ Servlet support just GA'd at time of design - too high of risk
  - ▶ CGI is passive processing, just provides hook into Java application
  - ▶ HTML presentation generated by Java classes delivered via CGI and Web Server
- ▲ Application 100% native Java - no AS/400 specific classes used
- ▲ Over 250 classes used to implement application
- ▲ Contains custom
  - ▶ Database connection pooling and monitoring
  - ▶ Socket connection caching and monitoring
- ▲ Used current Database store which allowed existing Apps to run
- ▲ Created new Database store for data not previously available
- ▲ Average response time well within customer's requirements
  - ▶ One request spawns 3 threads to send and receive responses from each credit bureau
  - ▶ Each response can range from 40k -200k of information
  - ▶ Application standardizes each response, removes duplicate information and merges the data
  - ▶ Avg. response time: 6 -10 seconds
  - ▶ Previous time for a request to be processed: 2 -5 days
  - ▶ Estimated Return On Investment (ROI): 3 - 4 months
  - ▶ Target: 40,000 request a day

# *Mohawk Carpet Introduction*



- ▲ Mohawk Industries
- ▲ Based out of Calhoun, Georgia USA
- ▲ One of the top leaders in the carpet industries

## *Mohawk Technologies and Tools Employed*



▲ Java

▲ IBM Web Server

▲ VisualAge for Java

▲ IBM WebSphere Application Server

▲ Servlets

▲ JSPs, JavaScript, HTML

▲ Java DataBase Connectivity (JDBC)

▲ AS/400 Toolbox for Java

▲ Program Calls

▲ IBM DB2 Universal Database

# Mohawk Carpet Current Process



- ▲ 5250 RPG application used by customer service center
  
- ▲ Retailers call Mohawk
  - ▶ Product Availability
  - ▶ Product Reservation
  - ▶ Order Placement
  - ▶ Order Status
  
