Developing rich Internet applications for SAP® with Adobe® Flex™

Introduction

Global enterprises rely on SAP products for robust and reliable management of complex business processes. As businesses leverage the Internet to enable employees, customers and partners, IT architects and developers are challenged to provide rich desktop-like experiences that overcome the limitations of traditional HTML-based interfaces. These applications must be presented to end users through rich and intuitive interfaces that increase user satisfaction, improve process utilization and completion rates.

Since 2002 Adobe and SAP have engaged in a thriving partnership to bring compelling, innovative and cost effective business solutions to enterprises, their employees, customers and partners. SAP users benefit from solutions such as SAP Interactive Forms by Adobe, which allows users to integrate paper-like PDF forms into their electronic workflows, and Adobe Acrobat® Connect™ Professional for SAP Enterprise Learning, which extends training environments with web and video conferencing.

Best known for its animation capabilities, the Adobe Flash Player, which runs on 98% of PCs (Windows®, Mac OS®, Linux®) worldwide, is in fact at the core of a vibrant ecosystem of technologies that allow developers to create rich internet applications. Leveraging the Adobe Virtual Machine (AVM) to run applications that blend ActionScript 3.0, a powerful ECMAScript compliant object-oriented programming language and MXML tagging, developers benefit from just-in-time compilation and performance across platforms. An integral part of the Flash ecosystem, Adobe Flex provides organizations with development tools, user interface and connectivity components that simplify the development of Rich Internet Applications (RIAs) and allow users to fully harness the power of the SAP Enterprise Services. The Flex Framework adds out-of-the-box support for persistence, messaging, stateful local manipulation of data models, binary sockets, security sand boxes and standard protocols that simplify integration with SAP and other back-end systems.

These capabilities are supported with industry-strength development tools including an IDE, debuggers, compilers and standard libraries. Both SAP and its customers have successfully developed applications utilizing the Flash ecosystem to dramatically improve their users’ experience.
When enterprises need to move applications to the desktop, they can seamlessly migrate Intranet or Internet deployed applications using the Adobe® AIR™ integrated runtime.

Figure 1: The Flash Ecosystem is a robust platform for Rich Internet Applications.

This paper will discuss the Adobe Flex features and architecture, providing an overview of how Flex™ employs service oriented principles that allow SAP users to assemble innovative and engaging solutions.

**Advantages for SAP environments**

While HTML-based user interfaces have helped organizations to extend the reach of SAP and legacy back-end systems to employees, customers and partners, the page-based model, lack of client-side intelligence, and limited selection of user interface elements can make even simple tasks frustrating and error prone. These shortcomings curtail users' ability to visualize complex data, work offline, work efficiently with real-time data, or simply enjoy the responsiveness of a robust application. Adobe Flex combines the responsiveness and advanced interface capabilities of desktop applications with the power of the web to deploy broadly accessible solutions at low cost. The SAP Enterprise Service Oriented Architecture's clean separation of presentation from business logic and objects eases the integration of Adobe Flex-based solutions.

Figure 2: Flex applications provide rich UIs such as audio/video, effects and transitions, data synchronization and conflict resolution, offline operation, whiteboarding, and real-time data push.
Using Adobe Flex, organizations can better leverage their existing SAP installations with rich and engaging customer experiences that support tasks such as decision making with dynamic charts and visualizations, customer support and collaboration with animations and video, and a comprehensive palette of selectors, sliders, drag-and-drop functionality and other features expected from a desktop-like environment.

Adobe Flex also supports users with limited or occasional network access, such as field engineers or customers completing multi-stage transactions over discontinuous sessions. Through bindings to back-end SAP data sources, users benefit from real-time updates to the application user interface based on changes on the back-end. Further, multiple users can collaborate in real-time via robust messaging services.

Developers creating Adobe Flex applications benefit from Flex Builder, a full featured, Eclipse-based integrated development environment (IDE) with comprehensive support for rapid UI prototyping from standard components in design view and support for MXML, ActionScript and CSS development in code view. Advanced features such as an incremental compiler, integrated debuggers and code navigation aids facilitate development tasks. Comprehensive data access libraries simplify tasks such as accessing SAP applications as web services or requesting XML data via HTTP. Available on Windows and MAC OS, Flex Builder facilitates cross browser development for Linux, Windows and MAC OS platforms.

