

RIA: The Future of Internet Applications

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Abstract:- Rich Internet Applications, popularly known as RIA, are web applications loaded with features and functionality of traditional desktop applications. Macromedia defines RIAs as combining the best user interface functionality of desktop software applications with the broad reach and low-cost deployment of Web applications and the best of interactive, multimedia communication. The end result: an application providing a more intuitive, responsive and effective user experience. Specifically, the best of the desktop includes providing an interactive user interface for validation and formatting, fast interface response times with no page refresh, common user interface behaviors such as drag-and-drop and the ability to work online and offline.

The best of the Web includes capabilities such as instant deployment, cross-platform availability, the use of progressive download for retrieving content and data, the magazine-like layout of Web pages and leveraging widely adopted Internet standards. The best of communication means incorporating two-way interactive audio and video. This means that in a RIA, the client is capable of doing more than just rendering pages. It is able to perform computations, send and retrieve data in the background asynchronously from the user's requests, redraw sections of a screen, use audio and video in a tightly integrated manner and so forth, independently of the server or back end it is connected to.

Keywords:- Rich Internet Applications, behavioural model, client-side interaction, server-side interaction, context, Consumer RIA, Enterprise RIA, RIA Frameworks

I. INTRODUCTION

Rich Internet Applications (RIA) is the focal point of convergence between traditional desktop applications & browser based clients as shown in Figure-1. RIA is a lightweight application that combines strengths of both the domains while liberating the user from their respective constraints. RIA typically transfers the necessary processing of the UI to the web client but keep the bulk data back on the application server.

On the first use, RIA is downloaded & accessed on demand. They are cached for future use OR in some scenarios; deployed onto a device to provide access even when the user is disconnected from the network. Data may be locally cached & then synchronized with a remote server OR may be kept on the server & retrieved when necessary. RIA reflects the gradual transition of web applications from the simple thin client model of a traditional web browser to a rich distributed model that behaves more like the desktop in a client/server model.

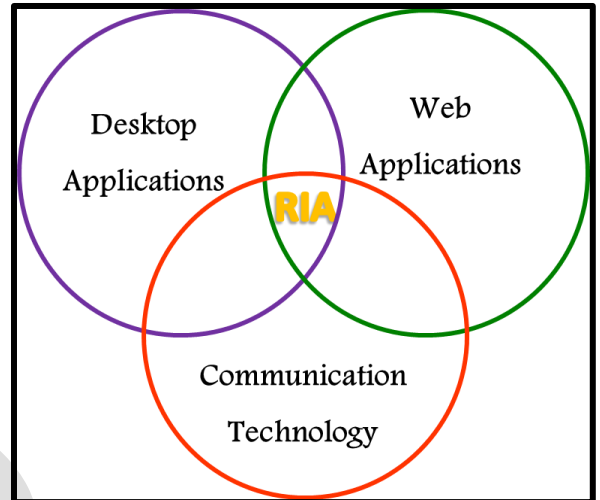


Figure 1: RIA as a focal point of convergence

II. EVOLUTION OF INTERNET APPLICATIONS

A. Client Side Evolution

As shown in Figure-2, earlier, web pages were designed using Plain HTML. The content to be displayed had to be simple & synchronous but it reached millions of people.

Today, with the evolution of Internet Applications, the content of these web pages has been enriched with graphics, audio & video.

B. Server Side Evolution

As shown in Figure-2, earlier, Internet Applications had a Database Application Layer, Business Logic Layer and the capability to utilise & display dynamic content.

Today, with the evolution of Internet Applications, a web page can enhance the user's experience by displaying dynamic & asynchronous content that encompasses multimedia data components.

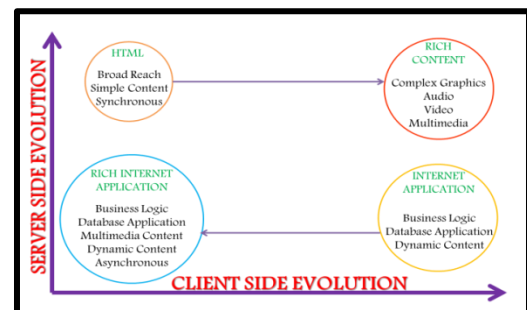


Figure 2: Evolution of Internet Applications

III. BEHAVIOURAL MODEL OF RIA

A reference model is useful for establishing a shared frame of reference or conceptual framework to structure subsequent discussions of a subject. The RIA Behavior Model, which represents the principle elements to be considered in any discussion of RIA behavior and in particular RIA performance and management. Note that the model does not address the complex human forces that determine perceptual, cognitive, and motor behaviors. It merely represents a few behavioral outcomes that are relevant in the context of an interaction between a human user and a Rich Internet Application.

