SOA, Services, APIs, & the ESB

or

How to misuse IBM MQ& IBM IB without really trying!

Table of Contents

Architecture

- **Oxford Dictionary ("modern" OED) definitions:**
  - "The style in which a building is designed or constructed, especially with regard to a specific period, place, or culture."
  - "The complex or carefully designed structure of something."
  - "The conceptual structure and logical organization of a computer or computer-based system."

- **About the Approach, Design and Structure of a solution.**
  - Identification of constraints to solution.
  - Maximization of Benefits and minimization of Costs.

- **Can be formally described and evaluated.**

- **Widely misunderstood within the IT community.**
  - Calling a "position" an architect or a document an "architecture" doesn't make it so!

Engineering - 1

- **Oxford Dictionary ("modern" OED) definitions:**
  - "The branch of science and technology concerned with the design, building, and use of engines, machines, and structures."
  - "The work done by, or the occupation of an engineer."
  - "The action of working artfully to bring something about".
- **Involves both "Design" and "Execution".**
- **Key Solution Evaluation Concepts**
  - Cost to Build
  - Cost to Maintain
  - Time to Market

Engineering - 2

- **Key Implementation Concepts**
  - Final Product Quality
  - Total Product Cost
  - Time to Market
  - Improving any one of these three usually puts pressure on the other two!
- **Reliability**
  - Mean Time Between Failure (MBTF)
  - Implications of Failure
- **Occam's Razor**
  - "Entities should not be multiplied unnecessarily".
    - ("Pluralitas non est ponenda sine neccesitate").
  - KISS (Keep It Simple Stupid)

Design Principles

- **Core principles first identified in the 1960s and remain unchanged today!**
  - **Coupling**
    - The manner and degree of independence between software modules.
    - Design goal is to have loose coupling.
  - **Cohesion**
    - A measure of the strength of relationship between pieces of functionality within a given module.
    - Design goal is to have high cohesion.
  - Coupling and Cohesion are interrelated and loose coupling tends to induce higher cohesion and vice versa.
- **Repackaging of the Original Principles**
  - SOA (Service Oriented Architecture)
  - S.O.L.I.D.
    - **S**ingle-Responsibility “Principle”, **O**pen-Closed “Principle”, **L**iskov Substitution “Principle”, **I**nterface Segregation “Principle, **D**ependency Inversion “Principle”
  - Etc.

Programming

- **Assemblers**
  - Assembler instructions mirror computer CPU instructions, there is a one-to-one correspondence between the two.
  - In essence, human readable executable binary code.
  - Translated into CPU binary code by an “Assembler” program.
- **High-Level Languages**
  - Fortran, COBOL, PL/I, C, C++, Java
  - Translated into CPU binary code by a “Compiler” program.
- **Program Calls / Method Invocations**
  - Program/Module/Class “A” wants to execute code in Program/Module/Class “B”
    - Local (same server)
    - Remote (server reached through telecommunications stack (e.g. TCP.IP)
  - Data passed between programs
    - Call by content (Data itself passed/copied)
    - Call by reference (Address of data passed)

