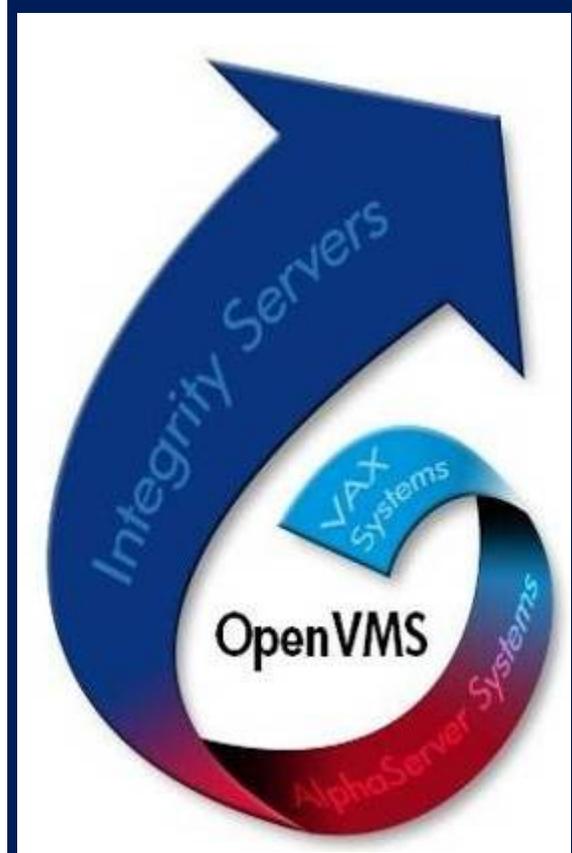




# Integration of OpenVMS Data and Applications



**John Apps**  
**Business Critical Servers**  
**HP**



# Agenda

- **Service-Oriented Architecture: Enabling an Adaptive Infrastructure for an Adaptive Enterprise**
- Integration Technology packaging on OpenVMS
- Software Development
  - ...no integration without it...
  - On OpenVMS
  - On other platforms for OpenVMS
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  - Data
  - Components
  - Applications
  - Web Services
  - Message Queuing and Caching
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- Questions and answers

## Service-Oriented Architecture

The evolution of [Web] applications into service-oriented components with Web Services

The concept of *Web Services* is the beginning of a new *Service-Oriented Architecture* in building better software applications

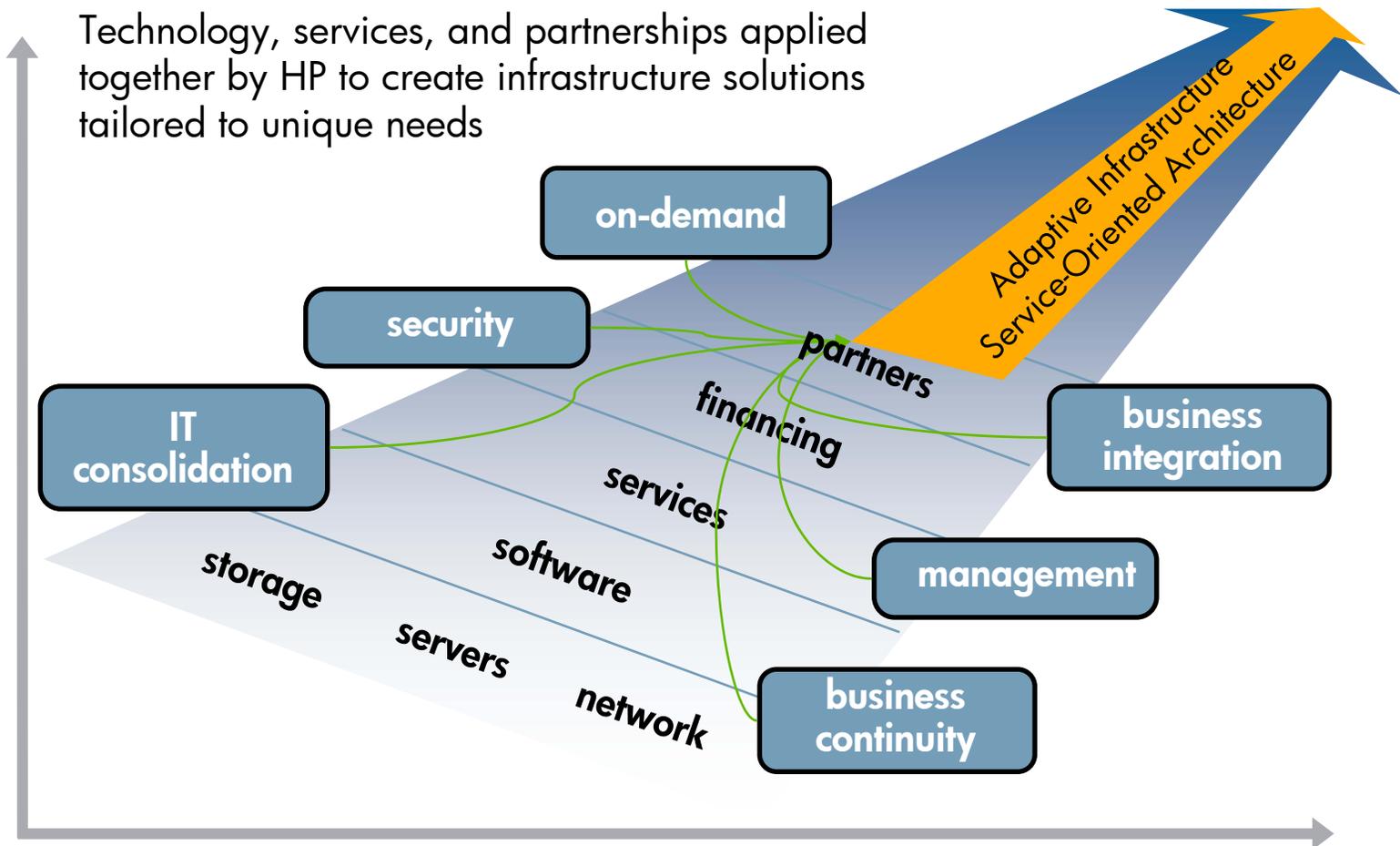
The change from an *object-oriented system* to a *service-oriented* one is an evolutionary idea stemming from the Internet and Web system

Services must be based on shared organizing principles that constitute a *Service-Oriented Architecture*, the architectural concept behind *Web Services*

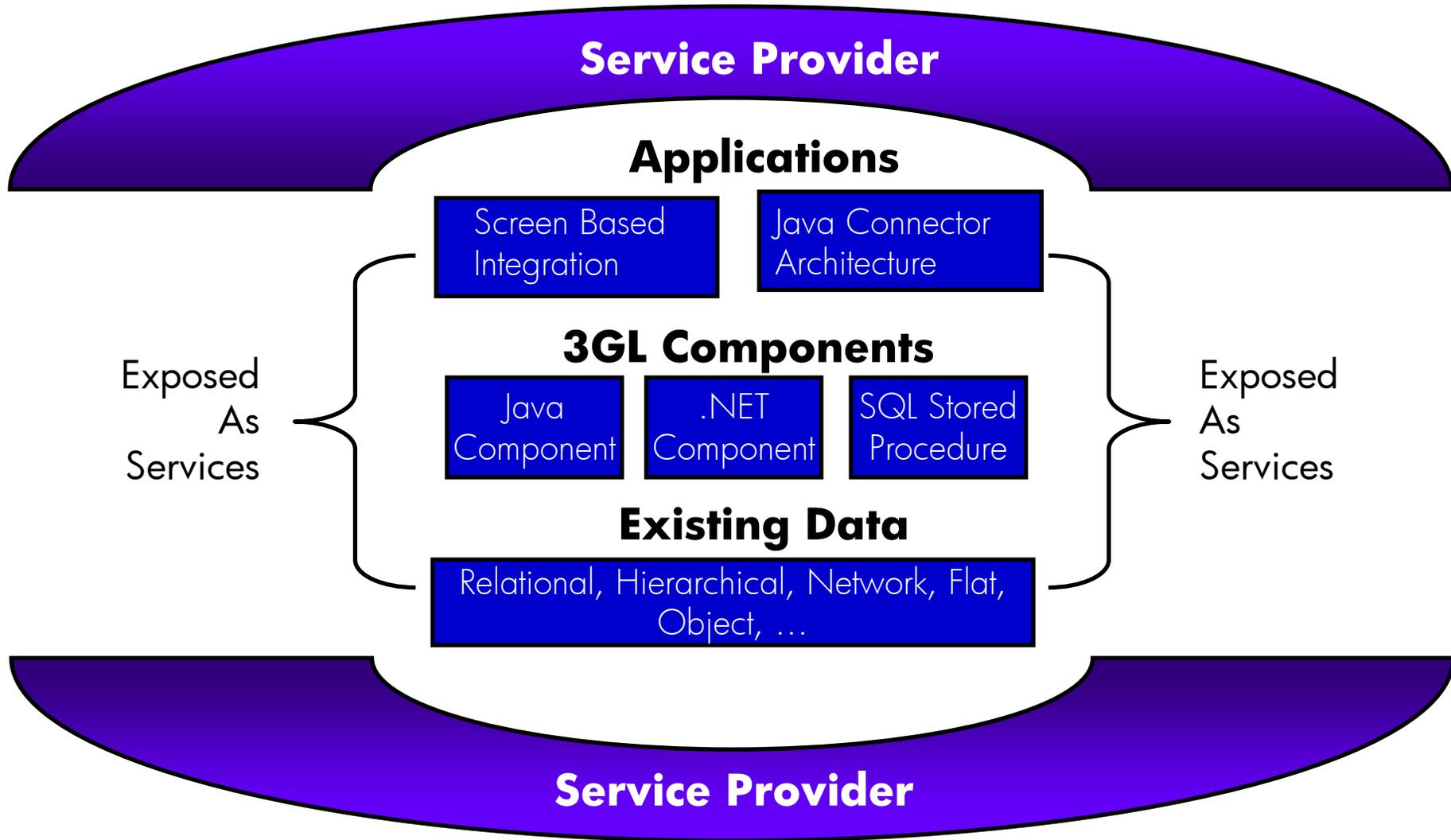
# Service-oriented Architecture Enabling an Adaptive Infrastructure for an Adaptive Enterprise