- ▲ All activity handled by phone, mail and fax statements

# *Mohawk Carpet Business Requirements*

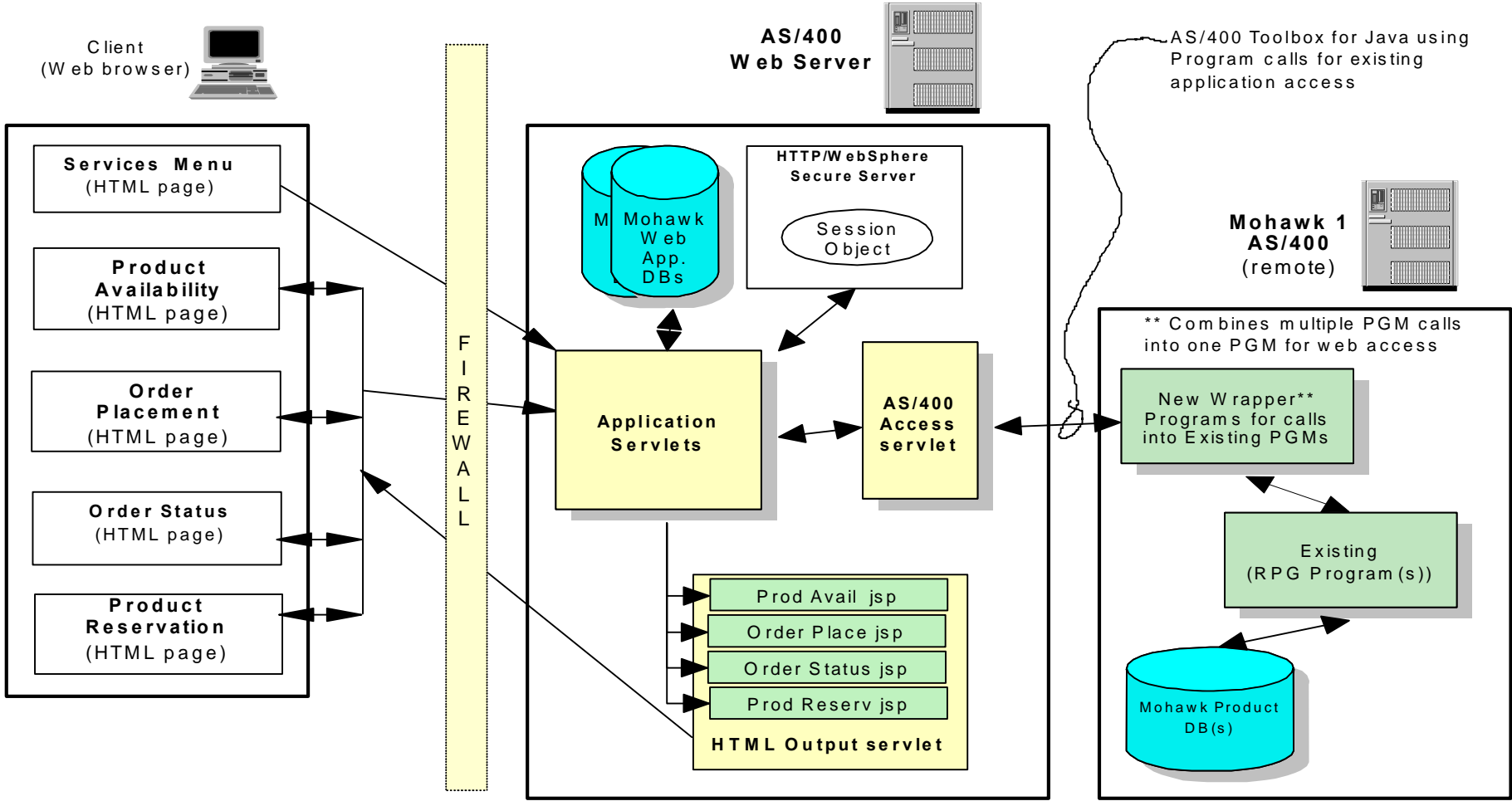


- ▲ To Web Enable existing RPG 5250 applications for
  - ▶ Order Placement
  - ▶ Order Status
  - ▶ Product Availability
  - ▶ Product Reservation
  
- ▲ Improve Customer Service through Automation and Availability
  
- ▲ Develop the system in time for industry trade show
  - ▶ Competitor promised to demonstrate similar web functionality

# Mohawk Carpet Solution Diagram



## Mohawk



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# Mohawk Carpet Summary



- ▲ Development effort took two months
  - ▶ Java and JSP development effort
  - ▶ Customer did all ILE programming efforts
  
- ▲ Minimal coding effort to integrate existing applications
  - ▶ Existing code base already modularized
  - ▶ Created ILE RPG wrapper pgms to minimize program calls from the application server
  
- ▲ Delivered LIVE not demo application at the trade industry show
  - ▶ Actually registered users to the application during the show
  - ▶ 3000 additional customers registered the following month
  
- ▲ Customer happy to reuse all existing code base

# *Renaissance Cruises Inc. Introduction*



- ▲ Travel Industry company based in Ft. Lauderdale Florida USA
- ▲ Passenger Cruise Lines and tour packages
- ▲ Utilizes both direct marketing and travel agencies for customers

## *Renaissance Technologies and Tools Employed*



- ▲ Java
- ▲ IBM Web Server
- ▲ VisualAge for Java
- ▲ IBM WebSphere Application Server
- ▲ Servlets
- ▲ JSPs, JavaScript, HTML
- ▲ Java DataBase Connectivity (JDBC)
- ▲ MQSeries for Java
- ▲ iSeries MQSeries
- ▲ Domino Web Server
- ▲ IBM DB2 Universal Database
- ▲ CTC's Web Enablement Framework
- ▲ CTC's Fixed Format Messaging

