Multimedia Messaging for Peer to Peer Communications – C-NetLiaison –

Osamu Nakazawa Haruo Fukuda
Kumiko Wada Kazuhiro Kawabe

The advance of IP technology as a key Internet infrastructure, and the increasingly fast improvements in network speed and capacity, have given rise to a growing need for content business environment architecture aimed at PC and server users, as well as users of all kinds of mobile devices, allowing them to distribute and share contents efficiently, in a secure and reliable manner. Oki's product, C-NetLiaison *1) 1) , is a content sharing and delivery platform which permits a highly reliable, secure and adaptable response to this growth in wide area network activities. By using C-NetLiaison, it is possible to provide an optimum network solution for telecommunications carriers, ISP, broadcast media, and other operators, who plan to supply and distribute multimedia content as part of their business.

The latest content business environments comprise two services, "content delivery" and "online storage", which are receiving special attention – attractive broadband services where C-NetLiaison can be used to great effect.

(Content delivery service)

This is a service for eliminating content delivery bottlenecks and providing an agreeable delivery environment to the user, for all kinds of rich contents, such as product information, finance information, educative information, recreational movies, live video, and the like. In the general delivery configuration, content delivery operators previously distribute undelivered contents in servers located in a network edge environment (ISP close to use or access site, etc.), in order that they can be accessed quickly by the user. There are also services wherein contents contracted in derivative form are delivered directly to the user's environment (for example, a PC or set-top box). In these content delivery services, it is vital that a "content distribution" framework can be constructed which provides flexible, safe and efficient linkage between the "content provider", "content collector", "content deliverer", and the "content user".

(Online storage service)

This is a WAN-based storage service which provides a content management environment that can be accessed by the user at any time and any place. For example, by registering content located on a company PC environment with the online storage service, it becomes possible for that content to be consulted and updated from a mobile environment outside the office, or from a worker's own home, and furthermore, the registered content can be shared and made public between a number of users very easily. An online storage service means that personal or communal contents can be used in a secure and efficient manner from any one of a number of different access points distributed nationwide, and the key to future expansion of this kind of system will be its ability to provide value added services that are attractive to users, over and above the simple network garaging of contents.

Below, this paper gives an overview of C-NetLiaison and its composition, and describes examples of a content delivery service and online storage service to illustrate the practical application of C-NetLiaison. We also introduce a Peer-to-Peer (P2P) type content sharing and delivery environment based on C-NetLiaison, which resolves the various problems associated with current services and generates new added value.

C-NetLiaison – An overview

In C-NetLiaison, by connecting groups of servers (hereinafter, called "content servers"), such as PCs or workstations providing contents, in a mesh configuration, it is possible to construct a content sharing and delivery system based on a P2P model over a wide-area network.

As shown in Fig. 1, by installing C-NetLiaison on a several number of content servers and registering contents that are to be shared or distributed under the C-NetLiaison management system, a P2P content environment is created which allows contents to be located, consulted and shared, from a different content server.

With C-NetLiaison, a large number of contents distributed in content servers are represented on a single directory layer structure, which provides the users with a single, virtual file sharing environment. By referring to the path name in the directory structure, the user is able to access content located on the WAN, just as if it were stored in his or her own PC, without being aware of the server in which the content is actually located. By building an integrated access control framework based on a directory structure which combines all contents located on a number of different content servers, whilst incorporating sufficient

*1) C-NetLiaison is a trademark or registered trademark of Oki Electric Industry Co., Ltd.

security considerations by constructing a system for mutual authentication between contents servers connected in a mesh pattern, and appropriate content encryption during delivery, it is possible to provide platform functions combining security and reliability which can be used for an Internet-based content business environment.

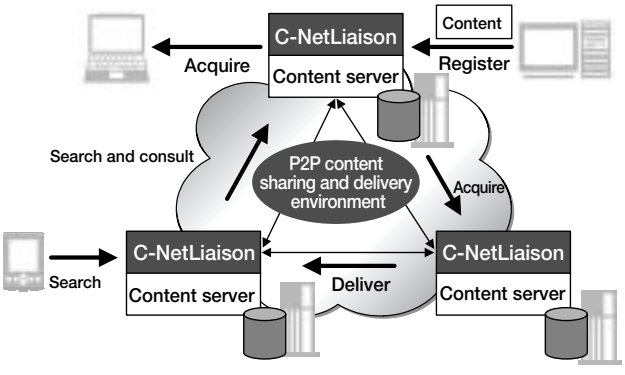

Fig. 1 Content sharing and delivery environment using C-NetLiaison

A P2P content sharing and delivery environment of this kind is suitable for building and running an online storage service or content delivery service, which are typical broadband services as described previously. This environment can be applied to:

- providing wide-area distributed online storage services, which create P2P links between storage environments distributed over a wide-area network, and enable efficient use of contents from many different access points;
- providing content delivery services, which achieve integrated support from the collection of contents held by a content provider, through to planned storage and delivery of contents to edge environment or user environment by content delivery operator (common carrier, ISP, etc.)