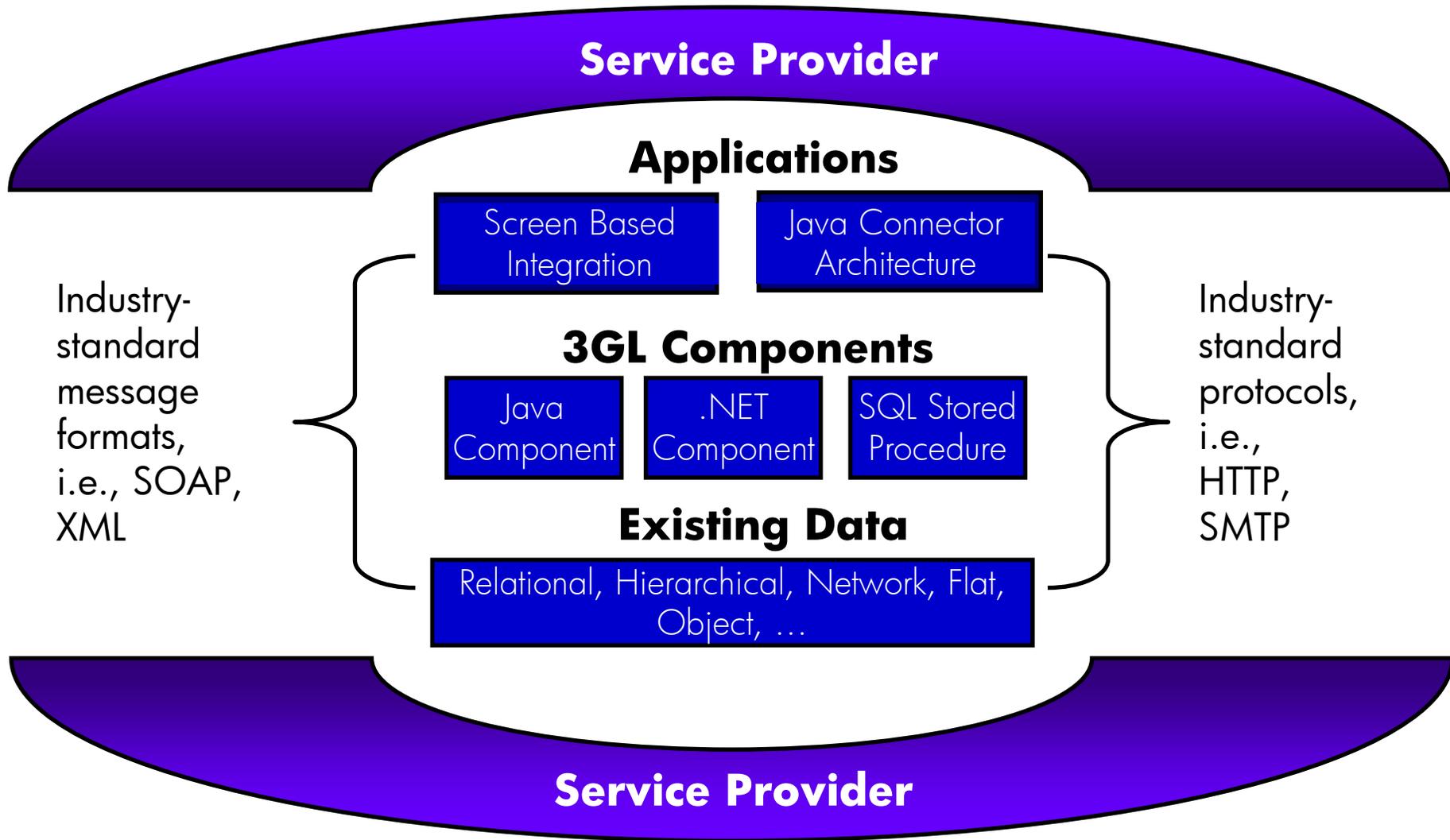
Technology, services, and partnerships applied together by HP to create infrastructure solutions tailored to unique needs



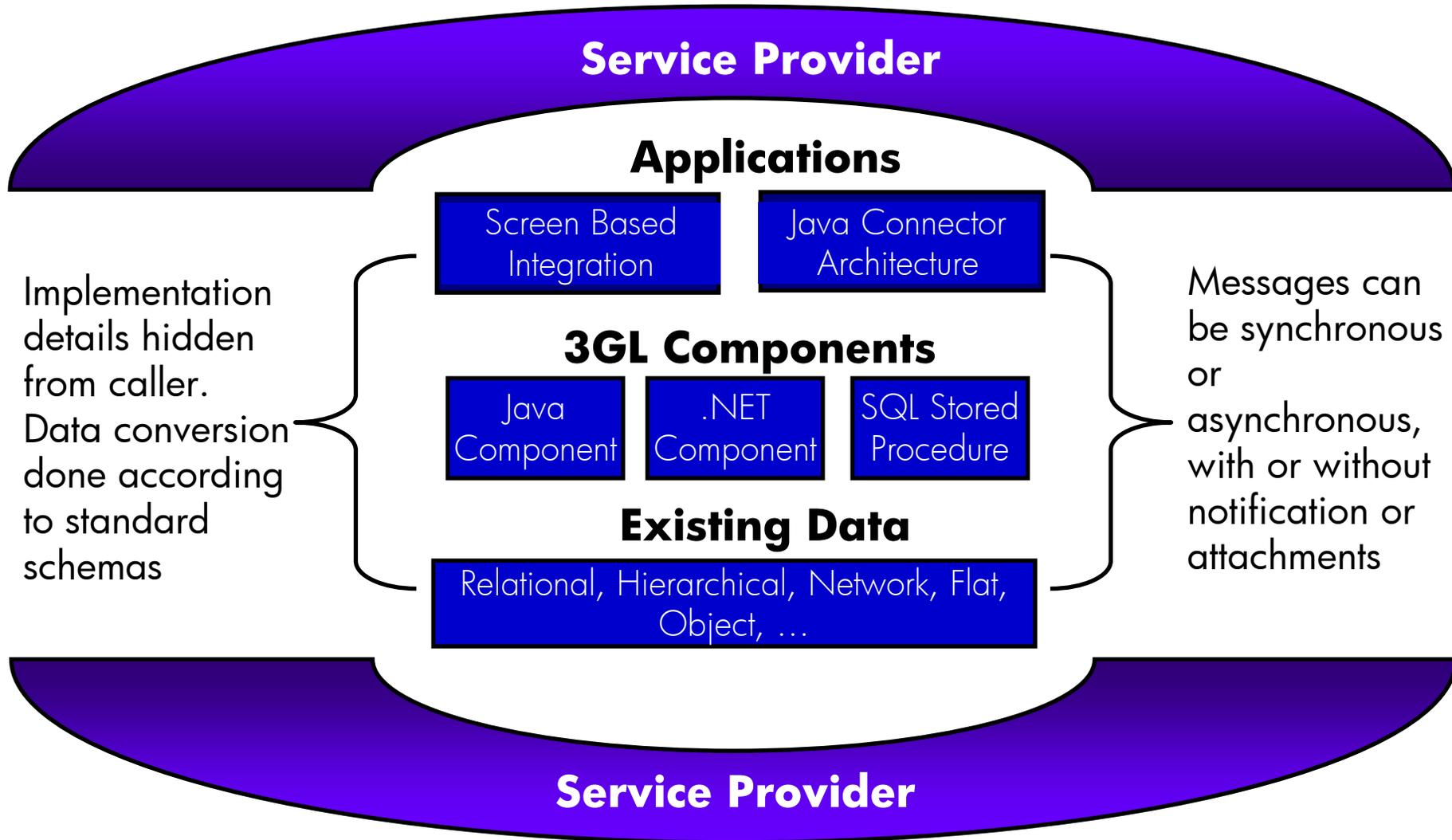
# SOA Integration Component Layers



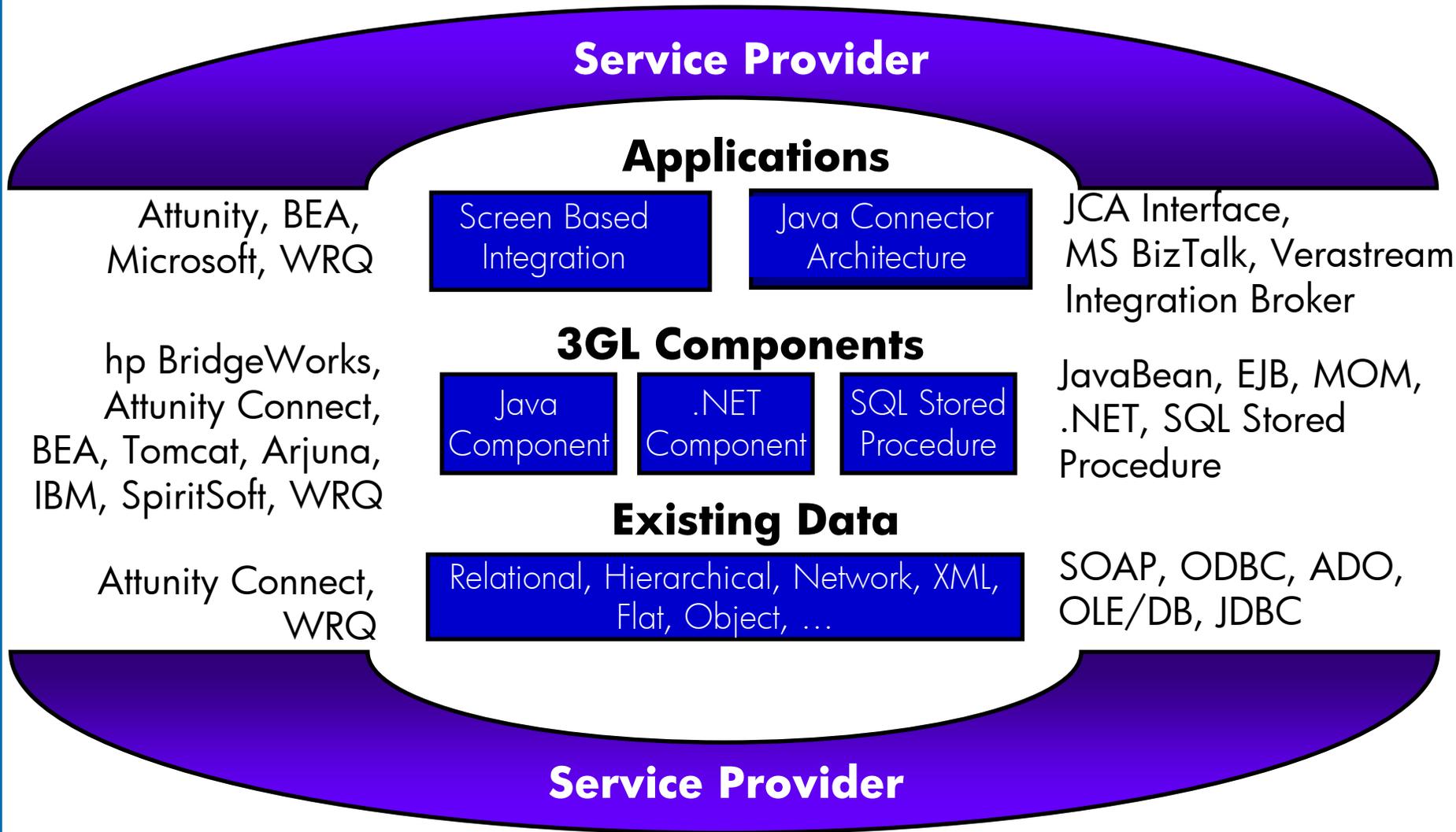
# SOA Integration Component Layers



# SOA Integration Component Layers



# SOA Integration Technology Layers



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# e-Business Infrastructure Packaging for OpenVMS I64 on Integrity Systems