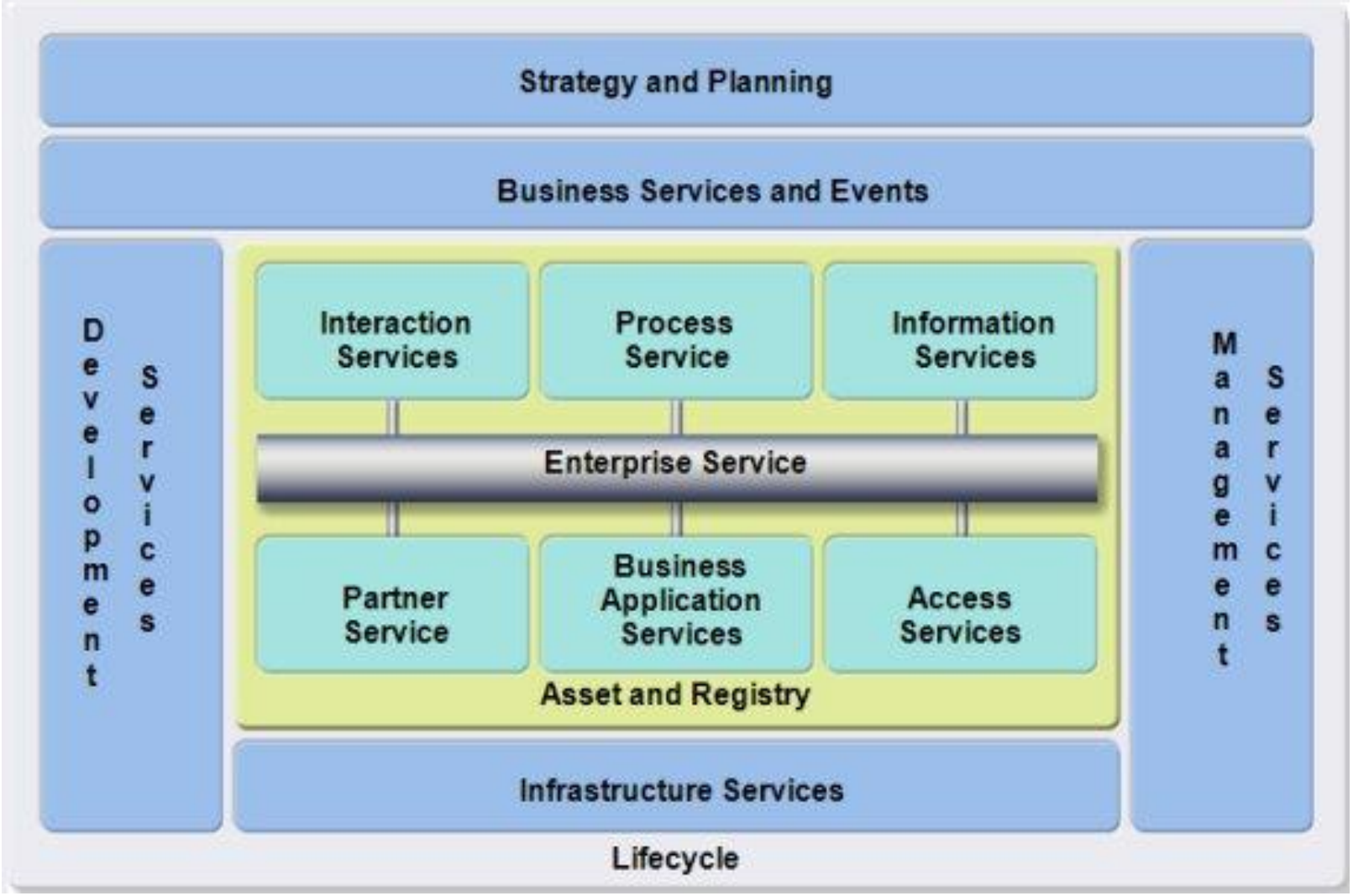
Infrastructure

- **Hardware**
  - Computers, Shared storage (disk), Network devices
- **Software**
  - Operating Systems
    - UNIX, Windows, i5/OS, z/OS
  - Databases
    - DB/2, Oracle, etc.
  - Application Hosting Environments (AHE)
    - Batch/Shell, CICS, IMS, JVMs, Application Servers
  - Middleware
    - MQ, Integration Bus, Adapters
- **Software Stack**
  - Hardware
  - Firmware (implement virtual instruction set)
  - Operating System
  - Middleware
  - Application

Service Oriented Architecture (SOA)

- **History**
  - First described by Alexander Pasik in 1994 (former Gartner analyst)
  - International conferences since 2003
  - Promoted by multiple hardware vendors
    - IBM (Rob High - Chief SOA Architect)
    - Oracle
    - SAP
- **SOA Underpinnings**
  - Architecture based upon loose coupling and high cohesion
  - Architecture lends itself to, but does not require, a distributed solution
  - Architecture technology neutral
- **Vendor Impact**
  - Vendors each “bent” the architecture to conform to their product sets
  - Vendors co-opted architecture to be a sales vehicle

IBM Service Oriented Architecture (SOA)



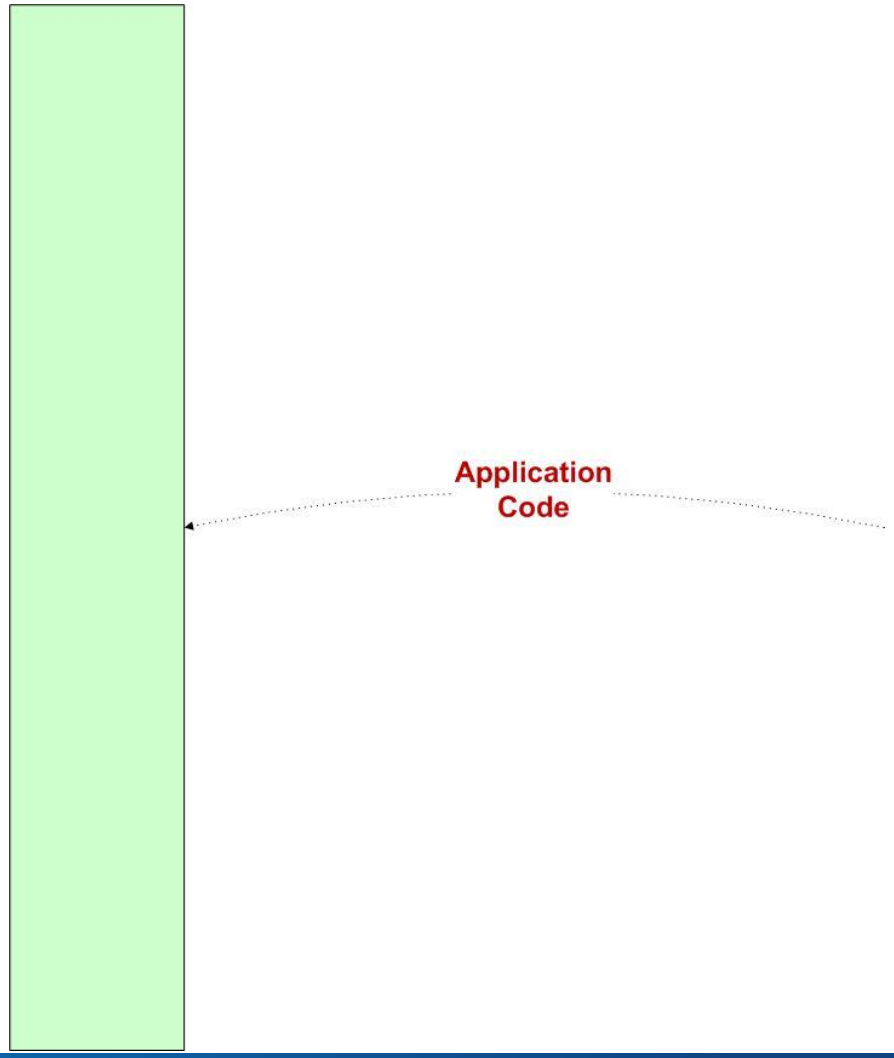
IBM SOA Layers - 1

- **Interaction Service**
  - User or Software Interface Layer – A true layer!
  - *WebSphere Portal Server*
- **Partner Service**
  - A second User or Software Interface Layer – A marketing layer!
  - *WebSphere Commerce Server*
- **Process Service**
  - Process Layer – A true layer! Process logic extracted from business logic.
  - Process modeling enabled as an abstraction (BPEL).
  - *Business Process Manager.*
- **Information Service (IaaS)**
  - Abstracting information storage/retrieval – A true layer. Abstracting SQL, etc.
  - *InfoSphere Information Server.*