Architecture

Adobe Flex and Service Oriented Architectures

Over the past several years, service oriented architectures have emerged as an approach that enables IT professionals to better leverage back-end systems and deliver solutions to users inside and outside the firewall. Adherence to SOA principles enhance an organization’s ability to organize and use distributed SAP capabilities, allowing business analysts, application architects and developers to match business needs with capabilities by exposing back-end processes as services that are readily assembled into targeted solutions, greatly improving an organization’s agility to meet changing business needs.

While SAP has embraced SOA principles for enterprise back-end architecture, web browsers have not advanced to provide the full range of client-side services required to extend the advantage of SOA to the user. Adobe Flex provides developers with the technical capabilities to modernize client-side components of their applications. Adobe Flex is a true service oriented client (SOC) for delivering RIAs that securely and intelligently interface with the SAP back-end.

To meet these SOA/SOC requirements, Adobe Flex delivers a high performance, cross platform runtime environment capable of manipulating data and executing business logic locally. Adobe Flex developers can integrate animation, audio and video as well as traditional text and graphics in their applications to present information most effectively. Further, Adobe Flex moves beyond the request/response model of web browsers with high performance data transfer, publish/subscribe, data push and other enhancements to client-server interaction. Adobe Flex also provides the functionality to support disconnected computing with seamless reintegration when the user connects to the network.

Flex Runtime Architecture

Adobe Flex employs a just-in-time deployment model. Developers use Flex Builder to generate a binary file of compiled bytecode for an RIA client. This file is simply deployed to a web server via FTP or any other traditional means. When an end user requests the application, it is downloaded and the bytecode is translated to machine code by the Flash Player’s just-in-time compiler. ActionScript application code executes within a virtual machine sandbox, providing safe, high performance support for business logic on the client. The Flash Player also renders rich text, supports graphics APIs, including vector graphics, executes animations and supports audio and video with an optimized codex.
Enterprise IT Architects have several options for integrating their Flex applications with their SAP environments.

SAP Remote Function Calls (RFCs) and SAP Business Application Programming Interfaces (BAPIs) are standard SAP interfaces for communication between SAP systems as well as between SAP systems and non-SAP systems. RFCs and BAPIs can be exposed as Web Services or Java APIs using the SAP Java Connector.

Enterprises can integrate their SAP solutions with Adobe Flex by using Java or ABAP Web services. The SAP Web Application Server implements Web services standards including eXtensible Markup Language (XML); Simple Object Access Protocol (SOAP); Web Service Definition Language (WSDL); and Universal Description, Discovery, and Integration (UDDI).

LiveCycle Data Services ES extends the capabilities of the Flex client framework by providing additional services for advanced integration with SAP applications. Managing services for tasks such as RPC, data management and messaging is simplified for developers. LiveCycle Data Services ES is implemented as a Java server application and can be deployed on the SAP Web Application Server or many other standard Java application servers.

LiveCycle Data Services ES leverage standard deployment tools provided with the server and can integrate with application server clustering features to enable highly available applications. LiveCycle Data Services integrate with the existing security profiles defined within the Java application server.
Using LiveCycle Data Services ES, developers can easily create and manage bindings between Flex applications and SAP. Using Flex Remoting developers can access BAPIs and RFCs exposed as Java APIs via the SAP Java Connector and benefit from superior client/server performance provided by LiveCycle Data Services ES.

Figure 5: Developers have multiple options for integrating Flex and SAP. Whichever method of programmatic integration is selected, Flex applications can be embedded within SAP NetWeaver Portal iViews, providing a seamless user experience within the enterprise. Integration is often as simple as calling an HTML file that loads the Flex application in an iFrame.

Adobe Flex Development Model
The development process for Flex applications is similar to that used in other object oriented environments such as Java and C++. Using Flex Builder or a text editor, developers write source code, which is then compiled to bytecode.

MXML is an XML-based markup language used in Adobe Flex applications to describe user interface elements, declare associations with client side logic and bindings between the user interface and application data. By clearly separating business logic from presentation, MXML helps maximize reusability and developer productivity.

