

CHAPTER 03

# **ADOBE AIR AND RTMFP**

## 1. Introduction :

Adobe Flash Player 10 and Adobe AIR 1.5 introduce a new communications protocol, Real-Time Media Flow Protocol (RTMFP), whose low latency, end-to-end peering capability, and scalability make it especially well suited for developing real-time collaboration applications by not only providing superior user experience but also reducing operators' costs.

Adobe Flash Player 10.1, Adobe Cirrus 2, and Real-Time Media Flow Protocol (RTMFP) are setting a firm foundation for peer-to-peer (P2P) with peer-assisted networking. Using the capabilities of groups and the new features around them, we can make deployments of nearly any scale and take advantage of multiuser interactive applications for data and media. Everything from application-level video multicasting to swarming file delivery and multiuser games are within easy reach of developers, without the heavy burden being laid upon a server infrastructure.

## 2. Adobe Flash Player:

The Adobe Flash Player is software for viewing multimedia, Rich Internet Applications and streaming video and audio, on a computer web browser or on supported mobile devices. Flash Player runs SWF files that can be created by the Adobe Flash authoring tool, by Adobe Flex or by a number of other Macromedia and third party tools. Flash Player was created by Macromedia and now developed and distributed by Adobe Systems after its acquisition. Flash Player supports vector and raster graphics, 3D graphics, an embedded scripting language called ActionScript and streaming of video and audio. ActionScript is based on ECMA Script, and supports object-oriented code, and may be compared to JavaScript. Flash Player has a wide user base, with over 90% penetration on internet connected personal computers,<sup>[10][11][12]</sup> and is a common format for games, animations, and GUIs embedded into web pages.

Flash Player is freely available as a plugin for recent versions of web browsers (such as Internet Explorer, Mozilla Firefox, Opera, and Safari) on selected platforms. Google Chrome integrated the player into the distribution. Each version of the plugin is backwards-compatible.

### 3. Adobe Integrated Runtime AIR:

Adobe Integrated Runtime, also known as Adobe AIR, is a cross-platform runtime environment developed by Adobe Systems for building Rich Internet Applications (RIA) using Adobe Flash, Adobe Flex, HTML, and Ajax, that can be run as desktop applications or on mobile devices. The runtime supports installable applications on Windows, Linux, Mac OS and some mobile operating systems such as BlackBerry Tablet OS, iOS and Android, or the BBC IPlayer Desktop.

With AIR, Adobe intends to provide a versatile runtime-environment that allows existing Flash, ActionScript, or HTML and JavaScript code to be used to construct Internet-based applications that have many of the characteristics of more traditional desktop-like programs. Adobe positions it as a browser-less runtime for RIAs that can be deployed onto the desktop, rather than as a full-fledged application framework. An application deployed in a browser does not require installation, while one deployed with AIR requires the application be packaged, digitally signed, and installed on the user's local file system. This provides access to local storage and file systems, while browser-deployed applications are more limited in where and how data can be accessed and stored.<sup>[13]</sup>

Adobe AIR internally uses Adobe Flash Player as the runtime environment, and ActionScript 3 as the sole programming language. Flash applications must specifically be built for the Adobe AIR runtime in order to utilize additional features provided, such as file system integration, native client extensions, native window/screen integration, taskbar/dock integration, and hardware integration with connected Accelerometer and GPS devices.<sup>[5]</sup> AIR enables applications to work with data in multiple different ways, including local files, local SQLite databases for which AIR has inbuilt support, a database server via web services, or the encrypted local store included with AIR.

### 4. Cirrus service :

Flash Player instances must connect to the Cirrus service in order to communicate with one another. Cirrus is a hosted rendezvous service that helps Flash Player instances contacts one another even if they are located behind NATs. Although connecting to Cirrus service is very similar to connecting to Flash Media Server, Cirrus does not provide any of the typical Flash Media

Server features (media relay, shared objects, demoting, etc.). Flash Player endpoints must stay connected to Cirrus during the entire time of communication. In order to access Cirrus, you will need a developer key that is generated when you create your Adobe Developer ID<sup>[14]</sup>.

## 5. RTMFP :

Adobe introduced the Real-Time Media Flow Protocol (RTMFP) with Flash Player 10 (November 2008)[14], which is deployed on over 90% of Internet-connected PCs. One of its major differentiators from Real-Time Messaging Protocol (RTMP), which is based on the Transmission Control Protocol (TCP) and exclusively used in previous versions of Flash Player, is that RTMFP is built on User Datagram Protocol (UDP).