## *Renaissance Cruises Inc. Current Process*



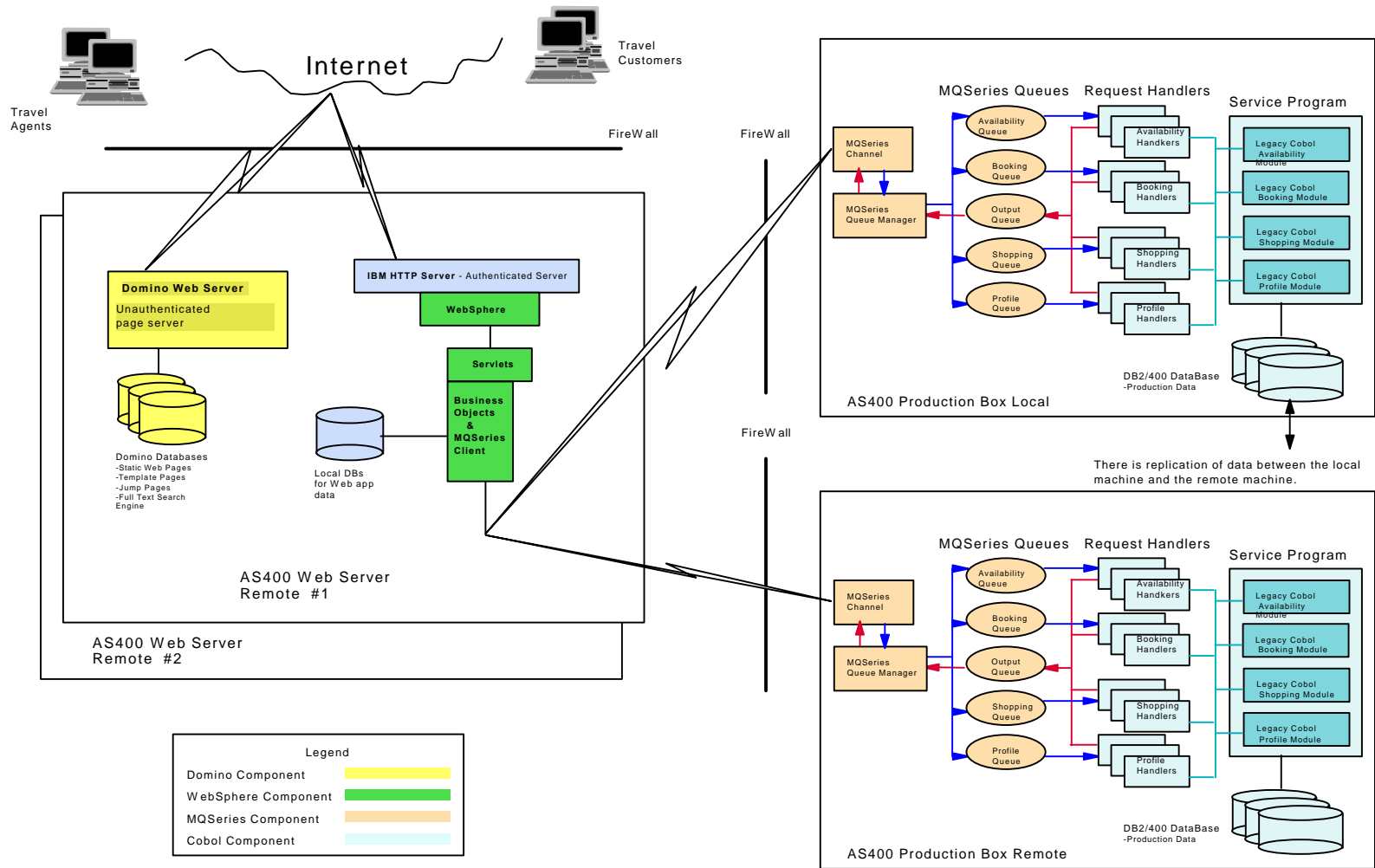
- ▲ Customer Service Center structure using 5250 COBOL applications with some internal web enabled applications provided by Host On Demand
  
- ▲ Travel Agents and Customers call Customer Service Center
  - ▶ To make travel queries
  - ▶ To book or cancel travel plans
  - ▶ To solve problems and collect all other travel information required
  
- ▲ Correspondence done by Phone, Fax, email, postal mail
  
- ▲ Domino servers currently used for email
  
- ▲ Basic web presence (no bookings) by NT servers

## *Renaissance Cruises Inc. Business Requirements*



- ▲ Be the first Cruise Lines to offer bookings over the web
- ▲ Utilize as much of the existing COBOL applications as possible
- ▲ Two second response time between Application Server and Host/Data server
  - ▶ This would ensure adequate response time to the end web user
- ▲ Secure Transactions for bookings
- ▲ Force a process flow throughout the booking process
- ▲ 24/7 365 days availability
- ▲ Provide a foundation for future enhancements and applications