- The key e-Business, integration, and Internet technologies are packaged with OpenVMS I64
  - Foundation Operating Environment (FOE)
    - Secure Web Server (based on Apache) including PHP, Perl, and JSP (Tomcat) support
    - Secure Web Browser (based on Mozilla)
    - Software Development Kit (SDK) *for the Java™ platform*
      - *Note: this is the Java JVM and tools from HP-UX*
    - Enterprise Directory
    - NetBeans Integrated Development Environment (IDE)
    - Simple Object Access Protocol (SOAP) Toolkit based on Apache Axis
    - XML Technology (parser and stylesheet processor for C++ and Java)
    - UDDI Client Toolkit
  - Mission Critical Operating Environment (MCOE)
    - Reliable Transaction Router

# e-Business Infrastructure Packaging for OpenVMS Alpha



- The key e-Business, integration, and Internet technologies are packaged with OpenVMS Alpha on the e-Business Infrastructure CD



- Secure Web Server (based on Apache) including PHP, Perl, and JSP (Tomcat) support
- Secure Web Browser (based on Mozilla)
- Software Development Kit (SDK) for the Java™ platform
- Reliable Transaction Router
- Enterprise Directory (LDAP)
- COM
- BridgeWorks
- NetBeans
- Simple Object Access Protocol (SOAP) Toolkit (based on Apache Axis)
- UDDI Client Toolkit

# Agenda

- Service-Oriented Architecture: Enabling an Adaptive Infrastructure for an Adaptive Enterprise
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# Software Development

## On OpenVMS:

- Used to have Enterprise Toolkit for Visual Studio (V6), now replaced by
- NetBeans
- DECset is still available for pure 3GL environments without full-blown graphical IDE

## On other platforms:

develop on 'platform of choice', test and deploy on OpenVMS using:

- **“Distributed NetBeans”** with remote code management and debugging (run on Windows, debug on OpenVMS)
- BEA WebLogic Workshop (strong support for Web Services)
- jDeveloper
- jBuilder
- Eclipse
- ...

# Software Development

## NetBeans?

- Sun-Sponsored Open-Source Integrated Development Environment
- 100% Java – runs anywhere there's a JVM
- Feature-rich, drag-n-drop GUI creation, JSPs, Web services
- Extensible
- Supports other languages (C/C++, XML, HTML, Fortran\*, Cobol\*, Pascal\*)
  - Support for CMS
  - CVS client
  - Ant (multiple platform builds from one build definition file)

# Software Development

## **“Distributed NetBeans”?**

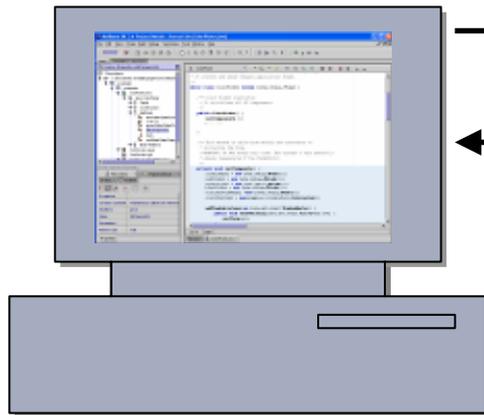
- Allows any desktop (Windows, Linux, HP-UX, etc.) to be used to do remote OpenVMS development
- NetBeans runs on the desktop
- Provides remote compilation (Java, C/C++), error navigation, remote execution, and eventually debugging
- Also provides remote Ant (*“Make without the wrinkles”*) operations
- Remote CMS operations

# Software Development Distributed NetBeans



## OpenVMS Alpha

### HP Desktop Computer



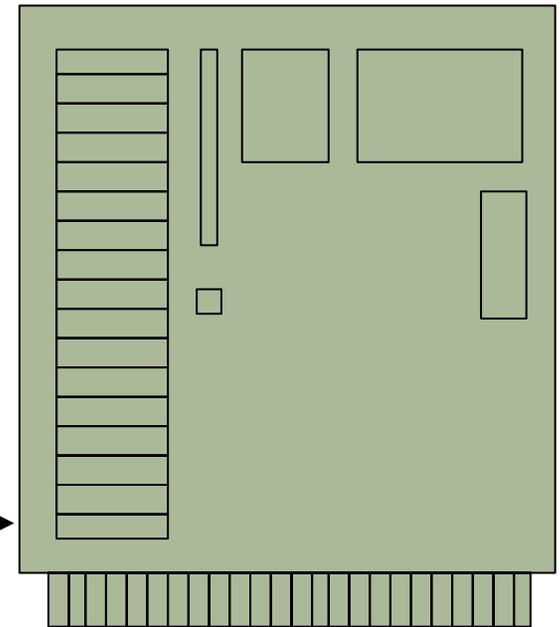
DCL Commands



DCL Command Output



Advanced Server  
Share, SAMBA, FTP



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# Data Integration

## Data

- Viewed as data
  - Supports multiple platforms:
    - OpenVMS, NSK, UNIX, Linux, Windows, IBM, ...
  - Supports multiple data sources:
    - Rdb, Oracle 9 and 10, Sybase, Informix, IMS/DB, DB2, NonStopSQL, SQL Server, ...
  - Supports multiple interfaces:
    - JDBC, ODBC, ADO.NET, OLE/DB, XML

Attunity Connect

- Viewed as [value] objects
  - Data in files and DBs exposed as:
    - JavaBeans
    - Enterprise JavaBeans
    - .NET Methods
    - Web Services

WRQ Verstream Integration Broker (VIB)

# Attunity Data Integration Products

EAI

EII

ETL / DW / BI

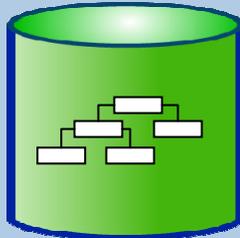
Data Access & Adapters      Data Federation      Change Data Capture

ATTUNITY  
**CONNECT**

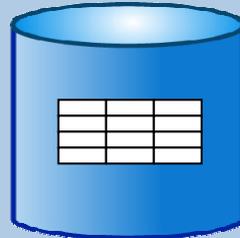
ATTUNITY  
**FEDERATE**

ATTUNITY  
**STREAM**

Attunity Server and Metadata



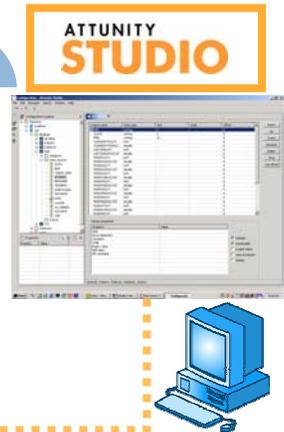
Legacy



Relational

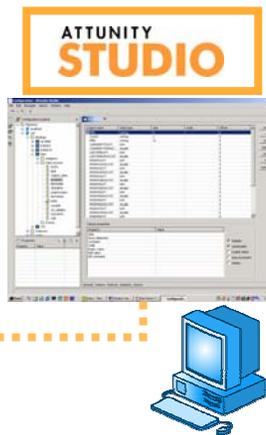
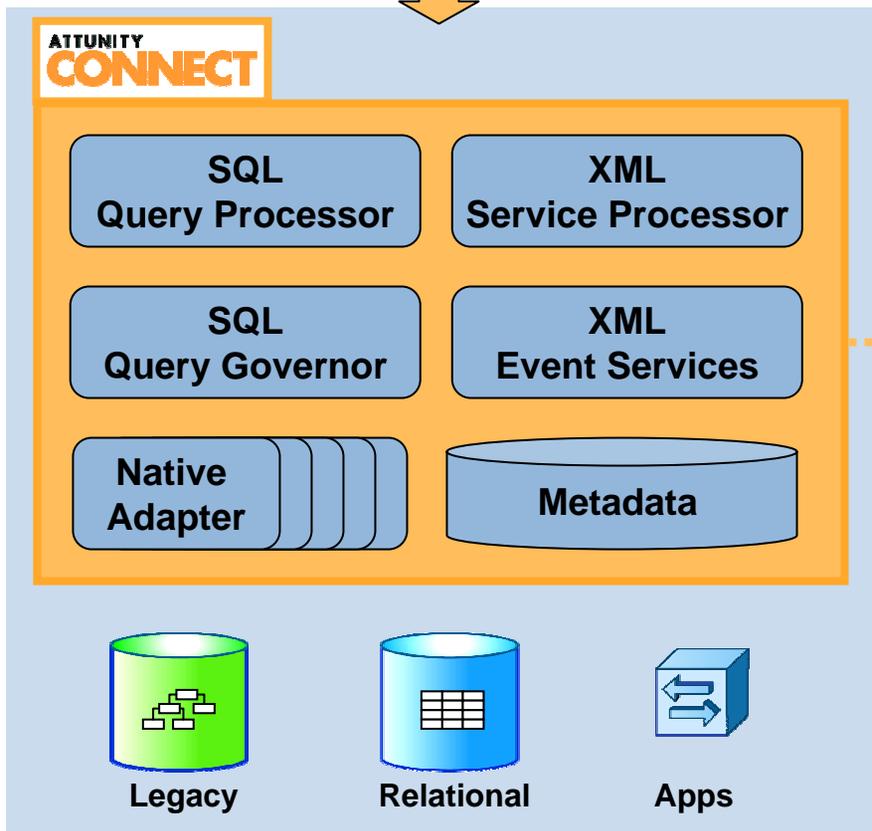
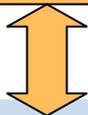
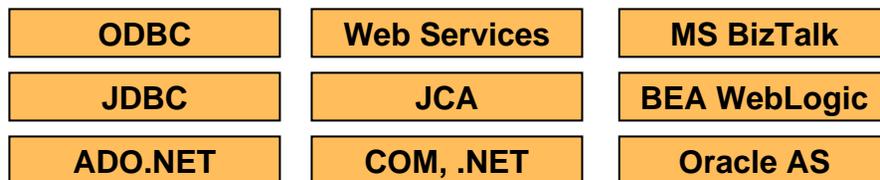