Enterprise developers can leverage their familiarity with object oriented programming languages to quickly become productive with ActionScript, the scripting language used for Adobe Flex development. Like JavaScript, ActionScript is an implementation of ECMAScript, the internationally standardized scripting language. Unlike JavaScript, ActionScript implements the latest ECMAScript proposal and supports features not commonly available in the versions of JavaScript found in most browsers. Developers benefit from strong typing, error handling, delegation, interfaces and ECMAScript for XML.

The Flex class library provides developers with a rich set of over 100 components, behaviors, bindings and more. Flex components are designed to provide a consistent user experience across platforms and browsers, relieving developers of significant effort.

Visual components provide developers with an out-of-the-box collection of user interface elements they can use to quickly prototype and create rich internet applications. Components can be extended to meet specific needs and developers can create custom components.

Flex service components provide built in classes for accessing data via HTTP and for calling SOAP-based web services. When developers need to access custom protocols, they can access binary sockets. Data retrieved to the Flash browser can be stored and manipulated in a variety of ways, including native XML, arrays, typed variables, or using the built-in Collection class which
helps developers manage changes and updates to data. Leveraging LiveCycle Data Services ES on a J2EE server further enhances the capabilities of Flex services.

Trigger-driven behaviors such as moving, pausing, resizing and fading are also provided. Developers can create their own effects or build composite effects to provide appropriate visual and audible feedback to users.

Case studies
Philips
Philips is a global electronics manufacturer based in the Netherlands. With over $35 billion in annual sales and a work force of over 125,000, it was vital that Philips achieve broad adoption of their SAP Customer Relationship Management system. They set out to develop an advanced interface that would streamline tasks so they could be achieved in fewer mouse clicks and key strokes, provide a better user experience, and embed charting for improved data analysis and decision support. At the same time, Philips wanted to reduce development time and costs.

LEAP Online is the pricing component of Customer2Day, the key account management tool for Philips Lighting. Philips needed to make key account managers more efficient and identified several innovations that would help them meet their goals. These include improving application performance by reducing the time users spend waiting for pages to be generated, batch updates, improvements to pricing approval workflows, providing on-demand visualization of data that impacts pricing decisions, and pricing comparison features. Adding to the complexity of the solution envisioned by Philips, Key Account Managers are often offline when updating price lists.

Figure 6: Usability of the LEAP Online project resulted in streamlined workflows and broader adoption of CRM within the Philips Lighting sales force.

Philips selected Adobe Flex as the best-in-class RIA development framework most suited to their SOA approach. Support for rich, cross platform front-ends and out-of-the-box capabilities to integrate with SAP Enterprise Services, coupled with the comprehensive and professional grade Flex Builder development environment helped Philips complete development on time and on budget. The ongoing partnership and vibrant collaboration between Adobe and SAP also helped ensure Philips of continuing development and support of engaging customer solutions.

Philips was able to dip into an ecosystem of Flex and Flash consultants, drawing on Apollogic for experienced assistance and quickly prototyped and developed LEAP Online as a modern, feature-rich presentation layer assembled from Adobe Flex components that simplified workflows from six clicks to two, with a corresponding reduction in training costs. Similarly, by moving away from the HTML page request model, system response times were lowered from 30 seconds to four. Philips exposed their SAP CRM system as a web service that was then straightforward to integrate into the client-side front-end. Incorporating their sales database, they were...
able to mashup graphic sales and pricing information that helps account executives to make better and faster decisions. Adobe Flex support for complex data models and disconnected operation using a local database met Philips’ need to support account professionals in the field.

Additional SAP pilot projects, to refactor the interfaces to the Marketing Attributes and Indirect Sales Tool have been successfully undertaken with Adobe Flex. Philips is also extending the usage of Flex to additional SAP applications (ERP, BI) and has implemented SAP Interactive Forms by Adobe for PDF forms workflows.

**Indo**

Indo is a multinational manufacturer of ophthalmic lenses, frames, sunglasses and equipment for ophthalmologists and opticians based in Barcelona, Spain, with revenue of nearly $200 million and over 1,800 employees worldwide. Long priding themselves for being innovative both in their products and their business practices, they were an early industry innovator of global online product ordering systems in 2002. While this HTML-based application has been successful at empowering customers and growing sales, the increasing numbers of frequent users were beginning to complain that the system was too slow and complicated for heavy use.

