UNDERSTANDING ENTERPRISE APPLICATION INTEGRATION

APPROACHES, TECHNOLOGIES, AND ISSUES

Hewlett-Packard Company

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OVERVIEW

- **Definition and Market**
  - WHAT EAI IS
- **Planning for EAI**
  - BUSINESS AND TECHNOLOGY DRIVERS AND BENEFITS
  - KEY STEPS TO TAKE
  - ROLE OF APPLICATION SERVERS
- **EAI Approaches**
  - PROCESS, DATA, MIDDLEWARE, MODEL
  - HOW TO SELECT THE RIGHT ONE
  - PRODUCTS AND SERVICES
  - FUTURE OF EAI
  - ISSUES AND ADVICE

OVERVIEW

- An EAI Reference Architecture
- Packaged ERP Integration
  - SAP
  - ORACLE
  - PEOPLESOFT
  - BAAN
- Wrap-Up
  - ISSUES AND ADVICE
  - A CALL TO ARMS

PART I

DEFINITION AND MARKET

What is EAI?

"EAI is the

business strategies, processes, and technologies

intended to provide seamless and uniform

development, extension, perception, use, and management

of the means to execute business functions."

-- Alternative Technologies

EAI In A Nutshell

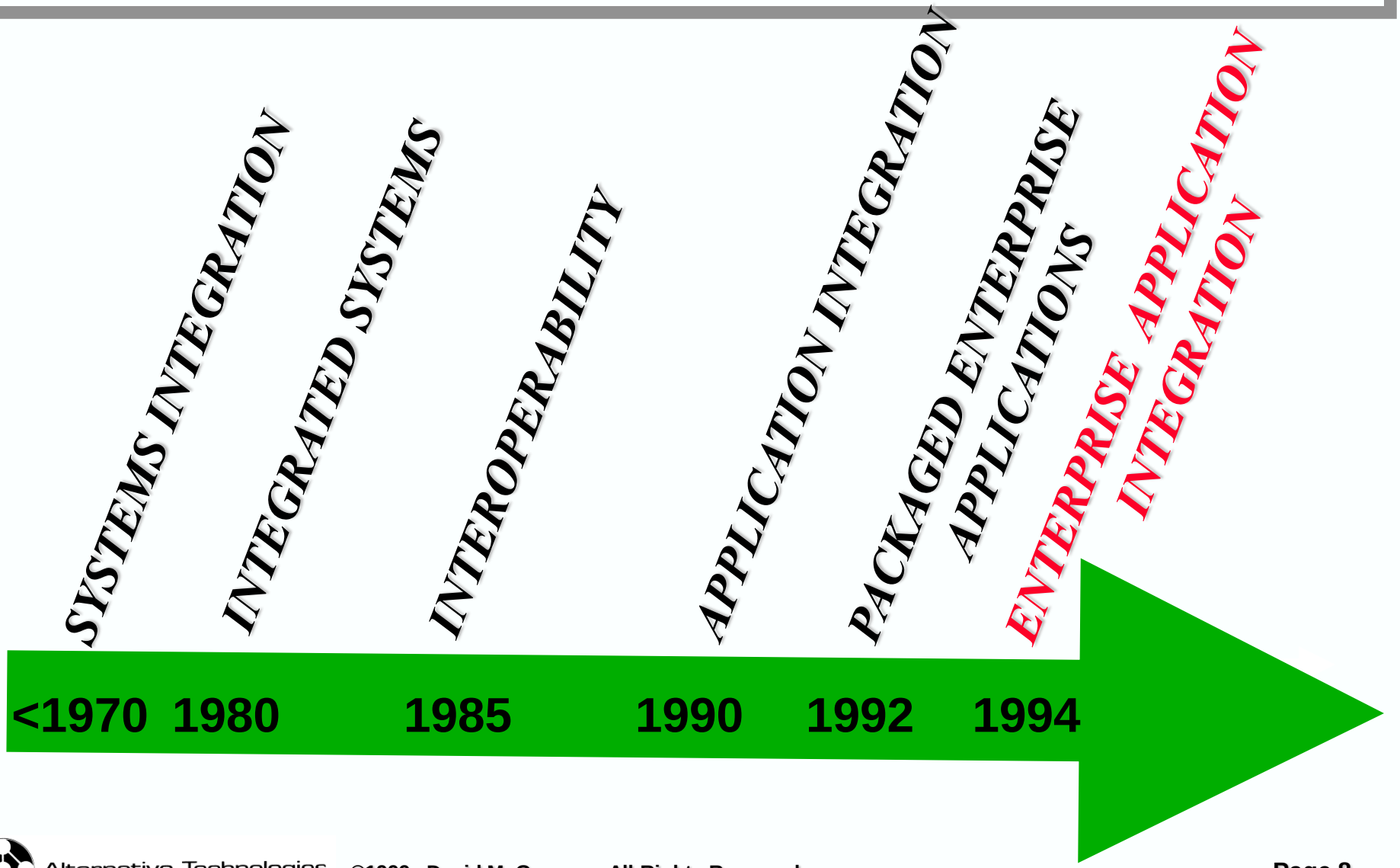
"Enterprise Application Integration is about maintaining the integrity of the enterprise."

-- Alternative Technologies

Where Did We Go Wrong?

- RAMPANT TECHNOLOGY ADOPTION
- SOFTWARE WITHOUT ARCHITECTURE
- ISLANDS OF AUTOMATION
- STOVEPIPE APPLICATIONS
- PACKAGED SOFTWARE
- NO INTEGRATION STANDARDS
- I.T. OUT OF PROPER CONTEXT
  - CAUSES ALIGNMENT PROBLEMS

EVOLUTION OF EAI



Recapturing the Purpose of I.T.

"Information Technology: ALL the technologies that enable the use of ANY information in support of business functions, *irrespective of the media* . . ."

- **PAPER**
- **TELEPHONE**
- **MEETINGS**
- **MEMO**
- **COMPUTER**

EAI Challenges

- **Few EAI Methodologies**
  - RELATIONSHIP TO EXISTING I.T. METHODOLOGIES?
- **EAI Scoping is Frequently Poor**
  - BUSINESS GOALS VERSUS TECHNICAL GOALS
  - NUMBER OF BUSINESS FUNCTIONS AND WHO IMPACTED
  - CROSS-ENTERPRISE AND VIRTUAL ENTERPRISE
- **Economics of EAI are Poorly Understood**

EAI Challenges

- **Relationship of EAI to Business**
  - MANAGEMENT CHANGES AND BUSINESS PROCESS OPTIMIZATION
- **EAI Requirements on I.T. Infrastructure**
  - DATA, MESSAGING AND COMMUNICATIONS BACKBONE
  - PROCESS MANAGEMENT
  - SCHEDULING
  - TRANSACTION MANAGEMENT AND RECOVERY
- **Standards: Too Many, But Not Enough!**

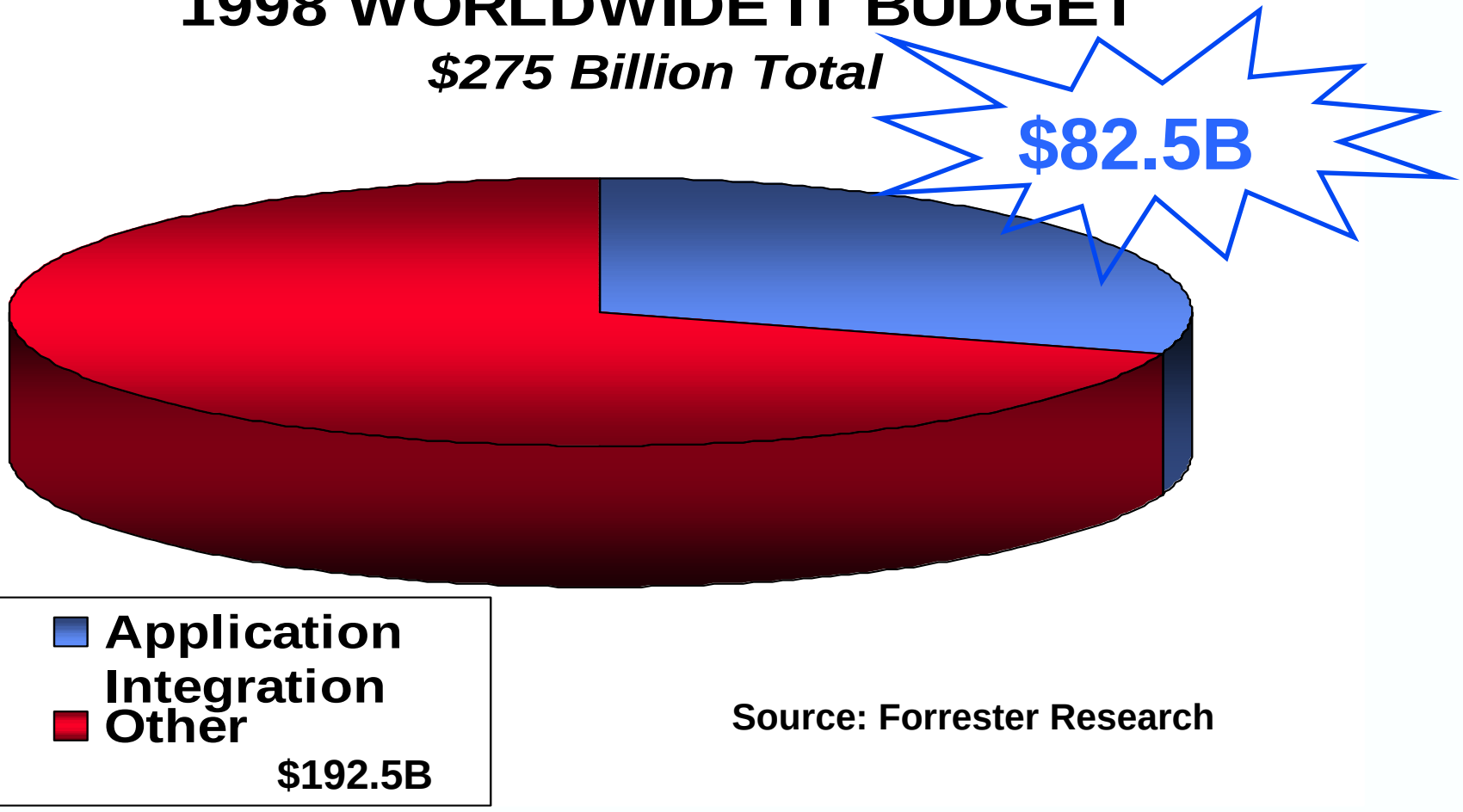
PART II

THE EAI MARKET

EAI MARKET

1998 WORLDWIDE IT BUDGET

$275 Billion Total



Source: Forrester Research

The EAI Market

- IDC
  - $46B ON INTEGRATION IN 1997
- Forrester Research
  - TOTAL INTEGRATION EXPENDITURES OF $82.5B IN 1998
  - 40% OF CORPORATE IT BUDGETS
- Gartner Group
  - ANALYSIS OF CROSS ENTERPRISE SOFTWARE
  - GROWING AT 150% CAGR
  - $5.7B IN 2002
  - ABOUT $1B IN 2000 AND $3.2 IN 2001
  - MOVING DATA IS 35-40% OF PROGRAMMING EFFORT
    - » DATABASE TO DATABASE

The EAI Market

- META
  - GLOBAL 2000 USE AN AVERAGE OF 49 SEPARATE (PACKAGED) APPLICATIONS
- Standish Group
  - 70%OF APPLICATION CODE IS INFRASTRUCTURE
  - $24B PER YEAR ON APPLICATION INTEROPERABILITY
- Other Estimates
  - $59B 2001
  - 11% CAGR
  - MORE THAN 90%OF EAI MARKET IS SERVICES
  - SUPPLY CONSTRAINED