# Renaissance Cruises Inc. Solution Diagram



# *Renaissance Cruises Inc. Summary*



- ▲ Created Integration Layer on Host data server
  - ▶ Consists of Request Handler ILE COBOL pgms to direct external requests to existing ILE COBOL pgms
  - ▶ Request Handlers communicate externally via MQSeries Queues
  - ▶ CTC's Fixed Format Messaging protocol and MQ API used to transmit messages and data
  
- ▲ CTC Web Enabling Framework provided
  - ▶ Middle tier transaction routing and processing
  - ▶ Presentation layer delivery and request routing
  
- ▲ Subsecond response times between application server and host data server
  
- ▲ System is averaging 35 transactions a minute during peak loads of 200 - 500 users
  
- ▲ First cruise line to offer bookings on the web without human intervention
  
- ▲ Created process flow on the web through tracking of web pages delivered vs. from what web page the request was submitted
  
- ▲ 24/7 365 days availability through dual sites and data mirroring

# Custom Technology Center CTC Mission



***The iSeries Technology Center ensures the successful development and deployment of key technologies for iSeries on a worldwide basis.***

## ***What CTC Has To Offer Business Partners and ISVs***

- Hands-on technical assistance to modernize (web enable) your AS/400 application
- Hands-on iSeries skills to assist in porting your application to the iSeries platform
- Access to iSeries skills and experience in new technologies to augment/assist your resources in providing services to your customers.

## ***CTC is a Source for "Hard to Find" AS/400 & iSeries Programming Skills***

- Experienced, "lab-honed" Resources for Opportunities
- Quicker Time to Delivery
- Proven Architectures/Programming Techniques
- Reusable Software Components

## ***WE have "Local" Access to Rochester Development Laboratory Knowledge***

- CTC Connections to Entire Lab Community
- CTC Resources Originate from the Lab

## ***Implementation of New Technology While Preserving AS/400 Investments***

# *Custom Technology Center CTC Offers*



## ***Custom Development Services Include:***

- Native e-Business Solutions using WebSphere, Servlets, JSPs, CGIs, HTML
- Modernizing Legacy Applications to Take Advantage of e-business Technologies (B2B)
- Native Java Programming
- Native Domino Solutions
- Native MQ Series
- Application Port Assistance
- Client/Server Development including Network Station
- Database Applications
- TCP/IP and Sockets Application Development
- Advanced Technology Implementation
- RPG, COBOL, ILE C Programming

## Custom Technology Center CTC Contacts



### Contacts Within the EMEA Geography

**General EMEA email: [CTCEMEA@fr.ibm.com](mailto:CTCEMEA@fr.ibm.com)**

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*John Stroh 33 (0)4 92 11 53 25 [jstroh@us.ibm.com](mailto:jstroh@us.ibm.com)*

*(Don't be fooled by John's US email, he resides in Nice, France)*

### Contacts Within the USA Geography

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*Pete Cornell 507-253-4955 [pcornell@us.ibm.com](mailto:pcornell@us.ibm.com)*

*Ray Harney 507-253-0920 [harney@us.ibm.com](mailto:harney@us.ibm.com)*

# References



▲ iSeries Java Reference accounts web page

▶ <http://www.as400.ibm.com/developer/java/solutions/jjem.html>

▲ Landsafe Case Study

▶ <http://www.as400.ibm.com/developer/java/solutions/landsafe.html>

▲ Mannheim Case Study - another CTC project

▶ <http://www.as400.ibm.com/developer/java/solutions/manheim.html>

▶ <http://www.manheim.com>

▲ Renaissance Cruises website - <http://www.renaissancecruises.com>

▲ Mohawk Industries Case Study

▶ <http://www2.software.ibm.com/casestudies/swcs.nsf/customername/82D231BAB00E2C2887256954003CB510>

# Notes



Randy Ruhlow has been a member of the Custom Technology Center, Rochester since 1996. He currently is on an international assignment to La Gaude, France to help in the start up of CTC EMEA.