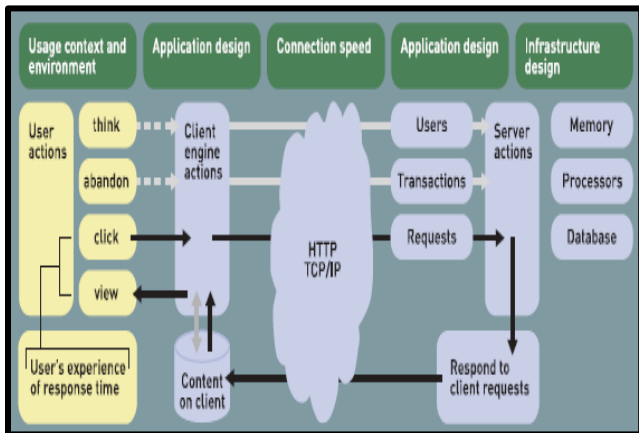


Figure 3: Behavioural Model of RIA

At the highest level, the model illustrates three major aspects (indicated by the color coding in the Figure-3), each of which influences application performance:

- 1) The application's design and usage environment or context represented in Figure-3 in green colour consists of usage context, application design, connection speed & infrastructure design.
- 2) The user's expectations and behavior represented in Figure-3 in yellow colour consists of user's actions & user's experience of response time.
- 3) The application's behavior represented in Figure-3 in blue colour consists of client-engine actions, HTTP or TCP/IP requests, the server actions & responses.

IV. INTERACTION BETWEEN BROWSER & SERVER

Web browser is the simplest form of client engine. The user clicks on a link in the browser, the browser sends requests to one or more servers.

Servers respond to client requests, and when enough of the requested content arrives on the client (in the browser cache), the browser displays it and the user can view it. The user's experience of response time is the elapsed time of the entire process from click to view.

Even a single Web page download typically involves many round trips between client (browser) and server, as most Web pages are an assemblage of content elements such as CSS files, script files, and embedded images, each of which is downloaded individually by the browser.

In a traditional synchronous Web application, this process repeats several times. Because applications usually require an exchange of information, at least one of the requests the browser sends to the server will typically be an HTTP POST (as opposed to the much more common HTTP GET request), to upload some data a user has entered into a form. Consider, for example, shopping at Amazon.com as a return visitor. At minimum, even if the application recognizes you from a cookie, you must re-enter your password to confirm your identity. But after that, the site already has your personal information and you can complete your transaction by clicking on the specified buttons on each page as they are presented to you.

V. SERVERSIDE ELEMENTS

Servers must field requests concurrently from many users. No matter how powerful the server, every concurrent user consumes a small share of the server's resources: memory, processor, and database.

Web servers can respond rapidly to stateless requests for information from many concurrent users, making catalog browsing a relatively fast and efficient activity. But a user's action that requires the server to update something (such as clicking a button to add an item to a shopping cart) consumes more server resources. So the number of concurrent transactions-server interactions that update a customer's stored information-plays a critical role in determining server performance.

People who design and test back-end systems already know that behavioral variables such as user think-time distributions and abandonment rates per page have a significant influence on the capacity and responsiveness of servers under load. Now RIA's give application designers the flexibility to design applications that attempt to take account of such behavioral variables.

VI. CLIENT SIDE ENGINE

Although implementations differ, all RIAs introduce an intermediate layer of logic - a client-side engine (Figure-4) between the user and the Web server. Downloaded at the start of the session, the engine handles display changes and communicates with the server. Adding this layer allows developers to build Web applications with characteristics that the Gartner Group has described as "between the fat but rich client/server model and the thin but poor Web based UI model." Adding a client-side engine does not prevent an application from implementing the traditional synchronous communication style. But it also allows the user's interaction with the application to happen asynchronously - independent of communication with the server.