PART III

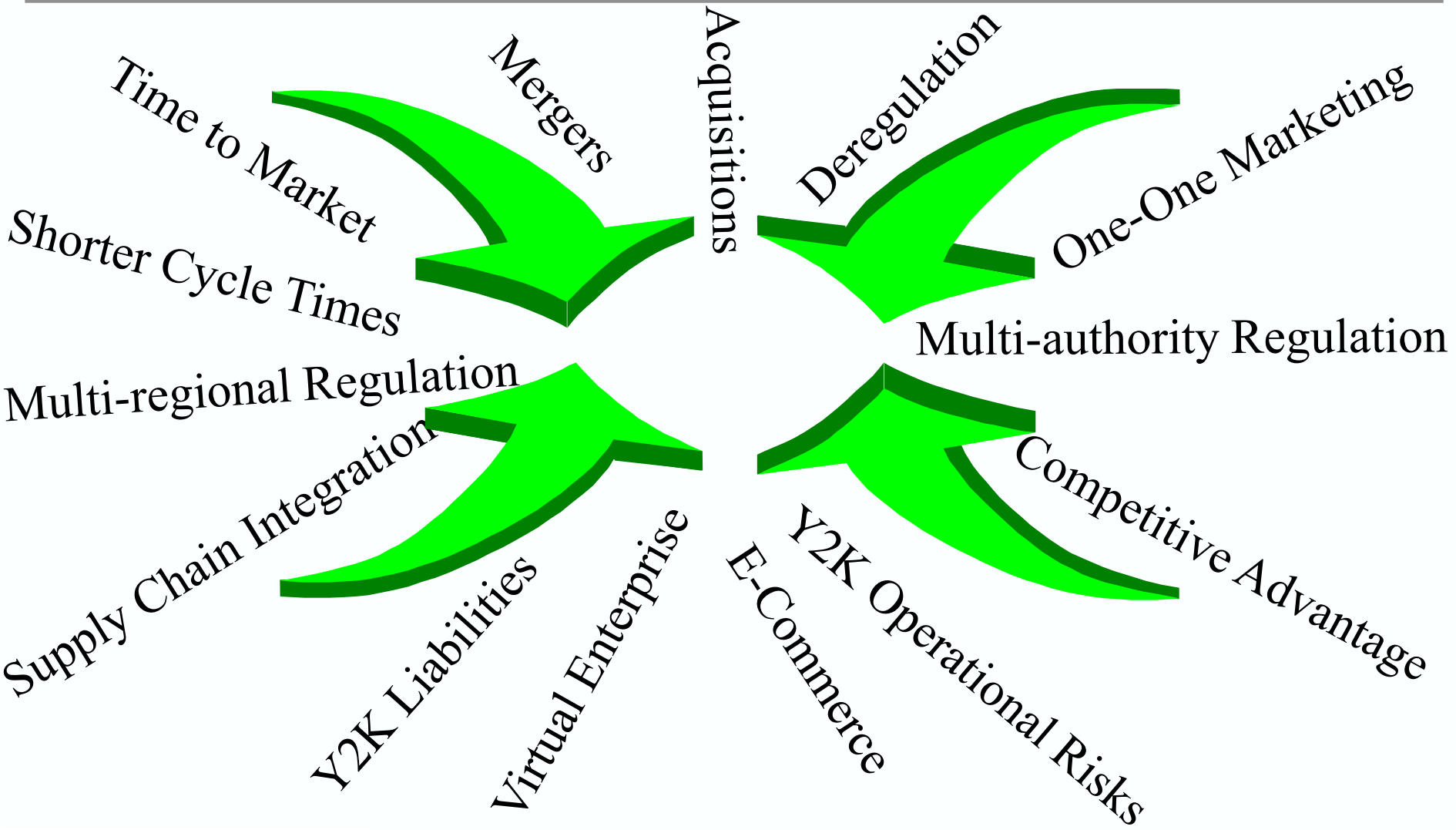
PLANNING FOR EAI

Business Drivers of EAI

- Competitive Advantage
- Agility & Resiliency in the Face of Frenetic Change
- Time to Market
- Shorter Cycle Times
- Mergers and Acquisitions
- Deregulation
- Multi-regional and Multi-authority Regulation
- Supply Chain Integration
- One-One Marketing
- E-Commerce and Virtual Enterprise
- Y2K Liabilities and Operational Risks

EAI BUSINESS DRIVERS

Agility & Resiliency in the Face of Frenetic Change



Business Benefits of EAI

- Improved Operating Efficiencies
- Improved Information Flow
- Consolidated Business Analysis
- Single Point of Management
- Predictability and Repeatability of Business Processes
- Leverages Existing Investments
- Improved Customer Satisfaction and Retention
- Reduced Cost of Ownership
- Increased ROI

Business Issues

- **What Are the *Economics of Integration*?**
  - **TCO, ROI, AND ROR DON'T TELL THE WHOLE STORY**
    - » ***EAI PROVIDES MUCH MORE THAN COST CONTAINMENT AND REDUCTION***
  - **NO ACCEPTED VALUE MODEL FOR *OPPORTUNITY CAPTURE***
  - **MUST USE PILOTS AND CASE STUDIES**
- **Dependence on I.T. Heavy and Growing**
  - **30%OF ALL MISSION CRITICAL APPLICATION CODE IS BUSINESS RELATED -- Standish Group**
    - » **I.E., *ITS ABOUT PROCESS FLOW AND BUSINESS RULES!***
  - **REMAINING 70% IS INFRASTRUCTURE**
    - » **I.E., *CEOs & CFOs DON'T UNDERSTAND I.T. INFRASTRUCTURE!***

Business Issues

- **Business Lacks Confidence in I.T.**
  - ***85% OF BUSINESS MANAGERS SEE I.T. AS AN IMPEDIMENT!***
  - **ALMOST 85% OF DEVELOPMENT NOT SUCCESSFULLY COMPLETED**
  - **58% OF LARGE SYSTEMS PROJECTS OVER BUDGET**
  - **63% OF PROJECTS OVER SCHEDULE**
  - **TOO SLOW, TOO EXPENSIVE, OUT-OF-DATE**
  - **ONLY 6% OF I.T. MANAGERS THINK THEY CAN KEEP UP**
- **But Business Needs**
  - **UNDERSTANDABLE TECHNOLOGY THAT DELIVERS DIFFERENTIATION *RAPIDLY***
  - **TAKE ADVANTAGE OF ECONOMIES OF SCALE**
  - **CAPITALIZES ON EXISTING TECHNOLOGY**

*CHAOS Report, The Standish Group and Open Systems Advisors

Conclusion . . .

Business Needs Enterprise Application Integration!

Technology Drivers for EAI

- **Growth of ERP and Packaged Applications**
- **Y2K and EMU**
- **New Software Categories and New Technologies**
  - **COMPONENTS, STANDARD APIs AND COMMUNICATION PROTOCOLS, DISTRIBUTED OBJECTS, APPLICATION SERVERS, AND MIDDLEWARE (ORBS, MOM, OTMS)**
- **Requirements for Modified and Extended Functionality**
  - **INFRASTRUCTURES JUST AREN'T FLEXIBLE ENOUGH**

Technology Drivers for EAI

- **Insufficient I.T. Resources**
  - CUSTOM PACKAGE DEVELOPMENT AND MANAGEMENT
  - REUSE OF ASSETS NOW MANDATORY
  - CONSTANT CHANGE AND NEW FUNCTIONAL REQUIREMENTS
- **Legacy Application Anchor**
  - CAN'T REVERSE ENGINEER
  - TOO FRAGILE TO TOUCH THEM TO MODIFY OR EXTEND
  - AFRAID TO REPLACE OR ABANDON

How EAI is Affecting I.T.

- **Changing Priorities**
  - EAI IS ENABLING THE NEW FOCUS ON RE-USE AND PACKAGED APPLICATIONS
  - UNDERSTANDING THE BUSINESS
- **A New Enterprise Focus on Infrastructure**
  - A RESURGENCE IN ENTERPRISE ARCHITECTURES
  - KEY TECHNOLOGIES FOR ALL ASPECTS OF INTEGRATION
- **System Management**
  - MULTIPLE LEVELS OF SYSTEM MANAGEMENT
  - INTERFACE AND APPLICATION TO APPLICATION
- **Need for EAI Expertise**
  - KNOWLEDGE OF INTEGRATION PROJECT MANAGEMENT
  - INTEGRATION APPROACHES
  - TOOLS AND METHODOLOGIES

Key Steps to Take

A BRIEF CHECKLIST FOR EAI PLANNING

- **Identify Your Business Goal(s)**
  - COST CONTAINMENT? FOR BUSINESS OR I.T.?
  - CUSTOMER SERVICE LEVELS?
  - GREATER AGILITY? MERGERS AND ACQUISITIONS?
- **Scope the Effort**
  - CROSS TECHNOLOGY? CROSS BUSINESS FUNCTION?
  - DEPARTMENT? DIVISION? B2B? B2C? E-COMMERCE?
  - WHO WILL BE AFFECTED AND HOW?
- **Establish a Strategy**
  - LONG vs. SHORT TERM
  - LOCALIZED (ISLANDS OF INTEGRATION) OR ENTERPRISE-WIDE?
  - TOP-DOWN OR BOTTOM-UP?

Key Steps to Take

A BRIEF CHECKLIST FOR EAI PLANNING

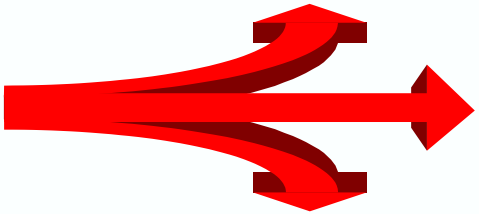
- **Establish a Business Integration Plan**
  - PROCESSES AND ENVIRONMENTS
- **Identify Realistic Technical Integration Targets & Scope**
  - FRONT OFFICE AND BACK OFFICE?
  - WEB WITH ERP OR ACROSS ERP?
  - DATA STORES?
  - TECHNOLOGIES: NEW (e.g., COMPONENTS) AND OLD (e.g., LEGACY)
- **Determine Technical Resources and Impact**
  - SKILLS, INFRASTRUCTURE, KNOWLEDGE, TOOLS, STANDARDS
- **Select the Best EAI Approach for Your Company**
  - MIDDLEWARE-CENTRIC
  - DATA-CENTRIC
  - PROCESS-CENTRIC
  - MODEL-DRIVEN

PART IV

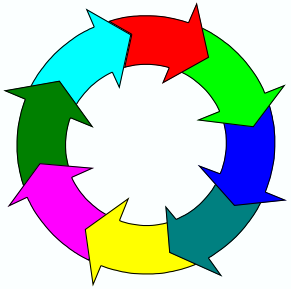
EAI APPROACHES

AN OVERVIEW OF APPROACHES

MIDDLEWARE-CENTRIC

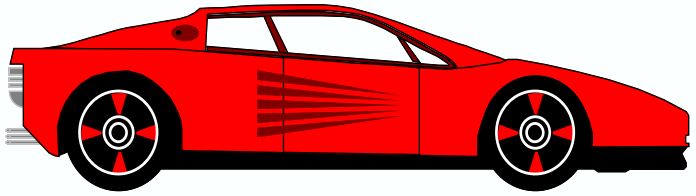


DATA CENTRIC



PROCESS–CENTRIC

MODEL-DRIVEN



MIDDLEWARE-CENTRIC APPROACHES
TECHNICAL ISSUES

- **Protocols and Standards**
  - COM, CORBA, JAVA, M/F
  - INSTABILITY MEANS VENDORS CAN'T KEEP UP
  - NO INTEGRATION STANDARD
- **Interface Definition and Data Marshalling**
  - CUSTOM vs. XML??
  - DATA TYPES, INITIALIZATION, BEHAVIOR, ERRORS, SECURITY
- **Incompatibilities**
  - SOURCE LANGUAGES AND LEGACY INTERFACES
- **Difficult Transaction Coordination**
  - OTM, TPM, 2PC, ROLLBACK, RECOVERY
- **Performance Problems**
  - STACK DEPTH, NAMING AND DIRECTORY SERVICES RESOLUTION

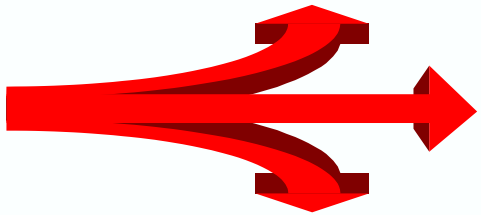
MIDDLEWARE-CENTRIC APPROACHES

Focus

– *THE TECHNOLOGY USED TO MANAGE AND IMPLEMENT THE INTERCONNECTION OF APPLICATIONS AND APPLICATION COMPONENTS.*

"WHAT TECHNICAL INFRASTRUCTURE WILL SUPPORT WHAT."