Apps

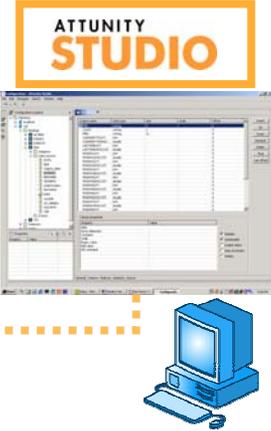
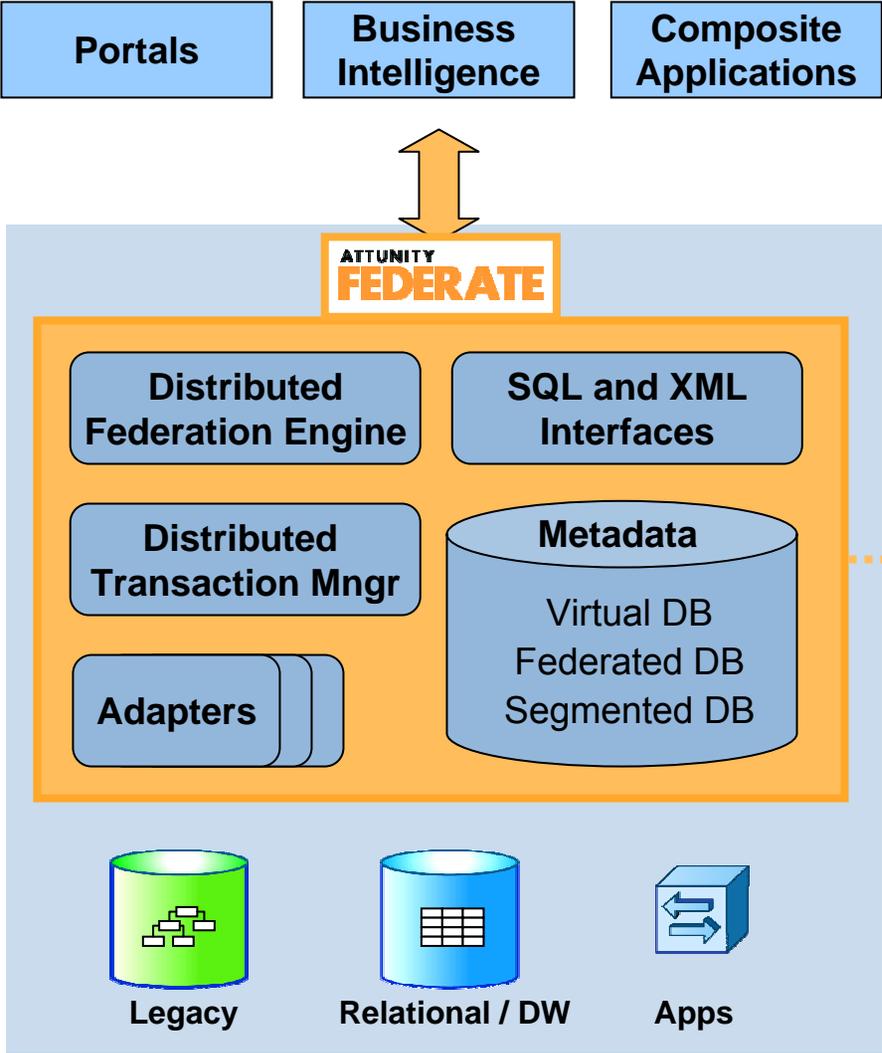


Enterprise Data Sources

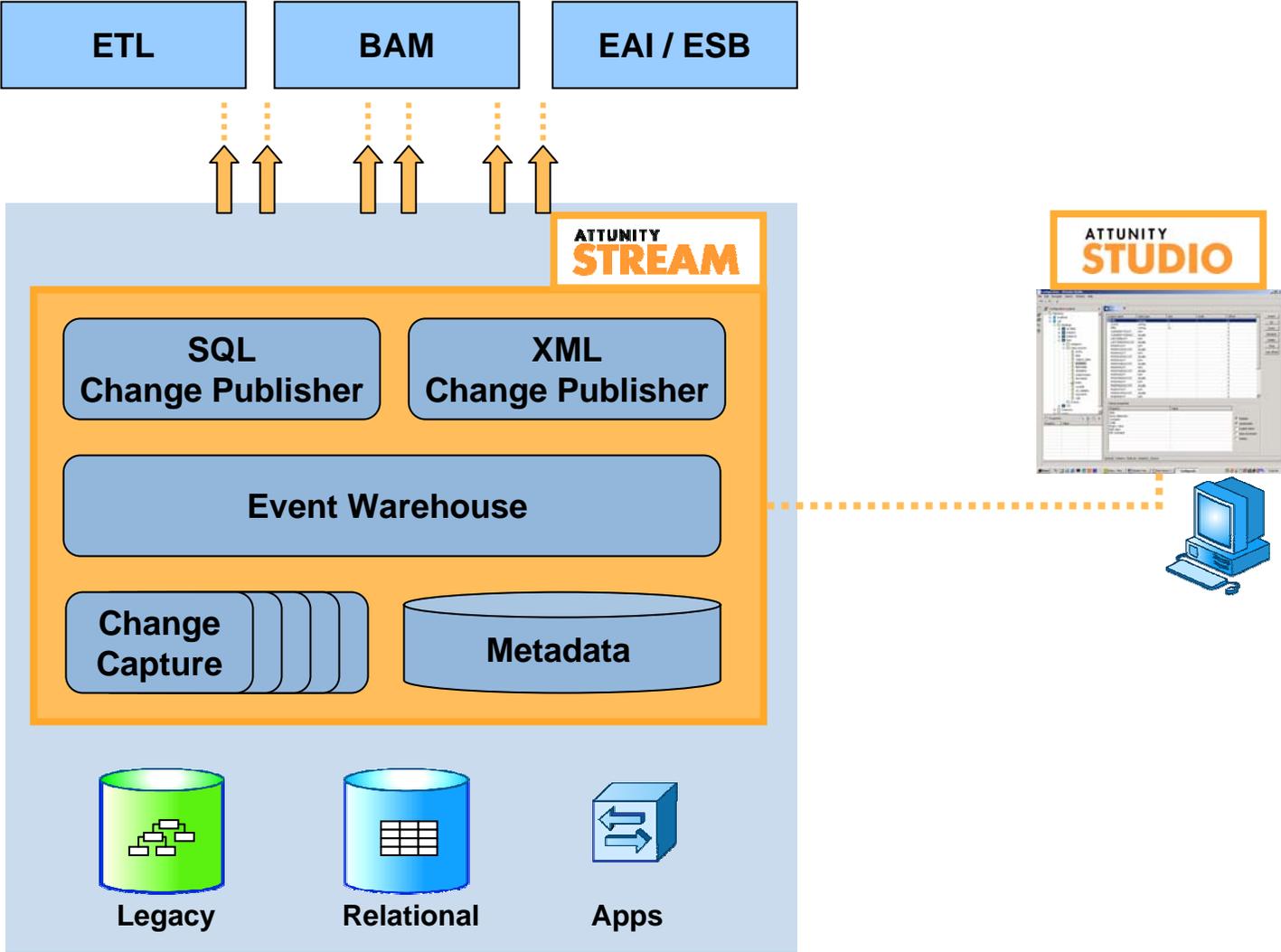
# Attunity Connect – Functional Architecture



# Attunity Federate – Functional Architecture



# Attunity Stream – Functional Architecture



## Data Integration

### Relational

- Oracle
- DB2
- Sybase
- Informix
- Ingres
- SQL Server
- Rdb
- SQL/MP
- DBMS

### Non-Relational

- VSAM
- IMS/DB
- Adabas
- QSAM
- Enscribe
- RMS
- C/D ISAM
- Flat Files
- Delimited Text

### Applications

- CICS
- IMS/TM
- Pathway
- Tuxedo
- Natural
- COBOL
- RPG
- C
- Any other 3GL

## Data Integration

### SQL

- ODBC
- JDBC
- OLE/DB
- ADO
- ADO.NET

### XML

- JCA
- .NET
- COM
- XML/HTTP
- Web Services  
(SOAP/WSDL)

### 3<sup>rd</sup> Party

- MS BizTalk
- BEA WebLogic
- Oracle AS
- BO Data  
Integrator

## Data Integration

### Windows

- NT
- XP
- Server 2000
- Server 2003

### Mid-Range

- HP/UX
- Solaris
- AIX
- HP Tru64 Unix
- DG-UX
- Linux
- OpenVMS
- OS/400

### High End

- OS/390
- z/OS
- HP NonStop NSK

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# Component Integration

## Components

- Viewed as “data”
  - Wrapped component is exposed as a SQL Stored Procedure
  - Invocation in same SQL query as one to pure data:
    - Join data returned from 3GL with SQL query

Attunity Connect

- Viewed as “objects”
  - 3GL modules wrapped and exposed as:
    - JavaBeans
    - Enterprise JavaBeans
    - .NET Methods
    - Web Services

WRQ Verstream Integration Broker

HP BridgeWorks

# Component Integration – HP BridgeWorks



## Wraps callable 3GL applications

Handles all languages adhering to the OpenVMS Call Standard (including Pascal, BASIC, Fortran, C, COBOL, DIBOL, ADA, C++, ...)

