Enterprise
Application
Integration

"A Tale of Two Factories"
A Manufacturing EAI Case History

fsc
Fuentez Systems Concepts

Middleway Plant

Tomorrow's Information Technology Solutions Today!
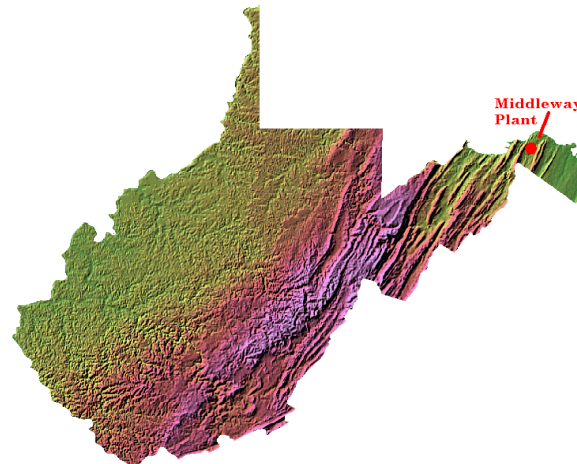
Competitive Edge Through Application Integration

Introduction

- **Jim Jennis**
    - ○ **Technical Director for Commercial Systems**
    - ○ **Fuentez Systems Concepts, Inc.**
    - ○ **(304) 263-0163 ext. 235**
    - ○ **jjennis@discovery.fuentez.com**
    - ○ **http://www.discovery.fuentez.com/**

What's this Project About?

- **Effectively managing Business and Technology changes through….**
  - ○ **The internet revolution...**
  - ○ **A global corporate integration followed by...**
  - ○ **A major spin-off and sale involving...**
  - ○ **3 separate companies,**
  - ○ **Vast differences in technology, business practices & corporate culture.**
  - ○ **20+ years of Legacy code & infrastructure….AND...**
  - ○ **Doing it all "right the first time!" -- Economically and with "zero downtime."….AND….**
  - ○ **Saving over $3,000,000 in the process!**

What are the Keys to Success?