IBM SOA Layers - 2

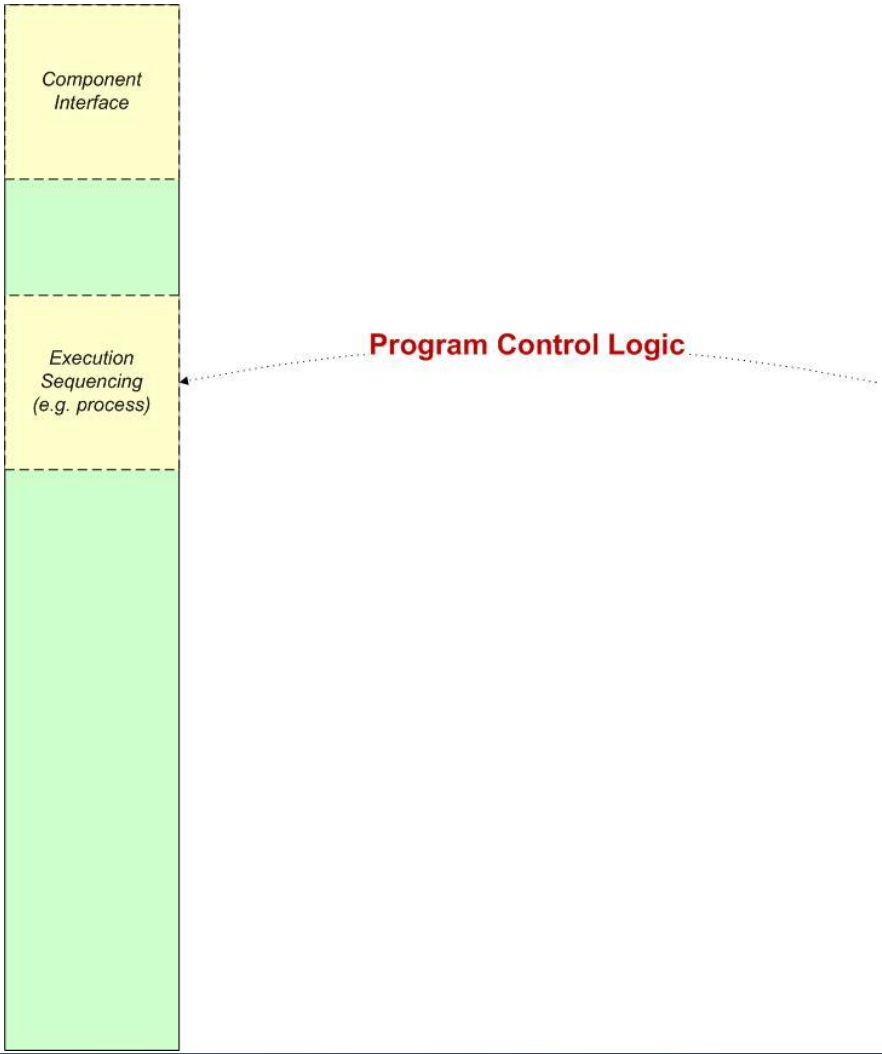
- **Enterprise Service Bus**
  - Communication, Routing. Transformation - A true layer!
  - Connections, Asynchronous Messaging, Routing, Transformation
  - *IMB MQ*
  - *IBM Integration Bus*
- **Access Services**
  - An extension of the ESB – A marketing layer!
  - Most turbulent portion of IBM SOA software suite
    - *(WBIA, Crossworlds, JCA, IIB Nodes)*
- **Business Application Services**
  - Application Hosting Environments – A true layer!
  - *CICS, WebSphere Application Server*