While TCP provides reliable data delivery (well applicable for file transfer, e-mail, etc.), it does not provide any end-to-end delay guarantees. Reliable data transmission in TCP is achieved by re-transmission of lost data, which introduces latency. Because minimizing end-to-end delay is one of the most important goals in real-time communications (a few hundred milliseconds' delay may render a conversation unusable), TCP is not well suited for this purpose. Transmission error resilience and recovery form an integral part of most advanced audio and video compression techniques—such as Speex audio and H.264 video codec, both available in Flash Player 10. Reliable delivery provided by TCP is therefore not needed. As a result, UDP, which provides an efficient and rapid data delivery, is popularly used in real-time collaboration applications where minimizing end-to-end delay is of paramount importance. Another advantage of UDP over TCP that it enables end-to-end peering—that is, direct data transmission between two clients located behind network address translators (NATs) [13].

### 5.1. Difference between RTMP and RTMFP :

When compared to RTMP, RTMFP provides the following advantages for real-time communications:

- **Low latency:** Since RTMFP is built on top of UDP, it provides minimal latency for real-time communications. It is important to note that RTMFP provides both reliable and unreliable service. When sending data between two Flash Player instances (for example, using the `NetStream.send()` method), reliable data transmission is used. When sending Speex audio

between two Flash Player instances, unreliable delivery is used, providing the smallest possible latency.

- **End-to-end media delivery:** Media is sent directly between two Flash Player instances without routing through a central relay server. When compared to RTMP, where all data is sent through Flash Media Server, RTMFP not only further reduces end-to-end delay, but also eliminates costs associated with a central data relay, thus lending itself to extremely scalable deployments.
- **Data prioritization:** Audio is transmitted with higher priority than video and non-time critical data (such as instant message, etc.). This can significantly enhance user experience over a bandwidth constrained communications channel.

## 5.2. Using RTMFP with Flash Player 10:

You should keep in mind the following considerations when using RTMFP with Flash Player 10:

- Peer-assisted networking with Flash Player utilizes a managed P2P solution from Adobe such as Adobe Cirrus for rendezvous services.
- Developers are responsible for exchanging peer IDs to create P2P applications. For instance, you might need to store the peer ID in an external tracking database and use that to allow additional Flash Player instances to make connections.
- To exchange audio, video, and data using a P2P application running on Flash Player 10, you are limited to using NetStream in a point-to-point topology. Data needs to be transmitted from the publishing peer once for each connected peer, making the solution good for one- or two-way conferencing or collaboration applications (see Figure 5).

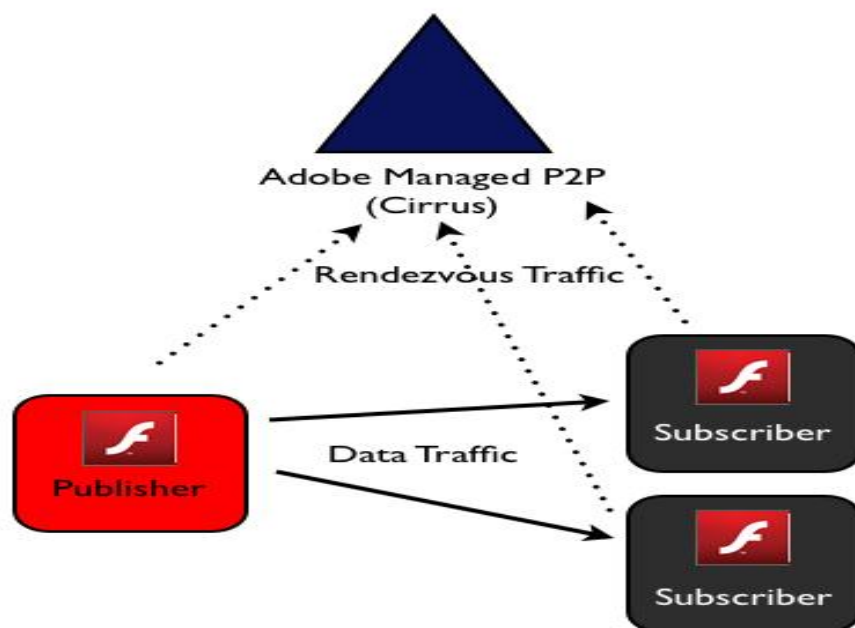


Figure 5- P2P point-to-point topology

Taking Figure 1 into account, if one publishing player had nine connected clients, the publisher would need to transmit all audio, video, and data nine times.