- **Types of Middleware**
  - **CONNECTION**
  - **DATABASE AND REPOSITORY**
  - **TRANSACTION** ***MIDDLEWARE-CENTRIC***
  - **MOM**
  - **ORBs AND MESSAGE BROKERS**
  - **DIRECTORIES**
  - **APPLICATION SERVERS**



MIDDLEWARE-CENTRIC APPROACHES
PROS AND CONS

PROS

- ESTABLISHES ESSENTIAL INFRASTRUCTURE
  - » *KEY TO IMPLEMENTING A TECHNICAL ARCHITECTURE*
- FOCUS ON I.T. TRADITIONAL CORE COMPETENCIES
- MOTIVATES TECHNICAL STAFF
- VALUABLE IF OTHER APPROACHES USED LATER

CONS

- HEAVY INVESTMENT OF TIME AND MONEY
- EASY TO MISALIGN WITH BUSINESS OBJECTIVES
- ROI DEPENDS ON SIGNIFICANT REUSE
  - » *BEFORE THE TECHNOLOGY CHANGES!*
  - » *DIFFICULT TO ANTICIPATE TECHNOLOGY DIRECTIONS*

CORBA
ARCHITECTURAL COMPONENTS

- **OMA**
  - OBJECT MANAGEMENT ARCHITECTURE
- **ORB**
  - MANAGES IDs
  - MEDIATES ALL REQUESTS
  - INTERFACE AND IMPLEMENTATION REPOSITORIES
  - POA
- **POA**
  - "PORTABLE OBJECT ADAPTER" REPLACEMENT FOR BOA, BASIC OBJECT ADAPTER
  - *ORB-SERVER INTERFACE*
  - *DISPATCH OBJECTS, MAINTAIN/EXCHANGE*
  - *MESSAGES*
    - » BETWEEN SERVER OBJECTS
    - » BETWEEN USER VS. SERVER IMPLEMENTED OBJECTS

CORBA
ARCHITECTURAL COMPONENTS

- **CORBAServices**
  - LIFECYCLE, RELATIONSHIP, PERSISTENT OBJECT, EXTERNALIZATION
  - NAMING, TRADER, EVENT, TRANSACTION, CONCURRENCY, PROPERTY, QUERY,
  - SECURITY, LICENSING, CHANGE MANAGEMENT, TIME MANAGEMENT, ASYNCHRONOUS MESSAGE, MESSAGING
- **CORBAFacilities**
  - USER INTERFACE
  - INFORMATION MANAGEMENT
  - SYSTEMS MANAGEMENT
  - TASK MANAGEMENT
  - VERTICAL FACILITIES: HEALTHCARE, FINANCIAL, etc.

CORBA
ARCHITECTURAL COMPONENTS

- **Interfaces**
  - *IDL - INTERFACE DEFINITION LANGUAGE*
  - *COMPILE TO CREATE STUBS AND SKELETONS IN THE TARGET LANGUAGE*
  - *STORE IN AN INTERFACE REPOSITORY*
- **Invocations**
  - *SII: STATIC INVOCATION INTERFACE*
    - » *SYNCHRONOUS, SYNCHRONOUS ONEWAY*
  - *DII: DYNAMIC INVOCATION INTERFACE*
    - » *SYNCHRONOUS, ASYNCHRONOUS (SEND AND GET), DEFERRED SYNCHRONOUS*

CORBA

- **Manual Development Steps**
  - DEFINE INTERFACES WITH IDL
  - STORE IN INTERFACE REPOSITORY
  - OPTIONALLY COMPILE IDL IN TARGET LANGUAGE
    - » *GENERATES STUBS AND SKELETONS*
  - COMPLETE CODE UNDER STUBS AND SKELETONS
  - INVOKE SERVICES AND FACILITIES AS NEEDED
- **Integrated Development Environments**
  - MAY GENERATE IDL AND STORE IT FOR YOU
  - WRAPPER CODE WITH CORBA INTERFACE
- ***PROS***
  - SUITED FOR DISTRIBUTED INFRASTRUCTURES
- ***CONS***
  - INCOMPLETE, NOT PERVASIVE, HARD TO USE

COM/DCOM

- **Architectural Components**
  - **INTERFACES**
    - » ***BINARY, STATIC TYPING, VECTOR OF FUNCTION POINTERS***
    - » ***DEFINED IN MIDL(ROOTS IN DCE IDL, OLE ODL)***
    - » ***GLOBAL UNIQUE IDENTIFIERS***
    - » ***PRIMITIVE TYPES, STRUCT, UNION, ENUM, ARRAYS, POINTERS***
    - » ***MONIKERS***
  - **CLIENT**
  - **COM RUNTIME SERVICES**
    - » ***AUTOMATION, STORAGE, COMCAT, DATA TRANSFER, IR***
  - **SECURITY**
  - **ORPC (ON TOP OF DCE RPC)**
  - **SERVICE CONTROL MANAGER**
    - » ***HANDLES REMOTE ACTIVATION AS NEEDED***

COM/DCOM

- **Development**
  - **WRITE IDL AND COMPILE WITH MIDL COMPILER**
    - » **PRODUCES *typelib*, C/C++ HEADERS, AND INTERFACE MARSHALERS**
  - **USE GUI DEVELOPMENT ENVIRONMENT**
  - **DYNAMIC INVOCATION NATIVE**
  - **STATIC INVOCATION**
    - » **USE *vptr* TO *vtbl***
    - » **USE DISPATCH INTERFACE (*IDispatch*) AND *dispid* (TYPELIB)**
  - ***IUnknown* - THE MOTHER OF ALL INTERFACES**
  - ***IUnknown* METHODS**
    - » ***QueryInterface***
    - » ***AddRef***
    - » ***Release***

COM/DCOM

- *PROS*
  - TRANSPARENT INVOCATION
    - » PROCESS, OUT OF PROCESS (LOCAL OR REMOTE)
  - TRANSPORT INDEPENDENT
  - A DE FACTO STANDARDS FOR WINDOWS
  - PERVASIVE USE WITHIN WINDOWS
  - EASY TO USE
- *CONS*
  - NOT ROBUST YET
  - SIMPLISTIC, LOW LEVEL SECURITY FACILITIES
  - BINARY
  - REQUIRES THIRD PARTIES FOR NON-WINDOWS SUPPORT
    - » EXAMPLE: SAGA

COM-CORBA

- **COM/CORBA "Interworking" Bridges**
  - CORBA V2 SPECIFICATION
  - BRIDGE ACTS AS A SERVER TO COM
    - » *BECOMES THE SERVER, EXECUTABLE, OR DLL ASSOCIATED WITH A REFERENCED CLASS ID*
    - » *TRANSLATES AUTOMATION METHODS, PROPERTIES AND DATA TYPES TO CORBA EQUIVALENTS*
    - » *RETURNS AN INTERFACE POINTER FOR CORBA OBJECTS*
  - BRIDGE ACTS AS A CORBA CLIENT (PROXY), CAN BE ANYWHERE
    - » *SYSTEM-CENTRIC (VS. SYSTEM-NEUTRAL)*
- **EAI Uses**
  - INTEGRATING COM (READ WINDOWS) DESKTOP AND DEPARTMENTAL APPLICATIONS TO CORBA-BASED ENTERPRISE
  - PROVIDING ACCESS TO ENTERPRISE JAVA BEANS
    - » *POSSIBLY ON THE MAINFRAME*
  - HELPFUL FOR BUILDING DESKTOP BUSINESS PORTALS

COM-CORBA

- **Development Steps**
  - SELECT / CONFIGURE A COM/CORBA INTERNETWORKING BRIDGE
  - SELECT / INSTALL A DEVELOPMENT TOOL (VB, C++, JAVA)
  - IDENTIFY THE CORBA-BASED BACKEND FUNCTIONS
  - OBTAIN THE CORBA IDL IN FILE OR CORBA INTERFACE REPOSITORY
  - USE BRIDGE TOOL TO EXPOSE IDL TO AUTOMATION
    - » *GENERATES AUTO DEFINITION, HEADER FILES, MIDL (ODL)*
    - » *WINDOWS REGISTRATION*
    - » *OLE TYPELIB - INTERFACES DECRIPTION*
      - MAKES ACCESSIBLE TO COM DEVELOPMENT TOOL
      - INCLUDE TYPELIB AS A REFERENCE FOR THE PROJECT
    - » *MAP OBJECT FROM CORBA TO AUTOMATION DEFINITION*
  - WRITE AND COMPILE COM APPLICATION
    - » *DECLARE VARIABLES, CREATE FACTORY INSTANCES, REQUEST OBJECTS, GET PROPERTIES*
  - RUNNING APPLICATION INVOKES CORBA OBJECTS

SAVING STATE

- aka Persistence
  - OBJECT OR DATA
  - MULTIPLE INSTANCES AND VERSIONS
- Performance and Scalability Crucial
  - RECOVERABLE CACHE
  - WRITE AND READ THROUGH CACHE
  - DBMS CAPABILITIES
  - EXPIRATION
- EAI
  - ESSENTIAL FOR MOM-BASED INTEGRATION
  - USE WITH COMPONENTS, WEB, CROSS-APPLICATION
  - CAN SOMETIMES USE TO RECOVERY FROM FAILED TRANSACTIONS
    - » *OPTIMISTIC CONCURRENCY CONTROL*
    - » *COMPENSATING TRANSACTIONS*

APPLICATION SERVERS

- **Enterprise Application Servers for EAI**
  - A KEY MIDDLEWARE FACILITY
  - STATE MANAGEMENT
  - AVAILABILITY, LOAD BALANCING, AND SCALABILITY
  - RAPID LEGACY, ERP, AND WEB INTEGRATION
  - MAY BE ESSENTIAL FOR E-COMMERCE
- **EAI Enhances Application Server Value**
  - ADD EAI BENEFITS TO THE COST/BENEFIT ANALYSIS
  - MAKES AN APPLICATION SERVER CONCEPT EASIER TO SELL
  - EAI FOCUSES THE PURPOSE OF A.S. ON THE ENTERPRISE
  - HELPS US UNDERSTAND THAT THE KEY WORD IS “SERVER”
    - » *EACH SERVICE IS PROVIDED BY ONE OR MORE SERVERS*
    - » *APPLICATION: A SERVICE WITH IDENTIFIABLE BUSINESS VALUE*
- **No Real Standards**

DATA-CENTRIC APPROACHES

Focus

– ***MAKING DATA FROM ONE OR MORE APPLICATIONS AVAILABLE AS INPUT TO ONE OR MORE OTHER APPLICATIONS***

"WHAT DATA CAPTURES WHICH EVENTS."