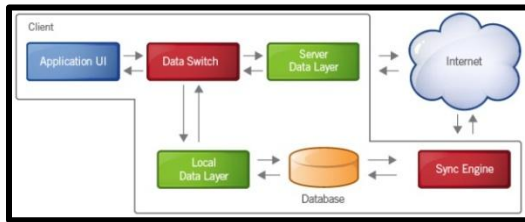


Figure 4: Client Side Engine

In a Rich Internet Application:

- 1) Information can be fetched from a server in anticipation of the user's input
- 2) In response to an input, the screen can be updated incrementally instead of all at once
- 3) Multiple user inputs can be validated and accumulated on the client before being sent to the server
- 4) Responses to some user inputs can be generated without communicating with the server
- 5) Processing previously handled by servers can be offloaded to the client desktop

VII. IMPORTANCE OF CONTEXT

The users' satisfaction with any application depends on the usage context and environment, that is, how well the application design matches the users' needs at the time, their ways of thinking, and their behavior when using the application.

A user's experience of response time depends on the combined behaviors of the client and server components of the application, which in turn depend on the application design, the underlying server infrastructure design, and, of course, the user's Internet connection speed. The most effective RIA will be one whose creators took into account these factors at each stage of its development life cycle, and who created the necessary management processes to ensure its success when in production.

VIII. RIAACCESS POINTS

Web, desktop, and mobile applications all serve as entry points for accessing RIAs. The de facto approach has been through the browser using asynchronous JavaScript and XML (AJAX), a group of development technologies for creating interactive web applications.

One area in which RIAs are delivering on their promise is portal technology. RIAs are being used to enhance, and in some cases replace, portals. The flexibility that portals were expected to deliver has been hard to achieve, and RIAs are now being used to provide the functionality that portals were going to bring to the Market.

When an RIA is deployed on the desktop it can be cached locally, allowing users to work when connected or

disconnected from the network. In addition, the application can also integrate better with existing installed programs, such as word processing, spreadsheet, and email applications, enabling common actions such as drag-and-drop between RIAs and native applications.

The next frontier for RIAs is the plethora of devices beyond personal computers. Just as the Internet greatly extended the reach of personal computer applications, the rapid evolution of smart phones and Internet-connected mobile devices is changing expectations for how content is delivered on the go and how applications can be accessed by a more mobile audience.

Regardless of the mobile device (laptop, mobile phone, PDA), RIAs work independent of the underlying operating system. As with any technology, however, reaching out to all access points will take time.

IX. CONSUMER RIA

There are generally two types of consumer RIAs: those that allow your customers to engage with you and your products (marketing and business-to-consumer applications) and those that provide a better experience when consuming content such as films and music (media applications). RIAs work well in both of these spaces because the rich-media capabilities and interactivity allow developers and designers to engage users and create that stickiness that defines an exceptional customer-facing application.

Engaging customers is always a challenge for online business-to-consumer applications. It is one that has restricted the potential for online shopping compared to visiting real-world shops. Early attempts to create online clothing shops where the user could see what the clothes looked like on a mannequin with their measurements were slow and difficult to use.

RIAs are now being developed to improve these types of applications, allowing the buyer to get a real idea of whether the clothes will fit and resulting in a reduction of costs associated with returns and stock management for the vendor.

Buying cars is another area where RIAs have revolutionized customer interaction by enabling users to create their own car specification, see how it looks, make changes, and then submit an order to be custom built by the factory. Kitchen and bathroom suppliers are already following suit and building their own RIAs to streamline similar processes.

X. ENTERPRISE RIA

For some time, enterprises have had to choose between using Web applications, which are often low on rich features, and deploying desktop applications, which are complex and difficult to install. By combining the strengths of both web and desktop applications, RIAs add value rather than complication. There are a number of ways that RIAs can be used effectively within the enterprise. RIAs work well where line-of-business applications need to be

deployed quickly and maintained constantly. They have a small footprint and can be delivered via a web server or an application server on the company network. This multiple delivery approach is important because it allows RIAs to be delivered over a wide variety of connections from the LAN to the Web and even via CD or DVD.