Application Structure - 1

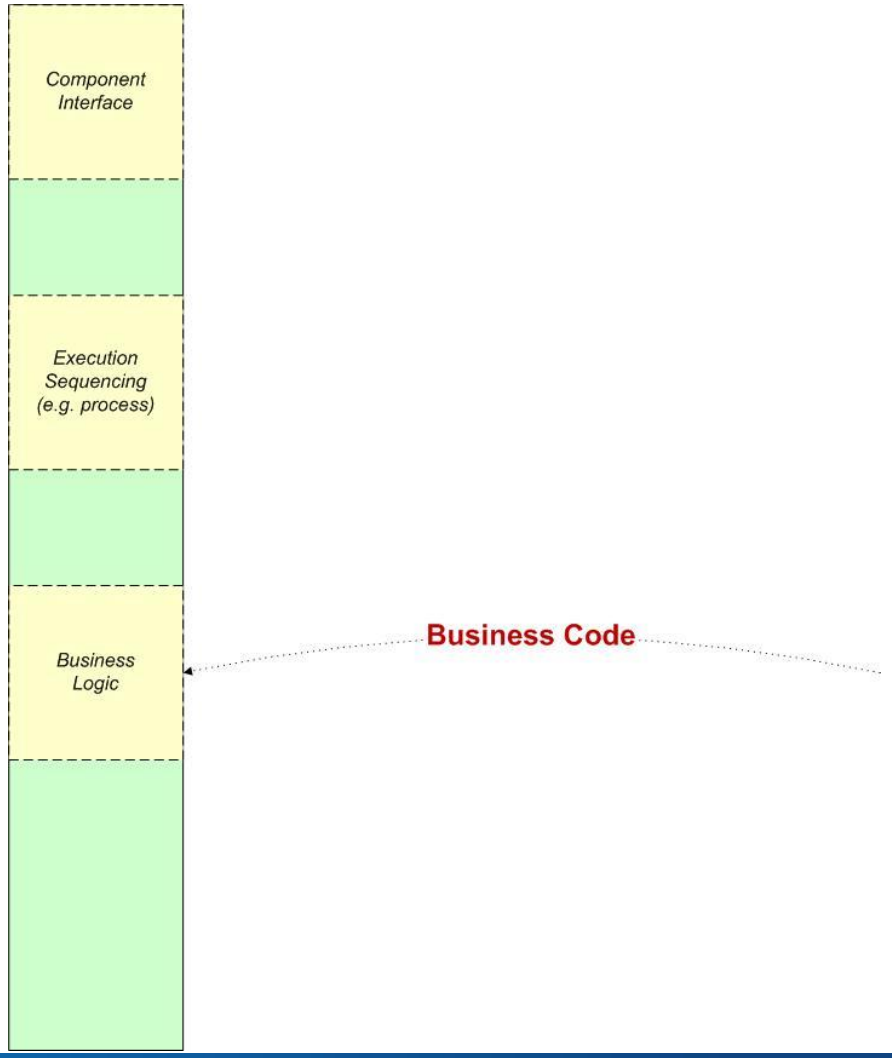


Application Structure - 2

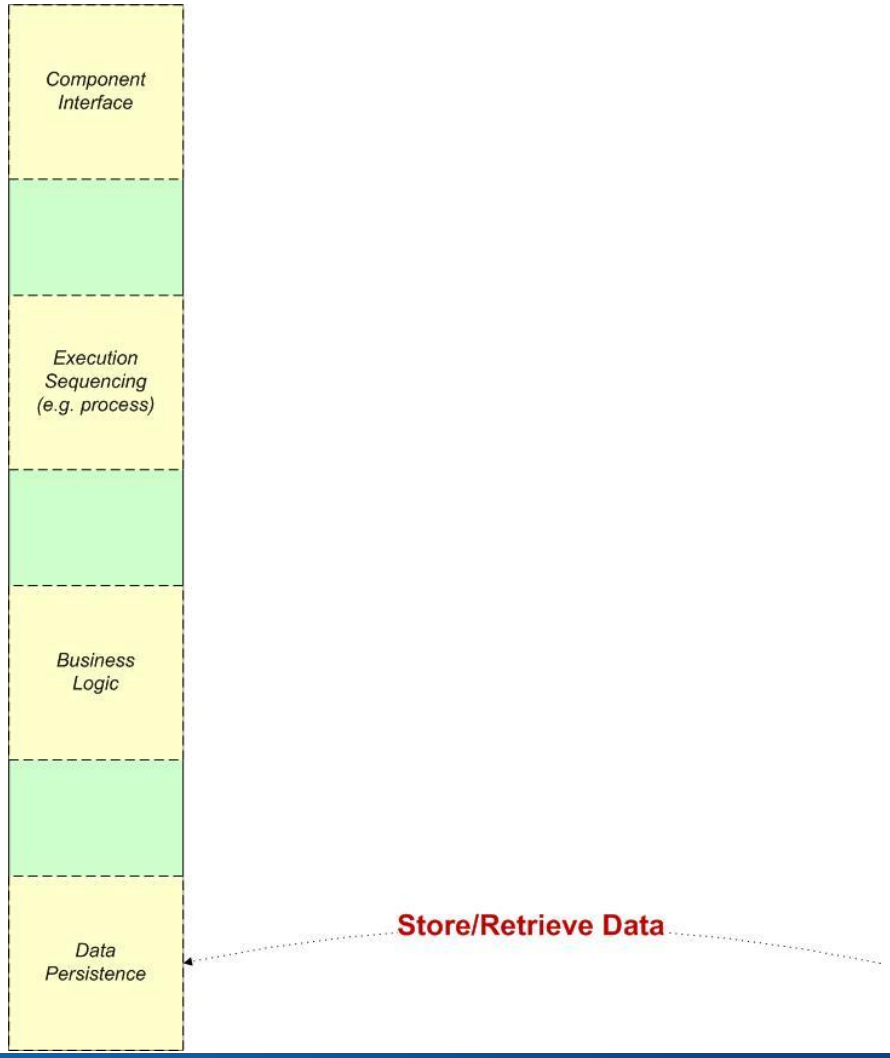
Application Structure - 3



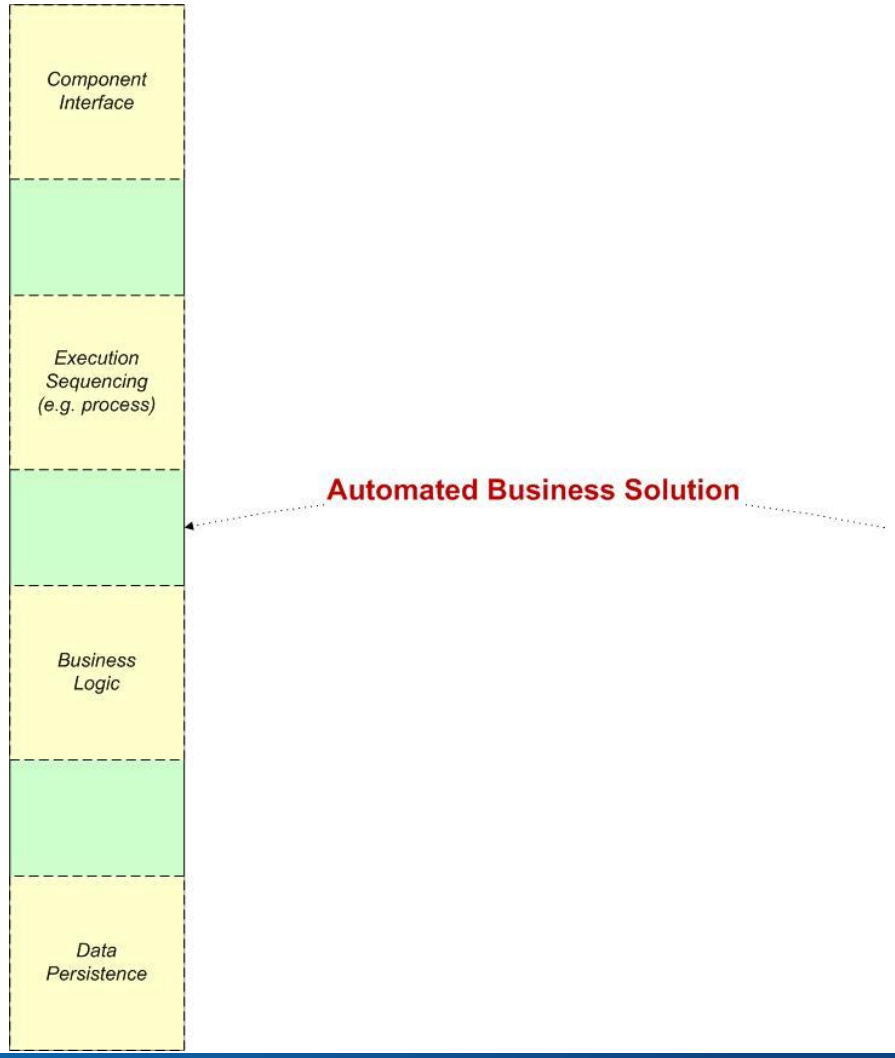
Application Structure - 4



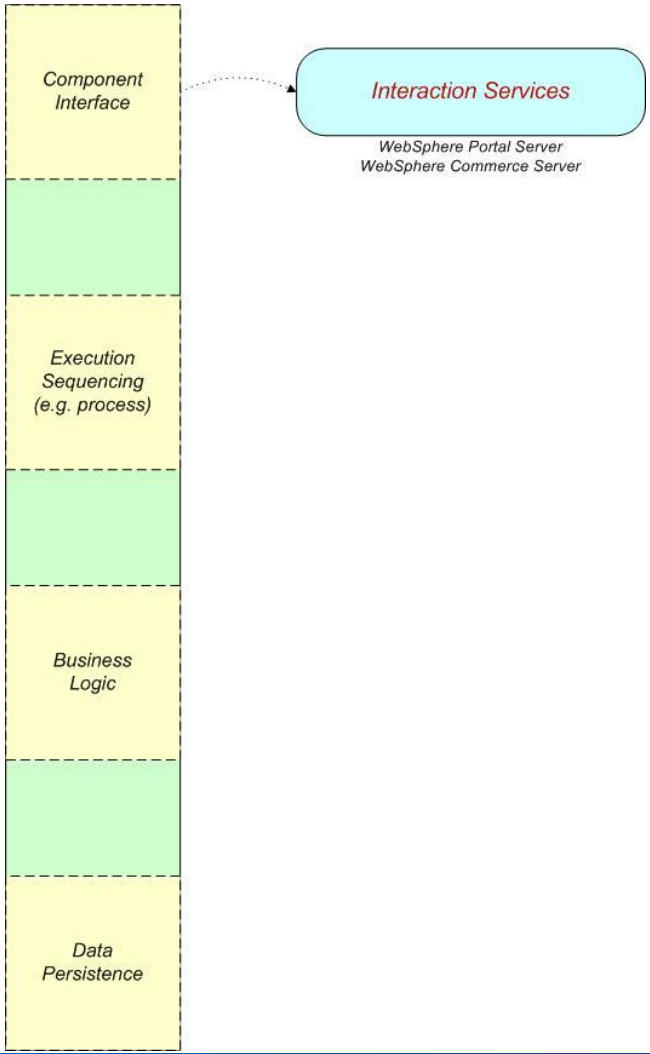
Application Structure - 5



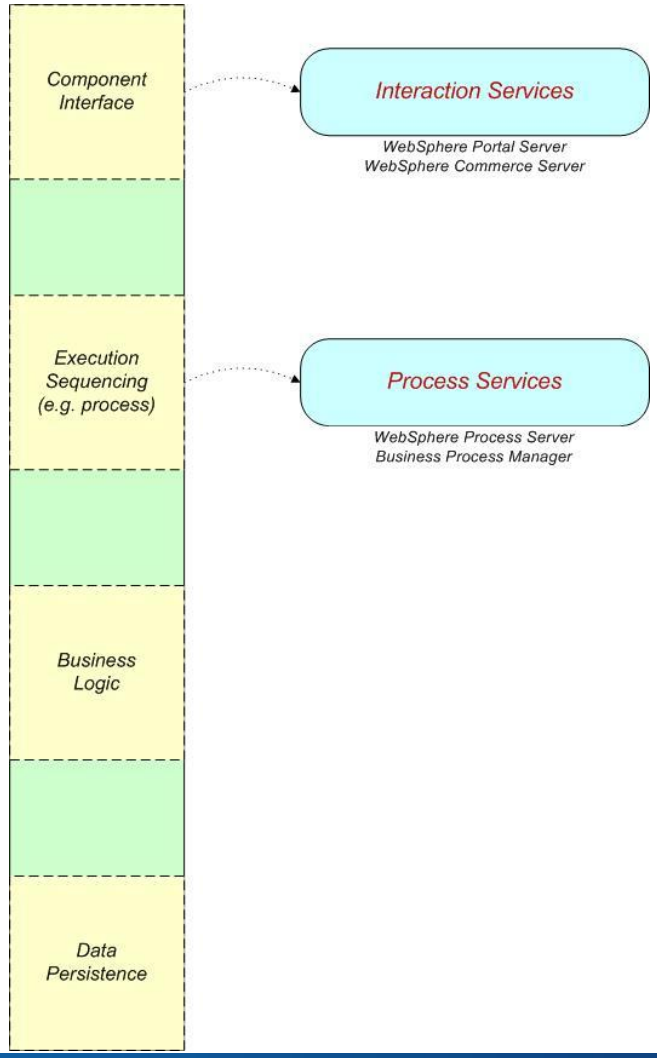
Application Structure - 6



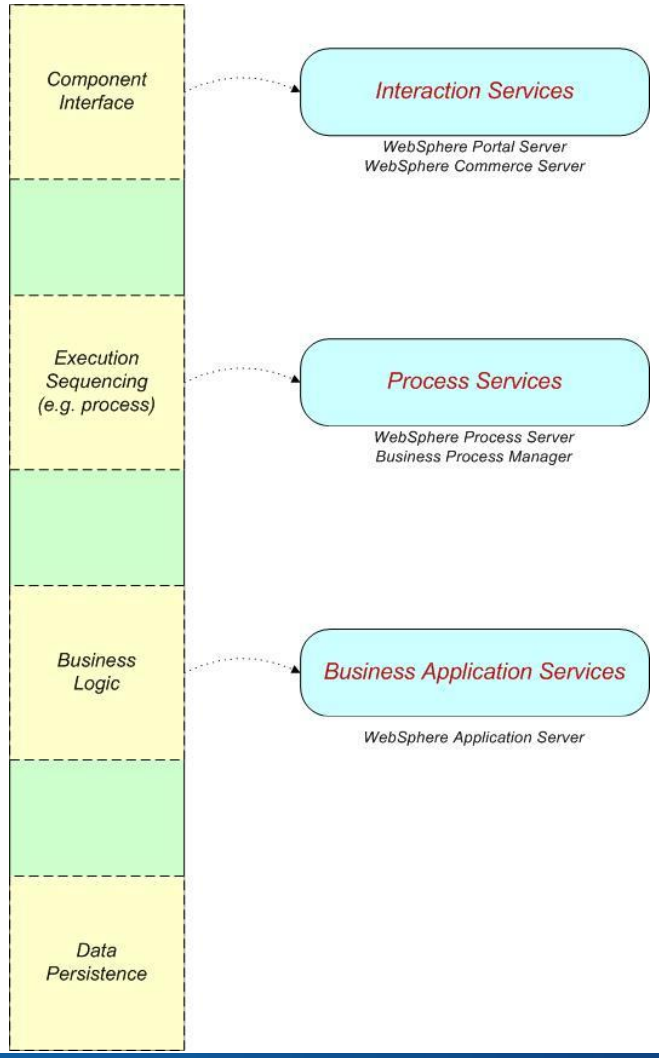
An Application in SOA - 1



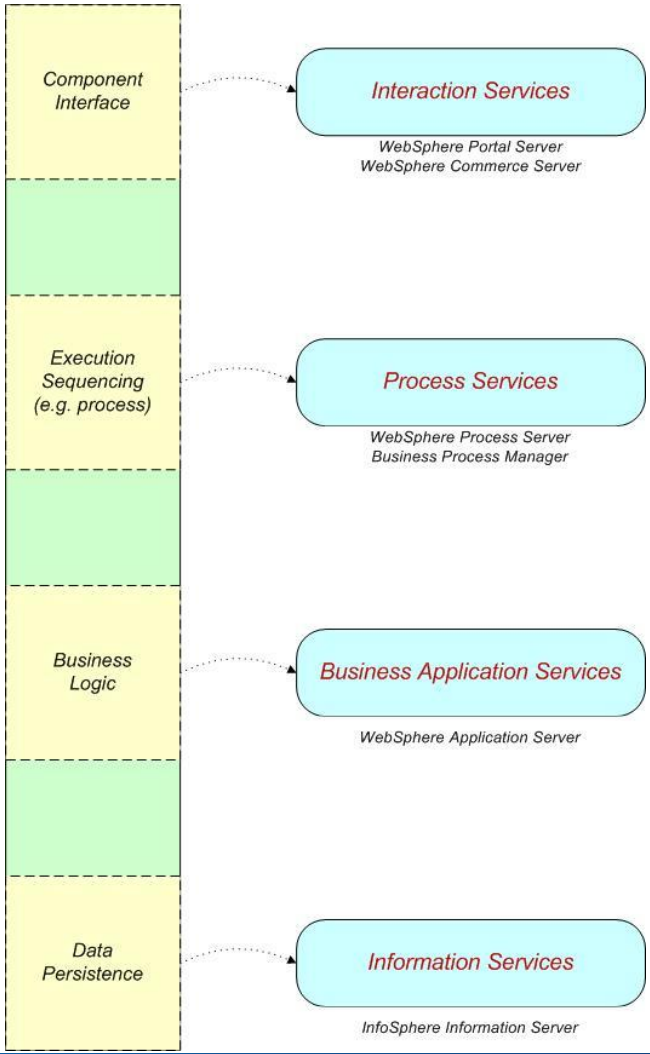
An Application in SOA - 2