- **Types of Data-centric Integration**

FROM \ TO	DATA STORE	APPLICATION
DATA STORE	utilities, custom programs, replication, copy management	extract, direct access
APPLICATION	direct access, screen scraping	screen scraping, APIs, interface generators, transformation hubs

DATA-CENTRIC APPROACHES
TECHNICAL ISSUES

- **Capture**
  - SCREEN SCRAPING
  - ACCESS FROM APPLICATION DATABASE
  - EXPORT VIA NATIVE API
- **Translation**
  - DATA TYPES, FORMATS, CONTENT, NAMING
  - ENCAPSULATING THE RIGHT SET OF DATA ELEMENTS
  - TYPICALLY A POINT BY POINT APPROACH
- **Access / Transport**
  - POINT-TO-POINT
  - MERGE OR CONSOLIDATE DATASTORES
  - CENTRAL REPOSITORY MAY BE A BOTTLENECK
  - DATA STORES ARE OFTEN SEMANTICALLY INCONSISTENT AND REDUNDANT

DATA-CENTRIC APPROACHES
TECHNICAL ISSUES

- **Protocols and Standards**
  - ODBC, JDBC, SQL, XML, EDI
  - PACKAGED APPLICATION APIs
  - NO INTEGRATION STANDARD
  - NO STANDARD LEVEL OF ABSTRACTION
  - NO STANDARDS FOR BUSINESS INTELLIGENCE
- **Interface Definition**
  - DATA TYPES, FORMATS, CONTENT, NAMING
  - BEHAVIOR, ERRORS, SECURITY
  - MUST BE AT THE BUSINESS EVENT LEVEL
- **Difficult Transaction Coordination**
  - OTM, TPM, 2PC, ROLLBACK, RECOVERY
  - SYNCHRONIZATION WITH BUSINESS EVENTS

DATA-CENTRIC APPROACHES

PROS AND CONS

PROS

- FAMILIAR DESIGN PROCESS
- NUMEROUS TOOLS AND AVAILABLE TALENT
- WELL-DEFINED DATA ACCESS PROTOCOLS
- COST IMPROVEMENT OPPORTUNITIES
  - *"70% OF EXTRACTION, CLEANSING, AND LOADING PROCESSES ARE BUILT BY HAND."* --- META GROUP

CONS

- REQUIRES MIDDLEWARE
  - *DATABASE, CONNECTION, AND TRANSACTION ORIENTED*
- REQUIRES DISCIPLINE TO AVOID CREATING PROBLEMS
  - *MAY BYPASS KEY PROGRAMS*
  - *CAN INTRODUCE ERRORS OR INTEGRITY PROBLEMS*
  - *TRANSACTION CONSISTENCY OFTEN LOOSE*

TYPES

- **Common Data Store**
  - RELATIONAL DBMS TYPICAL, SOMETIMES FLAT FILES
  - OFTEN LOOSES CONTEXT
  - USUALLY COARSE GRANULARITY
  - CAN MOVE TO DATABASE IF APPLICATION DOESN'T
  - SOMETIMES HARD TO KNOW SCHEMA USED BY APPLICATION
- **Screen Scraping**
  - SOMETIMES USEFUL WHEN API DOES NOT EXIST
- **Portals**
  - CONSOLIDATE MULTIPLE WEB-BASED USER INTERFACES
- **Packaged Application API**
  - SAP BUSINESS OBJECTS APIs, ORACLE PACKAGES, PEOPLESOFT
- **Point-to-Point**

MULTIPLE DATA STORES

- **Multiple Copy**
  - MUST SYNCHRONIZE DATA
- **Replication**
  - ASYNCHRONOUS COPY DELIVERY, HARD TO RECOVERY
- **Copying**
  - EASY TO CREATE OUT-OF-SYNCH COPIES, HARD TO RECOVER
- **Distributed Transactions**
  - 2PC OVERHEAD, SYNCHRONOUS, HARD TO RECOVER
- **Federated Databases**
  - LOCAL UPDATE, REMOTE ACCESS
  - A DATA PORTAL

"SINGLE" DATA STORE

- **Consolidation**
  - DATA STORE BECOMES A BOTTLENECK
  - CAN IMPEDE SOURCE APPLICATION PERFORMANCE
  - OPERATIONAL VARIANT OF A DATA WAREHOUSE
    - » *SAME TECHNOLOGIES*
- **Gateways**
  - CHANGING AN APPLICATION'S DATA STORE
  - SIMULATE SINGLE DATA STORE
    - » *BY PROVIDING TRANSPARENT ACCESS TO MULTIPLE*
- **Distributed Transactions**
  - CROSS APPLICATION TRANSACTIONS ARE DISTRIBUTED
  - 2PC OVERHEAD, SYNCHRONOUS, HARD TO RECOVER

XML
EXTENSIBLE MARKUP LANGUAGE

- **What It Is**
  - DERIVATIVE OF SGML, INTENDED TO FIX PROBLEMS WITH HTML
  - XML FILES FOR CONTENT
  - DTD FILES FOR DEFINITION
  - XSL FOR SCHEMA MAPPING
  - XML DATA, SCHEMAS, RULES, …
- **Value for EAI**
  - LOOSELY COUPLED (MESSAGES) EXCHANGE OF “PURE” CONTENT
  - POTENTIAL REPLACEMENT FOR EDI

XML
EXTENSIBLE MARKUP LANGUAGE

- **BIZTALK ™ Framework**
  - **MICROSOFT LED GROUP**
  - **XML "FRAMEWORK FOR APPLICATION INTEGRATION AND E-COMMERCE,**
  - **BIZTALK NAMESPACE**
  - **BASED ON XML-DATA**
  - **SUPPORT OF BUSINESS PROCESS**
    - » ***REQUIRES APPLICATION MANAGED "HANDLES"***
  - **REGISTER SCHEMAS AT www.biztalk.org IN THE REPOSITORY**
  - **XSL SCHEMA MAPS (BETWEEN BIZTALK SCHEMAS)**

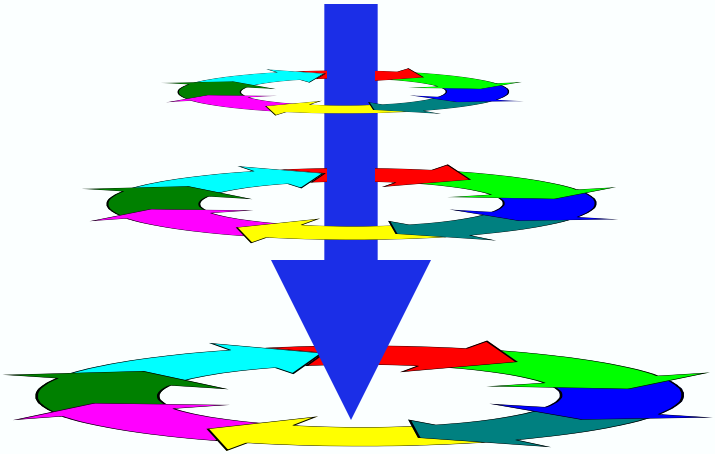
PROCESS-CENTRIC APPROACHES

Focus

– ***INTEGRATING PROCESSES, CONNECTING THE EXECUTION OF BUSINESS FUNCTIONS IN TIME.***

"WHAT MUST BE DONE AND WHEN."

- **Multi-Level Processes**
  - **B2C, B2B, ENTERPRISE, WORKFLOW,**
  - **TECHNICAL IMPLEMENTATION**
- **Types of Process Integration**
  - **POINT-TO-POINT**
  - **WORKFLOW**
  - **BUSINESS PROCESS AUTOMATION**
    - » ***REQUIRES PROCESS ENGINE***
    - » ***COMBINES MESSAGE BROKER, TPM, DIRECTORY, AND RESOURCE MANAGER FEATURES***



PROCESS-CENTRIC APPROACHES
TECHNICAL ISSUES

- **Protocols and Standards**
  - UML, WFMC, PROPRIETARY PROCESS CONTROL
  - NO INTEGRATION STANDARD
- **Granularity of Integration Points**
  - PROCESS ENABLEMENT
  - APPLICATION, SERVICE, BUSINESS OR PHYSICAL TRANSACTION
- **Incompatibilities**
  - INCONSISTENT BUSINESS PROCESS VIEWS
  - SOURCE LANGUAGES AND LEGACY INTERFACES
- **Difficult Transaction Coordination**
  - OTM, TPM, 2PC, ROLLBACK, RECOVERY
- **Performance Problems**
  - THE OVERHEAD OF EXTERNALIZED BUSINESS LOGIC

PROCESS-CENTRIC APPROACHES

PROS AND CONS

PROS

- ENABLES PROCESS ABSTRACTION
- RECOGNIZE MISALIGNMENT WITH BUSINESS
- CAPTURE BUSINESS REQUIREMENTS
- HIGH POTENTIAL

CONS

- UNFAMILIAR TO I.T.
- SHORTAGE OF EXPERTISE
- DEPENDS ON AVAILABILITY OF “ADAPTERS”
- EASY TO INTEGRATE INCONSISTENT PROCESSES
- IMMATURE: FEW TOOLS AND PROTOCOLS AVAILABLE

PROCESS-CENTRIC APPROACHES

- **Development Steps**
  - IDENTIFY BUSINESS GOALS AND SUCCESS MEASURES
  - SELECT / DESIGN TARGET BUSINESS PROCESS
    - » APPLICATIONS AND MANUAL PROCESS STEPS
  - INSTALL ADAPTERS FOR EACH STEP
    - » BUY VS. DEVELOP
    - » IF DEVELOPING
      - IDENTIFY SUPPORTING INTERFACES
      - RECTIFY WITH REQUIRED INTERFACES
      - DECIDE ON ADAPTER ARCHITECTURE
  - INSTALL PROCESS ENGINE
  - DEFINE PROCESS STEPS

MODEL-DRIVEN APPROACHES

Focus

- DRIVING AND MANAGING INTEGRATION FROM AN ***INTEGRATION MODEL***

- **Key Integration Model Components**
  - ***TECHNICAL ARCHITECTURE***: DETERMINES INFRASTRUCTURE
    - » MIDDLEWARE SUPPORTING THE *PROTOCOLS, INTERFACES, LANGUAGES, TRANSACTIONS*
  - ***DATA MODELS***: THE BLUEPRINT FOR DATA INTEGRATION
    - » *INTEGRATE DATA AT CONCEPTUAL LEVEL AND DERIVE PHYSICAL FROM CONCEPTUAL*
  - ***PROCESS MODELS***: THE BLUEPRINT FOR PROCESS INTEGRATION
    - » *BUSINESS PROCESS MODELS ENFORCE ALIGNMENT*
    - » *TECHNICAL PROCESS MODELS SPECIFY INFORMATION FLOW REQUIREMENTS AND LEAD TO DATA FLOW MODELS*
    - » *EVOLVING FROM STATIC TO DYNAMIC*

MODEL-DRIVEN APPROACHES

PROS AND CONS

PROS

- CAN PRECLUDE MISALIGNMENT WITH BUSINESS
- DYNAMIC CHANGE WITH BUSINESS REQUIREMENTS
- HIGHLY AGILE BUSINESS AND I.T.
- HIGH POTENTIAL
- RAPID, HIGH-VALUE RETURN

CONS

- REQUIRES BUSINESS MANAGEMENT LEVEL COMMITMENT
- REQUIRES RETHINKING BUSINESS/I.T. RELATIONSHIP
- UNFAMILIAR TO I.T. AND BUSINESS
- SHORTAGE OF EXPERTISE
- IMMATURE: FEW TOOLS AND PROTOCOLS AVAILABLE
- NO INTEGRATION STANDARDS: UML, E-R, BPM, OMT, ZACHMAN, etc., etc.,

