macromedia®

# The Flash® Platform

Delivering Effective User Experiences
Across Browsers, Operating Systems, and Devices

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# Experience Matters

Today, we imagine a world where every digital interaction—whether in the classroom, the office, the living room, the airport, or the car—is a powerful, simple, efficient, and engaging experience. Macromedia Flash Player is widely used to deliver these experiences and has evolved into a complete platform across browsers, operating systems, and devices.

We have spent more than a decade creating technology to help people build and deliver experiences in memorable, compelling, and effective ways – from the early days of interactive CD-ROMs to compelling websites to Rich Internet Applications (RIAs) on personal computers and mobile devices.

We believe great experiences build great businesses. Great experiences improve customer interactions; they improve sales and productivity while delivering a compelling brand experience, leading to financial return through increased use, brand loyalty, and customer satisfaction. The Flash Platform offers a tremendous opportunity for you to improve the experience of your content and applications on the Internet and bring real returns to your business in terms of increased customer satisfaction, improved productivity, stronger branding, and reduced support costs.

# Flash Platform Elements

Flash Player is the backbone of the Flash Platform, supported by a layer of tools, servers, components, patterns, and developer programs that provide the on-ramp for over a million designers and developers to build rich content and applications. On the outer edge, an array of complete solutions take advantage of the Flash Platform, including Macromedia Breeze™ for web conferencing, training, and presentations.
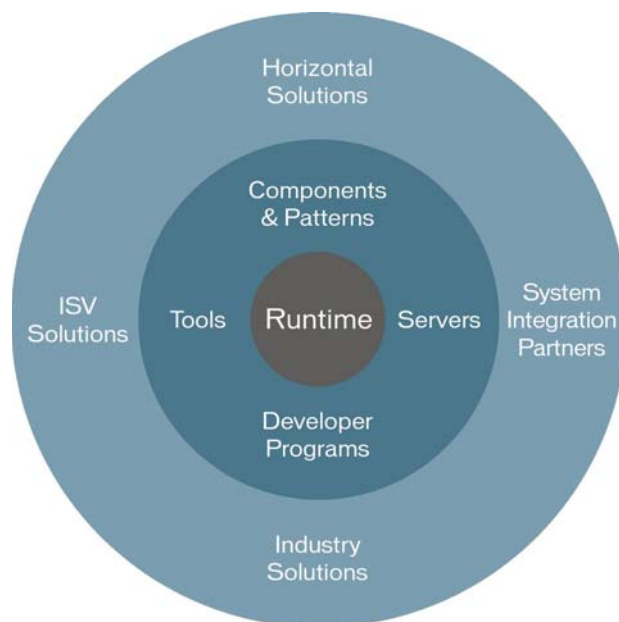


These components of the platform are delivered not only by Macromedia, but also by a host of other providers, who leverage the published Flash file format (SWF). At the time of writing, more than 100 independent software vendors (ISVs) and developers provide software around the Flash Platform.

# Flash Platform Reach

It's important for a platform to reach a large number of people so anything developed with it will be widely usable. Flash Player is installed on more than 600 million personal computers and devices. It reaches over 98% of personal computers connected to the web, and over 100 OEMs are building Flash into their devices.



Flash Player is distributed more widely than any other software on the Internet, and can be updated more quickly than any other client technology. Flash Player is installed across the web at a rate of over two million installs every day. Each new release of Flash Player achieves 80% reach in about 12 months, which means that designers and developers can take advantage of new Flash Player functionality quickly.
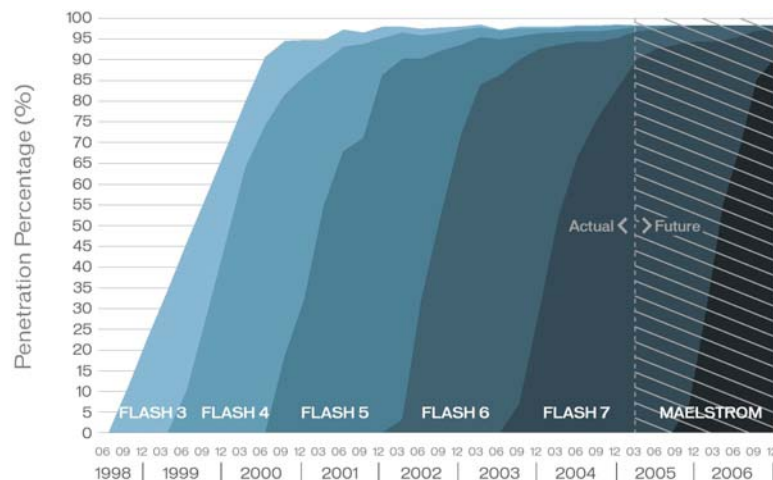


More than a million designers and developers are working with the Flash Platform today. There are numerous books and training materials from Macromedia Press, O'Reilly, and others. In general, Flash is supported by a vibrant online community across sites and weblogs (such as http://weblogs.macromedia.com), as well as international user groups and conferences such as the annual Macromedia MAX conference and third-party conferences such as FlashForward.

# Flash Platform Uses

The Flash Platform is used across a wide range of industries including financial services, telecommunications, education, and government. Typical uses of the Flash Platform across these industries are in the areas of content, application, and communication, delivered not only to personal computers but also to the emerging world of mobile devices.

## Content



Flash is best known for rich, interactive content on the web and innovation in this area continues today. The most recent trend in rich content is integrating video with the interactive experience. Companies such as IBM®, Microsoft®, Amazon.com®, Fox Broadcasting Company, and many others use Flash Video to deliver their content. Flash Player is the number one video player on the Internet today; no other video player has as much reach.

## Applications



Macromedia has been working to improve the experience of web applications through rich internet applications (RIAs), which combine the functionality of desktop applications with the broad reach and low-cost deployment of web applications. This results in more intuitive, responsive, and effective user experiences.

Companies such as SAP, Intelligent Finance, TJ Maxx®, and Brocade have embraced RIAs due to their unique ability to offload application processing to the client, reduce the number of page refreshes to accomplish tasks, require less bandwidth, and deliver a better experience.

There are many successful examples of RIAs running on the Flash Platform today. TJ Maxx replaced its HTML-based check-out process with one based on Flash, increasing their conversion rate by 50%, which is a dramatic increase in the number of people who actually bought items placed in their shopping cart. The Broadmoor Hotel saw an 89% increase in online reservations after introducing a reservation user interface based on Flash technology. Yankee Candle saw a decrease in customer support calls of 70% after introducing a Flash application for configuring purchases. Zones (the PC and Mac Zone mail order company) used the Flash Platform to create a new unified user interface for its call center representatives. The new solution combines five separate applications into one integrated application built with Macromedia Flex®, keeping all the existing back-end systems while providing a more productive user experience and reducing training time from months to weeks.

A close look at how the application experience has evolved over time reveals a dramatic shift in the reach of applications versus the richness of their interactivity.
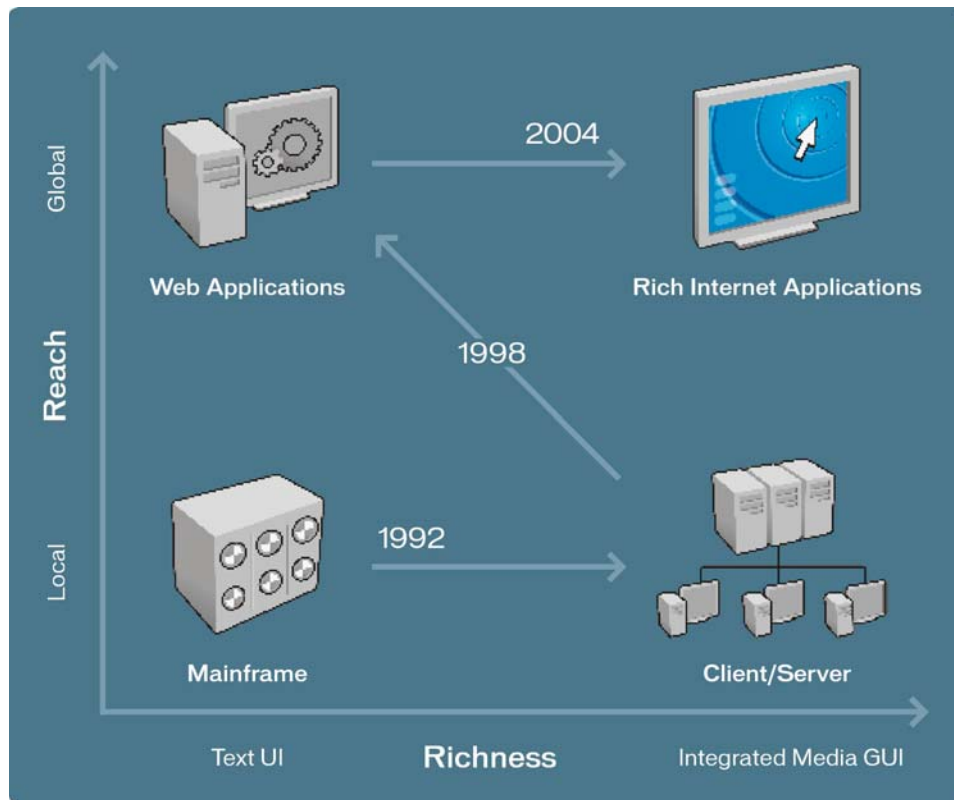


In the days of mainframe computing, users worked on text-based "dumb" terminals connected to a centralized machine, which provided a rudimentary user experience. Client-server computing introduced the rich experience of graphical desktop user interfaces based on stronger local processing power, but typically remained connected to local servers inside an enterprise.