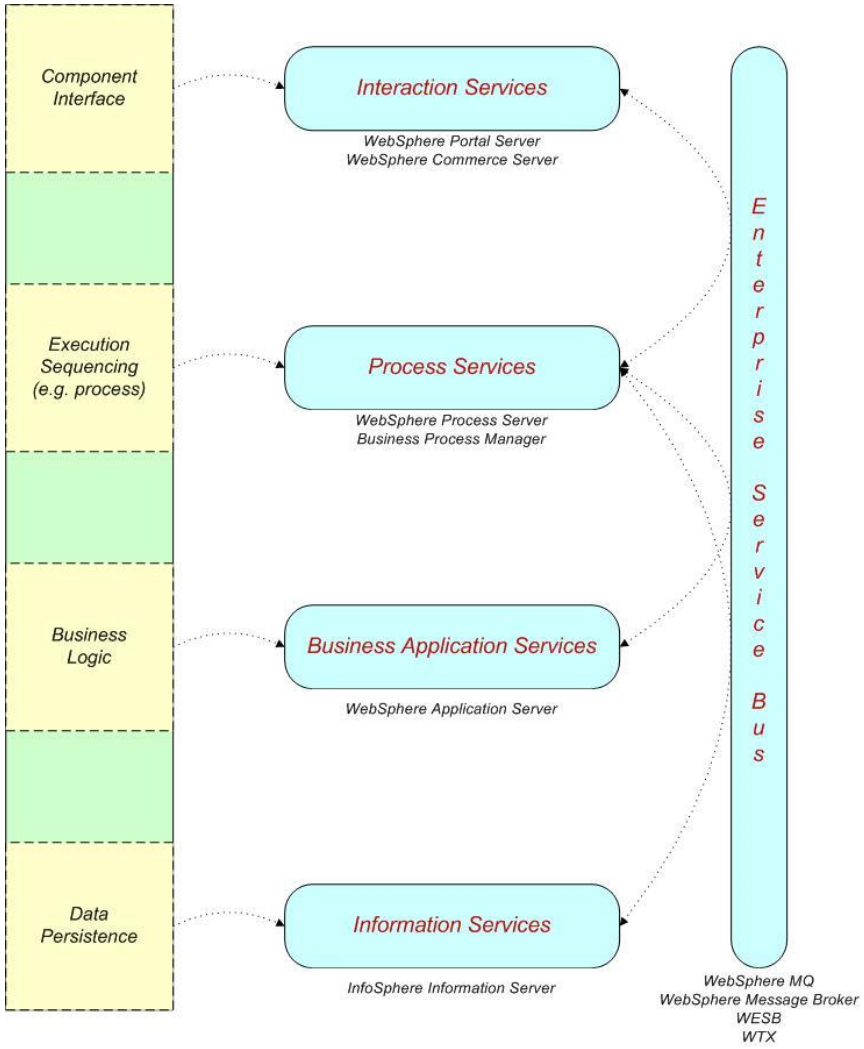
An Application in SOA - 3



An Application in SOA – 4



An Application in SOA - 5



SOA using Spaghetti

SOA Objectives

- **Goal #1 - Agility**
  - Deploy software to market more quickly
    - Reuse infrastructure patterns
    - Minimize impact upon existing applications
    - Modest reuse of new/existing business software
  - Concept is to assemble business solutions from available components (e.g. services)
    - Easy access to existing business logic
    - Rapid development of new business logic
- **Goal #2 - Cost Reduction**
  - Minimize new solution impacts upon existing systems
    - Achieved through loose coupling
    - Achieved through high cohesion (reduces/isolates new development)
    - Faster time to market

Side Effects of Services

- **Ownership**
  - If software is shared, who owns it?
- **Management**
  - If software is shared, who performs change control?
  - Notification?
  - Testing?
  - Performance?
  - Tools
- **Monitoring**
  - How do you predict the shared load on software?
  - When will it break?