- **No Rocket Science involved...**
  - ○ **Look for the "Renaissance people"**
  - ○ **Business & People…(not technology) are the drivers**
  - ○ **Experiment!!! Build small stuff that works and sells.**
  - ○ **Reserve the right to be "smarter tomorrow than you are today!" - Open Systems & Standards Approaches.**
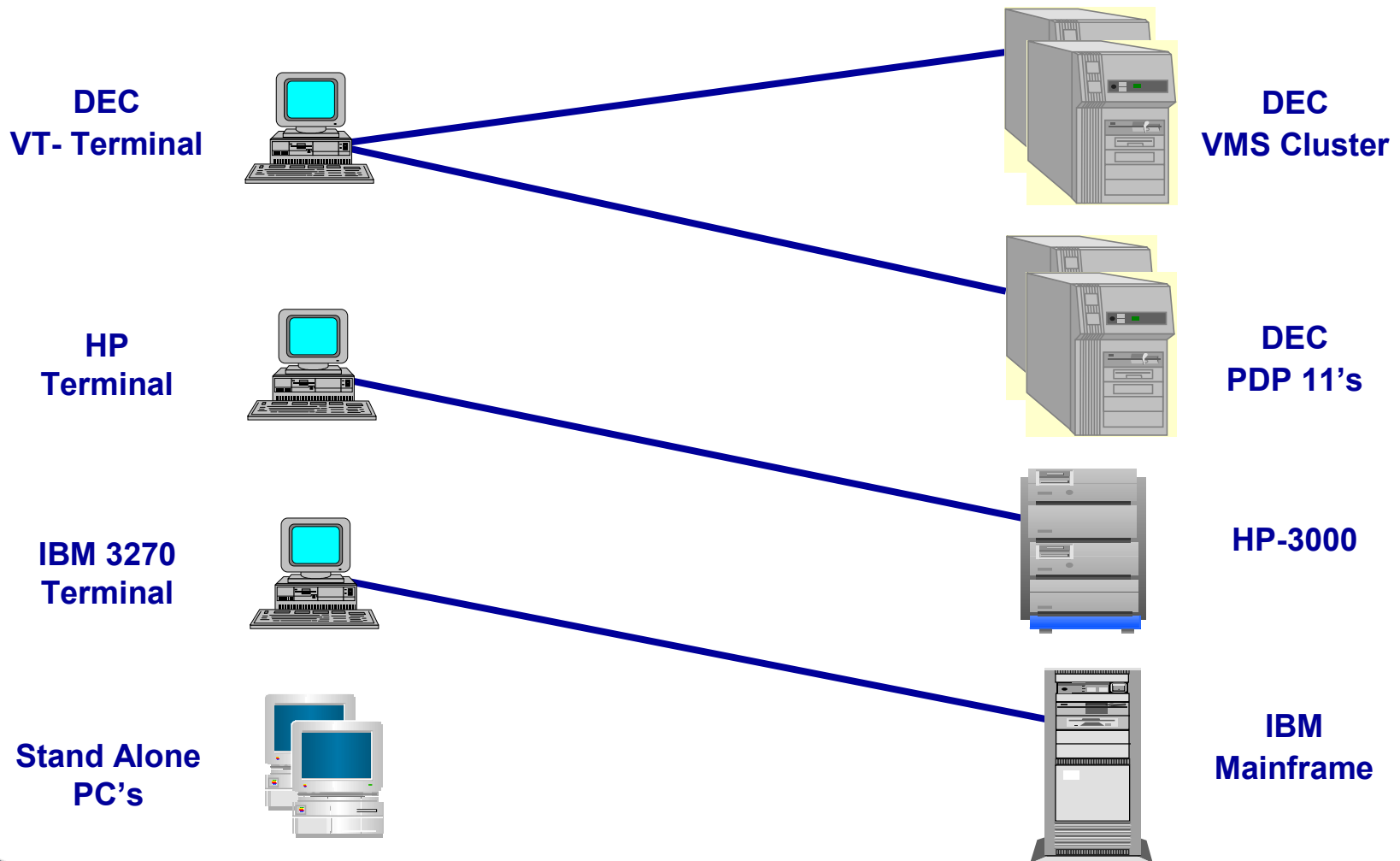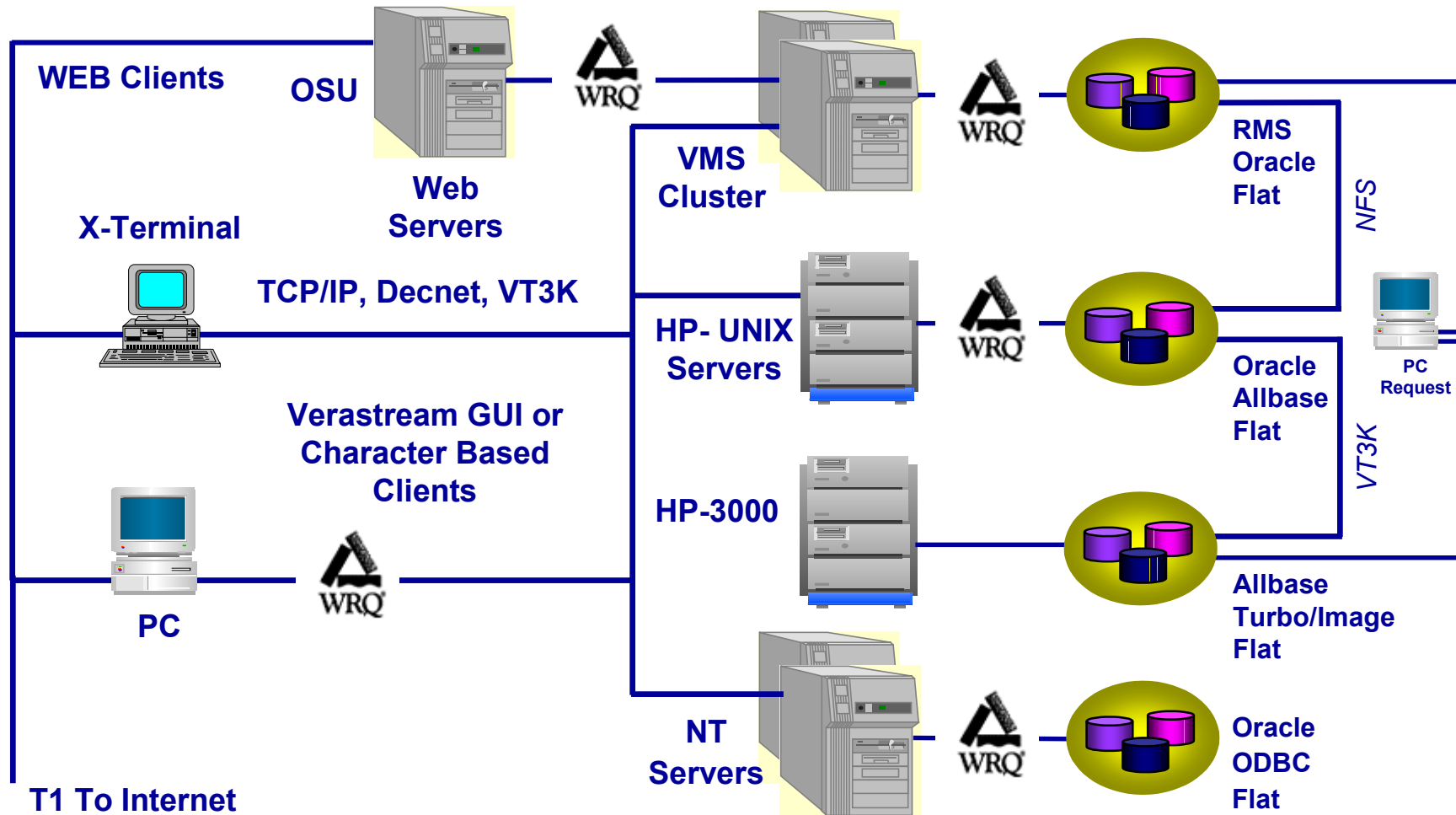
Global Middleway Milestones

- Plant opened by 3M 1961.
- Plant and corporate IT systems developed 1975 - 1995.
- Death by ISO-9000 (1992 - 1994).
- The DCE Decision (and it's aftermath) 1994.
- First major WEB/EAI project completed 1993 - 1996.
- Plant spun off from 3M to Imation 11/95.
- Second major WEB/EAI project completed 1997 - 1998.
- Plant offered for sale by Imation 4/98.
- Installed first Linux server into the factory 6/98.
- Began Verastream Linux beta test 9/98.
- Plant Sale to Spectratech International completed 12/98.
- Spectratech begins production operations 1/99.
- Installed Linux Production Servers & began Linux qualification 3/99.
- Complete Linux Qualification, Begin 3rd major EAI project 10/99.
- Live 5/2000!