Automates process using compiler generated ANA files

## Wraps callable ACMS Tasks\*

Generates multi-threaded agent

(provides access to SignIn, SignOut, Extended Status, and ACMS Application Name)

Automates process using ACMS compiler generated\*\* STDL files

\* Java™ based connections only

\*\* Requires ACMS V4.2+

# Component Integration – HP BridgeWorks



## Wraps DCL Procedures as routines

Allows passing in parameters and passing back a return value

For example:

wrap a DCL procedure and invoke it from a VB program – the DCL procedure writes the results of execution to a log file

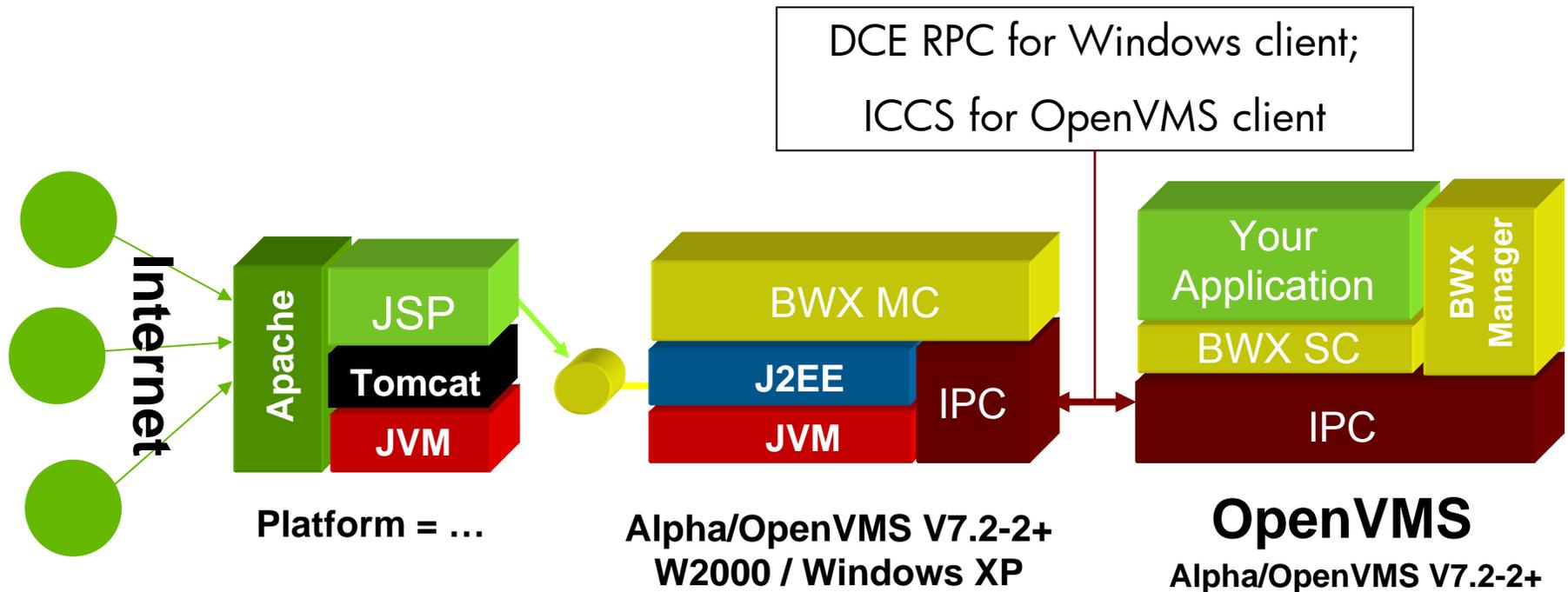
## Provides generic wrapping of OpenVMS based Files

Returns contents as a String

For example:

wrap the log file produced by the above DCL procedure and 'read' it to check the results of the invoked command procedure

# Component Integration – HP BridgeWorks



Components in **green** you supply, BridgeWorks provides/generates the rest

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# Application Integration

## Applications

- Integrate at the screen level
  - Support for multiple platforms
    - 3270
    - VTs
    - AS400
    - HP3000
    - ...
  - Screens exposed as
    - JavaBeans
    - .NET methods
    - Web Services
  - Runtime available on
    - OpenVMS
    - HP-UX
    - Linux, U\*IX
    - Windows
    - ...
  - Development GUI on Windows

- Integrate using JCA
  - J2EE standard
  - Interfaces available or being developed by SAP, PeopleSoft, Siebel, ...
  - Interfaces for CICS and IMS and other TP software

- Integrate using EDI

## Verastream Host Integrator

- Includes flow manager for controlling interaction between connected systems
- Seamless integration with MS BizTalk
- Build composite applications with data, components and applications regardless of technology, e.g.,
  - .NET methods for screens
  - Java methods for components
  - Java objects for data sources

## Verstream Integration Broker Attunity Connect

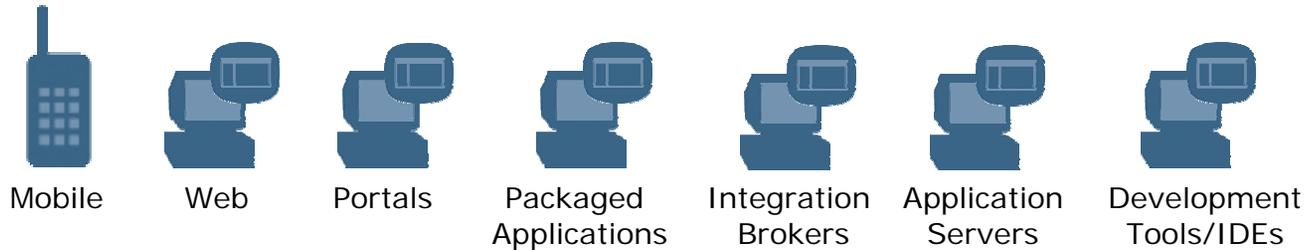
## Verastream Integration Broker

# Application Integration



## Target Applications & Tools

Reuse legacy functions in new ways



## Interfaces

.NET, COM, Java, EJB, Web-services, HTTP/XML, JMS

## Composite Services

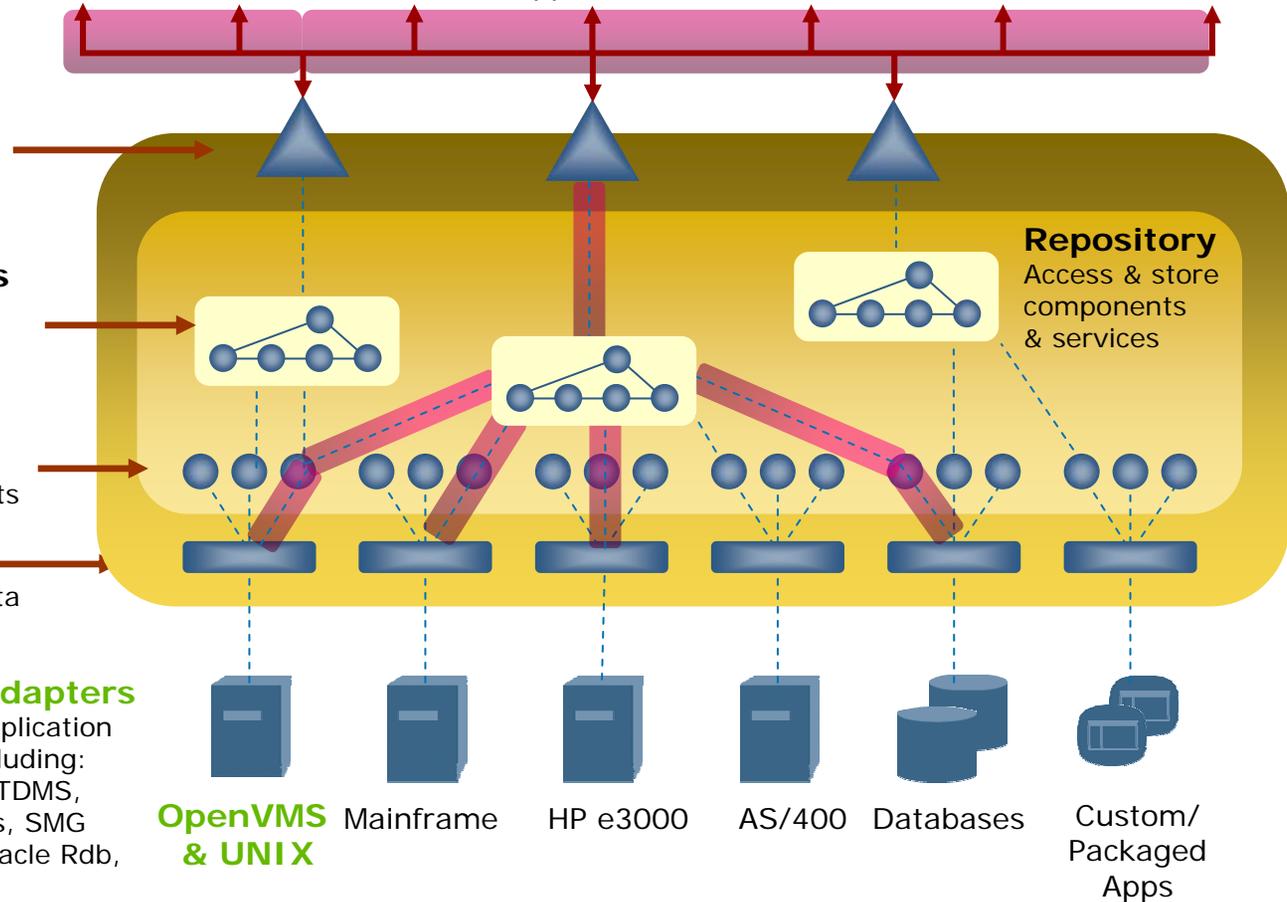
Combine components into high value services

## Components

Represent business functions or data elements

## Adapters

Abstracts host logic & data into components



## OpenVMS specific adapters

**Screen:** Any VT-based application (VAX, Alpha, Itanium) including: All-in-1, FMS, DECforms, TDMS, Cognos Powerhouse, 3GLs, SMG  
**Data:** RMS Files, RMS, Oracle Rdb, Oracle CDD, Oracle DB

