

Web/Internet based Multimedia Retrieval System

Venson M. Shaw
School of Applied Science
Nanyang Technological University
Nanyang Avenue, Singapore 639798
asmhshaw@ntu.edu.sg

Abdul Wahab
School of Applied Science
Nanyang Technological University
Nanyang Avenue, Singapore 639798

Samuel S. Y. Sung
Department of Information Systems and Computer Science
National University of Singapore
Kent Ridge, Singapore 119260

Abstract

The success of E-commerce critically depends on the reliability of the Internet, and the speed with which real-time data and multimedia applications may be allowed to transmit over it. This would require an effective strategy for Internet Traffic Management. The paper suggests the Resource ReSerVation Protocol (RSVP), a standard developed by the Internet Engineering Task Force (IETF), as a suitable solution for handling time-critical traffic.

1. Introduction

The today's Web/Internet based Multimedia Retrieval System is largely relying on the browser based paradigm. However, these systems have encountered multiple constraints which do not allow them to provide the overview of multiple objects, presentation of the object structure, and the deadlock of iterative short-range navigation.

The proposed method of this paper proposes a complex icon based object browsing system which overcomes all of the abovementioned constraints.

In summary, our system allows an icon to present several path values of an object along with its associated class hierarchy and offers the following significant advantages: Firstly, the system allows the icon to reflect an conceptual structure of a complex object.

As a result, this allows the user to have more information on this complex object and to allow more accuracy in selecting the multimedia object. Secondly, the database query and the browsing is being integrated and interleaved in order to provide incremental search/refinement of the query result. Finally, a complex object icon is used to prevent inexperienced user from repetitive navigation of the database by providing overview of the object as well as the referred object at different hierarchy.

Accordingly, in this paper, we have shown that an efficient retrieval system for multimedia object can be achieved. We have used a complex object based browsing model as illustration, and example and supporting results are included.

Meanwhile, the heavily subsidised creation of subnetworks for science and research, falling access costs and the broad availability of early implementations of the corresponding transmission protocols has led to an exponential growth of the *Internet*.

However, this external growth has also drastically aggravated the allocation problem with regard to scarce bandwidth resources.

When the network becomes congested, the Internet packet switching technology causes considerable delays in *data transmission time for all users*. Traditional applications like electronic mail or file transfers can react in an elastic fashion to such deviation in available bandwidth.

On the other hand, new time-critical applications like medical imaging, voice transmission and video conferencing cannot, therefore causing employment to be severely limited in such situations. The paper aims to analyse the Internet Model and discuss the suitability of RSVP for E-commerce.

During the emergence of Internet technology in recent years, it is obvious that Electronic Commerce has rapidly become one of the most prominent applications in this field. As the first generation Internet technology mainly focused on the content providing, e.g., news, art, et. al. The browser and search engine provides a readily available tool for users to surf the Web and to locate their subject of interest according to their individual needs and requirement. The Electronic Commerce however introduces significantly different and more stringent functional requirements for the Internet technology such as real time transaction processing, and traffic management, encryption secured data transmission, et. al.

What Electronic Commerce has further brought about is the fundamental change of business behavior from what human have long been acquainted with in a traditional physical commerce system to a new computerized Web agent based client server system model. Such change of business behaviors will make significant impact on the business management philosophies of supply, demand, pricing, promotion, shopping, research, decision making, buying, and after-service.

Accordingly, in addition to the traditional technical issues such as traffic management, transaction processing, et. al. we have embarked on multiple research projects in order to understand the impact of these business behavior, and to further explore the technological solution so that, in the future, intelligent systems would be able to computerize and to dynamically manage such business behavior for the Electronic Commerce.

Research Methodology

As transmission bandwidth is limited in Internet, and will be significantly reduced when the network traffic becomes congested. Therefore, the optimization and management of hyperlink as well as the utilization of the multimedia object becomes particularly important. It is foreseeable that Electronic Commerce would requires more extensive usage of the multimedia object for advertising, promoting, comparison, and presentation of the merchandise, as well as the visual communications between the merchants and the consumer. Therefore, the object of this project is to provide a intelligent browser which is allowed to provide better optimization and management of the hyperlink as well as efficient utilization of the multimedia objects.

The nature of the multimedia object has introduced

several design challenges for the design of a new intelligent browser. Namely, the appropriate presentation of the object data structure, the repetitive short range navigation of the multimedia object, and the simultaneous overview of multiple objects. This is because a multimedia object comprises more than one data types, it can selectively comprises image, audio, graphics, video, or text. Furthermore, a multimedia object is a complex object that often requires additional reference to other objects. Finally, as multimedia objects are stored and retrieved from a database, it is not easy to describe multimedia objects in formal textual terms through traditional query language. Therefore our new browser would also need to provide with complementary query capability in order to allow user to take advantage of the human cognitive capability and to navigate database for multimedia object without sufficient knowledge of the query language and the organization of the database.