MODEL-DRIVEN APPROACHES
DEVELOPMENT STEPS

- ***Business***
  - IDENTIFY BUSINESS GOALS AND STRATEGY
  - IDENTIFY BUSINESS PERFORMANCE METRICS
  - ESTABLISH BUSINESS RULES
  - DEVELOP ENTERPRISE ARCHITECTURE
- ***Process***
  - DEVELOP ENTERPRISE BUSINESS PROCESS MODELS
  - ESTABLISH METRICS
  - CREATE A HIERARCHY OF PROCESS MODEL LEVELS
    - » BASIC REFINEMENT TECHNIQUE
    - » SHOULD MIRROR MANAGEMENT CONTROL STRUCTURE
  - BOTTOM LEVELS OF PROCESS MODEL ARE PHYSICAL
    - » SHOULD MIRROR I.T. DATA AND PROCESS FLOWS
  - IMPLEMENTS VERY IMPORTANT PROCESS INDEPENDENCE

MODEL-DRIVEN APPROACHES
DEVELOPMENT STEPS

- ***Middleware***
  - ESTABLISH TECHNICAL ARCHITECTURE
  - IMPLEMENT INFRASTRUCTURE AS REQUIRED
  - DICTATES ADAPTER STANDARDS
- ***Data***
  - MODEL DATA FOR EACH APPLICATION INTERFACE
  - DIFFERENTIATE LOGICAL FROM PHYSICAL
  - CREATE ENTERPRISE LOGICAL DATA MODEL
    - » NOTE THIS IS AN ITERATIVE EFFORT
  - DEFINE LOGICAL DATA MODEL AS A TARGET HUB
  - DERIVE PHYSICAL DATA MODEL FROM LOGICAL
    - » TRANSLATE ALL DATA TO THIS COMMON FORMAT
  - NEED NOT BE STORED IN ONE DATA STORE
  - CAN ACCOMMODATE REPLICATION

MODEL-DRIVEN APPROACHES
DEVELOPMENT STEPS

- ***Implementation***
  - **USE DECISION SUPPORT SYSTEMS TO SUPPORT BUSINESS METRICS**
  - **USE PROCESS-CENTRIC PRODUCTS TO SUPPORT BUSINESS PROCESS MODEL AND ENTERPRISE ARCHITECTURE**
  - **USE MIDDLEWARE-CENTRIC PRODUCTS TO SUPPORT TECHNICAL ARCHITECTURE**
  - **USE PREVIOUS TWO WORK IN CONJUNCTION TO IMPLEMENT AND MANAGE CHANGING TECHNICAL INFRASTRUCTURE**
  - **USE DATA-CENTRIC PRODUCTS TO SUPPORT THE ENTERPRISE LOGICAL DATA MODEL**
  - **IMPLEMENT THE DERIVED PHYSICAL DATA MODEL, PERFORM TRANSFORMATIONS**
  - **PROCESS ENGINE AND ADAPTERS MUST COLLECT METRICS**

THE "RIGHT" APPROACH

WHAT YOU DON'T KNOW WILL HURT YOU!

- **A Middleware-centric Approach When…**
  - THE INFRASTRUCTURE NEEDS STRENGTHENING

  AND
  - LIMITED SCOPE WILL PROVIDE A HIGHLY VISIBLE BUSINESS BENEFIT

  OR
  - YOU CAN AFFORD A LONG DELIVERY AND BOTH DATA AND PROCESS INTEGRATION REQUIREMENTS ARE MINIMAL
- **A Process-centric Approach When…**
  - GOALS ARE LONG-TERM, GOALS ARE GENERAL, FLEXIBILITY IS KEY,

  OR RAPID, HIGH-VALUE RETURN IS NEEDED
- **A Data-centric Approach When...**
  - THE FOCUS IS ON BUSINESS INTELLIGENCE AND CONTROL

  OR
  - GOAL IS INTEGRATION OF EXISTING APPLICATIONS AND DATA SYNCHRONIZATION, CONSISTENCY, AND CONSOLIDATION ARE KEY

THE PRODUCTS

MIDDLEWARE CENTRIC

- **Bluestone Software**
- **NetDynamics**
- **Platinum**
- **IBM (MQIntegrator)**
- **Visual Edge**
- **CrossWorlds Software**
- **Frontec**
- **Active Software Inc.**

THE PRODUCTS

MIDDLEWARE CENTRIC

- **BEA Systems and WebLogic (Tengah)**
- **Inprise Corp.**
- **TSI International Software (Mercator)**
- **Tibco (Rendezvous)**
- **GemStone**
- **Microsoft (MSMQ, COM+, MTS)**
- **NetDynamics Inc./Sun Microsystems**
- **SuperNova Inc.**

THE PRODUCTS

DATA CENTRIC

- Oracle (Applications and Application Server 4.0)
- Sybase (Replication Server)
- SmartDB Corp.
- Constellar Corp.
- Broadbase Information Systems
- SQRIBE
- SAP
- PeopleSoft
- Enterworks Inc.
- Influence Software Inc.

THE PRODUCTS
PROCESS CENTRIC

- HP (ChangEngine)
- Vitria Technology Inc.
- IBM (MQ Workflow)
- InConcert
- NeonSoft, Inc.
- Concept Five Technologies Inc. (services)
- Telos (system integrator)
- Lots of evolving workflow products…

THE PRODUCTS

MODEL DRIVEN

- **Vitria Technology Inc.**
- **Cygent, Inc.**
- **A few others emerging so watch this space…**

PART V

AN EAI REFERENCE ARCHITECTURE

The Future of EAI

"… technology that provides a "workflow-like" coordination framework for process integrity at the business process level will become an integral part of these companies' technology infrastructure."

-- Delphi Group

- **Model-driven, Integrated Approaches**
  - **INDEPENDENCE FROM TECHNOLOGY**
  - **MINIMIZE IMPACT OF CHANGE**
  - **PROCESS REQUIREMENTS DETERMINE DATA REQUIREMENTS**
  - **PROCESS AND DATA REQUIREMENTS DETERMINE MIDDLEWARE (INFRASTRUCTURE) REQUIREMENTS**
- **Introducing . . .**

"Zero Management"

Principles of Zero Management
Well, A Few Anyway...

Motivation

"In a world of ever more rapid change, we cannot afford the high cost of delays in the decision making process, let alone the implementation of a decision."

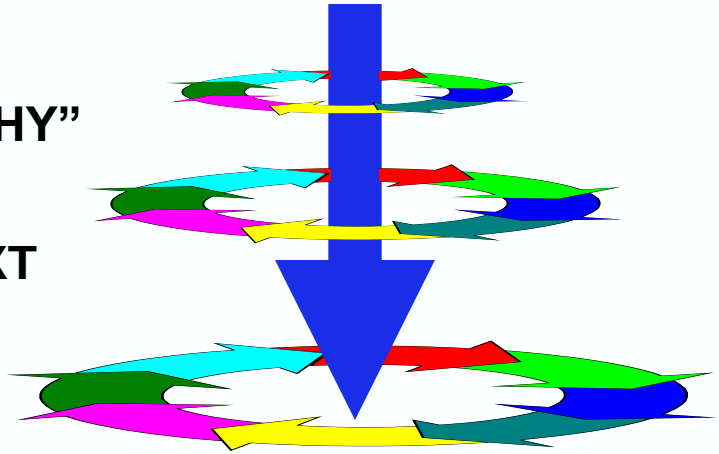
Adaptation is Becoming More Important Than Efficiency

- **OPPORTUNITY ACQUISITION VS. COST CONTAINMENT / REDUCTION**
- **APPROPRIATE LATENCIES SERVE A PURPOSE; *DO NOT REMOVE!***

- **Push Implementation and Decisions to Control Points**
- **Eshew Micro-Management**
- **Constrain Behavior Through Goals and Rules**
- **Every Goal Has Associated Metrics**
- **EAI Is Essential to Implementation of Zero Management**

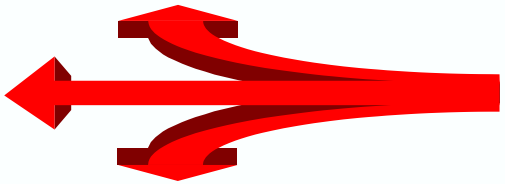
ZERO MANAGEMENT tm
INTEGRATED APPROACHES

- **Vertical Process Integration**
  - TOP DOWN MANAGEMENT "HIERARCHY"
  - PROCESS INDEPENDENCE
  - PROVIDES EVENT AND DATA CONTEXT
  - DYNAMIC CONTROL
  - I.T. OWNS TASK LEVEL PROCESSES
  - I.T. SUPPORTS PROCESS BACKBONE

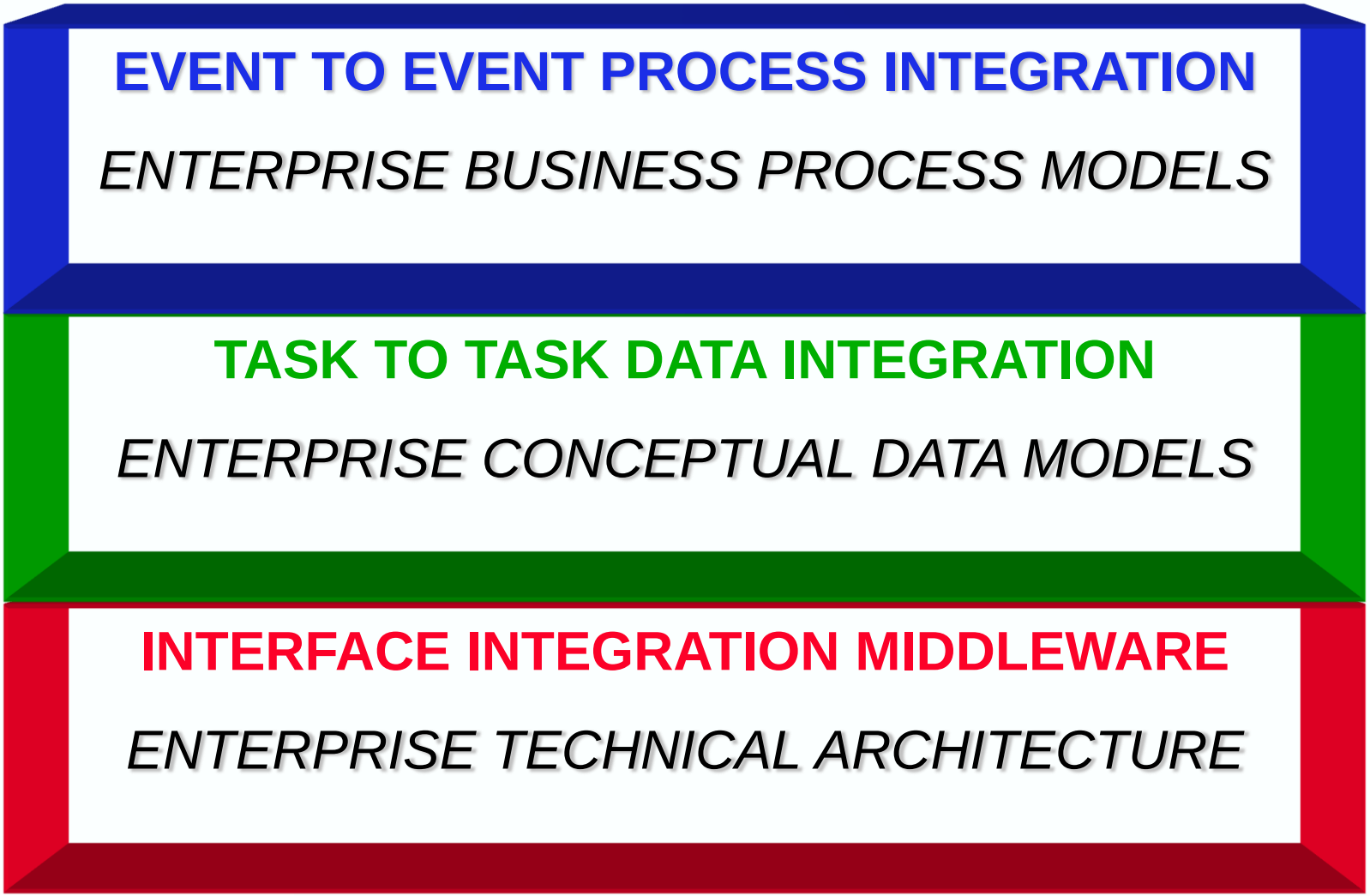


- **Horizontal Data Integration**
  - ACTIVITY TO ACTIVITY
  - PROCESS ENGINE CONTROLS DATA TRANSFER
  - FACILITIES FOR REPLICATION, TRANSFORMATION, CLEANSING
  - BUSINESS TRANSACTION INTERFACES