**OpenVMS & UNIX**

Mainframe

HP e3000

AS/400

Databases

Custom/  
Packaged  
Apps

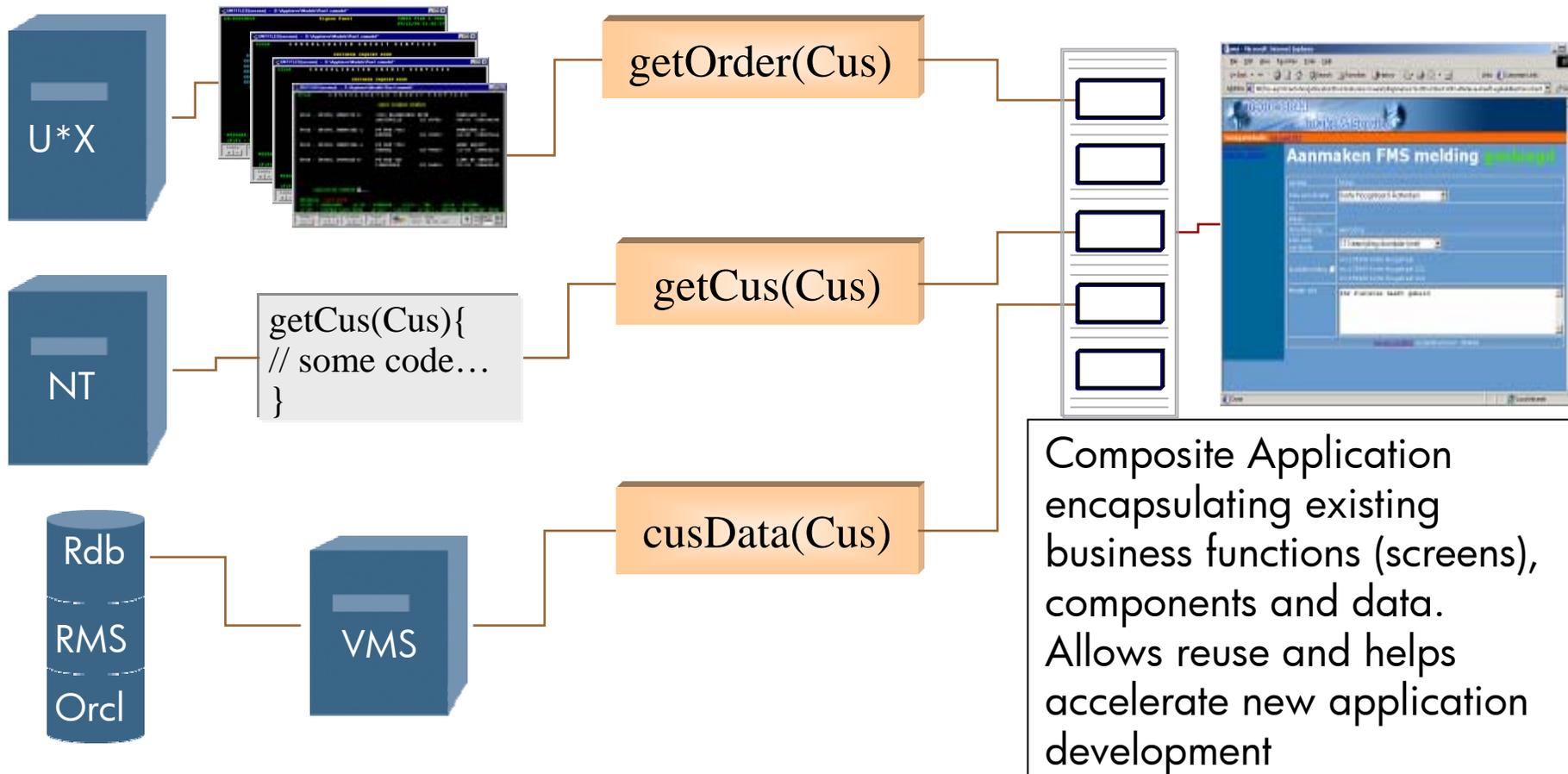
# Application Integration

Existing applications, components & databases

Reusable business components

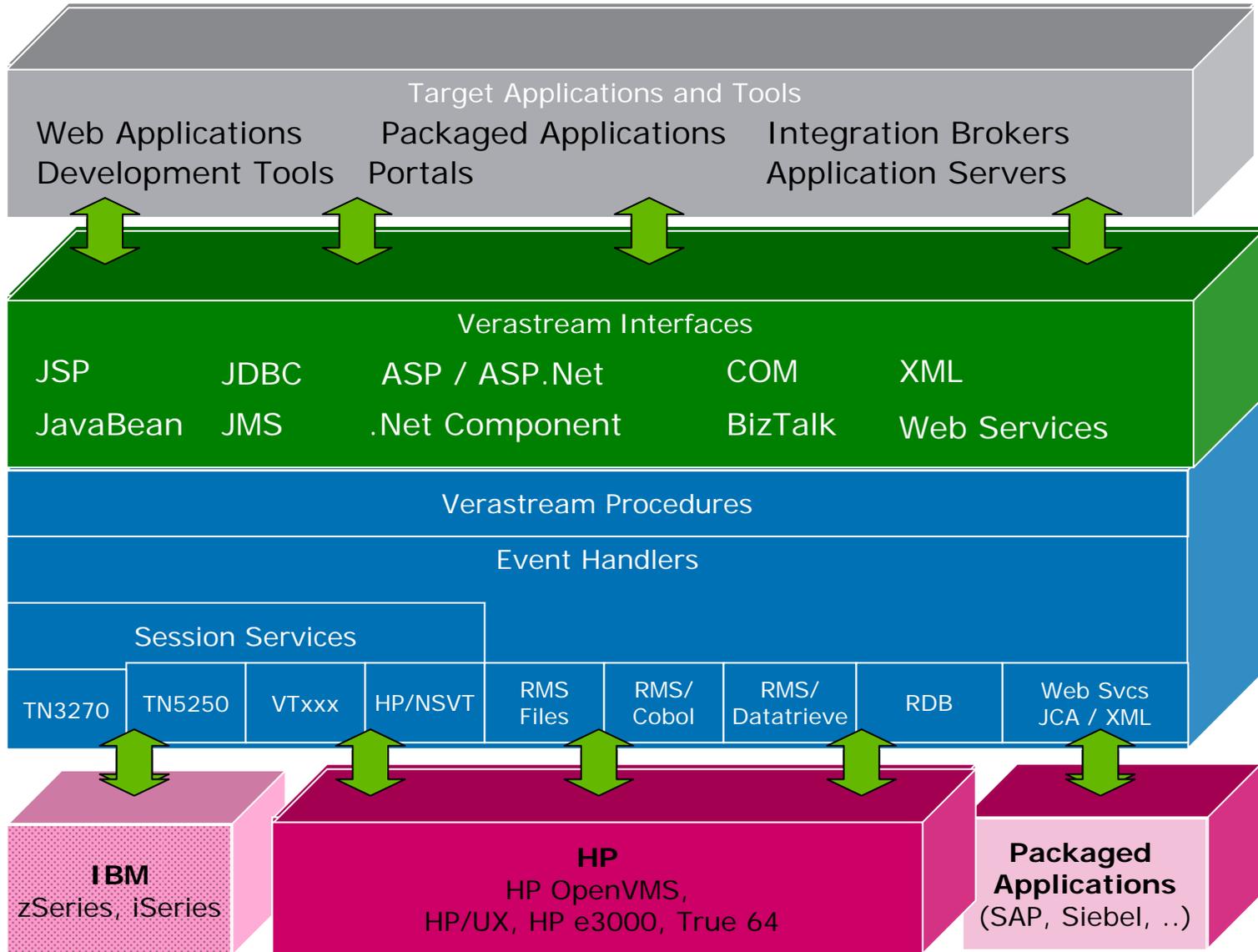
“Composite application” components

New “Composite application”

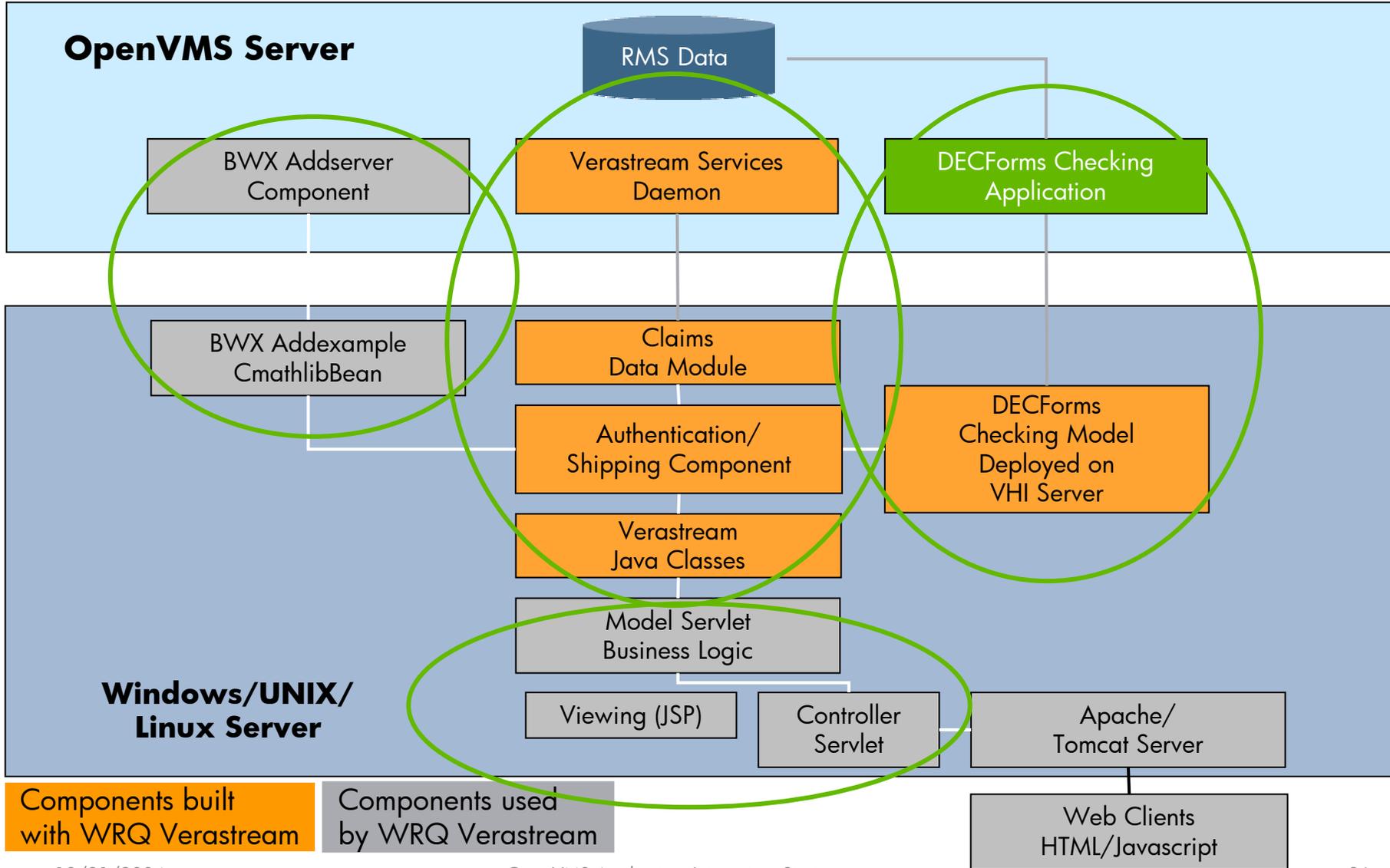


Composite Application encapsulating existing business functions (screens), components and data. Allows reuse and helps accelerate new application development