IBM patterns for eBusiness website can be found at: <http://www-106.ibm.com/developerworks/patterns/>

The AS/400 Toolbox for Java page delivers the latest information specifically for iSeries 400.

Accredited Standards Committee (ASC) was organized to develop standards for electronic commerce. X12 is the set of standards that the Mortgage and Credit industries fall under. For more information about ASC X12: visit <http://www.x12.org>

Custom Technology Center Web Page [http://www-1.ibm.com/servers/eserver/iseries/service/welcome\\_3.htm](http://www-1.ibm.com/servers/eserver/iseries/service/welcome_3.htm)

The new IBM iSeries and AS/400 website can be found at <http://www-1.ibm.com/servers/eserver/iseries/>

IBM WebSphere Application Server for IBM® iSeries - <http://www-1.ibm.com/servers/eserver/iseries/software/websphere/wsappserver/>

MQSeries for IBM iSeries - <http://www-4.ibm.com/software/ts/mqseries/platforms/os400/>

AS/400 Information for Java - <http://publib.boulder.ibm.com/pubs/html/as400/ic2924/info/java/INDEX.HTM>

AS/400 Developer's kit for Java - <http://publib.boulder.ibm.com/pubs/html/as400/ic2924/info/java/rzaha/devkit.htm>

## Notes - Continued



AS/400 Toolbox for Java - <http://publib.boulder.ibm.com/pubs/html/as400/ic2924/info/java/rzahh/toolbox.htm>

AS/400 Developer Kit for Java JDBC Web Page - <http://www.as400.ibm.com/developer/jdbc/index.html>

Java for iSeries information can be found at - <http://www.as400.ibm.com/developer/java/index.html>

IBM developerWorks website provides access to the different web and e-Business enabling technologies  
<http://www-106.ibm.com/developerworks/?loc=089,t=nl>

VisualAge Developers Domain provides a place for VAJ developers to discuss, learn and exchange experiences  
<http://www7.software.ibm.com/vad.nsf/>

VisualAge for Java home site - <http://www-4.ibm.com/software/ad/vajava/>

Learn more about DB2 Universal Database for iSeries at <http://www-1.ibm.com/servers/eserver/series/db2/>

## Appendix 1 - CTC Framework (WEFW) OVERVIEW



Custom Technology Center's (CTC) Web Enablement Framework (WEFW) is a custom set of Java software components which provide web enabling services for existing applications and data residing on AS/400 - iSeries systems. Java based WEFW components provide a platform neutral mechanism for integration with AS/400 - iSeries systems. WEFW includes a customized communication messaging protocol, Fixed Format Messaging (FFM) that is DDS based and can be used over sockets or MQSeries. The FFM protocol is not exclusive to WEFW and data access can be obtained by various other technologies such as Java Database Connectivity (JDBC), Java Stored Procedures and Remote Procedure Calls (RPC).

The main components of the framework are:

Web Services Integration (WSI) - Provides a presentation layer set of components that allow the developer(s) of the web application to concentrate on writing the application and not so much on the coding efforts required to integrate with HTTP and the web. Included with this component are custom servlets and supporting objects designed to automatically call the proper Controller objects that correctly processes incoming requests. WSI can be loosely or tightly coupled to the Transaction Management Component depending on the Servlet used as the entry point into the application. A set of external configuration files are used to map the requests to the proper Controller. This component also provides a caching mechanism of the Controller objects so that object creation and heap size do not impact the performance of the application.

Transaction Management (TransMgmt) - Provides a built in mechanism for moving requests received from the WSI component into the proper Transaction and Application objects. Transaction objects identify the units of work and use Application objects to process the transactions with existing applications or data on remote application and data servers. This component may use but is not limited to the Host Routing component to communicate and pass message data to and from the remote AS/400 - iSeries systems. Other data access methods and technologies such as JDBC or RPCs can be utilized with extensions to the Transaction or Application objects. External configuration files provide the mapping of Transactions to Applications and Applications to the Host Routing mechanism. This component provides a pooling mechanism for the most commonly used resources for better application performance.