Indo immediately saw the benefit of overhauling the system, replacing it with one that would even further boost sales while helping them promote themselves as innovators. They contacted Capgemini, the consulting firm behind the original HTML application, to develop Indonet. Capgemini knew that, architecturally, an RIA approach would best meet Indo’s need to provide customers with desktop-like functionality and performance while leveraging the cost effectiveness of web deployment and integration with their SAP R/3 environment. The growing enthusiasm of analyst firms such as Gartner and Forrester in RIA approaches also helped convince Indo that it was the best option.

Adobe Flex was chosen as the RIA framework for Indonet partially because it eased development in a SAP environment. The integration of Adobe Flex with SAP NetWeaver greatly eased development efforts for solutions that take advantage of SAP business logic for order verification and confirmation. Capgemini knew from previous projects that HTML coding accounts for about 60% of effort in traditional web application development. By eliminating this work they were able to produce results faster and less expensively.
Users of Indonet report that it greatly simplifies and speeds online purchases from Indo. Adobe Flex enabled such a simple to use application that none of their users around the world – even in the smallest practices – has required training or even a manual.

**Outlook**

Adoption of RIA technologies continues to accelerate as they demonstrate real value to businesses, with market research firms such as Gartner Group predicting that over 60% of new projects will include RIA technology by 2010.

Adobe and SAP continue to work together to deliver compelling options for innovation to enterprise IT architects and developers. Now fully compatible with NetWeaver Developer Studio 7.1, Flex Builder continues to redefine the development of RIA business solutions. Additionally, SAP is developing Flex-based solutions such as intuitive dashboards for SAP xApp Analytics as part of the SAP family of products and had identified RIAs as a key technology for improving user experiences.

IT managers need to know that investments in skills, code development and supporting infrastructure will continue to benefit the organization as technologies evolve. The support for standards-based languages and protocols such as Java, ActionScript, JMS, XML, SOAP, CSS and Web Services, and emergent enterprise architectures such as SOA/SOC help ensure that Adobe Flex can leverage current and future investments.

When organizations need to migrate Adobe Flex applications to the desktop, Adobe AIR provides a seamless migration path that takes full advantage of existing code as a starting point for new development.

**Conclusion**

As IT architects, developers and others face the challenge to maximize the return on their SAP investments, they must provide sophisticated and appropriate front-end clients that overcome the limitations of traditional HTML browsers. Clients that combine the low cost deployment advantages of the web with the richness of desktop applications can help enterprises streamline workflows, improve decision-making, avoid online transaction abandonment and improve revenues, and provide customers with more satisfying and cost effective support.

The SAP Enterprise Service Oriented Architecture supports the development of Rich Internet Applications by cleanly separating business logic and business objects from presentation layer implementations. The Adobe Flex framework is a complete RIA development environment that allows organizations to support existing investments in SAP, developer skills and code. The high performance, cross platform runtime environment enables clients to manipulate data and execute business logic locally. Adobe Flex supports high performance data transfer, publish/subscribe, data push and other enhancements to client-server interaction, including disconnected computing. These Service Oriented Client principles allow organizations to take full advantage of SAP and other back-end investments in their SOA environment.

**Resources**

- Adobe Flex Product Homepage:

- Flex 3:

- Flex Developer Center:

- Flex.org:

- Engaging User Interfaces with Adobe Flex (SAP Developer Network):
• Developing SAP Applications with Adobe Flex:

• Programming Flex 2:
   http://www.oreilly.com/catalog/9780596526894/index.html

• Demonstration Video of Adobe Flex application on top of SAP:
   http://my.adobe.acrobat.com/flexsappoc/

• Flex Demonstrations at SAP TechEd 2006 Demo Jam:
   http://my.adobe.acrobat.com/saptechedflexdemojam/

• Flex Coders list on Yahoo!:
   http://tech.groups.yahoo.com/group/flexcoders/

• Flex 2 Store Example:

• Adobe AIR:
   http://labs.adobe.com/technologies/air/