# WRQ Verastream Architecture



# Application Integration



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# Integration using Web Services

## Web Service?

- Standards-based, defined by organizations such as JCP, OASIS, ebXML
- Loosely coupled connectivity, often using HTTP as transport mechanism
- Synchronous or asynchronous
- Supports Remote Procedure Call (RPC) or Document Exchange (one way)
- Platform agnostic: Java, .NET, LAMP, home-grown
- Connectivity testing defined by WS-I.org

*Is to computers what a browser is to users.*

*A modular piece of code on the internet/intranet/extranet that provides one or more business functions and that can be discovered and used on demand.*

*A small step for technology; a giant leap for business.*

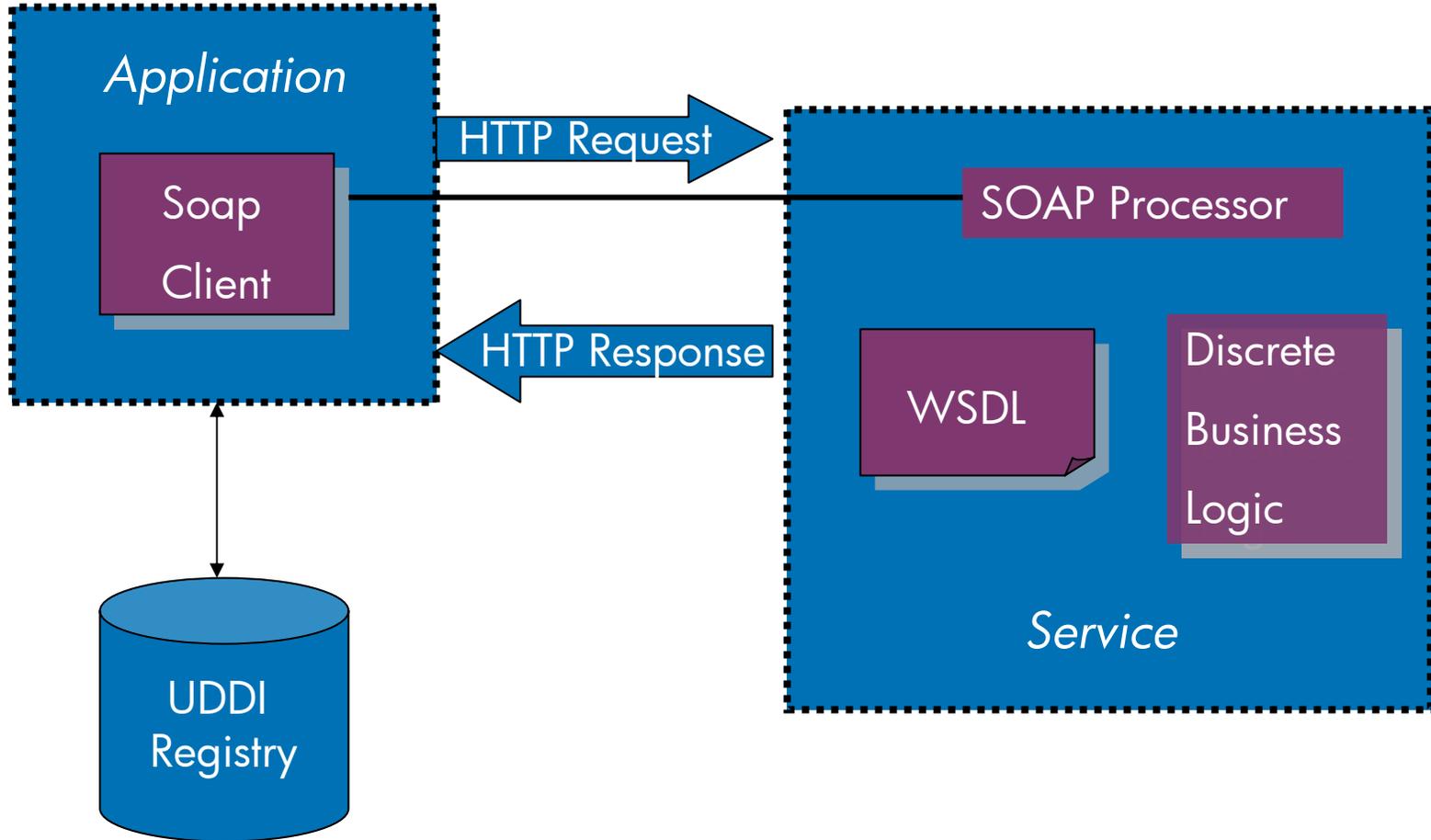
*This leap is not about technology; it is about enabling organizations to conduct business, with technology assisting business, not restricting it.*

*This leap is the beginning of the era when information technology matures to become invisible in business interaction.*

# Major Web Service Technologies

- SOAP – Simple Object Access Protocol
  - Standard packaging structure for XML doc transport
  - Transport over SMTP, HTTP, FTP
  - Also defines encoding and binding standards for non-XML RPC invocations
  - EJBs can be exposed through SOAP and so can .NET components
- WSDL – Web Services Description Language
  - XML technology that describes the interface to a web service in a standardized way
  - Describes I/O parameters of an invocation externally
  - Describes service protocol binding
- UDDI – Universal Description, Discovery, and Integration
  - Registry of available web services (worldwide)
  - Used for advertising, discovering and integrating web services

# Web Service Interaction



# Web Services Integration

|   |  |
|---|--|
| <p>Web Services</p> <ul style="list-style-type: none"> <li>– Invoke 3GL routines and ACMS Tasks which have been wrapped as JavaBeans or EJBs</li> </ul>   | <p>HP BridgeWorks</p>  |
| <ul style="list-style-type: none"> <li>– Serve 3GL routines which have been wrapped as .NET methods, JavaBeans or EJBs</li> <li>– Serve data as Web Services</li> </ul>   | <p>WRQ Verstream Integration Broker (VIB)</p> <p>Attunity Connect, VIB</p> |
| <ul style="list-style-type: none"> <li>– Expose VT screens and other terminal devices as Web Services; allow their invocation from Web Service-enabled software such as .NET, Apache SOAP Toolkit (Axis)</li> </ul> | <p>WRQ Verstream Host Integration</p>                                      |
| <ul style="list-style-type: none"> <li>– Transactional Web Services</li> </ul>  | <p>Arjuna ArjunaXTS</p>  |

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# Message Queuing and Caching

## Messaging Queuing

- Asynchronous delivery of messages:
  - Peer to peer: guaranteed once, delivery coordinated by distributed transactions, notification of receipt
  - Pub/Sub: optimal transmission of messages to multiple, subscribed, parties with guaranteed delivery and notification of receipt
- Standards-based JMS
- Integration with MQ Series, Tibco, MSMQ
- Fault tolerance through clustering
- Load balancing across cluster nodes