The revolution of the web enabled people to connect to servers all over the world, providing tremendous reach. However, the web took a giant step backwards in interactivity as application user interfaces in browsers were almost as limited as early mainframe terminals. The opportunity before us is to bring back the interactivity of desktop applications while retaining the reach of the web – this is what we refer to as rich internet applications. The Flash Platform has evolved to provide the leading environment for these applications today.

## Communication
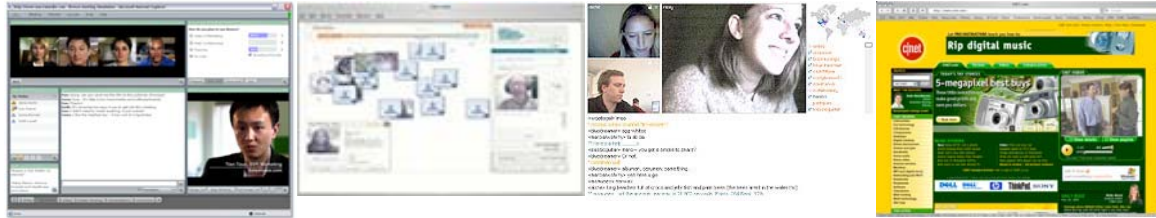


In addition to content and applications, the Flash Platform enables rich communication. It supports streaming, two-way audio-video and data communications using Flash Player,. This enables social software, web conferencing, training, and bridging traditional television media with the web.

One example of these new possibilities is Macromedia Breeze, a rich application built on the Flash Platform for conferencing and collaboration. Breeze brings together a rich collaborative environment for sharing documents and applications, chat, VOIP, and video conferencing in a fluid and responsive user interface that runs in Flash Player with no additional install required. Companies such as Salesforce.com®, Intro Networks, CNET, and many others are leveraging the communications capabilities of the Flash Platform to forge the future of communications over the Internet.

## Mobile
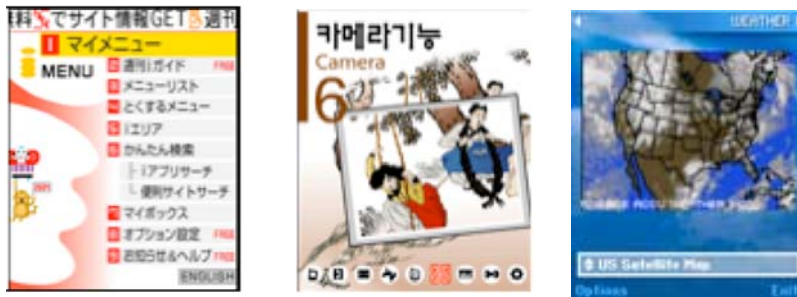


The Flash Platform extends beyond personal computers to include a wide variety of devices. The fastest growing category of devices is mobile phones, where Flash is used for rich content and applications, and even for the phone UI itself.

Flash brings a richer user experience to mobile devices, taking advantage of its interactive graphics capabilities, local storage and consistent development platform. Development time for mobile interfaces and content is dramatically accelerated with Flash, typically three to five times faster than other approaches.

Companies such as Nokia, Samsung, NTT DoCoMo, KDDI, Vodafone™, and many others are building better mobile experiences using the Flash Platform.

# Flash Platform Architecture

The Flash Platform has a layered architecture that encompasses the following key elements:

| Solutions | Breeze | Flash Cast | Third Party Solutions | |
|---|---|---|---|---|
| **Client Runtimes** | Flash Player | Flash Lite | Central | |
| | Flash Runtime | | | |
| **Programming Model** | ActionScript – ECMA procedural language | Class Libraries | **Tooling** | |
| | | | Flex Builder | |
| | MXML – XML based Declarative Interface language | Extensibility Kits | "Zorn" | |
| **Experience Servers** | Flex Presentation Server | Flash Communications Server | Flash Cast Server | Flash Authoring |
| **J2EE**  ColdFusion | | .NET | | Third Party IDEs |

- Rich client: The core of the platform is Flash Player, which is deployed in browsers on personal computers, on devices as Flash Lite, and on the desktop in the developer release of Macromedia Central, which supports occasionally connected computing.

- Programming model: A consistent model for developers that combines ActionScript (an ECMAScript procedural language just like JavaScript) and MXML, which is an XML-based declarative language for rapidly developing user interfaces and data binding. The programming model extends across rich clients and the experience servers.

- Experience servers: A set of server technologies that work with existing back-end systems built on J2EE, .NET, or standard web servers. These server technologies include Macromedia Flex server, Flash Communication Server, and FlashCast™ server. The Flex server enables the integration of rich user interfaces with back-end services in application servers. The Flash Communication Server enables streaming, scalable audio-video delivery. The FlashCast server enables telecom carriers to deliver a better, more responsive user experience through background delivery of data to mobile devices.

- Tools: The Flash Platform provides a strong collection of tools for building interactive content and applications. The Flash authoring tool is the leading authoring tool for rich interactive content. Macromedia has also joined the Eclipse Foundation and is creating a new development tool based on Eclipse, code-named Zorn for building RIAs. Many third-party developers have also produced tools that target the Flash Platform, such as SAP Visual Composer, a model-driven tool that enables business analysts to build composite applications with rich interactive front ends.

- Solutions: Complete applications have been built on top of the Flash Platform, including Breeze for web conferencing and collaboration, FlashCast applications for mobile phones, and many other third-party solutions.

## Rich Client

Flash Player delivers an incredible set of capabilities in a tiny package. Its small footprint (less than 1 MB in size) translates into a quick download for people who need to get it – which has led to its wide deployment. Content and applications that run in Flash Player work consistently across operating systems and browsers, which reduces development and testing time and provides a consistent user experience.

Flash Player is also backward compatible, enabling content and applications built for previous versions of Flash Player to live on without requiring any update as new versions of Flash Player are released.

Flash applications run in a secure, domain-based sandbox, and are not freely accessible across domains. Secure communication in Flash is supported through SSL, as in other web applications.

The Flash file format (SWF) is published so third parties can build innovative solutions around the Flash Platform, and more than 100 software providers output to the SWF format. Flash Player also builds on and incorporates existing standards:

- Its programming language, ActionScript, is an ECMAScript language

- Media formats include JPEG images, MP3 audio, and H.263 video

- Data integration supports XML and SOAP web services

- Networking uses native HTTP/HTTPS protocols

Flash Player 7

The most recent release of Flash Player for personal computers contains a rich set of capabilities, including ActionScript, rich media support, data and networking capabilities, local storage, privacy and security control, and other system services.

ActionScript

ActionScript is a procedural programming language that will be familiar to anyone who has worked with JavaScript. ActionScript supports object-oriented development and strong data typing of variables.

Flash Player contains a virtual machine that executes compiled ActionScript code in exactly the same way across operating systems and devices. Flash Player is event-driven – it supports asynchronous events as they occur, which lends itself well to building responsive Internet applications. ActionScript also provides a robust set of APIs and components for building content and applications.

Media

The display engine in Flash Player is based on vector graphics, which scale easily to any screen resolution, and enables smooth transitions and other rich graphic effects. It is also the basis for the small download size of Flash content, as vector graphics can deliver experiences with much smaller bandwidth requirements than bitmap graphics.

For audio playback, MP3 support is built into Flash Player, enabling high-quality audio and music to be played either as a downloaded element or as a stream. Audio can be synchronized with other concurrent events.

For video playback, Flash Player supports the H.263 video standard, using the Flash Video (FLV) format. Video can be converted from other popular formats such as QuickTime (MOV) or Windows Media (WMV) to FLV for playback in Flash Player. Most video tools support export to the FLV format today. Flash Video can be integrated seamlessly into content for playback inside a variety of rectangular and non-rectangular shapes.

For live communication, Flash Player has built-in support for two-way audio-video communication, which supports the use of a video camera and microphone plugged into a personal computer from within content and applications based on Flash technology. This communication enables a host of next-generation collaboration applications, and access to the camera and microphone is fully under user control on a per-domain basis.