II. The Internet System Model

Say a certain web-site experiences a certain number of hits from different IP addresses each day. If a hit is defined as an object (Web page, graphic object, Java or ActiveX control object, etc.), the connection model may be thought to resemble an art project where each nail on the board is an IP address or Internet Object (see Figure 1 below) [1].

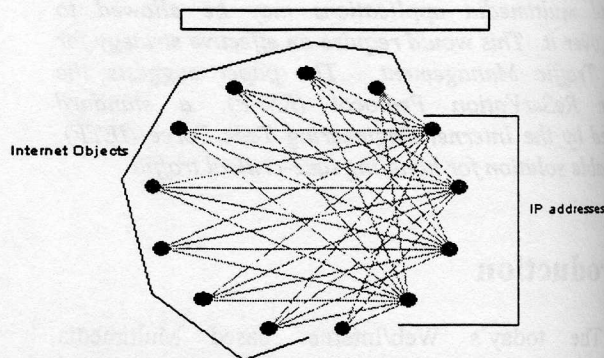


Figure 1 Over-simplified Internet Model

Each string between the IP address and Internet object is a packet path.

The structure of the model can now be improved to better represent the true nature of the Internet (see Figure 2).

It is worth mentioning it is rare for any packet to travel only a single hop (straight path) to its destination. Instead, we need to add new nails to the board, defining points that the string needs to pass through to get to the final destination; each nail therefore represents a router or switch on the Internet.

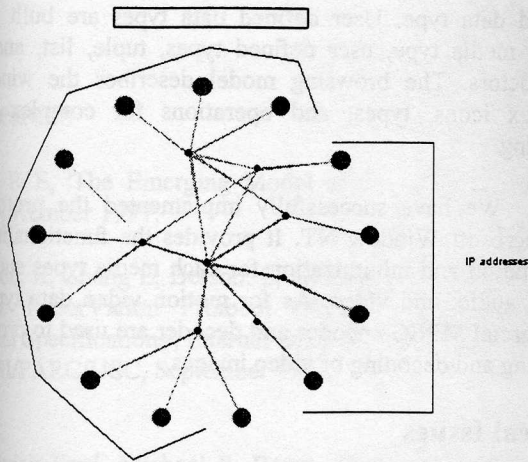


Figure 2 Simplified Internet Model

As we add each string or packet/path, the router at each intermediary point requires enough capacity to allow each packet to pass through. Let us think of the router as a nail that is a few inches in height. Each packet is like a string. When it passes through the router, it takes a little of the vertical space on the nail. At some point, the space is filled. This means leaving incoming packets will disappear from the network when this congestion point is reached. As more packets are forced through a given router, the probability of that router's capacity overflowing increases, just as forcing a number of strings onto the same nail would fill the nail to capacity.

Since the Internet is actually a dynamic space, each packet occupies space in the router for an instance, but the sheer numbers of packets passing through the Internet makes this problem very tangible and similar to the string and nail in the artwork project. This demonstrates the topology and throughput problem of the Internet.

III. System Overview

A Fresh Look

A fresh look would be useful here. Perhaps it is time to build super-fast routers supporting 100 gigabits per second or higher speed links. Maybe we should use a high degree of parallel processing and "very wide switch architecture construction sets" to help achieve the target high performance. Since signalling for Quality of Service (QoS) tends to be complicated, we may just construct simple "tolled" network highways for premium services, or deploy "traffic conditioners" capable of managing network bandwidth automatically. If router buffers will never be large enough to handle the large number of expected TCP flows, maybe routers should restrict the number of allowed connections, or even better, deploy link-flow to avoid buffering at all!

Resource ReSerVation Protocol (RSVP)

The Real Time Protocol (RTP) can carry real time traffic across a TCP/IP network. Real time traffic usually has tight time constraints, and must reach its destination within a certain time period. On its own, RTP is at the mercy of the Internet Protocol's delivery service, and IP is an unreliable protocol, as it only makes a *best effort* to deliver data. RSVP comes to aid by reserving network resources. Once reserved, these resources are dedicated to the application.

RSVP is a protocol through which the receiver can request a resource reservation along the path between the source and the receiver for particular data streams or flows. Routers establish and maintain state to provide the requested service, and deliver QoS control requests to all nodes along the path.

Working Example

Figure 3 shows a real-time video stream for Electronic Commerce traversing the network. To keep the video acceptably smooth, say the application requires 31 Mbit/s (30 frames/s * 1024000 bits) of network bandwidth. A router inside the network must support the video traffic as well as other traffic on the network. As the Figure shows, say a separate file transfer is temporarily peaking at 30 Mbit/s. Since the ATM network only has an access rate of 51 Mbit/s ($< [31+30]$ Mbit/s), the router cannot support both traffic flows at flow speed. To efficiently share the limited resource of 51Mbps, it would be better for the router to maintain the video transfer of 31Mbps by limiting the file transfer to 20Mbps. The file transfer will take longer but will still be acceptable. Many routers are capable of making the 'right' allocation of bandwidth, but they have to know what that allocation is. That is where resource reservation comes in.