The basic elements of C-NetLiaison products

C-NetLiaison products fall into two groups: the "content delivery and sharing service" group for supplying core functions for achieving a P2P-type content delivery and sharing service, and a "system management service" group for supplying security management and services management functions required when running and administering a content delivery and sharing service.

(Content delivery and sharing service group)

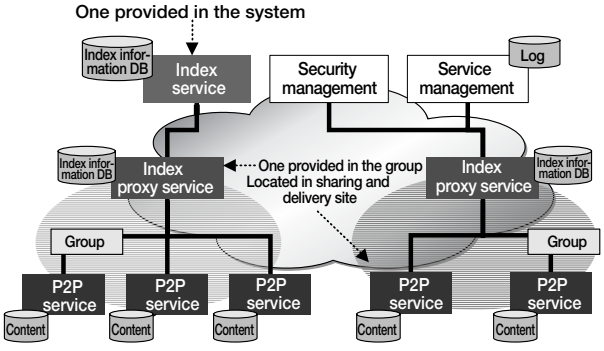

Fig. 2 Structure of C-NetLiaison product

The basic elements of the delivery and sharing service are an index service and a P2P service, and by connecting a plurality of P2P services to an index service, a content sharing and delivery environment centred around a single index service is built. Fig. 2 gives an illustration of the layout of C-NetLiaison sharing and delivery service groups on a WAN. All of the service functions described below run on Linux *2) (or Solaris), allowing a content sharing and delivery system to be constructed by IP connections.

- P2P service : This service holds and manages contents to be shared and delivered by C-NetLiaison. It comprises content manipulation functions, for registering, deleting, updating and indexing contents according to the requirements of the user, and transmission and reception functions for cache contents (duplicated contents) by communication with other P2P services.
- Index service : The index service manages the content attribute information distributed over the P2P services. Standard attribute information (Index information) includes items, such as "content identifier", "content owner", "registration date", "access rights", "original content / duplicated content (cached content) indicator", "resident P2P service information", and the like. These attributes are grouped as keys and corresponding values which can be used in searches, and form a unique framework in which additional settings can be made for each content, separately.

In order to rationalize content management and distribute the load on the index service, it is also possible to set up an index proxy service which acts as a proxy for the index service.

- Index proxy service : This is a service which provides a proxy for the index service when managing index information in virtual groups representing a collection of P2P services, and sharing and delivering contents within a group. For example, it is possible to set up a group which unites P2P servers for particular content categories, or a group which contains P2P services which are relatively close together in terms of

*2) Linux is a trademark or registered trademark of "Linus Torvalds" in the USA and other countries.

network distance. This is particularly effective in improving search efficiency.

(C-NetLiaison management service group)

- Security management : The security management mechanism implements user and manager authentication for the content sharing and delivery system built using C-NetLiaison, as well as unified access control for all contents residing in a plurality of P2P services. By using a PKI (Public Key Infrastructure) and providing a certification authority to issue valid public key certificates in the system based on C-NetLiaison, a high level of security and reliability can be guaranteed. Using a PKI foundation provides a framework for mutual authentication between P2P services using SSL (Secure Socket Layer) technology, encryption during content transmission, and access right verification when a user wishes to refer to or update contents.
- Service management : This is a management mechanism for sharing and delivery service groups operating on a C-NetLiaison system. It provides functions for managing startup and execution of P2P services and Index services, as well as acquiring activity logs.

System structures using C-NetLiaison

This section looks at examples of actual system structures for a distributed online storage service and a content collection and delivery service, using C-NetLiaison, and describes the main features of each configuration.

(Distributed online storage service)

This is a WAN-based online storage service which supplies added value functions, such as content sharing and delivery, between different users. This service not only allows a user in-house access to the contents they need, it also permits safe and efficient access from a whole number of mobile sites, such as the user's home, or hot spots. Moreover, in forming a site for storing and sharing contents used within a company, this service can also be delegated to handle content access management and backup management, instead of the company's system administrators or users. The main features of using C-NetLiaison in this system are described below.