Data and Networking

Flash Player supports standard requests for data over HTTP connections, including HTTPS for secure communication over SSL, and handles XML parsing. This can be used to load information from sites or to use the REST (representational state transfer) model of interaction with server applications.

Flash Player communicates asynchronously with servers, enabling rapid local interactivity and display without waiting for a server response on each interaction. When data returns from a server, an event is received and processed by the client.
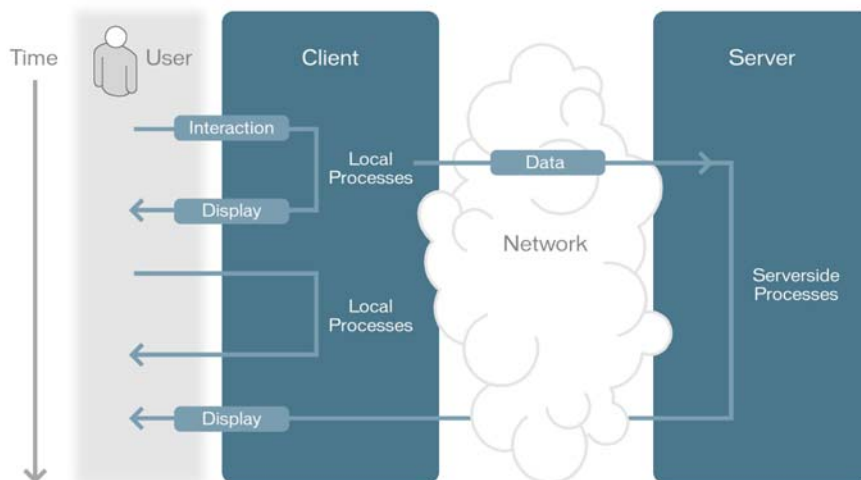


Sockets can also be opened with Flash Player not only to send information to a server, but also to listen for incoming data pushed from the server to the client.

Calling web services using ActionScript is very simple; functions can be called on a server with the same syntax as is required to call local functions. Since Flash Player is event-driven, asynchronous calls to the server can be made, and whenever the response arrives, an event is generated in Flash.

The following snippet shows an example of calling a web service from Flash Player, and handling the response:

```
// 1. Access stock web service.
stockService = new WebService(
    "http://www.flash-db.com/services/ws/companyInfo.wsdl");
// 2. Call web service to get company info.
stockRequest = stockService.doCompanyInfo(
    "anyuser", "anypassword", "MACR");
// 3. Handle the result when it returns.
stockRequest.onResult = function(result)
    {
    stock.companyInfo = result;
    }
```

The Flash security model by default limits web services calls to within the originating domain of the application. Web services providers can enable cross-domain access to their services by placing an access policy file on their web servers.

To optimize the communication between Flash Player and servers, an optional, binary format called AMF is available. This format is completely transparent to developers, with Java or .NET objects serialized at the server side and automatically deserialized as ActionScript objects at the client side. To support real-time communications, the RTMP protocol is available for streaming audio, video, and data communications for synchronized, collaborative applications.

Local Storage

Flash Player can store information locally, much like cookies can store information in a browser. Flash Player is not able to read and write to locations on a user's hard disk arbitrarily – local storage is in an isolated location that Flash Player makes accessible only to the domain of origin. Flash local storage has a greater capacity and offers much more flexibility than cookies, and users have full control over how much information can be stored by domain.

Privacy and Security

Flash Player runs content inside a virtual machine that implements a security sandbox. All resources (applications, data, network URLs, and so on) known to Flash Player are associated with a sandbox. Applications may interact freely with resources within the same sandbox, but the security manager controls access to all other resources. This is similar to the model used for Java and JavaScript.

By default Flash Player provides security and privacy controls that are optimized so that no user or developer knowledge is needed to operate securely in most environments. Flash Player is not able to access private or sensitive data without the user's express consent. For advanced users and developers, an interactive settings manager, configuration files, and developer APIs allow configurations with increased flexibility.

For more details, see the Flash Player Security white paper at
http://www.macromedia.com/devnet/flashplayer/articles/client_security.html

System Services

Flash Player integrates with browsers and system services in a number of ways. Although Flash Player works consistently across browsers and platforms, these points of integration may vary depending on the capabilities of its surrounding environment.

For printing, Flash Player supports the browser Print command. Flash also enables developers to create alternate layouts that are optimized for print, which may be different than layouts designed for the screen.

Accessibility of applications and content to everyone is critical, and Flash supports a number of accessibility approaches such as integration with popular screen readers.

As RIAs move more processing to the client, the browser URL no longer shows every state of an application, since server round trips are not required for every interaction. To support bookmarking of particular states, Flash can update the current state in the browser URL. For more information, please see http://www.macromedia.com/go/flashstates

To integrate logic in a Flash application with the logic on a surrounding web page, JavaScript and ActionScript integration is available and works across all major browsers, enabling functions to be called across these environments. Using this connection, one can take advantage of the strengths of Flash applications and the strengths of HTML pages employing techniques known as Ajax. For more information, please see http://www.macromedia.com/go/flashjavascript

Upcoming Flash Player Capabilities

The next major release of Flash Player, code-named Maelstrom, has significant advances in graphical expressiveness, performance, increased fidelity of font rendering and video delivery, and other new functionality – while still retaining a small download size.
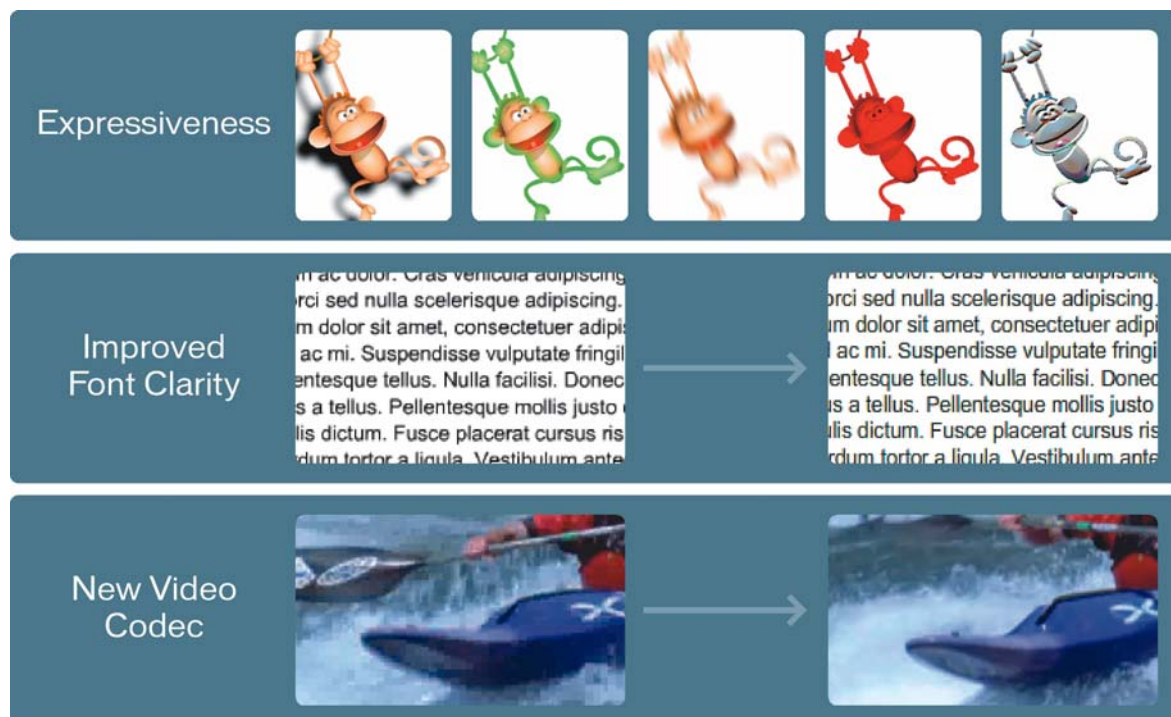


- New graphical expressiveness: New graphical capabilities include a host of image effects such as drop shadows, blurs, glows, beveled highlights, color transformation and convolution, and new blending modes, all of which can be applied to any object in Flash Player and can be stacked to combine effects. Since these effects can be generated dynamically at runtime, they can be accomplished without incurring a download size penalty. A new image API enables custom effects to be created through ActionScript. Additional graphic formats are supported by Flash, including GIF, PNG, and progressive JPEG.

- Improved performance: Performance of Flash Player has been increased in graphics rendering, text scrolling, component rendering, ActionScript execution, and memory management. Bitmap surfaces have been added to accelerate rendering through caching, resulting in a major performance boost in the display of complex graphical information.