Middleway Architecture: "The Good Ole Days" Circa 1992

DEC VT- Terminal

HP Terminal

IBM 3270 Terminal

Stand Alone PC's

DEC VMS Cluster

DEC PDP 11's

HP-3000

IBM Mainframe

Middleway Architecture 1998

WEB Clients

OSU

Web Servers

X-Terminal

TCP/IP, Decnet, VT3K

Verastream GUI or Character Based Clients

PC

T1 To Internet

VMS Cluster

HP- UNIX Servers

HP-3000

NT Servers

RMS Oracle Flat

Oracle Allbase Flat

Allbase Turbo/Image Flat

Oracle ODBC Flat
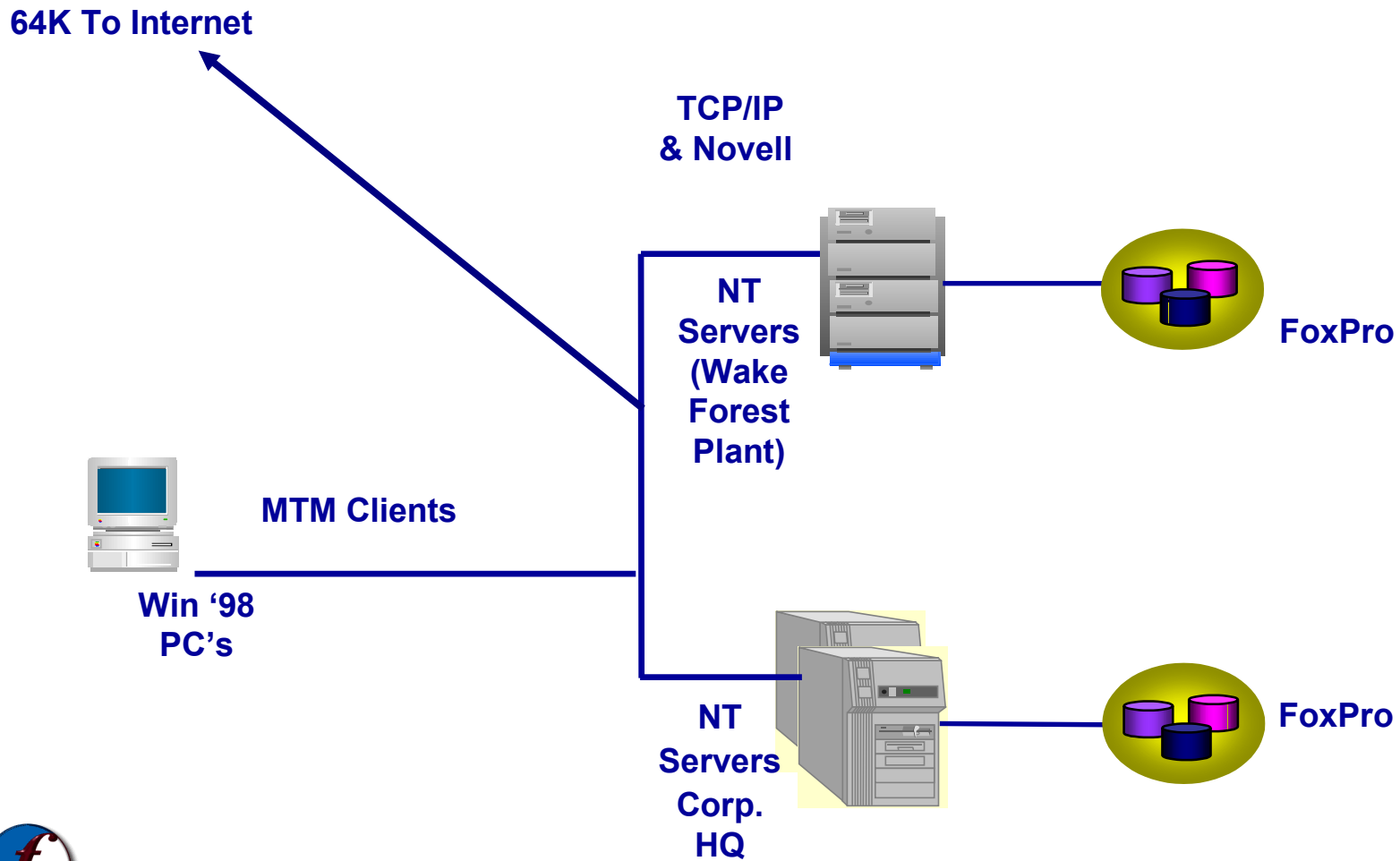
NFS

VT3K

PC Request

Cost/Benefit Analysis

Object/Middleware Solution (Verastream WEB Client) vs. Traditional Client/Server Implementation

Item	Cost Of Traditional Client/Server	Cost of Verastream WEB Solution	Savings
Tech Support Contract	$33,417	$6,800	$26,617
Database Licensing	$192,000	$32,000	$160,000
Hardware Upgrades	$250,000	$0	$250,000
Hardware Maintenance	$20,000	$0	$20,000
Application Development	$75,000	$10,000	$65,000
Application & DB Porting	$400,000	$100,000	$300,000
Client Software Licences	$20,000	$1,300	$18,700
Network Upgrades	$200,000	$0	$200,000
PC Client Upgrades	$40,000	$0	$40,000
Employee Training	$134,000	$2,200	$131,800
Estimated Lost Business	$650,000	$0	$650,000
Total Cost	$2,257,427	$189,300	$2,068,127