With resource reservation, an application gives advance notice of the network resources (say 31Mbps for the real time video) that it requires while the affected hosts and routers commit to providing these resources. Resource reservation can also indicate when the necessary resources are not available. E.g. If the real time video tried to reserve 62 Mbps of bandwidth, the routers would refuse the reservation because the network, with 51 Mbps ATM link, clearly cannot support that requirement.

IV. Performance Evaluation

Today's browsers have limited capability of viewing multiple objects at the same time, due to the constraint of the display resolution, it is not feasible to present detail views of all the retrieved objects simultaneously. In the case of our browser, an icon, or a

simplified version of the object, are used to represent the partial view of an object, such partial view can be one of the pages, or one of the attributes of an object. Therefore, instead of a full resolution image, only a small image is displayed. Our system first observe the traffic condition of the network, the system then provide a bandwidth controller for producing the allowed transmission bandwidth budget. According to the budget, a complex icon is produced which comprises compressed signal with much reduced signal resolution.

From the operation viewpoint, our browser first formulate a query at a client device and retrieve a set of multimedia objects from the database via the server according to the multiple path selected from the class composition hierarchy. The browser then request the server to perform filter function in order to create a set of projected objects from the retrieved set of multimedia objects. The browser further produce a complex icon, which comprises thumbnails of the selected projected image. The complex icon is sent and presented to the user at the client device for viewing multiple icon at the same time and for determining how to further proceed with the next navigation path.

The advantage of our approach is that, without repetitive navigation, a user can gain overview of the objects and to refer to the next desired object via complex icon simultaneously. Each of the icon reflects conceptual structure of a complex object by presenting several path value of the object. Therefore, selectivity of the multimedia object is significantly improved. Finally, our browser allows the interleaving of query and browsing operation so that query results can be incrementally refined.

Accordingly, after the user initiate the query request and retrieve a set of objects from the database, the browser further perform intelligent algorithm to group said set of objects into a plurality of subsets of objects, said browser further schedule the presentation sequence of said plurality subsets of objects so that each subset of objects is presented to the user one at a time. The browser further formulate a complex icon to present said subset of objects to the users for browsing. This would allows the user to get an overview of the entire subset of the objects, and to view the representation of the next or previous object provided the user choose to further proceed with the same navigation path. Accordingly, user no longer have to deal with the short range navigation, i.e., proceed to the next or previous objects repetitively.

The complex icon browser provides user the ability to browse a database at a conceptual level as well at an instance level, therefore meaningful information such as the structure of a complex object can be conveyed. The object-oriented data model that we consider here has classes whose instances are also objects. Therefore, there is an one-to-one correspondence between the name of those class and the user

defined data type. User defined data types are built from atoms, media type, user defined types, tuple, list, and set constructors. The browsing model describes the window, complex icons, types, and operations for complex icon browsing.

We have successfully implemented the prototype for Microsoft Window NT. It provides the functionality of presentation and minimization for each media types such as image, audio, and video. As for motion video data type, a commercial MPEG encoder and decoder are used to provide encoding and decoding of video images..

Critical Issues

RSVP supports multicast or unicast simplex data delivery. It handles heterogeneous receivers. It is receiver-oriented and is not a routing protocol. It adapts to changing group membership as well as changing routes. In many ways RSVP provides a unique architecture for applications to secure reservations for QoS over the network elements (routers, switches etc.). RSVP can be implemented on top of any routing protocol.

However, RSVP has certain limitations of its own. It needs the help of other protocols (like RTP) to operate. Unlike services like ATM, RSVP can only request for allocation of resources. It cannot guarantee that these resources will be available. RSVP is not of much use with non-RSVP compliant routers. A router must be capable of separating streams so that it can give priority to real-time traffic and forward it before forwarding data traffic, for example. Upgrading all routers to comply with the RSVP protocol is a time-consuming and costly affair.

V. Conclusions

In this paper, a complex icon browser is presented, which overcome the overview of multimedia object and the repetitive short-range navigation. For the proposed method, we define a browser data model, and design the run-time execution mechanism using such data model. Our system enhances the expressive power of the icon by allowing each icon to represent the value of several paths on the composition class hierarchy level. We have further improve the selectivity of an multimedia object. Finally, without repetitive navigation, users are allowed to observe object as well as the referred objects simultaneously. Internet congestion is a critical hurdle in the effective transfer of data for electronic real-time transactions in the Internet. The paper showed how RSVP can be promising in this regard.

Computing Geometric Moments of Objects with an Exact Rational Representation

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