- Better font readability: Flash technology already enables the use of any font for text, and does not require that font to be installed on the user's machine to display properly. It accomplishes this by converting fonts into vector graphics, which enables designers to use their choice of fonts. However, since Flash turns them into vector graphics it no longer knows they are letter shapes – this results in small fonts appearing blurry in Flash Player. Maelstrom solves this issue by including a great new font-rendering engine that enables arbitrary fonts to display crisply even at small sizes. Additional control for text layout and display has also been added, including full justification and fine adjustment of kerning.

- Enhanced video: Video is greatly enhanced in Maelstrom, with new support for VP6 video, enabling higher fidelity display at the same bitrates. In addition, a new eight-bit alpha channel has been added, enabling blending of video seamlessly on top of any other elements in Flash applications, including compositing in real time on top of other video elements. This will enable a whole new level of interactivity in video over the Internet.

- New file upload and download: Maelstrom supports file upload and download capabilities, which are under full user control. A Flash application can request that a file be selected for upload by presenting an Open dialog box to the user to navigate to a file and select it. Applications can also offer to download a file by presenting a Save dialog box. This paves the way for a whole class of RIAs that can intermediate between local content on a user's machine and the web such as web-based photo management applications that enable users to upload their photos easily.

- Enhanced privacy control: Additional privacy control for local storage in Flash applications enables users to automatically block local storage by applications that originate from a domain other than that of the containing web page. For example, advertisements on web pages are typically served from an advertiser's web server rather than the site itself. This would block storage of tracking information that might be placed by those applications.

- New IME context switching: For users in countries that make use of input methods for large character sets, such as Kanji in Japan, Flash technology now supports IME context switching to help make this input more convenient by placing the input method in the correct mode for various input fields, such as numeric entry or text entry.

Macromedia Central

Central is a next-generation environment that enables users to install and update connected applications over the Internet, while running the applications locally in a secure environment. This combines the advantages of web applications with the convenience of desktop computing. Central is currently available as a developer release (http://www.macromedia.com/software/central/) to give developers the opportunity to experiment with and learn about the next important step in RIA development – achieving a balance between web and desktop applications .
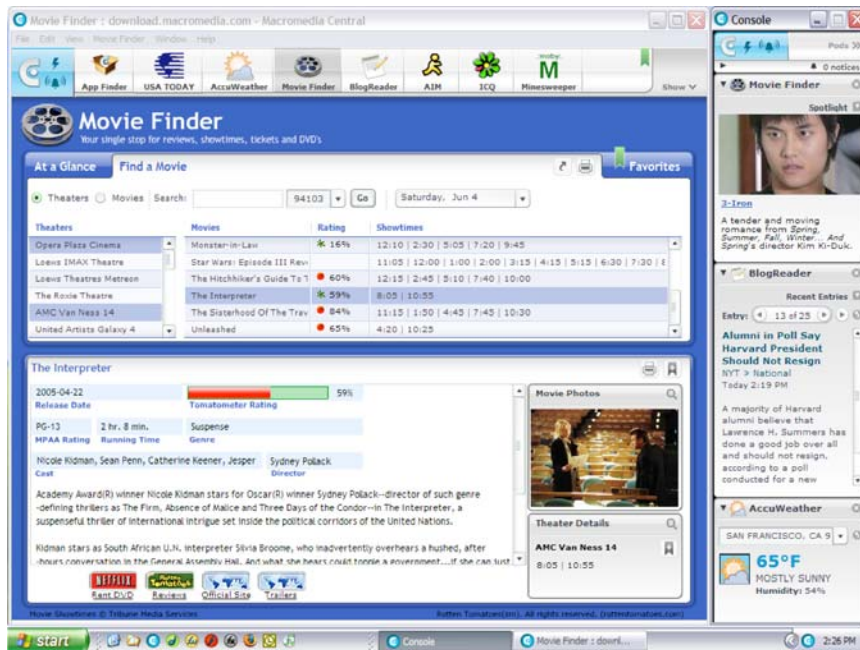


Central enables seamless deployment and automatic updating of applications over the Internet, devoid of cross-platform and cross-browser issues. Applications can be installed directly from a website or made available through the Central Application Finder built into the Central environment.

Central is designed to exist in an occasionally connected world of network access – Central applications can be used whether or not you have a network connection. Remote data is cached locally, enabling you to work efficiently while offline, and data synchronization occurs when the Central environment gets a network connection. Applications can also cooperate and share data under user control, allowing for smarter interactions between applications.

Central supports instant messaging and online presence detection in applications, including direct access to the AOL instant messaging services (AIM and ICQ). This enables a new breed of presence-enabled applications, which add context to online forums and discussion groups, virtual classrooms, and multiparty chat.

As part of the Flash Platform, Central leverages key standards such as SOAP and XML, enabling rich user interfaces to web services. This facilitates the integration of Central applications into service-oriented architectures.

Flash Lite

Macromedia Flash Lite is a lightweight version of Flash Player for mobile phones. It runs on a variety of embedded operating systems, supports integration with a phone's operating system, provides network support for dynamic data in applications, and utilizes hardware codecs when available. Flash Lite is used for a range of purposes on mobile phones, from content to applications to the actual phone user interface itself.

The code footprint of Flash Lite is 280K and an additional 117K for SVG-T support. These sizes are as generated by the ARM compiler – code size is dependent on CPU, compiler, and operating system. The recommended minimum phone specs for Flash Lite are 1 MB ROM, 50 MIPS, 2 MB RAM, and a 32-bit data bus.

Flash Lite runs on top of the phone operating system and delivers a rich set of capabilities.
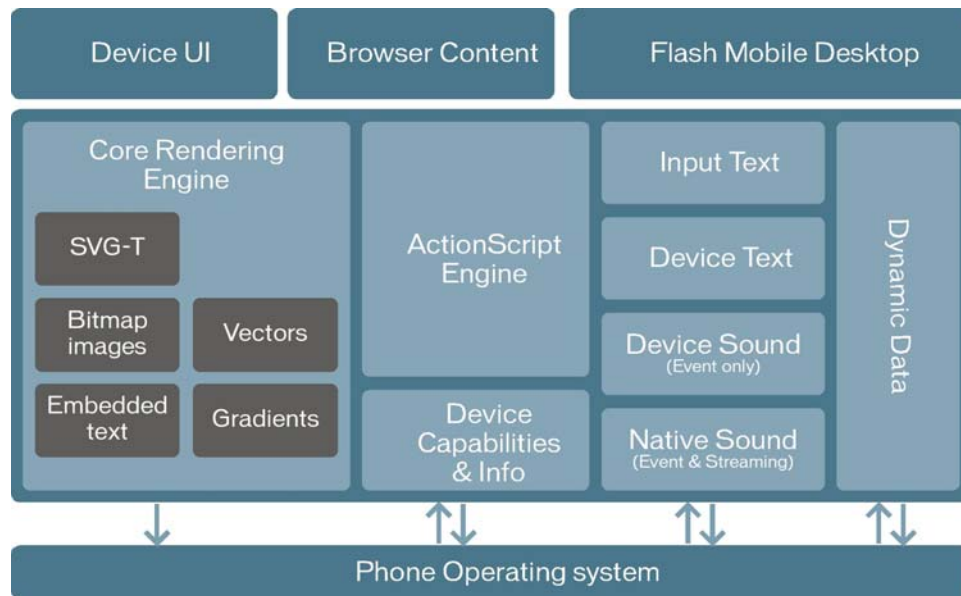


Media functionality is based on the core rendering engine of Flash Player, which supports vector graphics, bitmaps, gradients, and frame-based animation. Native device fonts can be used, or arbitrary fonts can be embedded for display, and of course text input and dynamic text are supported. SVG-T is available in Flash Lite as an option, supporting XML-based vector graphic display. Audio capabilities include access to device sounds and streaming audio.

Scripting is accomplished with ActionScript, which in Flash Lite 1.1 is at the level of Flash 4. Flash Lite supports scripting integration with device capabilities, including keypad navigation, button presses, notification, and integration with general phone operating system functionality.

Flash Lite also supports dynamic data and network access, enabling requests for information from Flash applications to be brought in over the wireless network and displayed in Flash Lite content and applications.

The next major release of Flash Lite, code-named Deuce, is based on Flash Player 7, which will elevate scripting for mobile applications to a more powerful level with ActionScript 2 support.

Flash Player in Consumer Electronics

In addition to mobile phones, a wide array of other consumer electronics can make use of the Flash Platform to deliver a great user experience. Flash Player has already been embedded in set-top boxes, home control systems, personal digital assistants, educational toys, refrigerators, a Yamaha grand player piano, and many others.

A software development kit is available to integrate Flash Player with device functionality and embedded operating systems. Flash Player can be used within browsers on devices, can be integrated with device-specific applications for tasks such as photo management on cameras, or can be used to deliver a rich user interface for the device itself.