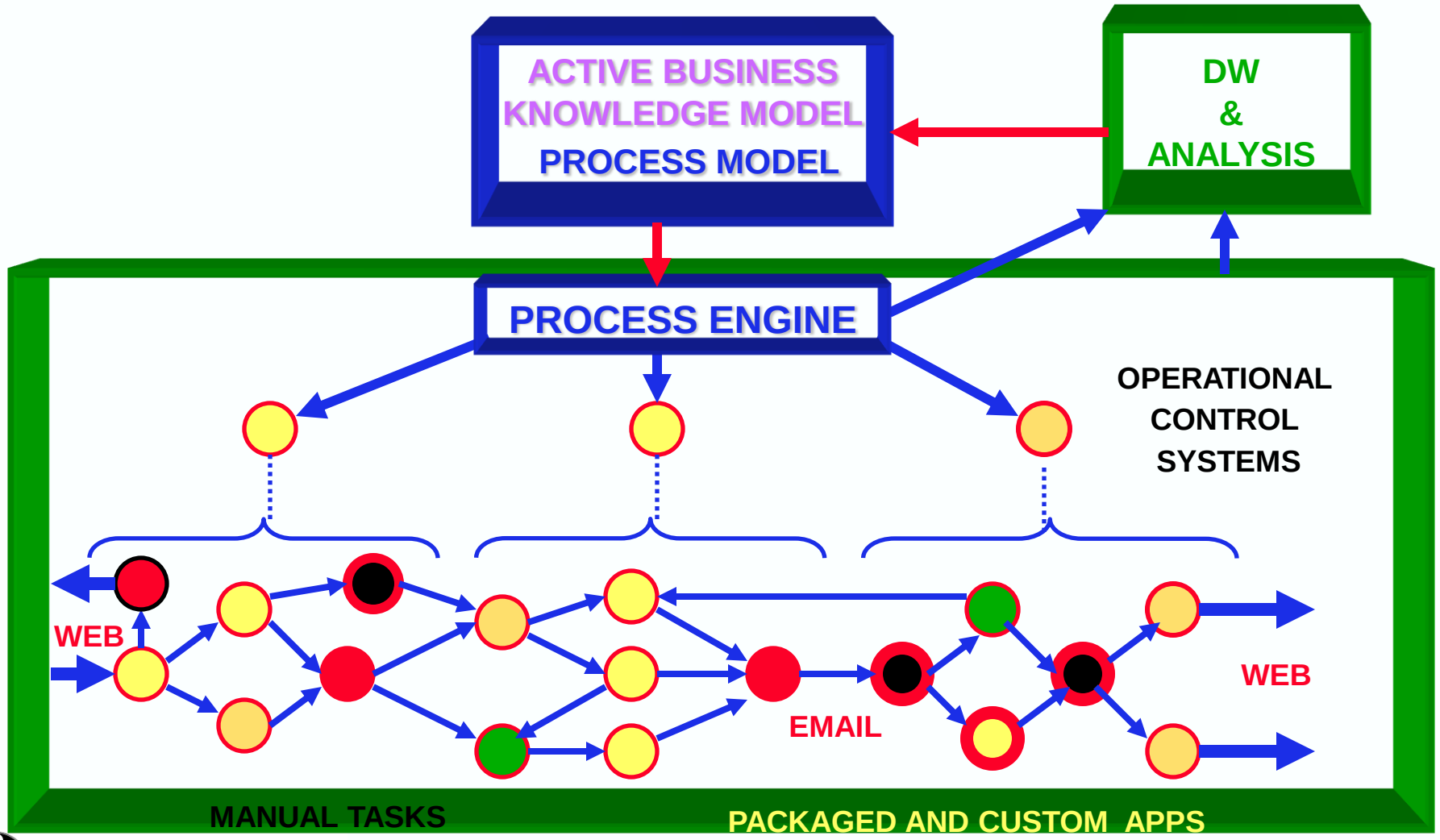
- **Pervasive Middleware Enablement**



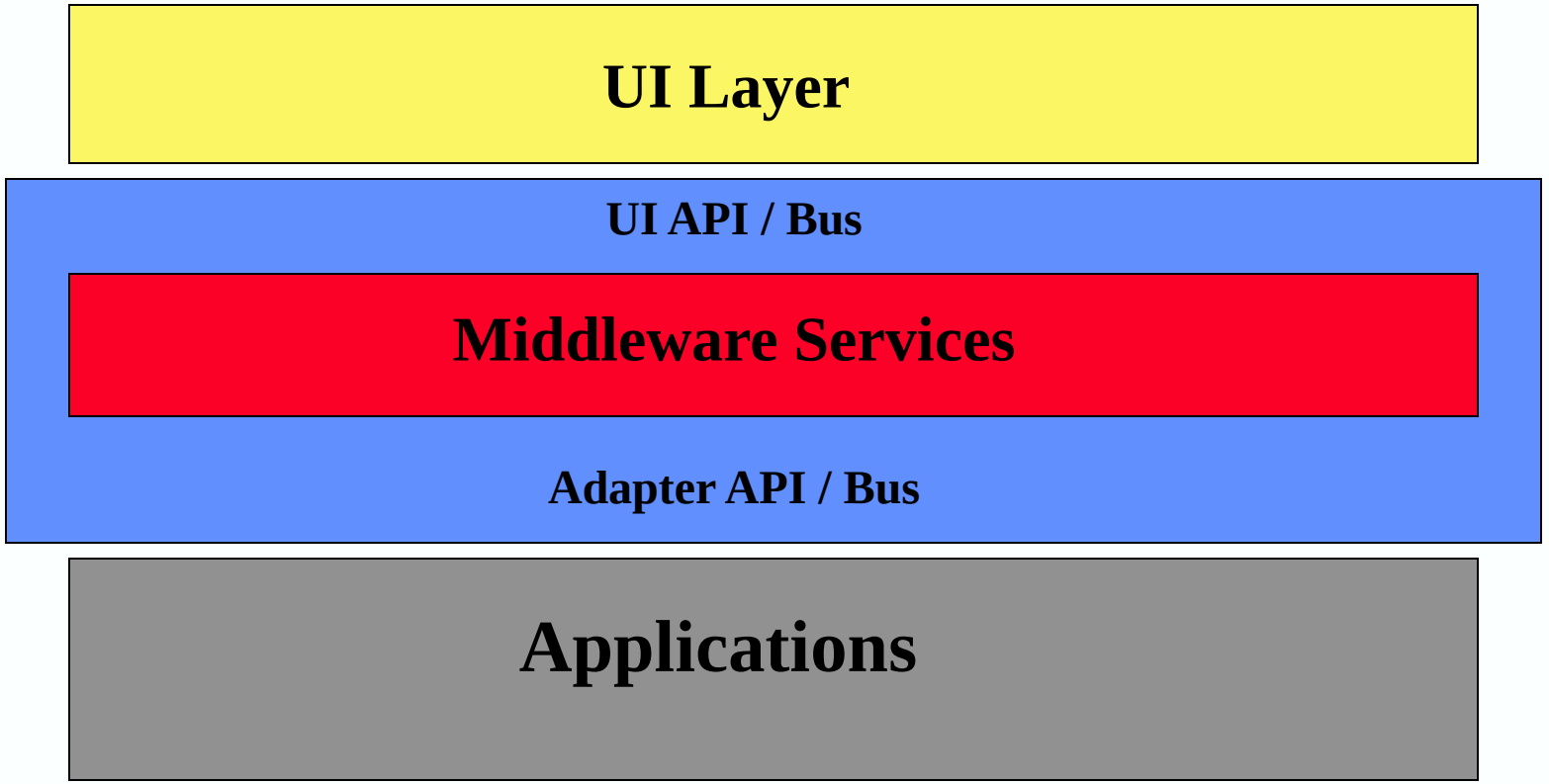
ZERO MANAGEMENT tm
REFERENCE ARCHITECTURE



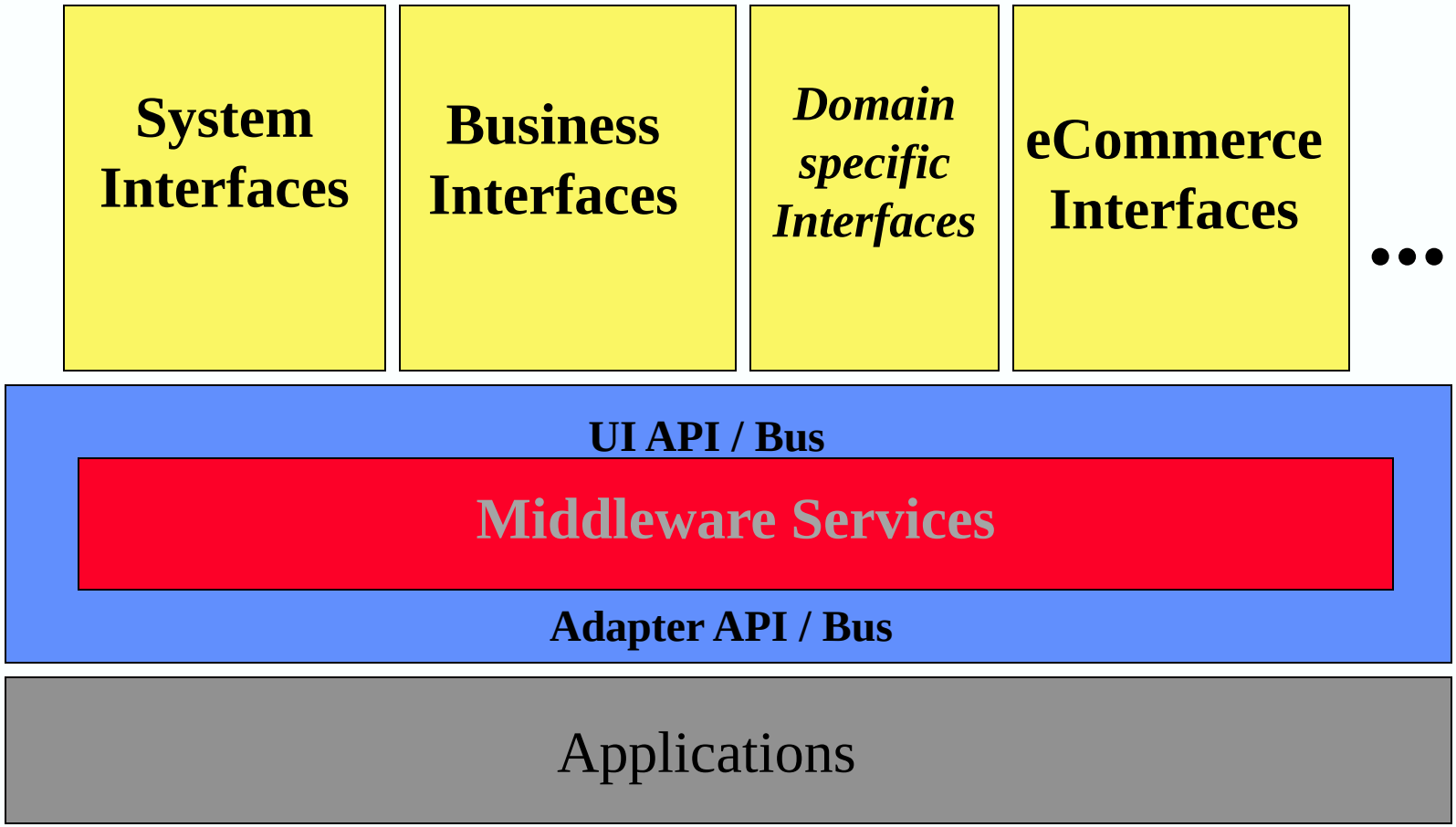
ZERO MANAGEMENT's
ENTERPRISE APPLICATION INTEGRATION