## 6. What's new with RTMFP, Flash Player 10.1, and Cirrus 2 :

Flash Player 10.1 and Cirrus 2 introduce a host of new features and enhancements to make P2P data flow in Flash Player more efficient and, therefore, more useful in more scenarios. The addition of *groups* is one of the main foundation items that will improve P2P capabilities on the Flash Platform[14].

Groups offer the capability to create virtual groups of multiple Flash Player 10.1 (or Adobe AIR 2) clients communicating efficiently with one another in a number of different ways. A key benefit of all the aforementioned features is true scalability in a P2P scenario without the need for a server, other than helping to establish the proper connections and authorization for group individuals. The following sections outline other key advantages offered by Flash Player 10.1 and Cirrus 2.

**Network efficiency:** Using a rendezvous server such as Cirrus 2 enables clients to connect to the P2P overlay network and groups automatically via a server

channel. This effectively eliminates the need to pass around peer IDs using an external data service or manual ID exchange.

Peer-assisted networking in Flash Player utilizes a self-managed topology where peers will try to establish communication links based on response time metrics. In other words, lowest latency peers are preferred, increasing the possibility of decreased traffic over slower links within the network and saving bandwidth costs.

**Secure communications:** Peer-assisted networking through Flash Player is a managed solution. For Internet-based applications, a server such as Cirrus 2 is required to connect and authenticate clients for any communication to take place. (RTMFP can use LAN discovery to detect other clients on the same LAN and participate in groups without needing a server.) Once the clients have been authorized, data is transmitted between peers via RTMFP, which is encrypted to ensure that content is protected when it traverses the network.

RTMFP groups can be configured to require authentication before posting content. As another layer of security, Flash Player will prompt a user before participating in peer-assisted networking, giving the user the option to accept or decline their participation in the peer-assisted network.

**New ways to distribute data:** You can still use NetStream to transfer audio, video, and data from a smaller number of publishers effectively. Flash Player 10.1 has a new class called NetGroup that has been optimized for transferring data from many publishers at a lower bit rate. This is done through group posting, directed routing, and objects replication:

- **Group posting:** Posting is used to send and receive ActionScript objects. Events will be dispatched at each peer as postings are received. Group posting opens the door to creating highly scalable and interactive applications such as group chat applications, team whiteboard applications or even monitoring applications where a large number of nodes report their status on a frequent basis. One thing to note about posting is that objects sent are subject to transmit timeouts. If the application requires reliable transmission, use the new object replication feature mentioned later.
- **Directed routing:** Flash Player 10.1 introduces directed routing; a feature that allows peers to route messages through the P2P mesh. For instance,

messages can be routed to all neighbors, the neighbor nearest a specific group address, or even a specific neighbor. The main benefit of directed routing is that it enables a publisher to send data to specific peers within a group. Directed routing can be used to build applications that take advantage of distributed hash tables (DHT). DHT applications take full advantage of the scalability of a peer-assisted application by utilizing the resources of every connected peer vs. the traditional hub and spoke model in a client-server architecture.

- **Object replication:** Object replication is used to replicate data to all peers participating in the P2P mesh. Object replication is managed automatically by the nodes within the peer-assisted network. The benefit to using object replication is that any data replication request will eventually make it to all the clients in the P2P mesh. This feature is a perfect candidate for situations where shared data needs to be distributed to many clients. Businesses can leverage this feature to take advantage of Adobe managed peer-assisted networking to distribute data reliably to all the connected clients in their enterprise, reducing hardware costs and decreasing the reliance on centralized data centers.

Several new P2P topologies are also supported:

**Managed data delivery using peer-assisted networking:** RTMFP and Cirrus 2 enable you to build applications that take advantage of the peers within a group. Rather than pulling files from one server source, you can source files via the overlay network created by the group. A benefit to this is reducing the amount of bandwidth required to retrieve files from one particular host. Another benefit is the ability to deliver files to more peers simultaneously due to the increased bandwidth gained by having multiple peers to source data for delivery (see Figure 6).