## Experience Servers

The Flash Platform offers a number of technologies to enable building applications more rapidly, supporting mobile devices, and working with streaming audio/video services.
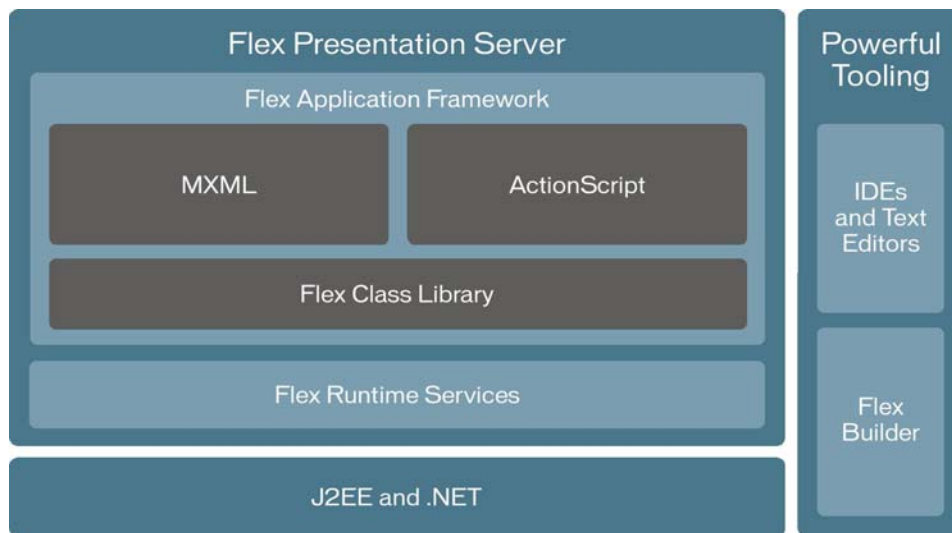
Macromedia Flex

Flex is a presentation system that enables programmers to develop applications that combine the responsiveness and richness of the desktop with the reach and deployment characteristics of the web. Flex provides a programming model that will be intuitive to both enterprise and web developers and a comprehensive set of components that fosters rapid application development.

Flex applications are stateful, and are neither cluttered with page refreshes nor limited to a handful of user interface controls. They can expose rich user interface metaphors such as drag and drop, support smart client-side data manipulation (for example, client-side sorting and filtering), and access a local data store to work in an offline mode.

Over 300 companies have adopted Flex in its first year, and they are using Flex to create a better experience in a wide range of applications, including dashboard, business process automation, self-service, and commerce applications. The Flex system consists of three main elements:

- A programming model for building applications that uses the MXML and ActionScript programming languages. MXML is an XML-based language that is used to declaratively define the user interface, while ActionScript, an ECMAScript object-oriented language, is used to write the client-side logic of an application.

- A rich, object-oriented application framework for programming the presentation tier that runs in Flash Player. The framework provides a complete set of user interface components as well as advanced services for layout, data binding, and integration with remote data sources.

- A set of runtime services that runs natively on J2EE application servers and integrates the presentation tier with the other tiers of the application. Data services enable back-end connectivity using SOAP-based web services, XML over HTTP, and remote method invocation into Java objects. Other runtime services include dynamic compilation, caching, security, session management, and media transcoding.

Flex Presentation Server

Powerful Tooling

Flex Application Framework

MXML

ActionScript

Flex Class Library

Flex Runtime Services

IDEs and Text Editors

Flex Builder

J2EE and .NET

The simplest way to understand how the Flex system works is to look at an example. The following snippet shows a simple application that invokes an XML web service and displays the returned data in a tabular grid; the final result is shown on the next page:

```xml
<?xml version="1.0" encoding="utf-8"?>
<mx:Application xmlns:mx="http://www.macromedia.com/2003/mxml"
  initialize="ws.getList()"/>

  <mx:Style source="main.css"/>

  <mx:WebService id="ws" wsdl="http://www.myserver.com/CatalogWS?wsdl">
    <mx:operation name="getList"/>
  </mx:WebService>

  <mx:Panel title="Product Catalog">
    <mx:DataGrid dataProvider="{ws.getList.result}" widthFlex="1"
   heightFlex="1">
      <mx:columns>
        <mx:Avery>
          <mx:DataGridColumn columnName="name" headerText="Name"/>
          <mx:DataGridColumn columnName="price" headerText="Price"/>
        </mx:Avery>
      </mx:columns>
    </mx:DataGrid>
  </mx:Panel>

</mx:Application>
```

A simple MXML-based application interface.



MXML files are ordinary XML files that conform to the W3C XML Schema, so you have a wide choice of development environments. You can write code within a simple text editor, a dedicated XML editor, or an integrated development environment (IDE) that supports text editing.

Like HTML, MXML is a markup language that describes user interfaces. However, unlike HTML, MXML does not have a fixed set of tags, but rather is a set of rules for how to create either built-in or user-defined components that make up the user interface. For example, in the application above, the user interface consists of a Panel component that contains a DataGrid component specified by the `<mx:Panel>` and `<mx:DataGrid>` tags.

When the application is compiled, the MXML statements are converted into ActionScript and compiled into a SWF file that is sent to Flash Player in the browser and executed. Since the presentation-tier components and logic are executing within Flash Player on the user's machine, instead of on the server, the resulting application is more responsive and provides a better experience.

Tags in MXML are not limited to creating visible, user interface components. For example, we use the `<mx:WebService>` tag to declare that data from an XML web service is going to be used by this application, with the `wsdl` attribute specifying the URL of the web service.

Data binding is a powerful feature of both MXML and the Flex framework and allows developers to declaratively state how data is bound to a user interface object for both display and editing. The above code, for example, specifies that the data for the grid comes from calling the XML web service `getList` method using the following code fragment:

```
<mx:DataGrid dataProvider="{ws.getList.result}" … >
```

Flex provides a number of mechanisms for customizing the user interface. In the above application, the `<mx:Style source="main.css" />` tag links to a standard cascading style sheet (CSS) file that can be shared with HTML portions of the application or other applications. By supporting CSS, Flex applications integrate with existing web-based user interfaces and leverage existing skills and assets. In addition to CSS, Flex builds on many industry standards, including XML and XML Namespaces, SOAP web services, REST web services, and HTTP/S transport.

Although this application did not require any custom logic, ActionScript can be used to define event listeners and handlers, set or get the values of component properties, handle callback functions, load remote data, and implement other functionality of applications.

Flex Class Library

The Flex framework features an extensive library of user interface components, including DataGrid, Tree, TabNavigator, Accordion, Menu, media controls, and charting components. Flex components are customizable, using either CSS or programmatic methods, and can be extended using inheritance. The Flex class library follows the Macromedia experience model for building effective user interfaces, which provides a consistent set of visual cues, interaction patterns, and application navigation conventions. This consistency across applications can benefit developers and users in the same way that consistency in interface benefits the users of native applications in operating systems today.

The Flex Class Library also provides prebuilt behaviors that enable the simple addition of motion and sound to applications, giving users more context in their actions. These prebuilt behaviors combine a trigger and an effect. A trigger is an action, such as a mouse click on a component or a component becoming visible. An effect is a visible change to a component such as fading, moving, or resizing over a period of time, measured in milliseconds. For example, behaviors can be used to cause a dialog box to bounce slightly when it receives focus.

Flex Runtime Services

Flex focuses on the presentation tier of the application and provides runtime services to integrate with the other tiers. Flex does not require any changes to the other tiers of the application. The Flex data services enable back-end connectivity using SOAP-based web services, XML over HTTP, and remote method invocation into Java objects. Data services can be set up declaratively in the client application using MXML tags: `<WebService>`, `<HTTPService>`, and `<RemoteObject>`. Flex also integrates with existing presentation technologies and frameworks, such as JSP Struts, and Enterprise Portlets.

In addition to data services, the Flex runtime services include dynamic compilation and caching, security, session management, media transcoding, and other functionality. All Flex services minimize redundancy and take full advantage of existing enterprise resources. For example, authentication and authorization is provided through integration with existing underlying application servers rather than introducing redundant approaches to these fundamental capabilities.

The Flex runtime services are deployed as a standard web application (WAR file) in a J2EE application server. Flex is supported on a number of Java application servers, including IBM WebSphere®, BEA® WebLogic Server, Macromedia JRun, Apache Tomcat, Oracle® 10g, SAP Net-Weaver, and Fujitsu Interstage® 6.

Upcoming Flex Capabilities

The next major release of Flex, code-named Mistral, will provide an extensive set of new features.

The class library will be extended with new and improved user interface components. An extended effects and skinning infrastructure will make it even easier to build highly expressive and branded applications. The Flex programming model will also leverage new industry standards, such as E4X (ECMAScript for XML). Flex will also provide tight integration with functional testing tools and support usage analysis of RIAs.