Spectratech/Southern Architecture 1998

64K To Internet

TCP/IP
& Novell

NT
Servers
(Wake
Forest
Plant)

FoxPro

MTM Clients

Win '98
PC's

NT
Servers
Corp.
HQ

FoxPro

Our Recommendations

- **Install T1 Link to Corp. HQ.**
- **Standardize on TCP/IP Phase out DECNET network.**
- **Phase out use of OpenVMS, HP-3000, HP-UX servers.**
- **Retain HP-UX workstations only as required.**
- **Use Verastream/Linux as the primary integration tools/technologies.**
- **Retain a mix of Xwindows & Windows 95/98/NT Clients.**
- **Retain existing Intellution FIXX/DMACS Process Control Packages running on NT.**
- **Phase out all other installed databases and use Corporate Standard FoxPro Database.**
- **Rearchitect Databases & Re-engineer Business Logic.**
- **Develop & Deploy new applications**

EAI Strategic Objectives

- **Provide the ability to access and integrate all business & technical information seamlessly between Middleway plant, other Spectratech/Southern Litho Plants and Corp HQ.**
  - ❍ **"Integration from the production floor to the customer's door"**
- **Port Data from existing to new FoxPro Databases**
- **Re-architect Database Schema to improve data flow and integrity and allow easy integration with Corporate MTM software.**
- **Consolidate business logic to improve data integrity and eliminate extra data validation.**
- **"Provide User Transparent" Database/System connectivity and reporting.**
- **Provide a more "user friendly" interface to all systems & applications.**
- **Taylor applications to the workflow of the business, its customers & employees.**
- **Build a scaleable architecture that can "grow with the business"**
  - ❍ **Support global standards easy transition between platforms/databases.**
- **Meet Corporate Security Standards while providing "Single Sign On" user authentication for all data access**
- **Design and architect a solution with CTI in mind.**

EAI Strategic Objectives

- **Maintain a standard of virtually 100% system availability while minimizing downtime required for any reengineering or porting**

- **Reduce application development and maintenance cost/workload/complexity where possible by consolidating programming languages and tools.**

- **Minimize costs (Hardware/Software/Infrastructure)**

Why Verastream?

- **A superior product that provided a complete solution that addressed all major concerns**
  - **Performance**
  - **Flexibility**
  - **Scalability**
  - **Transparent Cross Platform/Cross Database support using Powerful N-tier architecture**
  - **Dynamic Application Partitioning & Fault Tolerance**
  - **Rapid Application Development and Ease of Maintenance**
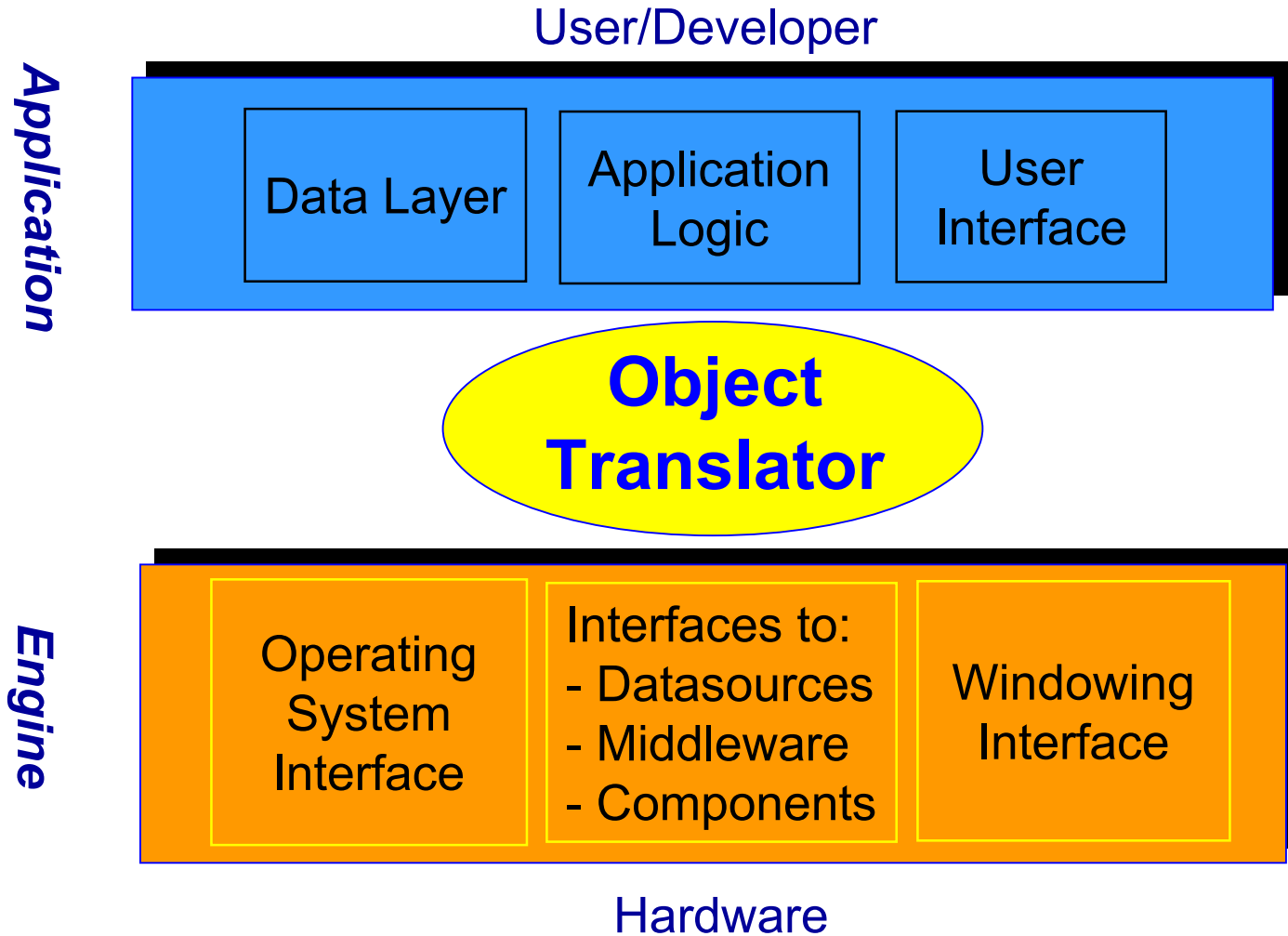 - **It functioned "As Advertised"**