Just as with consumer RIAs, there are two areas where initial development has been concentrated in the enterprise: task-oriented applications and providing decision support. In some cases it can be difficult to differentiate between an enterprise task-oriented application and one that can be extended to your customers.

Often these task-oriented RIAs provide an opportunity to incorporate real-time collaboration between customers and employees.

XI. DESIGNING AN RIA

RIA's are still in the early stages of development & user adoption. There are a number of restrictions & requirements that need to be followed:

- 1) **BROWSER ADOPTION:** Many RIA's require modern web browsers in order to run. Advanced JavaScript engines must be present in the browser as RIA'S use techniques such as XML HTTP Request for client-server communication & DOM Scripting, Advanced CSS Techniques to enable rich user interface.
- 2) **WEB STANDARDS:** Differences between web browsers can make it difficult to write an RIA that will run across all major browsers. The consistency of Java Platform, particularly after Java 1.1, makes this task much simpler for RIA's written as Java Applets.
- 3) **DEVELOPMENT TOOLS:** Some Ajax Frameworks & products such as CURL, ADOBE FLEX & MICROSOFT SILVERLIGHT provide an integrated environment in which RIA could be built.
- 4) **ACCESSIBILITY CONCERNS:** Additional interactivity may require technical approaches that limit applications accessibility.
- 5) **USER ADOPTION:** Users expecting standard web applications may find that some accepted browser functionality may have an unexpected behavior.

XII. RIA FRAMEWORKS

A. ADOBE FLASH, ADOBE FLEX, ADOBE AIR

ADOBE FLASH is another way to build rich internet applications. This technology is cross-platform and quite powerful to create an application UI.

ADOBE FLEX is a framework that provides the option for a developer to build user interfaces by compiling MXML, an XML based interface description language. This Adobe Flex framework is compiled and turned into a SWF file to be run in the Adobe Flash player.

Adobe has also released **ADOBE AIR** (Adobe Integrated Runtime), which is a runtime platform that is independent to

the hosting operating system. Adobe AIR allows for Flash Player and Ajax applications to be deployed/installed onto a user's desktop as one would a desktop application.

B. CURL

CURL is a reflective object-oriented programming language for interactive web applications whose goal is to provide a smoother transition between formatting and programming. It makes it possible to embed complex objects in simple documents without needing to switch between programming languages or development platforms.

CURL combines text mark-up (as in HTML), scripting (as in JavaScript), and heavy-duty computing (as in Java, C#, or C++) within one unified framework. It is used in a range of internal enterprise, B2B, and B2C applications.

CURL applets are viewed using the Curl RTE, a runtime environment with a plugin for web browsers & currently, supported on Microsoft Windows, Linux and Mac OS X.

CURL has had a feature of detached applets for several years, which is a web deployed applet which runs on the user's desktop independent of a browser window much as in Silverlight 3 and Adobe AIR.

C. MICROSOFT SILVERLIGHT

MICROSOFT SILVERLIGHT is an application framework for writing and running rich Internet applications, with features and purposes similar to those of Adobe Flash.

The run-time environment for Silverlight is available as a plug-in for web browsers running under Microsoft Windows and Mac OS X.

While early versions of Silverlight focused on streaming media, current versions support multimedia, graphics, and animation, and give developers support for CLI languages and development tools.

Silverlight is also one of the two application development platforms for Windows Phone, but web pages which use Silverlight cannot run on the Windows Phone or Windows Mobile versions of Internet Explorer, as there is no Silverlight plugin for Internet Explorer on those platforms.

XIII. ADVANTAGES OF RIA

- 1) Develop new kinds of applications with features or capabilities that would be extremely difficult or impossible for a developer to create using traditional Web technologies.
- 2) Engage, guide and listen to their customers on-line more intimately or more closely to how they would do it in person to increase loyalty, improve service, deepen the customer relationship, distinguish the company, or guide product development.
- 3) Create compelling, attractive Web sites using audio, video, text and graphics that generate leads, increase sales, simplify communication and create a unique online experience worth returning to.