New data services are being added to Flex to support transparent data persistence across tiers, occasionally connected clients, data synchronization, a robust data push infrastructure, and paging large datasets. The new data services remove the need to write the traditionally complex and error-prone code required to synchronize data between tiers. Modifications made at the client side can be persisted transparently to the server. Combined with existing persistence solutions used at the server side (like Hibernate and JDO), these services can provide an end-to-end, client application-to-database, persistence solution.

The new data services also support offline data access: Data modifications made offline are stored in a persistent data store at the client side, and are synchronized with the server when the network becomes available. The data services will also manage the resolution of conflicts inherent to this type of system where multiple users may attempt to modify the same data at the same time.

Collaboration is becoming an important aspect of an online experience. To enable development of collaborative applications, Flex will support presence, integration with enterprise instant messaging, and application sharing.


Flash Communication Server

The Flash Communication Server integrates streaming audio, video, and data into a Flash application. This enables the development of a wide variety of collaborative multiuser applications, such as chat, shared whiteboards, webcasts, and web conferencing.

Collaborative applications consist of a client Flash application and a server component that communicates with the client. Both the client and the server elements consist of ActionScript files.

The client and the server communicate over a persistent connection using the Real-Time Message Protocol (RTMP). In a typical scenario, a web server delivers the Flash application to Flash Player over HTTP. The Flash application then establishes a persistent connection to Flash Communication Server using RTMP, allowing for an uninterrupted data stream to flow between client and server. Multiple users can connect to the same application running on the server, which acts as a live communication channel between connected users. Flash Communication Server is scalable; your application's processing can be distributed across multiple servers.

In traditional client-server applications, the server typically is used to execute a transaction: the client makes a request, the server performs a database lookup or calculation, and then returns a result to the client. The connection between the client and server is maintained just long enough to complete the transaction. While you can use the Flash Communication Server to implement transactions, its design center is in handling *interactions*: coordinating the actions of multiple, connected users and transmitting live data.

Flash Communication Server provides two communication models that simplify the process of handling user interactions: streams and shared objects.

Streams

Streams are a time-based flow of synchronized audio, video, and data messages that flow from client to server, or from server to client. Streams enable two-way audio-video communication using capabilities built into Flash Player to access users' microphone and camera connected to their computers. This capability is under full user control and Flash Player requires user permission whenever an application requests access to the camera and microphone.

A stream can be played in real time or recorded and played later. Recorded streams are stored in the Flash Video (FLV) format, and can contain data messages in addition to video and audio. FLV files can also be created from existing digital video or audio files using third-party video-encoding utilities such as Sorenson Squeeze.

Shared Objects

Shared objects are a way to synchronize and replicate data automatically across multiple users in a shared space. Flash clients connect to a shared object and receive updates whenever a change is made to that shared object. Changes are made by simply setting new values on the local properties of a shared object, and these properties are then propagated to other clients by Flash Player through the Flash Communication Server. For example, a text field can be turned into a multiuser chat display by simply using a shared object for its contents.

There are two aspects to shared objects: local and remote. Local shared objects are a feature of Flash Player and can be compared to cookies in a browser — they let you save data to a user's computer for off-line access or for saving preferences. Remote shared objects are their server-side equivalent and managed by the Flash Communication Server to provide messaging, data synchronization with local shared objects on each client, and data storage services. A remote shared object can persist across application sessions or be temporary to the current usage session.

Flash Video Streaming Service

Flash Communication Server is hosted by the leading content delivery network (CDN) providers to deliver on-demand Flash Video across high-performance, reliable networks. This service is currently offered by Speedera, VitalStream®, MirrorImage, and Akamai. It is integrated directly into the delivery, tracking, load balancing, and reporting infrastructure of their CDN networks, enabling delivery of Flash Video to the largest possible audience without requiring setup and maintenance of your own streaming server and network.

The Flash Video streaming service supports uploaded Flash Video content for on-demand viewing, delivery of live broadcasts with real-time encoding, and secure delivery of video to support pay-per-view or subscription video.

Upcoming Flash Communication Server Capabilities

The next major release of the Flash Communication Server, code-named Edison, will support the new hi-fidelity video capability in Maelstrom, and provide integration with the Flex programming model for quickly blending communication elements in RIAs.

Macromedia FlashCast

FlashCast is a client-server technology that enables delivery of rich, up-to-date information to mobile devices. It is built for mobile operators, and is currently in trial deployment.

FlashCast brings together disparate data services into a single, coherent user experience. To mobile users, FlashCast is a mobile device application that provides data services that look great and are highly responsive. To service operators, FlashCast provides a means to package and market data services in a very convenient way for users, and is a terrific opportunity to build their data service brand around great user experiences.
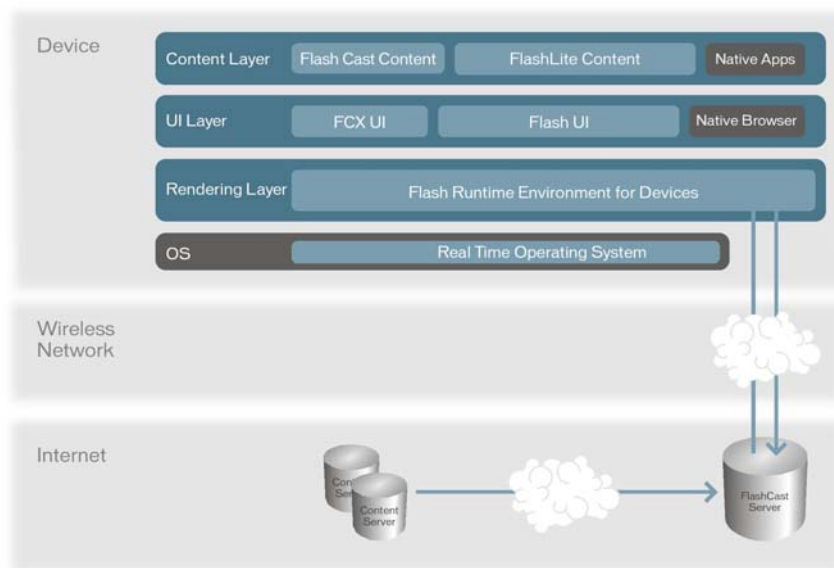


The FlashCast client resides on mobile devices, and is a means to view information and access applications using a channel metaphor (like television channels). A channel is a small Flash application that has its own user interface, and consumes streams of structured data, called feeds, provided by the FlashCast server. A channel presents information on its own in an easy-to-use, attractive manor. It can also seamlessly launch a browser, media players, or other device applications to access additional resources on the network. In this way, a channel is the means and primary building block for creating an integrated, convergent data service experience.

The FlashCast client manages local storage, communicates with the FlashCast server for content updates, and ensures the overall security of the channel distribution system. By caching channel data on the handset, the client delivers an always-on experience that is responsive and easy to use, even in areas with weak or no wireless reception.

The primary function of the FlashCast server is to aggregate channel feeds from external Data Feed Servers, to filter the feeds based on user preference and device type, and to deliver the feeds to the FlashCast client over the operator wireless network. The FlashCast server also provisions channels, over the air, onto the FlashCast client, when the user first signs up for the service, or when the operator updates existing channels or adds new channels.

The FlashCast server provides a flexible interface framework that supports integration of the FlashCast solution with an operator's infrastructure. Potential integration points include authentication and authorization, provisioning, billing, monitoring, logging, and push signaling systems.

FlashCast Channel Production

Channel producers develop channels using the Macromedia Flash authoring tool, along with a FlashCast authoring extension to develop and test channels locally. The FlashCast authoring extension includes a client emulator, as well as a local FlashCast mini-server.

To the FlashCast server, a feed data source is simply a URL where the server acquires channel feeds. Thus, a feed data source, in the simplest case, is a static XML document that resides on a web server. The URL may also point to a syndicated document, such as an RSS (Really Simple Syndication) or Atom feed. A more sophisticated data source could be a web application that performs some database operations, and dynamically outputs an XML data feed.

## Tools

There are a number of Macromedia and third-party tools that can be used to develop content and applications for the Flash Platform.

### Flash Authoring

Macromedia Flash MX 2004 enables designers and developers to integrate video, text, audio, and graphics into immersive, rich experiences. The next major release of the Flash authoring tool, code-named 8ball, will support the new capabilities in the upcoming Maelstrom release of the Flash Player, include increased support for mobile content development, and many other improvements.

### Flex Authoring

Flex application developers can work with a wide choice of tools, including any generic text editor, such as VI, emacs, or Notepad. The normal text files that contain MXML and ActionScript code also make Flex applications easy to manage with existing source code control systems. Integrated development environments (IDEs) such as Borland® JBuilder®, JetBrains IntelliJ IDEA, and Altova® XMLSpy® can also be used to create Flex applications.

The current IDE for Flex application development at Macromedia is Macromedia Flex Builder™, which supports laying out Flex user interfaces through a visual, drag-and-drop interface and improves developer productivity through code-hinting, debugging, and other capabilities.