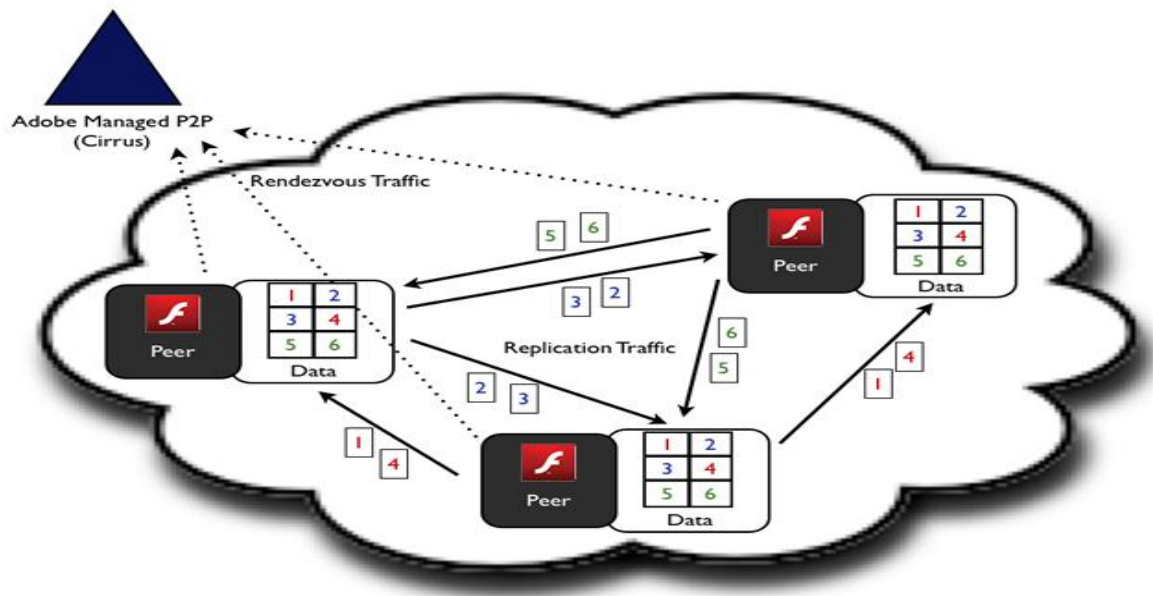


Figure 6- Managed data delivery using peer-assisted networking

In this scenario, businesses can take advantage of otherwise unused space available on the devices within their networks to store corporate documents in a highly available and redundant scenario. Also, thanks to the way the nodes in an Adobe-managed P2P cloud self-manage their topology, business managers don't need to worry about highly complicated configuration and maintenance to implement this solution, saving them money when it comes to deployment, development, and management.

**Live application-level multicast:** Utilizing live application-level multicast, businesses can leverage Adobe-managed P2P to host useful corporate webcasts such as "State of the Company" addresses, corporate newscasts, and other live events. All connected devices will establish a connection to the rendezvous service, which is used only to provide authentication and a directory of connected devices. From that point forward, all data will be routed through the P2P mesh as efficiently as possible (see Figure 7). The other benefit to this topology is that bandwidth is used more efficiently, since P2P peers will opt to retrieve content from peers that respond quickly, rather than from the publisher [14].