Verastream's Unparalleled Support

- **Verastream supported all critical needs identified**
  - **Platforms   - OpenVMS, UNIX, NT (as well as many others)**
  - **Databases - Oracle, RMS, Allbase, Cobal, ODBC, Flat ASCII (as well as many others)**
  - **Interfaces   - WEB, GUI (Windows/Motif) Character based**
  - **Networks   - TCP/IP, Decnet, Novell, NetBios, NFS**
  - **Popular TP Monitors**
- **Platform independent development tool set**
- **Fully Object Oriented language**
  - **Rapid Application Development and Easy Maintenance**
- **Allows for a "Vendor Independent Architecture"**

Universal Integration Engine

User/Developer

Application

| Data Layer | Application Logic | User Interface |

Object Translator

Engine

| Operating System Interface | Interfaces to:
- Datasources
- Middleware
- Components | Windowing Interface |

Hardware

Platform/OS Independence

Universal Integration Engine

Hardware/Operating System

- Engine Shields Applications From The Environment
- Port Applications By Copying To Target Platform
- Easy Deployment In Heterogeneous Environment

Support For 28+ Platforms And Operating Systems

- AIX
- AS/400
- Amdahl
- OpenVMS Vax
- OpenVMS Alpha
- DG-UX
- HP-MPE/IX
- HP-UX
- Linux
- MS-DOS

- Windows `95
- Windows `98
- Windows NT
- SCO-Unix
- Sinix
- Solaris
- SUN-OS
- Tru64
- Unixware
- UNIX V.4

Data Source Independence

Universal Integration Engine
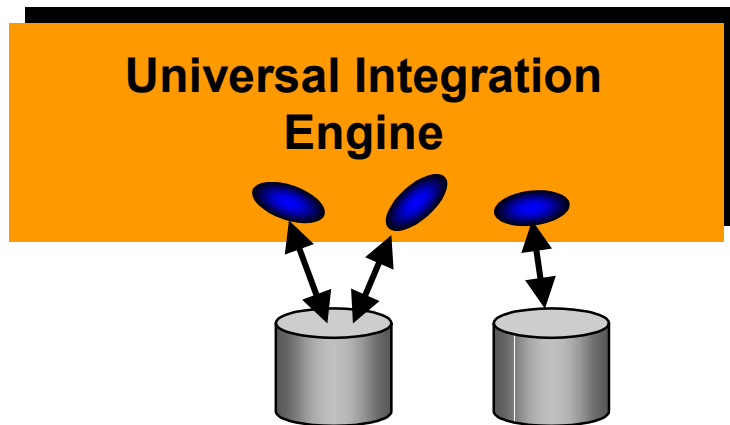
- Uniform Database Interface
- Data Manipulation Via Generic Commands
- Fields Mapped To One Or More Physical Databases
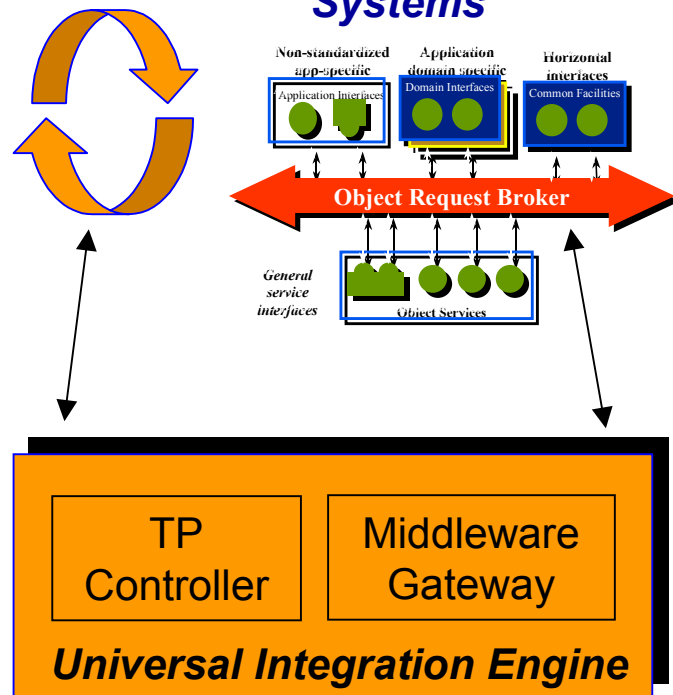- C and Component APIs For Custom Interface Development