To further support Flex development, Macromedia has joined the Eclipse Foundation and is building a new development tool code-named Zorn, based on Eclipse. Zorn will unify the design, development, and debugging of RIAs and provide a more robust, extensible environment that supports the full range of Flex development needs.

As they continue to evolve, Zorn and Flash authoring tools provide complementary capabilities to the Flash Platform. The Flash authoring tool enables web developers, multimedia professionals, animators and videographers to create rich, interactive content, whereas Zorn will enable more traditional application developers to target the Flash Platform and create RIAs. The Flash authoring tool and Zorn can also be used together, allowing structured, Flex applications to be enhanced with rich media or highly interactive elements.

Macromedia Captivate

Captivate enables the creation of interactive simulations and software demonstrations, which are delivered in Flash Player. It can record onscreen actions automatically, and supports adding e-learning interactions like data-entry fields and customizable quizzes. Captivate content works well for rapid application training, user support tutorials, and online product demonstrations.

FlashPaper

FlashPaper enables easy conversion of any printable files into the Flash file format, and integrates closely with Microsoft® Office applications.

## User Interface

RIAs are a new breed of applications that have characteristics distinct from today's web or desktop applications. This is an opportunity to set the user experience bar high for this new class of applications to make them:

- Useful, usable, and desirable: The Holy Trinity of application design – it's time to move beyond merely usable software to software that is truly useful and feels great to use.

- Appropriate: RIAs live in a different environment and can leverage different capabilities than desktop or typical browser-based applications.

- Brandable: Differentiated experiences can be created that enable applications to build brand loyalty.

RIAs can improve the relationship between people and the things they want to do. Using all that we have learned from user interactions in desktop, web, and device environments gives us a great jumping-off point for this new frontier.

The Flash Platform enables innovative applications that are:

- Human centered: People want to interact with information and people, not computers. Interface and presentation models must evolve from articulating the user-computer relationship to supporting the relationship between people and their information as well as relationships between people.

- Direct: Interface is always a compromise: every interface element, no matter how successfully implemented, can be as much a barrier between the user and the content to be used as it is an aid. It's best to provide direct manipulation of information and minimize the barriers.

- Engaging: The more engaged people are, the more productive they are. Healthy, attractive work environments support higher levels of productivity. Our digital work environments are no different. It's increasingly important not just to test for usability but also for enjoyability.

- Effective: Things should work, so work gets done. The goal of every application is to be truly useful. Advances in power and bandwidth now make it possible for even the lowliest web application to aspire to be useful and engaging.

Components

The Flash Platform contains guidelines, patterns, and components for building great experiences on personal computers and mobile devices. These components can be styled with CSS to match a particular brand identities or be replaced with fully custom designs.

## Flex Component Library

### Data Input

| Numeric Stepper | Check Box | Radio Button | Date Field | Date Chooser |

2004

☐ Web services c
☑ CSS support
☐ Rich library of

○ 1952
◉ 1962
○ 1972

June 2005
S M T W T F S
              1  2  3  4
5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25

### Sliders

0                    747.05            1000

Low Value:   205
High Value:  747

| Horizontal Slider | Vertical Slider |

### Lists

| USB Watch | 007 Digital Camera | 2-Way Radio Watch | USB Desk Fan |
| $129.99 | $99.99 | $49.99 | $19.99 |
| Caffeinated Soap | Desktop Rovers | PC Volume Knob | Wireless Antenna |
| $19.99 | $49.99 | $34.99 | $49.99 |
| TrackerPod | Caffeinated Sauce | Thinking Putty | Ambient Orb |
| $129.99 | $6.99 | $11.99 | $149.99 |

Tile List

### Data Grid

| Phone |
| 555-219-2270 |
| 555-219-2100 |
| 555-219-2030 |
| 555-219-2012 |
| 555-219-2012 |

007 Digital Camera
2 Way Radio Watch
USB Desk Fan

| Email | Active |
| ccoenraets@fictitio | ☑ |
| lfreligh@fictitious.r | ☑ |
| rhodgman@fictitiou | ☐ |
| jwall@fictitious.cor | ☑ |
| maurice@fictitious. | ☐ |
| mjones@fictitious. | ☑ |

| Image Renderer | Retrieving Data | CheckBox Renderer |

| Q1 | Q2 |
| --- | --- |
| 1289 | 1456 |
| 1143 | 1543 |
| 1098 | 1345 |
| 1145 | 1176 |
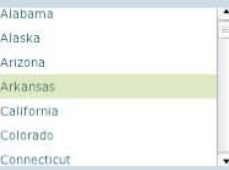
Name   Joanne Wall
Email   jwall@fictitious.com
Phone   555-219-2012
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| Email |
| ccoenraets@fictitious. |
| lfreligh@fictitious.com |
| rhodgman@fictitious.c |
| jwall@fictitio |
| maurice@fictitious.cor |

| Computed Columns | Update, Add, Delete | Editable Grid |

Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut

Visa ▼

Visa
Master Card
American Express

| List | Combo Box |

| USB Watch | 007 Digital Camera | 2-Way Radio Watch |
| $129.99 | $99.99 | $49.99 |

Horizontal List
Product images courtesy of ThinkGeek

### Flow Control

Menu1   Menu2
  MenuItem 1-A
  MenuItem 1-B

[Click Me]
[💾 Save]

Flex | Dreamweaver | JRun

About Macromedia

| Menu Bar | Button | Link Bar | Link |

## Navigators



View Stack | Tree | Accordian | Tab

## Panels and Windows



Popup Window | Panel | Alert Window | Panel with Control Bar

## Charting Components



Line Chart | Pie Chart | Bar Chart | Area Chart | Plot Chart | Column Chart | Custom Styles

## Mobile Component Library



Scroll Bar | Numeric Stepper | Actions Menu | Button | Dropdown Menu | Check Box | Radio Button
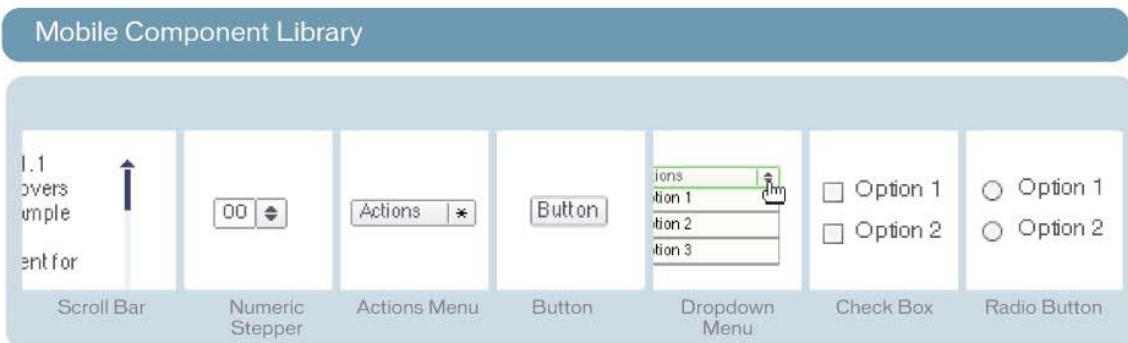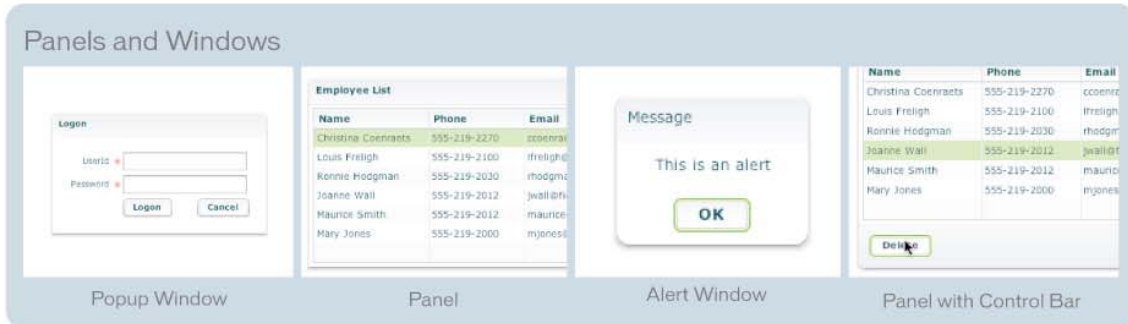
## Solutions

Many solutions have been built on the Flash Platform to take advantage of its powerful programming model, cross-platform deployment and expressiveness. Here is a small sample of these to show the diversity of applications being built on the Flash Platform today:

- SAP Analytics: More than 100 industry-specific analytic applications empower users with innovative new ways to drive core processes and business decisions based on actionable business insight. SAP Analytics are a new breed of model-driven composite applications that change the analytic application playing field across more than 25 industries. For more information, visit http://www.sap.com/company/press/press.epx?PressID=4518.