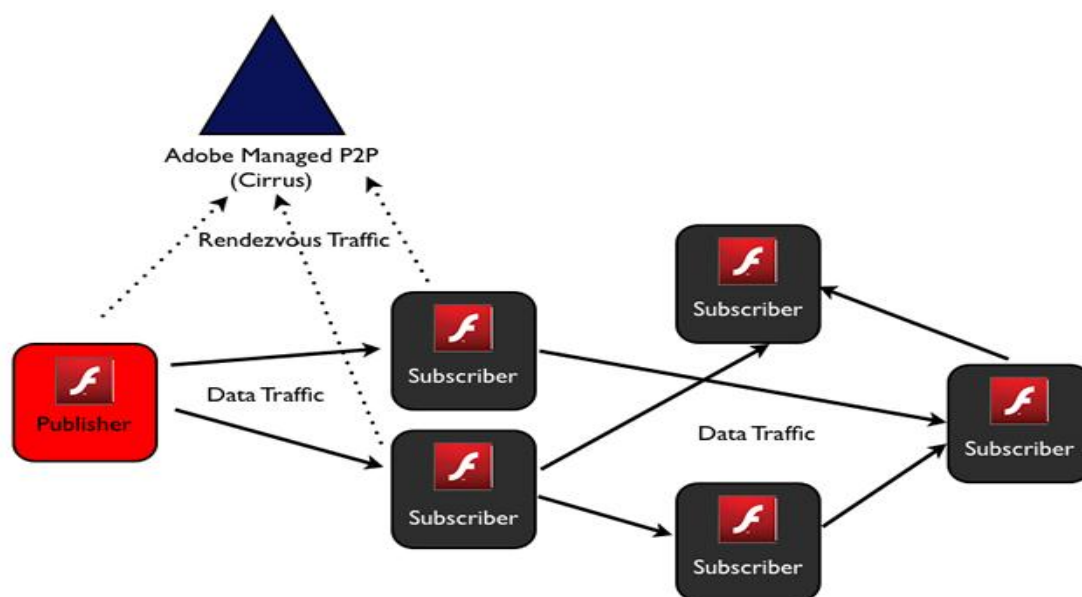


Figure 7- Application-level multicast

**Distributed data storage:** Rather than having to deploy a central database system, businesses can take advantage of Adobe-managed P2P to implement distributed hash tables (see Figure 8). Utilizing directed routing to build DHT applications, corporate knowledge-sharing can scale and even increase in availability and speed as the number of connected peers grow [14].

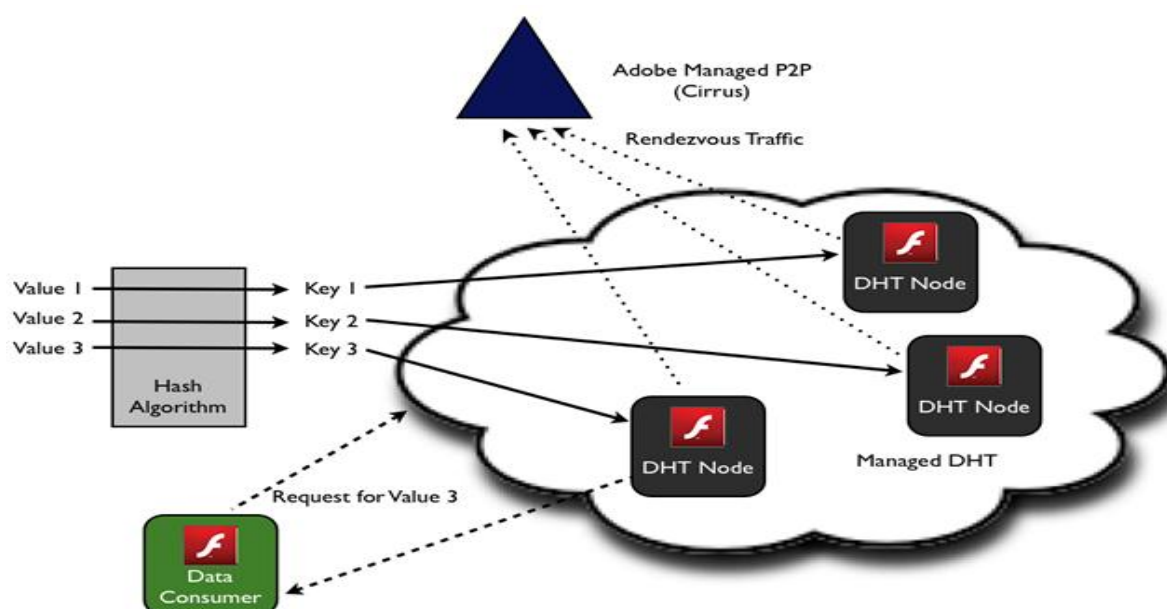


Figure 8- Distributed data storage

Often, businesses have implemented caching servers to store frequently used information locally to their networks. With a solution built on the Flash Platform

and taking advantage of directed routing, businesses can decrease the need to deploy caching servers for particular use cases such as search tools, company directories, and other data directory applications [14].

## **7. Conclusion:**

We presented in this chapter the various concepts related to platform Adobe Flash Player and protocol RTMFP that give developers and users with a set of high level services for the creation and use of applications based on P2P technology.

In what follows we will exploit this technology to develop our own application, allowing the public to share mode peer-to-peer their documents.