- 4) Simplify typically complex processes like registration, configuration or purchasing leading to increased leads, sales, bookings, time on the site and repeat visits.
- 5) Present information to their employees, management and partners in clear, innovative, intuitive and effective ways to increase productivity, information sharing, decision-making and competitive advantage.
- 6) Provide an engaging, highly interactive presentation layer to underlying Web Services.
- 7) Reduce bandwidth costs associated with frequent page refresh for high traffic sites.
- 8) Dramatically increase sales of their products and services through their Internet channel.
- 9) Build an engaging, highly interactive Web site or application at a reduced cost compared to using alternative Web technologies.

XIV. ROLE OF RIA IN ENTERPRISES

The responsive, intuitive and effective user experience provided by RIA holds long term business implications for enterprises. By broadening the mode of interaction between end-users and applications, RIA opens new, enriched ways for enterprises to add value to their products and services. RIA offers the following business benefits to enterprises:

- 1). Increase customer and partner productivity
RIA eliminates multi-screen interface, other single application view and reduces interaction in business process. This results in enhanced user productivity and satisfaction.
- 2). Improved customer loyalty
RIA allows customers and partners of e-commerce sites to manage and communicate account information, check order status and re-order in a more effective way. Companies can offer sophisticated online experience to increase customer retention rate to drive revenue streams.
- 3). Increase in new Customers
Apart from depending on existing customer relationship, RIA also helps businesses acquire new customers. As individual and organization conducts more business online. Web applications double up as the “first line” of interface with the end-customers. With growing competition, it is important to leave a lasting first impression.
- 4). Reduced operational cost
RIA reduces bandwidth usage and server load by moving processing to the web browser

XV. CHALLENGES FACED BY ENTERPRISES ADOPTING RIA

Enterprises need to factor in the following challenges while adopting RIA technologies:

- 1) Lack of Standards
There is a considerable flux, lack of standards and best practices in RIA technologies. The community is debating whether to use Ajax or Flash or even both, while some developers even claim that “Flash is Ajax”. Many Ajax tools have cross-browser and cross platform problems. To solve

these problems, Open-Ajax Alliance, an organization of more than 60 leading vendors, open source companies and companies using Ajax, is striving to identify and consolidate best practices, reach a consensus a programming models, provide reference implementations for tolls interoperability and generate wider Ajax adoption throughout the industry.

2) Market volatility

The commercial RIA technology market is still nascent. New Players are emerging continuously. Most of the current vendors -Jack Be, Back base and Sun Microsystems have only started RIA support in their existing product suites.

3) Security Concerns

Security is a major area of concerns for RIAs, especially Ajax based RIAs. Yammer, Sy and Spadefish-type worms are exploiting “client-side” Ajax frameworks, providing new avenues of attack and compromising confidential information. Several such cross-site scripting attacks were observed, most notable being the Yammer attack on Yahoo Mail and Sammy work on Myspace.com

XVI. FUTURE OF RIA

The new generation of RIA tools must do the following:

- 1) Allow developers to write applications using familiar development models to utilize and extend their current skills without requiring them to adopt entirely new or different skills
- 2) Use standard and standards-based technologies
- 3) Use industry specific programming models and patterns.
- 4) Use and/or leverage the existing IT infrastructure through wrap and reuse rather than rip and replace.
- 5) Provide pervasive, familiar programming models and an expressive user interface across platforms and devices.
- 6) Allow developers to create a solution that delivers scalable, secure, high performance solutions that are bandwidth efficient.

CONCLUSION

Rich Internet Applications, popularly known as RIA, are web applications loaded with features and functionality of traditional desktop applications.

RIA will be the key to delivering the CARS experience (customized, aggregated, relevant and social) for online & offline applications.

Macromedia defines RIAs as combining the best user interface functionality of desktop software applications with the broad reach and low-cost deployment of Web applications and the best of interactive, multimedia communication.

The end result: an application providing a more intuitive, responsive and effective user experience. Specifically, the best of the desktop includes providing an interactive user interface for validation and formatting, fast interface response times with no page refresh, common user interface

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The best of communication means incorporating two-way interactive audio and video. This means that in a RIA, the client is capable of doing more than just rendering pages.

It is able to perform computations, send and retrieve data in the background asynchronously from the user's requests, redraw sections of a screen, use audio and video in a tightly integrated manner and so forth, independently of the server or back end it is connected to.

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