## Appendix 1 - CTC Framework (WEFW) OVERVIEW



Host Routing - Provides the underlying communications and messaging protocol with remote AS/400 - iSeries systems. It provides either Sockets or MQSeries communications and incorporates the FFM messaging protocol developed by CTC. The combination of FFM and Sockets or MQSeries provides a performance optimized messaging system specifically designed to receive and pass messages to AS/400 - iSeries systems. To accommodate communications on the remote AS/400 - iSeries systems, an external CTC Socket Server or MQSeries FFM asset is installed and incorporated in the web enablement solution. FFM uses DDS files to provide a common definition point for the development of the messages. The DDS files define the structure of the messages and is used to build the buffer structures in the ILE/OPM programs and to generate Java classes used in the Host Routing component. External configuration files are used to define the characteristics of the communications required for the application. The Host Routing objects are pooled for optimum performance and reuse of the system communication resources.

Remote Services Integration (RSI) - Provides other than web access to the same application code used for web enabling existing AS/400 - iSeries applications and data. This is done using the Host Routing components to provide either Sockets or MQSeries connectivity to the existing application code base. It is FFM base and provides the same benefits of the Host Routing component except it is not using the HTTP protocol and the HTTP Web Server for connectivity into the entry point of the application.

## Appendix 2 - CTC General Purpose Socket Server



### AS/400 TCP/IP General Purpose Socket Server II

The AS/400 TCP/IP General Purpose Socket Server (GPSS) offers performance, reliability and especially ease of implementation. This server has been in use since V3R1 and will migrate to future OS/400 releases. The GPSS is packaged as a standalone library with everything needed to get started. A complete Programming Guide is supplied. Support and consulting services are also available. The GPSS optionally includes File Format Messaging (FFM) capabilities and utilities to create associated Java classes for TCP/IP clients. All of the server's source code is supplied (ILE-C, CL, etc.). Finally, we offer a restricted version for initial evaluation purposes.

The server is comprised of two parts; a framework which handles normal TCP/IP server overhead functions and the middle-ware which provides the server's data exchange interfaces.

The server's framework specifically provides simple server startup and shutdown through OS/400 commands. It will listen and accept connections on any TCP/IP Port. Connection handling, and job submission are managed within this framework. Multiple instances of the GPSS may be in operation on unique TCP/IP Ports. There is a capability to select any specific local IP interface and the GPSS will handle both Transaction orientated and Session orientated server implementations.

The GPSS requires a user written server plug-in program, in any AS/400 high level language. This plug-in program must handle TCP/IP data traffic and the business logic. This program interfaces to the server's middle-ware through Socket APIs. Samples of such programs are supplied in RPG, COBOL and C. The server supports OPM and bound (ILE) calls to the Socket APIs, however ILE calls are highly recommended.

The Sockets implementation pitfalls that are commonly experienced by those that are not familiar with them, are all handled within the GPSS middle-ware. The plug-in program's Socket I/O looks similar to DB2 file or data queue I/O. A rich set of send and receive API options is provided that will handle most methods of data exchange over TCP/IP. ASCII/EBCDIC translation, is provided under the covers or is available through the middle-ware APIs. Also included is a powerful internal trace capability, a client IP Address retrieve capability, the Socket APIs that can be used to implement an AS/400 TCP/IP client application, and more.

## Appendix 2 - CTC General Purpose Socket Server



### Terms:

- OS/400 - V3R1 and above compatible.
- Y2K ready.
- Enterprise wide license.
- Source code shipped.
- Code is "as is" Type II material.
- A Programming Guide and operation manual is included.
- Support and consulting time will be billed hourly if needed.

### Available on the following AS/400 Media:

- E-mail attachment (Preferred and the fastest delivery method).
- CD-ROM.
- Tape media of your choice.

**Pricing:** Flexible plans through IBM Global Services or IBM Business Partners.  
Contact the Custom Technology Center.

**Contact:** IBM iSeries Custom Technology Center in La Gaude, France

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