- Goowy Mail: It's an e-mail application built on the Flash Platform, focused on providing you with a great experience. Goowy mail has a fluid interface that delivers features not available in other web mail offerings including skins, sounds, transitions, drag and drop, right clicks, keyboard shortcuts, advanced contacts and more. It also includes standard features such as spam filtering, anti-virus, search, auto-complete and spell checking. You can check it out at http://goowy.com.

- Dorado ELS: The mortgage industry's first lending solution and service platform that enables unification of all loan channels, products, services, personnel, customers, and fulfillment partners through a single point of sale. The Dorado Enterprise Lending System (ELS) provides a centralized view and control of any loan, any channel, any user, and any partner, at any time. The Dorado ELS offers an unparalleled user experience that optimizes both efficiency and satisfaction through the use of Rich Internet Applications. For example, with the ELS, loan officers or brokers can navigate pages and save information using common keystroke combinations, just like they would with a regular desktop application. The Dorado ELS user interface also supports the ability to drag and drop content from one area of the application to another, and updated information in one area automatically updates in all other areas of the application. Alerts and updates to information, status, and pricing happen dynamically, all within the browser. For more information, visit http://www.dorado.com/ProductsServices/ELS.htm.

- MfgQuote: An online sourcing management system with automated supplier discovery and a global network of participating suppliers. The new RIA capabilities in MfgQuote will benefit MfgQuote's user base immediately. From dynamic supplier discovery, to drag-and-drop support in a web browser, MfgQuote users will experience exceptional usability not previously associated with HTML-based applications. Over 36,000 buyers across the industrial spectrum (aerospace, transportation, consumer products, electronics, and more) utilize MfgQuote to source, collaborate, and receive quotes online for more than 200 manufacturing processes such as CNC machining, metal stamping, forging, plastic molding, metal fabrication, and metal casting. For more details, visit http://www.mfgquote.com.

- Scene7 eCatalogs: The only end-to-end eCatalog solution allowing you to create an enhanced web version of your existing printed marketing materials easily and cost-effectively, driving multi-channel sales. Customers using the Scene7 eCatalog solution have grown conversion rates up to two times. The Scene7 standard eCatalog viewer comes with many unique features, including free form zoom, dynamic panning, labeled table of contents, more help with rollover tool tips, annotated sticky notes, e-mail to a friend, dynamic data-driven rollovers, keyword search, and the option to configure and customize the look and feel of the viewer. For more information, visit http://www.scene7.com/solutions/eCatalogs.asp.

- TravelClick iHotelier: The TravelClick single screen reservation process sets the industry standard and allows users to navigate effortlessly through room types, photographs, descriptions, and rates in a truly interactive fashion that generates better conversion rates than traditional HTML booking engines and encourages up sell. The OneScreen user interface is customized to the look and feel of your property website, creating a better user experience. For more information, visit http://www.travelclick.net/WebSolutions.

- SNL Merger Model: Compiling and evaluating an array of data and mergers scenarios for the highly acquisitive banking industry can now be completed easily and quickly with the SNL Merger Model, an RIA based on the Flash Platform.  Within minutes, analysts, investment bankers and other merger advisors can now simultaneously analyze, manipulate and create reports for multiple merger scenarios that would have previously taken hours to complete. SNL Merger Model is from SNL Financial LC and its application provider Teknision Inc. For more information, visit http://www.snl.com/press/20050511.asp.

Macromedia Breeze

Breeze is a rich web communication solution that delivers high-impact online communications that can be accessed instantly through Flash Player, providing a powerful, end-to-end solution with ubiquitous reach. Breeze was built on the Flash Platform to meet the demanding functionality, scalability, and reliability requirements of communication and collaboration applications.  Breeze is available as licensed software that can be hosted on-premise, or on a subscription (ASP) basis.



Breeze comprises the Breeze Communication Server and four applications for real-time and on-demand communication:

- Breeze Meeting for real-time meetings, web conferencing and online seminars

- Breeze Presenter for Microsoft PowerPoint authoring of narrated, self-paced e-learning courses and on-demand presentations

- Breeze Training for managing e-learning courses and curriculum

- Breeze Events for managing user registration, reminders, and tracking for large online events and presentations

The Breeze Communication Server is highly scalable and designed to meet the needs of high availability, real-time, and asynchronous communications. The Breeze Communication Server includes a host of administration services that include content management, user and permission management, content transcoding, notification and scheduling management, detailed reporting, account provisioning, and server failover.

By leveraging the Flash Platform, Breeze delivers instant access to meetings and content through the Flash Player, seamless rich media integration, real-time media and data streaming, server scalability, and powerful web services extensibility. Breeze also integrates seamlessly with Macromedia's content tools like Flash authoring, Captivate, and FlashPaper.

Breeze Extensibility and Customizability

One of the key differentiators for Breeze is its extensibility enabled by the Flash Platform. Breeze is designed to allow developers and designers to customize, extend and integrate it several ways:

- Web services: Breeze can be integrated with enterprise applications through web services over HTTP/HTTPS providing a number of integration options, including portal integration, directory services integration, and Flash user interface customization. Breeze can be integrated with enterprise desktop, data, voice, and e-learning infrastructure, including CRM/ERP solutions, user directories, and audio conferencing bridges.

- Breeze Meeting pods and extensions: Developers can create unique pods that leverage the full real-time server capabilities of Breeze, such as interactive translation and search services, customized user roster pods, media pods, and rich note pods. Breeze Meeting extensions support integrating full multiuser applications and content built with the Flash Platform directly into a web conferencing interface in Breeze. By using Flash and Flex technologies, developers can rapidly add custom functionality like product demonstrations, ROI calculators, financial modeling, interactive icebreakers, and interactive e-learning simulations.

- Customization: Breeze customization enables a designer to change content and the application user interface quickly, including changing logos and images to integrate Breeze's appearance with other enterprise systems and company branding.

Upcoming Breeze Capabilities

The next versions of Breeze will continue to leverage the Flash Platform to accelerate delivery of unique communication and collaboration functionality. Future Breeze releases will include support for hi-fidelity video streaming enabled by Maelstrom, content viewing and communications on mobile devices, the occasionally connected world of network access, and massive media streaming scalability enhancements.

# Future of Experiences

There is a tremendous opportunity to deliver better user experiences for hundreds of millions of people across the Internet.

The web, desktop applications, telephony and broadcast media are all converging into one networked digital world of content, applications, and communication. Soon you will be able to download and watch movies on your WiMax cell phone, see caller ID displayed on your TV, and share your online shopping experience remotely with your wife or husband. Mobile workers can view and act on business data even if they're not currently connected to the network. Mobile phones and VOIP will completely replace desk-bound, land-bound telephony. The ability to personalize the experience will have a transformative effect.

Universal interaction patterns are needed so people don't have to completely relearn interfaces when they move from their TVs to their cell phones. It means there can be no hard divisions between what is content and what is an application. It means that social networks and location will infuse all data with orders of magnitude more relevance and will become part of everything we do. It requires us to change our idea of what an interface even is, from buttons and tabs slapped onto data, to content that is truly interactive.

Communication on the Internet is becoming both broader and deeper. Increasingly, people are choosing to read online rather than reading paper. We will share stories in the form of written words, pictures, audio, and video as easily as we change TV channels, creating an even greater democratization of media. We will always be connected to each other and to our information, leveraging social networks to help focus our attention. This means that the richness of virtual communication needs to grow to more closely match the richness of interpersonal communication: We will be able to read body language and facial expressions in online meetings, we will be able to share any information with anyone else on any device, we will be able to help someone remotely by taking control of their device or application, and we will never have to worry about where our information is physically stored, or what format it is in.

We believe this will be the decade of the experience, and the role of the designer will become more critical to the creation of everything from software to financial reports to teapots. Design tools and languages will empower designers to rapidly prototype and test the usability of software to achieve the best experience, creating a much more effective partnership with software engineers. New approaches to understanding information through innovative presentation, interactivity and filtering will help us manage ever-increasing streams of data. Soon we will test for enjoyability and not just usability. Attractiveness keeps focus and improves task completion, so beauty will become a worthwhile pursuit.

The Flash Platform stands for empowering designers and developers to create the richest, most intuitive and desirable digital experiences on the planet.


# Conclusion

The Flash Platform delivers the most effective experiences for rich content, applications, and communications across browsers, operating systems, and devices of all kinds. It provides the solid foundation for developing complete solutions and fits into existing enterprise infrastructures and server-side technologies. We encourage you to consider how you might leverage the Flash Platform to increase customer satisfaction, improve productivity, reduce support costs, and build a stronger brand through better experiences on the Internet.

# For More Information

Further Reading

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- *Central,* http://www.macromedia.com/software/central