Support For 25+ Commercial Databases/Data Sources

- ACU COBOL
- Adabas C & D
- Allbase
- ASCII
- Btrieve
- Clipper
- C-Isam
- dBASE III / IV
- DB2
- DataTrieve (RMS)
- FoxPro
- Informix
- Ingres
- SAP R/3
- LPI Cobol
- Mem Table
- MicroFocus COBOL
- ODBC
- Oracle
- Progress
- RDB
- RMS
- Solid
- Sybase
- SQL Server
- Teradata
- UniSQL
- Manugistics

Network/Middleware Independence

Transactions **ORBs, Messaging Systems**

Non-standardized app-specific
Application domain specific
Horizontal interfaces

Application Interfaces
Domain Interfaces
Common Facilities

Object Request Broker

General service interfaces
Object Services

TP Controller | Middleware Gateway

Universal Integration Engine

Support For 13+ TP Monitors and Messaging Systems

- **Tuxedo**
- **Top End**
- **CICS**
- **MTS**
- **Jaguar**

- **TCP/IP**
- **Decnet**

- **DCE**
- **CORBA/IIOP**
- **DCOM**
- **MS-RPC**
- **ActiveX**
- **BAPI**
- **TIBCO**
- **MQ-Series**

User Interface Independence

Character Based
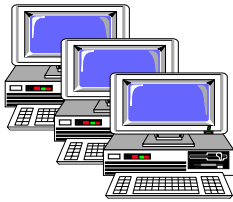
Motif

Windows

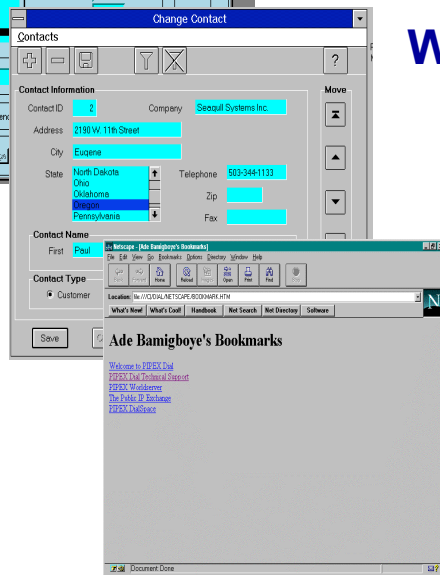**WEB Interfaces**

Support For Simultaneous Multiple User Interfaces
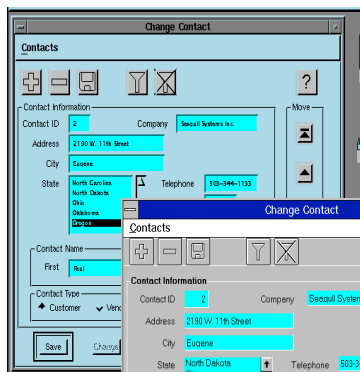
Graphical
- MS-Windows 95/98/NT
- OS/2 Presentation Manager
- OSF Motif