ESB Quality of Service

- **Different ESB implementations have different qualities of service**
  - Transactional (IBM MQ / IB, WESB, Web Services, etc.) & “Batch”/”Bulk” (FTP, ETL, etc.)
  - The implementation chosen should be based on the quality of service required
- **Connectivity**
  - Network connectivity
  - Operating System / Runtime environment support
  - Programming language support ‘/ Ease of use
- **Integrity**
  - Data Integrity / Transactional support
- **Reliability**
  - Availability (Uptime)
  - Monitoring (Proactive Management)
- **Agility**
  - Decoupling of endpoints
  - Ease of modification / insertion of new function / transparency to end-points
  - Routing and transformation
- **Security**

ESB Implementations

- **Enterprise Service Bus**
  - Web Services
  - Messaging
  - Extract, Transform, Load (ETL), File Transport (FTP)
- **Web Services**
  - Fundamentally a Remote Procedure Call
  - Tightly coupled point-to-point solution
  - Lowest quality of service
  - Maximum connectivity
- **Messaging**
  - Loosely or tightly coupled solution
  - Highest quality of service: Routing, Transformation, Value-Add processing enabled
  - Transactional, requires messaging engine and broker
- **ETL**
  - Alternative to messaging, with some possbile interoperability (e.g. IIB WTX Node)
  - Optimized for batch, requires a runtime ETL engine (WTX, DataStage)

Services

- **Every program ever written has an interface.**
  - Data is passed by content or by reference.
  - Interface may be called a “Service”.
  - Interface may be called an “API”.
- **Not every program written will be a “Service” with a wide potential.**
  - Most programs/services are local/tactical rather than strategic/enterprise.
  - These programs/services will still be executed in SOA middleware.
  - These programs/services will require minimal management.
- **Some programs/Services will be Enterprise in nature/potential.**
  - These programs/services must be managed and controlled.
  - In most shops, this is relatively a handful of Services.
- **Service Invocation**
  - Invocation should not be limited by channel (e.g. Web Service vs messaging).
  - Invocation should not be limited by runtime environment.
  - Invocation should be seen as a “front-end” channel to a service.
- **Service Versioning**

Service Goals

- **Connectivity**
  - Service should be highly reachable
  - Service access should be protocol independent (use facades)
- **Decoupling**
  - Decouple applications
    - Change Application-to-Application to Application(s)-to-ESB-to-Application(s)
    - Change Point-to-Point to Many-to-Many
    - Introduce “Point of Agility” (ESB)
  - Decouple Services
    - Location of service provider
    - Data structures used by service provider
    - Workflow (if any) embedded in Service Provider
  - “Publishing” Applications should only have one interface (ESB)
  - “Subscribing” Applications should have only one interface (ESB)
- **Cohesion**
  - Service should implement a single business function
  - Service should be decoupled from back-end provider workflow
  - Service should be decoupled from front-end client workflow