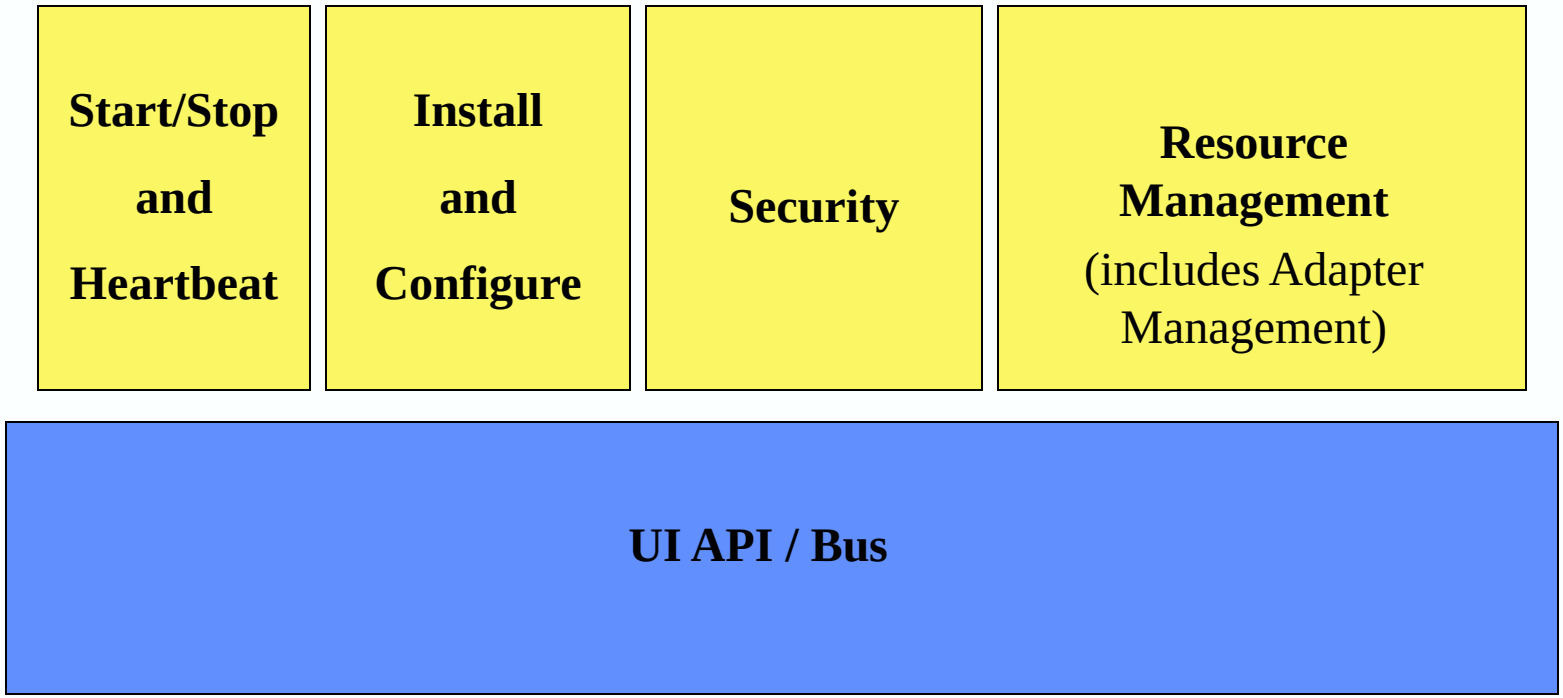
TECHNICAL REFERENCE ARCHITECTURE



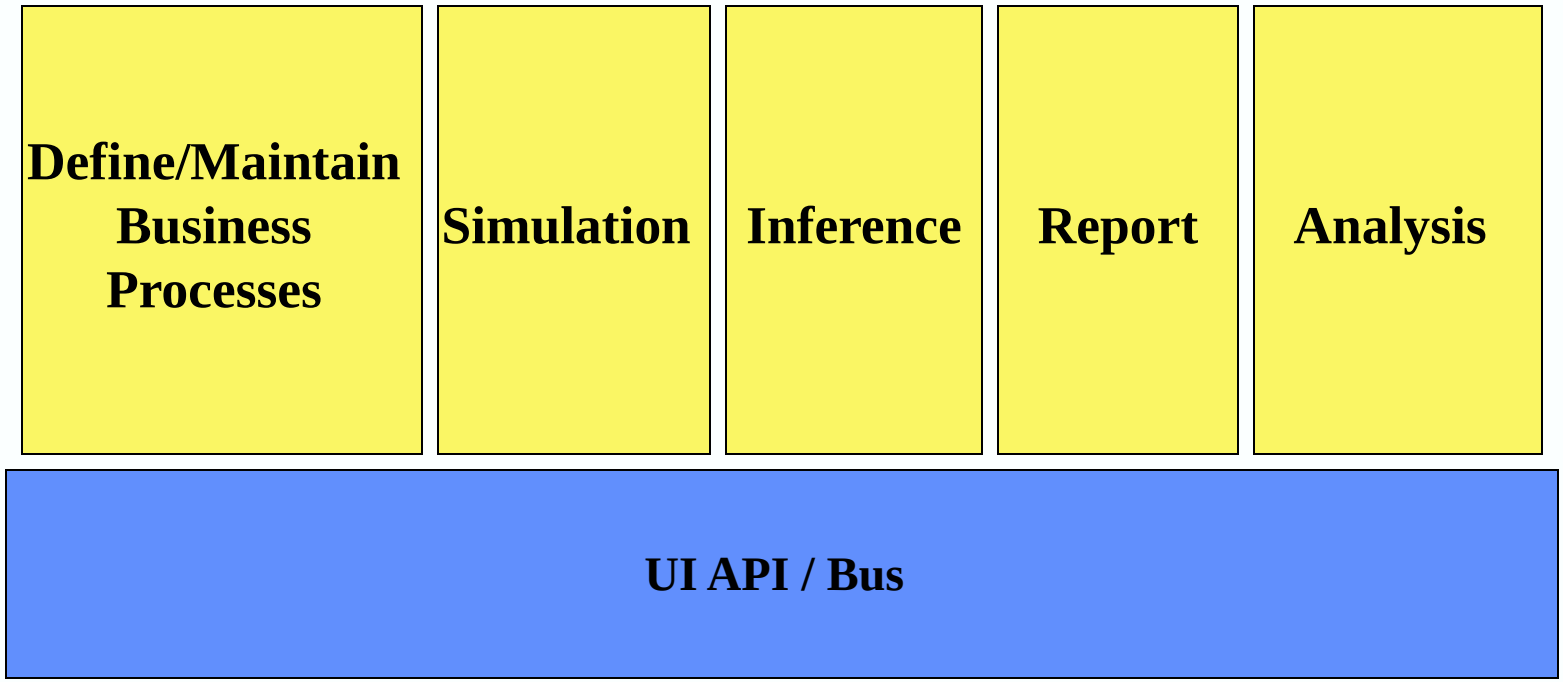
UI LAYER
COMPONENT DETAIL



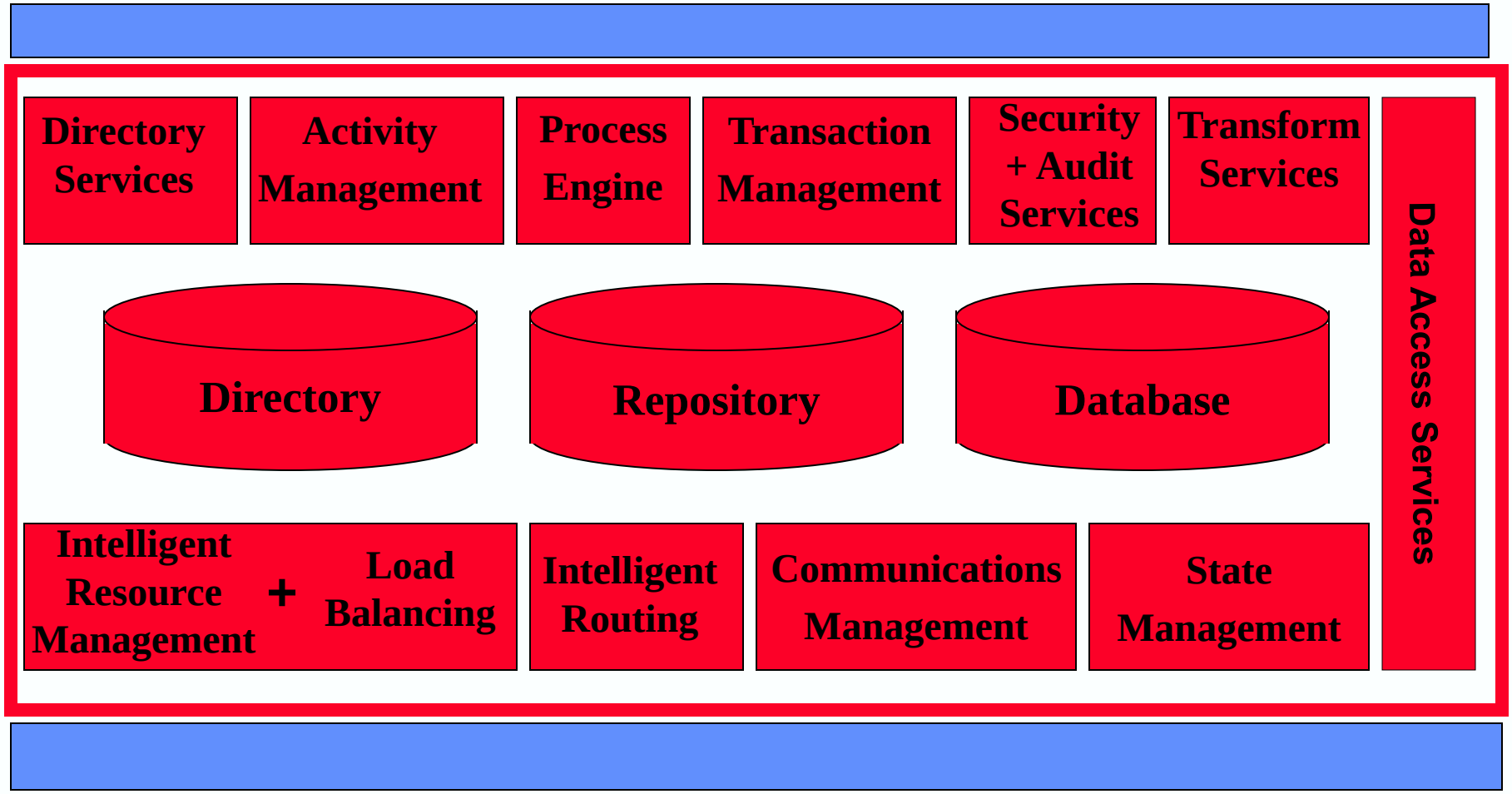
UI LAYER
EXPOSING SYSTEM FUNCTIONS



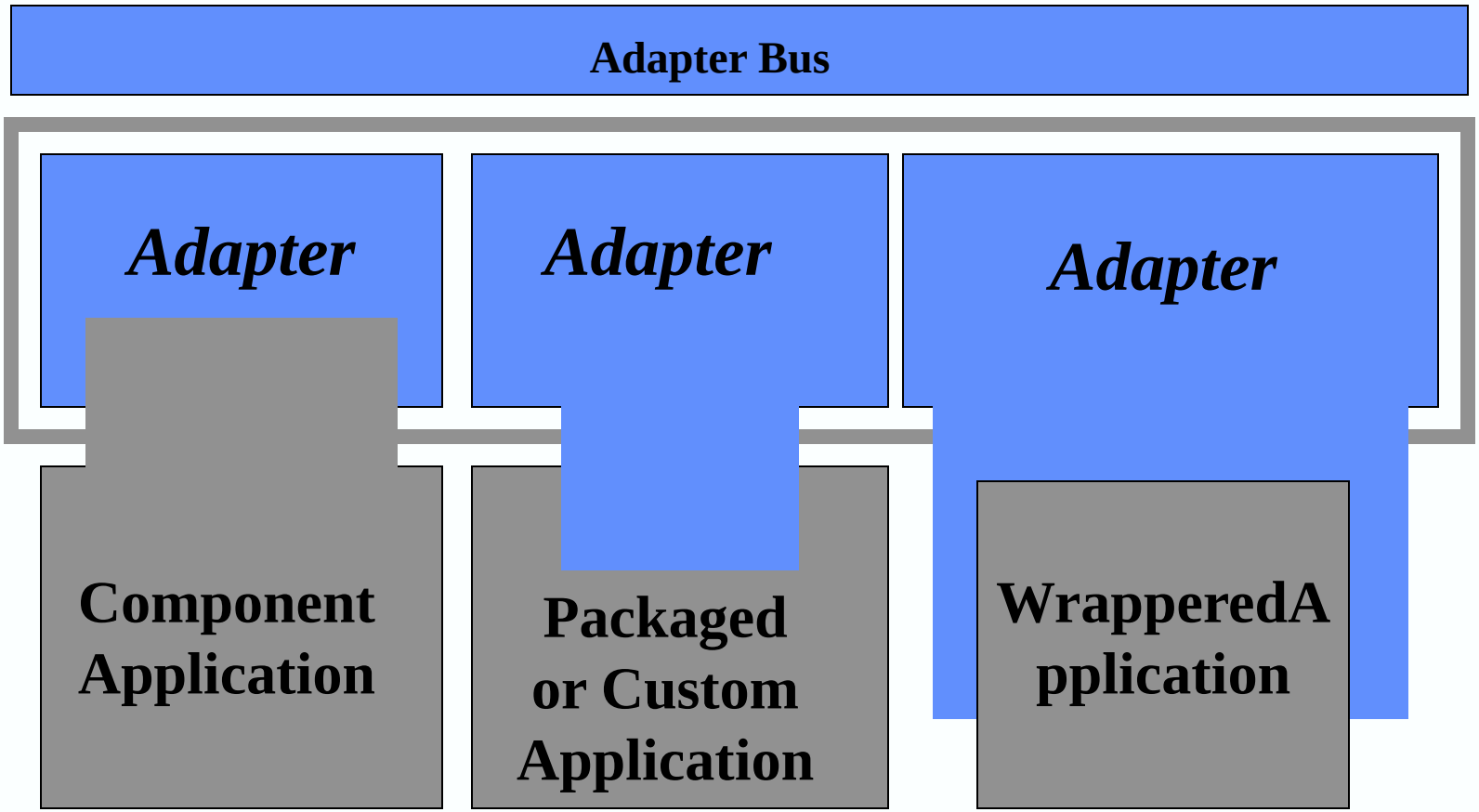
UI LAYER
EXPOSING BUSINESS FUNCTIONS



MIDDLEWARE SERVICES



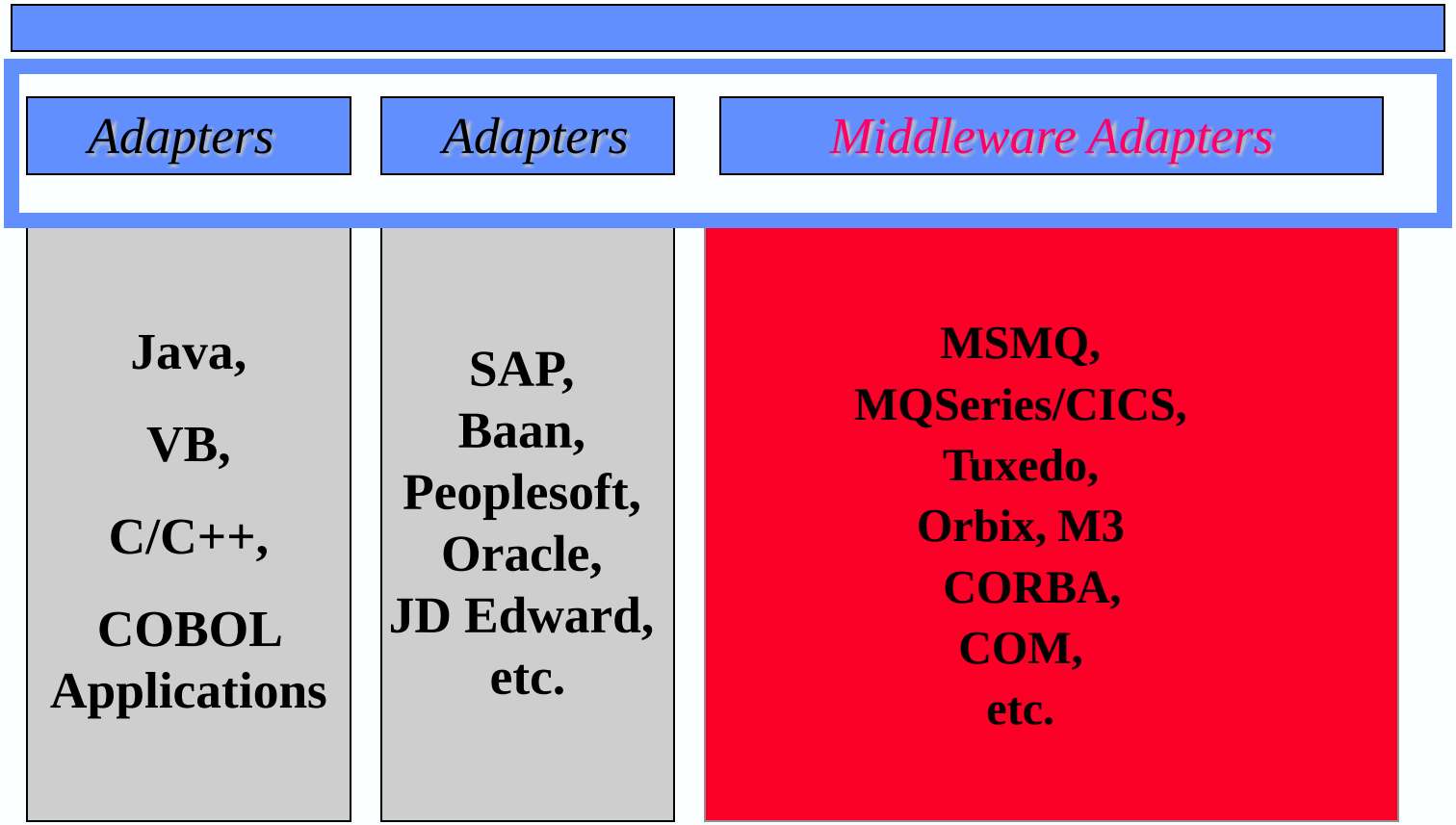
APPLICATION LAYER
ADAPTER EXAMPLES



ADAPTER INTERFACES
FUNCTIONAL EXAMPLES

Adapter Communication	Application Specific	System Integration
• process / schedule	• meta-data	• security control
• life cycle	• data mapping	• system management
• pub/sub support	• application I/F	• validation
• synchronization	• passivation	• testing
• messaging	• state management	• performance
• queue management		• monitoring

APPLICATION LAYER
APPLICATION EXAMPLES



PART VI

PACKAGED APPLICATIONS

SAP R/3

- ARCHITECTURE
- BAPI
- ALE
- RFC
- IDocs
- TECHNIQUES

ORACLE

- ARCHITECTURE
- PACKAGES
- PL/SQL
- INTERFACES TABLES
- WEB
- TECHNIQUES

PEOPLESOFT

- ARCHITECTURE
- PEOPLETALK
- API
- INTERFACE TABLES
- TECHNIQUES

BAAN

- ARCHITECTURE
- BAAN CONNECTIONS
- COM
- CORBA
- WEB AND JAVA
- TECHNIQUES

PART VII

WRAP-UP

EAI SCALABILITY

- **Scalability and Performance**
  - **MUST BE DESIGNED INTO THE ARCHITECTURE**
  - **MUST BE DRIVEN BY THE ARCHITECTURE!**
- **Avoid**
  - **SYNCHRONIZATION**
  - **RESOURCE WAITS**
  - **COUPLED RESOURCES**
- **Replicate Functional Services**

EAI SCALABILITY

- **Take Advantage of Natural Partitioning**
  - DESIGN INTERFACES FOR BUSINESS TRANSACTIONS
- **Scaleup Is Not Theoretically Limited**
  - SCALABLE DESIGNS PERMIT HANDLING MORE LOAD
- **Speedup Is Theoretically Limited**
  - SCALABLE DESIGNS DO ***NOT*** GUARANTEE MORE PERFORMANCE
- **Instrument**
  - BOTH COMPONENTS AND INTERFACES!
  - CONTROL, VALIDATION, TESTING, AND MONITORING