Non-Graphical
- Character Mode
- Block Mode

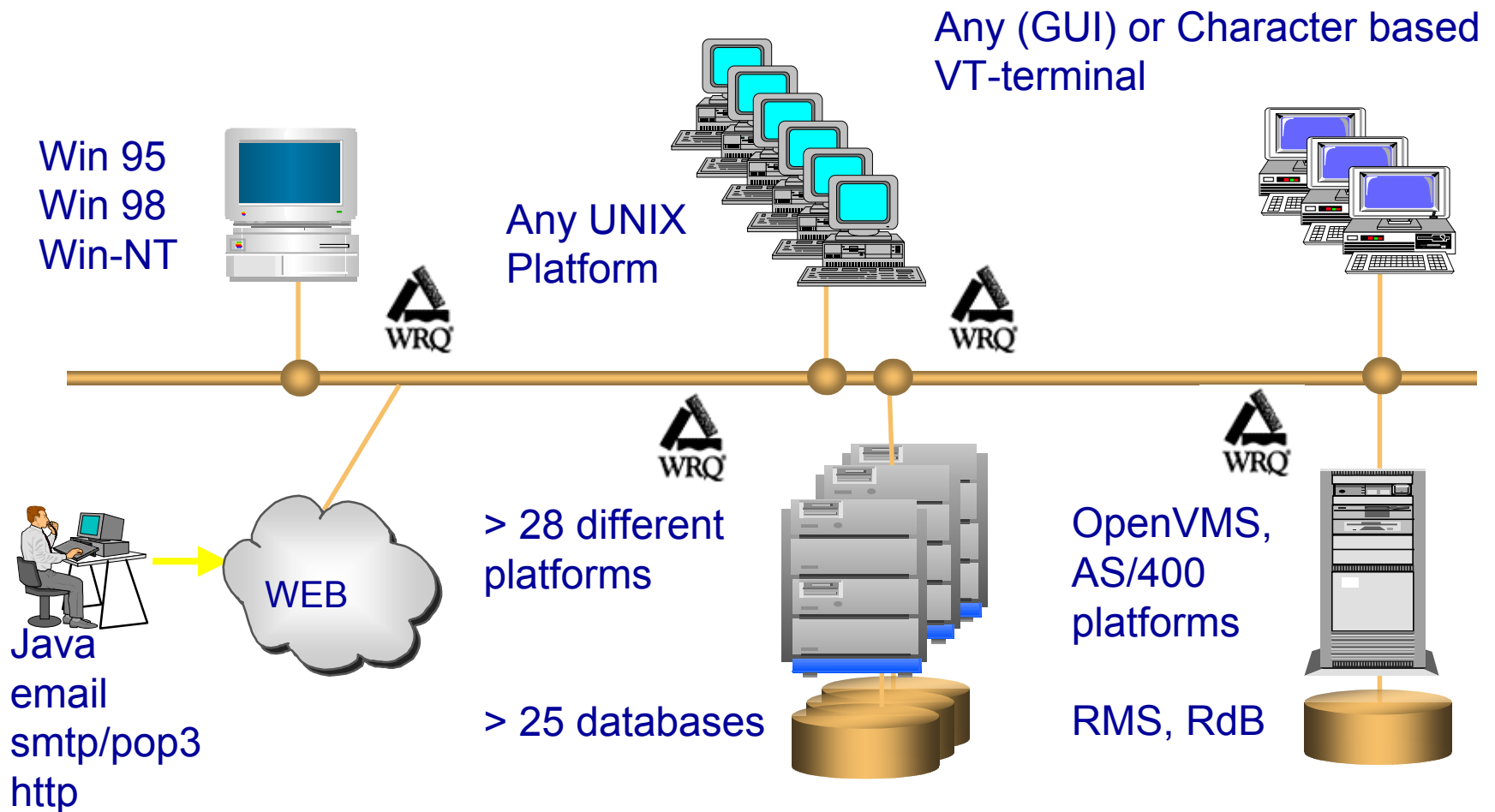### Web Interface
- Java
- Dynamic HTML

Verastream Deployed in the Enterprise

Any (GUI) or Character based
VT-terminal

Win 95
Win 98
Win-NT

Any UNIX
Platform

WRQ

WRQ

WRQ

WEB

WRQ

> 28 different
platforms

OpenVMS,
AS/400
platforms

Java
email
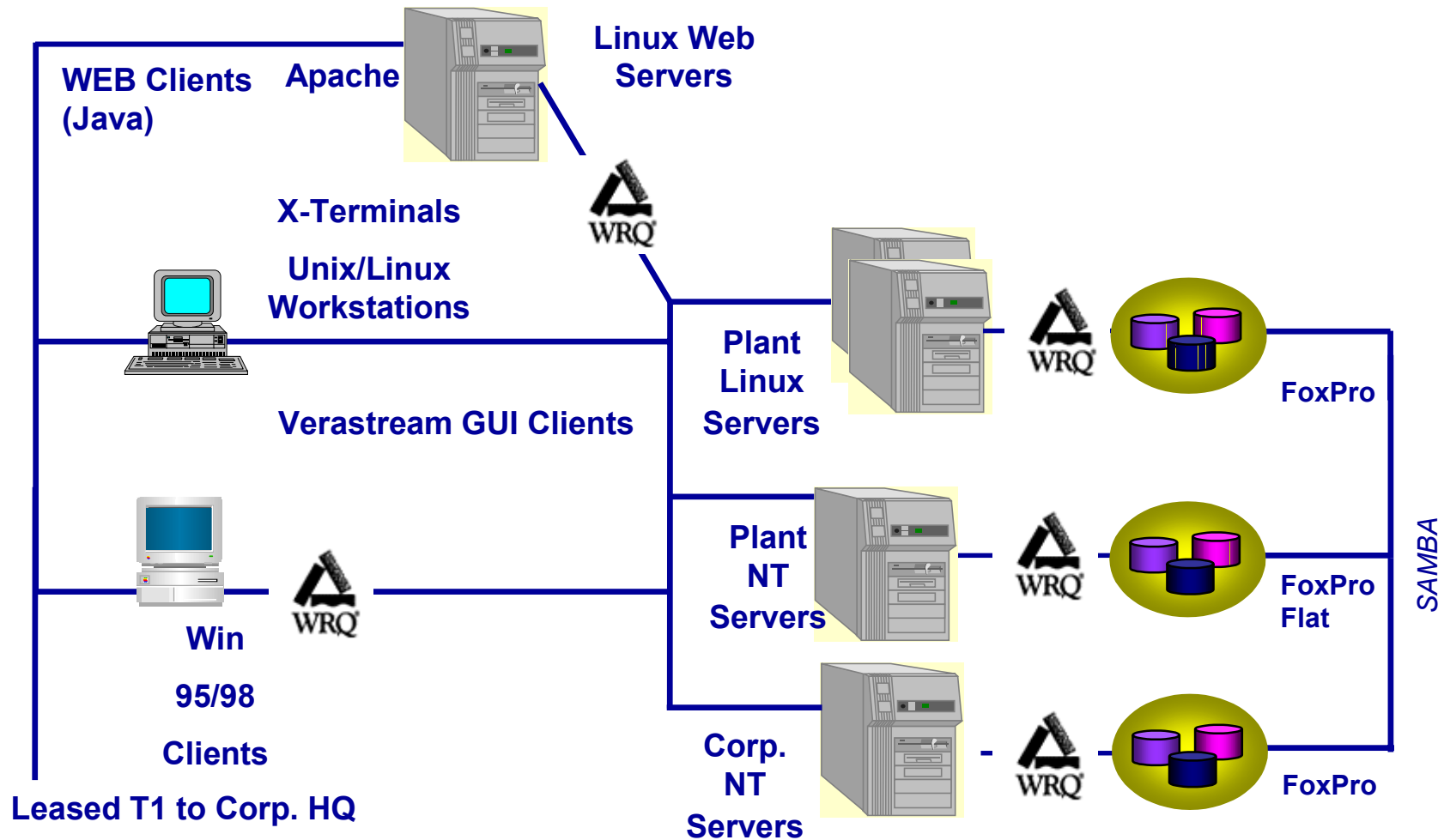smtp/pop3
http

> 25 databases

RMS, RdB

Where Did We Go From Here?