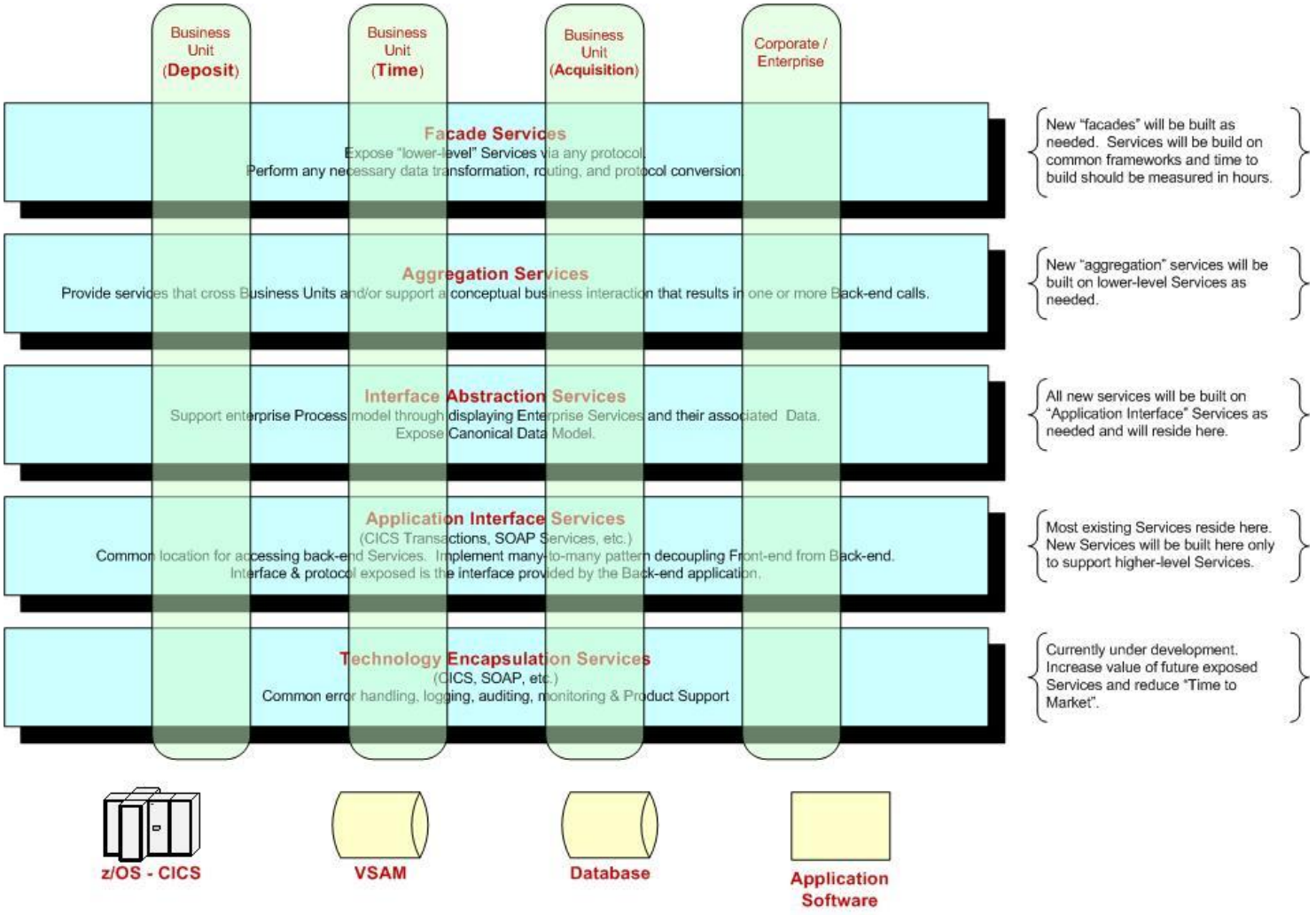
SOA implications for the ESB

- **Connectivity & Quality of Service**
  - Consider the Quality of Service (QoS) for each Service
  - Implement Services as Message Flows
    - Scalability, Reliability, Monitoring, etc.
    - Create protocol facades (SOAP, REST, etc.) for protocol support
- **Cohesion**
  - Break the Application-to-Application programming paradigm
  - IIB is NOT an mere extension of application code
  - Develop “layers” of service
  - Encapsulate technologies (e.g. CICS, SAP, etc.)
    - Common access sub-flow
    - Common error handling, logging, auditing, etc.
  - Encapsulate Back-end applications (as Service providers)
    - Encapsulate Back-end workflow
    - Canonical Data interface

SOA implications for the ESB - continued

- **Decoupling**
  - "Readers" and "Writers" should know as little about each other as possible.
    - Physical location and object name should be unknown
    - "Readers" and "Writers" should not directly bind to a common object (e.g. queue)
  - Many queues used for Point-to-Point messaging in a tightly coupled manner
    - "Reader" and "Writer" both bound to same object (queue)
    - "Reader" bound to object (queue) location (limitation in IBM MQ)
    - Unable to transparently intercept and manipulate a message
  - SOA style usage of IBM MQ
    - "Readers" and "Writers" each have their own (different) alias
    - Topics & Subscriptions
    - Application created solution for location of messages to be read
  - SOA style usage of IBM Integration Bus
    - Applications should "publish" one update
    - Routing and transformation necessary for readers performed in Broker

ESB Service Layers and Silos



Application Programming Interfaces (APIs)

- **SOA vis-a-vis API**
  - SOA Services and API interfaces are identical in function:
    - Allow software to intercommunicate with other known interfaces.
    - Increase capability and speed deployment through component assembly rather than build from scratch.
  - SOA Services and API approaches are complementary rather than competitive
  - Everything we have been through with SOA is being rediscovered / reinvented in APIs
- **Services**
  - Generally internal/proprietary to corporations
  - Primarily, but not exclusively, Intranet based
  - Protocols: Messaging APIs, Web Services (SOAP, REST)
- **APIs**
  - Akin to Open Source
  - Primarily Internet based & heavily TCP/IP oriented
  - Frequently closely bound to lightweight protocols

APIs and IBM MQ

- **Existing IBM MQ Programming Interfaces**
  - IBM – MQI, AMI, MQ Classes for Java, MQ Classes for JMS, .Net, C++, XMS.Net
  - Sun/Oracle – JMS
- **MQTT (formerly Message Queuing Telemetry Transport)**
  - Lightweight Publish/Subscribe protocol (Cirrus Link → IBM → OASIS)
  - Used in IBM Message Sight, Facebook Messenger
  - Amazon Web Services (AWS) IoT based on MQTT (per Amazon)
- **MQLight**
  - IBM Lightweight messaging protocol for the API world
  - Leverages AMQP 1.0 Wire Protocol
  - Does not yet interface with IBM MQ
    - Likely to interface with IBM MQ through API channels (like SVRCONNs)
    - Stay tuned
- **Competing Open Source APIs (IETF, OASIS, etc.)**

Putting it all together – ESB, SOA & APIs

- **Twenty plus years of IBM MQ success because of:**
  - Agility
    - Connectivity across disparate run-time environments.
    - Easy to learn API.
    - Significant speedup of cross platform application deployments
  - Data Integrity
  - No major transactional competitor when introduced over 20 years ago
    - ETL (Mercator).
- **What is now competing with IBM MQ?**
  - Web Services; and they are widely used for all of the wrong reasons.
  - APIs, and they are the hot new thing (see Web Services).
- **APIs**
  - Web Services all over again
- **How will we use IBM MQ in the next 20 years?**

Summary & “Takeaways”

- **IBM MQ**
  - Use aliases to decouple “Gets” from “Puts” (“Reader” from “Writers”).
  - Use Topics and Subscriptions to provide routing and many-to-many connections
    - Remember that a Topic should also be accessed through an alias.
- **IBM Integration Bus**
  - Applications should only “publish” an event once
  - “Writers” (Publishers) should be decoupled from “Readers” (Subscribers)
    - Writer should “publish” result in the standard format
    - Writer should provide all necessary data relevant to the event
  - Routing and transformation implemented in Broker
- **Enterprise Services**
  - Should be implemented using IBM MQ / Integration Bus
  - If required, can be reached by a Web Service facade
- **APIs**
  - Public facing facades

Questions & Answers

Presenter

- Glen Brumbaugh
  - Glen.Brumbaugh@TxMQ.com
- Computer Science Background
  - Lecturer in Computer Science, University of California, Berkeley
  - Adjunct Professor in Information Systems, Golden Gate University, San Francisco
- IBM MQ Background (20 years plus)
  - IBM Business Enterprise Solutions Team (BEST)
    - Initial support for MQSeries v1.0
    - Sponsored by Hursley Laboratory
  - IBM U.S. Messaging Solutions Lead, GTS
  - Platforms Supported
    - MVS aka z/OS
    - UNIX (AIX, HP-UX , Linux, Sun OS, Sun Solaris)
    - Windows
    - iSeries (i5OS)
  - Programming Languages
    - C, COBOL, Java (JNI, MQ for Java, MQ for JMS)


Thank
You