Arjuna ArjunaMS

IBM WebSphere MQ

SpiritSoft SpiritWave

Oracle Advanced Queuing

# Message Queuing and Caching

## Caching

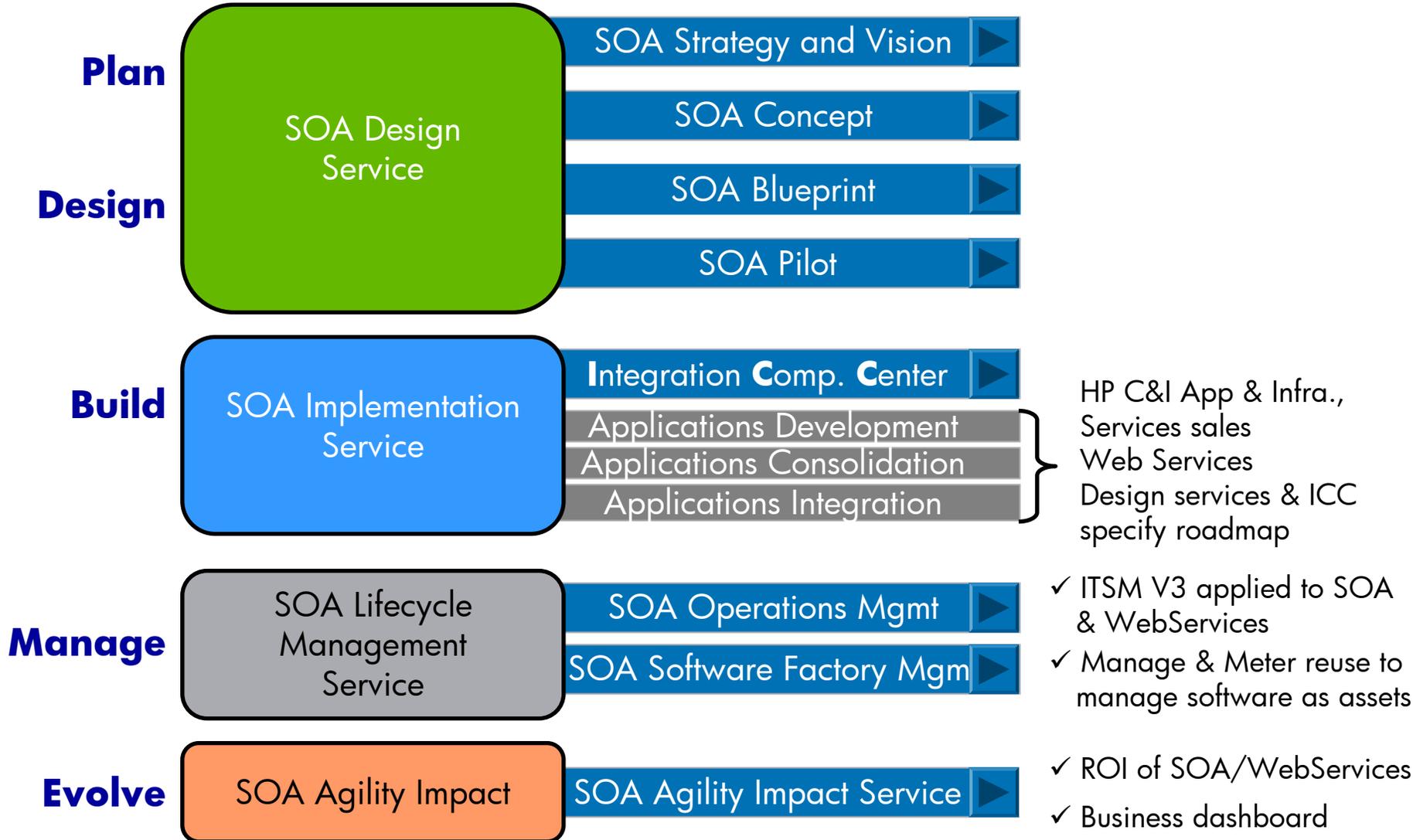
- Uses queuing for guaranteed delivery and fault tolerance
- Used primarily in read-only environments (up to 90% increase in throughput possible)
- Caches built in a hierarchical fashion as a fan-out:
  - large, medium and small caches, depending on environment
- Standards-based - JCACHE
- Non-intrusive optimization of IBM WebSphere MQ queues

SpritCache from SpiritSoft

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# What are we doing to help HP's SOA Services – What we deliver



# What are we doing to help

## OpenVMS eBusiness Lab

*provides a secure hardware and software environment for internal groups and external partners to stage and evaluate eBusiness products on OpenVMS*

- located in HP's Nashua, New Hampshire, USA, facility
- systems can be accessed locally or remotely
- systems are configured with the latest eBusiness technology on OpenVMS including web server (Apache), middleware, application servers, Java and database systems

# What we are doing to help

## Complementary Resources and Services

*hp will deliver transition  
tools, services and  
support portfolios at no  
charge to help with  
customer and partner  
transitions*

- two day workshops to evaluate the current environment and plan for transition and integration
- consulting expertise centers jointly staffed with HP and Intel experts
- worldwide porting centers for validating ISV and custom applications on Itanium™ processor family systems
- on-Line support including “test drive” systems for application testing over the net
- comprehensive portfolio of white papers with “how to” transitioning information

# Architectural Workshop

January 15<sup>th</sup> – Day 1

10:00 Welcome and Introductions

10:15 Customer Presents

- Business & Technical requirements regarding eCommerce Application / Environment and Goals
- Current Architecture
- Future Design
- Implementation Prerequisites
- Availability and Disaster Recovery Requirements today and future

12:00 LUNCH

1:00 Implementing Java based tiered solutions. Examples and best practices.

2:30 Discussion on Proposed Architecture

3:30 BREAK

3:45 Discussion on Architecture (continued)

4:30 Recap

5:00 Adjourn

# Architectural Workshop (2)

**January 16th – Day 2**

**9:00 Review Today's Agenda and make any necessary modification**

**9:15 Tru64 and HP-UX Roadmaps**

- **TruCluster and MC/ServiceGuard Architecture and Implementation Overview**
- **Application Integration into a HA environment**
- **Disaster Tolerance Solutions**

**11:15 BREAK**

**11:30 Review of overall HA architecture based on Customer design Implementation issues and product features required for Customer's HA requirements**

**12:00 LUNCH (working)**

**2:00 Recommendation of Platform**

**2:30 Recap and Summary**

**3:00 End**

# What we are doing to help

## Technology Seminars

*hp also has an extensive portfolio of seminars which can be adopted to customers' needs*

- available for delivery anywhere, anytime
- customizable for specific technologies
- can be tailored for specific customers
- can be delivered with partners
- available for delivery anywhere, anytime
- customizable for specific technologies
- can be tailored for specific customers
- can be delivered with partners

# Agenda eBusiness Seminar in Reading, UK

## Thursday, 24 October, 2002

|       |                 |  |
|-------|-----------------|--|
| 08:30 | All             | Introductions and Overview of the seminar  |
| 08:45 | hp              | OpenVMS eBusiness update and case studies  |
| 09:15 | hp              | Introduction to JNDI and LDAP with hp Enterprise Directory accompanied by online demos: what is a Name Service, how do I use it, what management tools are available and what do client programs look like?  |
| 10:30 |                 | Break  |
| 10:45 | <b>Attunity</b> | Introduction to JDBC and JCA with Attunity Connect accompanied with online demos: how do I integrate multiple data sources from multiple platforms with one SQL statement in a Java™ programme?  |
| 11:45 | hp/SE           | Wrapping 3GL code as Java™Beans or EJBs with hp BridgeWorks and invoking them from WebLogic: what options are open to reusing my existing investment in 3GL code whilst writing new applications in Java™?   |
| 13:00 |                 | Lunch  |
| 14:00 | hp              | Introduction to Java™Servlets and Java™Server Pages with Apache/Tomcat on OpenVMS: how can I invoke 3GL code and read OpenVMS RMS files from Java™ programs and display the results in a browser?  |
| 15:00 |                 | Break  |
| 15:15 | <b>Ericom</b>   | Introduction to SOAP and application integration with Ericom Host Publisher plus online demos: how can I integrate multiple, incompatible applications, and embed logic flow between them; and then make the results available to any client capable of processing SOAP requests, that is, Web Services? |
| 16:30 | <b>BEA</b>      | Introduction to JMS (Java™ Message Service) with BEA WebLogic Server: what is a J2EE™ Application Server and how can I use it for synchronous and asynchronous queuing?  |
| 17:45 | All             | General Q&A and Wrap-up  |

# What we are doing to help

Some references for  
further reading

- JAXTX provides an API for packaging and transporting ACID transactions
- <http://www.jcp.org/en/jsr/detail?id=156>
- OASIS<sup>1</sup> – Non-profit making organization promoting eBusiness standards
- <http://www.oasis-open.org/>
- A Framework for implementing business transactions on the Web
- <http://lists.oasis-open.org/archives/business-transaction/200103/pdf00001.pdf>
- OASIS Business Transaction Protocol Primer
- <http://www.oasis-open.org/committees/business-transactions/documents/primer/Primerhtml/BTP%20Primer%20D1%2020020602.html>
- Business Transactions in Workflow and Business Process Management
- <http://www.oasis-open.org/committees/business-transactions/documents/2001-07-12.BTPModelForWF2.doc>

# What we are doing to help

Some more references  
for further reading

- The Tao of e-business services
- <http://www-106.ibm.com/developerworks/webservices/library/ws-tao/index.html>
- A Young Person's Guide to SOAP: Increases Interoperability Across Platforms and Languages
- <http://msdn.microsoft.com/msdnmag/issues/0300/soap/toc.asp?frame=true>
- Web Services Primer
- <http://www.capescience.com/education/primer/index.shtml>
- XMethods Utility Services
- <http://www.xmethods.com/>
- WSDL / SOAP Web Services Search Engine
- <http://www.salcentral.com/salnet/webserviceswsdl.asp>
- Java Web Services – Using Java in Service-oriented Architectures (ISBN: 0-596-00269-6)
- Understanding Web Services (ISBN: 0-201-75081-3)



- Business agility is a core requirement for today's organisations
- An adaptive IT infrastructure enables business agility
- The application of Web Services & an SOA are a route forward
- HP has done this before
- **HP has done it for itself**

# Architecture Strategies Drive IT Transformation



- Real simplification of IT environment
- Radical reduction of IT infrastructure operating cost
- Innovation instead of maintenance



| <b>Pre-merger</b>            | <b>Today</b>                 | <b>Target</b>                |
|------------------------------|------------------------------|------------------------------|
| 7,000+ applications          | 4,000 applications           | 2,200 applications           |
| 25,000 servers               | 19,000 servers               | 10,000 servers               |
| 300 Data Centers             | 85 Data Centers              | 11 Data Centers              |
| IT cost = 4.6% of revenue    | IT cost = 3.5% of revenue    | IT cost = <3.0% of revenue   |
| Innovation = 28% of IT spend | Innovation = 34% of IT spend | Innovation = 55% of IT spend |

# What we are doing to help

Biggest IT merger of all time

## The size of the IT task

**1,200** networked sites  
**215,000** desktops  
**49,000** network devices  
**7,000+** applications  
**900+** web servers and  
infrastructure  
**21,671** servers  
**228,000** mailboxes  
**26** million emails a week  
**30** million B2B messages monthly



## The desired result:

- Customers and partners interact with HP as one company
- Products and solutions go-to-market through integrated, global supply chains
- HP workforce operates as a single company
- IT cost and complexity are reduced
- Business performance improves

# What we are doing to help

## *Driving business value*

- Achieved \$3 billion in cost savings in 9 months
- Delivered \$1.3 billion in supply chain integration savings in first nine months, \$1 billion more next year
- e-business operations on a path to triple transaction volume by 2004
- Reduced build-to-order PC manufacturing costs by 26%
- Rolled out world's largest, most complex PeopleSoft 8.0 e-HR installation
- Reduced financial transaction processing costs by almost \$20 million annually
- Reduced and simplified applications portfolio from 7,000 to 5,000
- Reduced overall IT costs by 24%



# Questions?



OpenVMS eBusiness program office:

- [OpenVMS.eBusiness@hp.com](mailto:OpenVMS.eBusiness@hp.com)

For more information:

- <http://h71000.www7.hp.com/eBusiness/>

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Thank you!