  - STRESS TESTING AND ON-GOING MONITORING

Final Advice

- Business Will Workaround I.T. If Necessary
- Aligning Business to I.T. is a ***Fatal Error***.
- Don't Plan to Align Business and I.T. After the Fact!
- Identify the Drivers, Benefits, and Costs Up Front.
- Establish or Understand the Application Architecture
- Understand the Impact
  - PROCESSES, PERSONNEL, CUSTOMERS, AND SUPPLIERS
- Avoid Disruption of Established Business Processes
- Let Models Drive the Effort

Final Advice

- Scope, Scope, Scope
- The Technical Process of Integrating Enables Re-Use
  - OF EXISTING OR NEW APPLICATIONS AND COMPONENTS
  - 3X-5X RE-USE REQUIRED FOR COST RECOVERY*
  - 1.5X-3X MORE COSTLY TO CREATE REUSABLE COMPONENTS*
  - 4X MORE COSTLY TO CREATE A REUSABLE COMPONENT THAN TO USE AN EXISTING REUSABLE COMPONENT*
  - 2-3 PRODUCT CYCLES BEFORE BENEFITS OF REUSE ARE SIGNIFICANT*
- Build in Scalability
- Instrument for Validation, Testing, and Monitoring
  - PLAN FOR STRESS TESTING AND ON-GOING MONITORING
  - INTEGRATION ELEMENTS ARE NOT JUST GLUE!

* Cutler Information Corp.

Where We Must Go

A Call to Arms…

Standards Now!

Where We Can Go

Announcing….

The EAI Journal

www.eaijournal.com

EIC

www.eicouncil.org

Questions?

For more information on *Zero Management*, please check our Web site: *www.AlternativeTech.com*

BIOGRAPHY

David McGoveran is an industry analyst, and an international management and technology consultant. He is president of Alternative Technologies (Boulder Creek, CA), specialists in solving difficult relational and distributed applications problems since 1981. He has authored numerous technical articles, co-authored several books (including those with Chris Date), and held editorial positions with several publications, including The EAI Journal. His newest book is *The Zero Minute Manager:* Business Success in the New Millennium.