- **Installed New T1 Line and first production Linux Servers 4/99.**
- **Began Data port to FoxPro on Linux 9/99.**
- **Completed Data port to FoxPro 10/99.**
- **Began Data re-architecture 11/99.**
- **Completed Data re-architecture and began application development 1/2000.**
- **Completed Application development & testing May, 2000.**
- **EAI deployment on line 5/23/2000.**

Evolving Present/Future Middleway Architecture - May 2000

WEB Clients (Java)

Apache

Linux Web Servers

X-Terminals

Unix/Linux Workstations

Verastream GUI Clients

Plant Linux Servers

FoxPro

Win 95/98 Clients

Plant NT Servers

FoxPro Flat

Leased T1 to Corp. HQ

Corp. NT Servers

FoxPro

SAMBA

WRQ

Summary of Benefits

- **Greatly Simplified Application Development, Design, Database Porting & Re-architecture-- _Reduced time & costs by nearly 40%_**

- **Dramatically reduced hardware upgrade and support costs --90% savings!**

- **Reduced software and OS licensing costs by two thirds!**

- **Thin/WEB client dramatically reduces application deployment/maintenance costs -- 90% savings!**

- **Provided a path for "zero downtime" reengineering/re-architecture -- No lost business!**

- **Easy customization to meet business needs & customer (user) requests. Reduced Training Costs!**

- **Open Standards - Architecture improves flexibility & allows us to use "_The Best Tools for the Job_" No doors are closed!**

Spectratech EAI Cost/Benefit Analysis
Traditional Client/Server/Platform vs. Verastream/Linux

Item	Traditional Solution	Verastream Solution	Savings
Hardware Upgrade Costs	$250,000	$24,000	$226,000
Software, DB & OS Upgrade & Relicensing	$300,000	$110,000	$190,000
Hardware Support Costs	$100,000	$10,000	$90,000
IT Support & Maintenance Costs	$400,000	$40,000	$360,000
Application Devel., Integration & Porting Costs	$400,000	$250,000	$150,000
Estimated Lost Business	$250,000	$0	$250,000
Employee Retraining Costs	$16,000	$2,500	$13,500
Totals	$1,716,000	$436,500	$1,279,500

Other Technological & Business Benefits

- **Verastream is an "Industrial Strength Pain Reliever".**
- **It provides a very robust, platform independent, Rapid Application Development environment with a variety of databases and communications protocols.**
- **Application Development, Deployment & Maintenance are <u>greatly simplified</u>**
  - ○ **Central repository of re-usable components/objects**
  - ○ **Common source code for all platforms/interfaces**
  - ○ **Easy to build custom applications which access multiple data sources/servers simultaneously and transparently**
  - ○ **Easy to port applications from one platform or one database to another without the need to recode**
  - ○ **Supports Team Development and Repository Management across the enterprise with a rich set of available tools**

Other Technological & Business Benefits

- **A distributed, dynamically partitionable N-tier architecture provides maximum power and flexibility at minimum cost**
  - **Can easily support a powerful "rules based" architecture for running the enterprise**
  - **Supports dynamic resource allocation & load balancing**
  - **Supports transparent migrations & major reengineering without business interruptions**
  - **Supports an infinite variety of client/server and server/server relationships to meet needs**

EAI Challenges
(Dorothy, we ain't in Kansas anymore!)

- **The sword cuts both ways…**

  Power and Flexibility Do Have a Cost!

- **Both the Learning curve and "Sales curve" are MUCH steeper than for "traditional" products, solutions or development environments!**
  - The complexity of EAI projects combined with the complexity of distributed architectures requires a different approach from start to finish.
  - In-Depth business AND technical knowledge are essential!
  - Both the product and the EAI solution require a broad and complex set of skills and a different thought paradigm than traditional application development.
  - Multi-tier, cross-platform Component/Object/Rules based architecture, design, development and deployment can be difficult to master.

EAI Challenges
(Dorothy, we ain't in Kansas anymore!)

- **The Power and Flexibility of this model and architecture demand broader skill sets, better cross-functional communications and greater discipline**
  - Excellent communications between disciplines (both business and technical) is essential
  - A core group of project people with a balanced combination of technical & business knowledge is absolutely ESSENTIAL!
  - Thoughtful & Thorough "up front" modeling, definition & specs are an ABSOLUTE MUST!

Project Summary

- **If properly designed and executed, a component based, object oriented middleware architecture can offer SIGNIFICANT cost savings benefits and efficiencies in designing, deploying, and managing enterprise business application integrations.**

- **Through two major EAI projects we have successfully developed, integrated and deployed an enterprise business IT infrastructure combining both legacy and state-of-the-art technologies in a heterogeneous cross-platform environment using a component based middleware architecture.**

Discussion/Questions
EAI Considerations?