- Unlike conventional online storage services which are managed centrally in a single data centre, here, it is possible to build a large-scale distributed online storage service, which links server storage in geographically separated sites. This makes it possible to resolve the problems associated with current services, such as service provision failures due to the concentration of access operations in a single centre.
- It is possible to provide duplicated contents in a storage point located near the user's access point, which is different to the storage point where the content was registered, meaning that the user can use the content without any problems, at any time. Duplicated contents can be updated automatically at the same time as the original contents, so that the user can always access the latest version of the content.

In Fig. 3, "P2P" indicates a P2P service and "Index" indicates an index service.

(Content collection and delivery service)

This is a content collection and delivery system

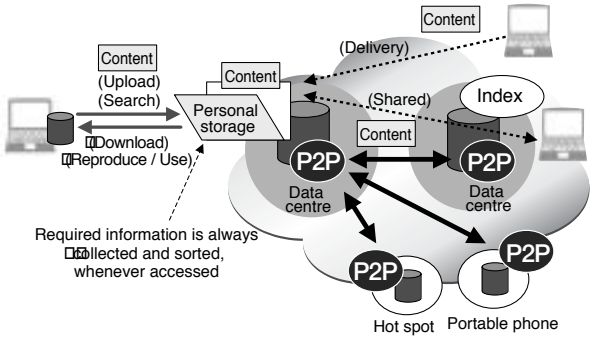

Fig. 3 Distributed online storage service

which links a content provider to a content deliverer, through to a user environment, by peer-to-peer connections. News, financing information, and so on, which have to be up-to-date but handled with confidentiality, can be supplied in a timely fashion, and other services, such as planned delivery of large-volume data, like training materials, amusement videos, software, or the like, can be set up very easily. Here again, the benefits of using C-NetLiaison in this system are described below.

- A content provider can manage delivery of contents according to their own schedule, and can therefore always supply the very latest contents in real time. Moreover, by time limit management of the delivered contents, it is easy to limit the valid time period of the contents so that they are, for instance, only loaned out for three days and two nights.
- Items matched to the user's preferences can be located and collated in a strategic manner, from the supply of network contents that is growing year on year, and the selected contents can be delivered to and stored in the user's personal storage environment (linkage between distributed online storage service and content delivery service).

Conclusion

C-NetLiaison is a cutting-edge software platform driven by Java/Jini technology *3) [2] and XML (extensible Markup Language), which provides a P2P type content sharing and delivery environment for wide-area networks. Since the first version was shipped in October 2001, it has been steadily introduced by telecom

*3) Java, Jini and Solaris are trademarks or registered trademarks of Sun Microsystems USA, Inc., in the USA and other countries.

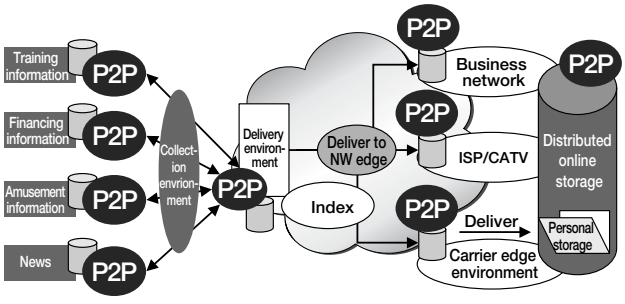

Fig. 4 Content collection and delivery service

carriers, service providers and broadcast related enterprises, forming the basis for new commercial services for distributed online storage and content collection and delivery, as presented above in the system examples.

At present, Oki is engaged in putting together a content delivery solution for set-top boxes based on the C-NetLiaison delivery environment. By using the P2P type delivery functions of C-NetLiaison, it is possible to achieve individual-oriented management for set-top boxes, which is valuable in the construction of E-Learning environments using moving pictures, and the like.

In the future, we plan to make the most of our advanced position in the business application of P2P technology and our accumulated technical expertise, to build new P2P network solutions. ◆◆

Basic Glossary of Terms

Peer to Peer (P2P)
Technology which allows "peers" (computers) forming basic system elements, to share contents and resources located in another "peer", via the network. The main feature of P2P is that it allows more efficient use of network and computer resources, and it is attracting a great deal of attention as an Internet business infrastructure.

Jini : Jini Network Technology
Distributed project environment using Java language environment provided by Sun Microsystems. Using Jini, it is possible to build a plug & work environment for network computer resources and services.

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Author

Osamu Nakazawa : IP Solutions Company, IP System Planning & Development Div., Application Platform Planning & Development Dept., General Manager

Haruo Fukuda : IP Solutions Company, IP System Planning & Development Div., Application Platform Planning & Development Dept., Assistant General Manager

Kumiko Wada : IP Solutions Company, IP System Planning & Development Div., Application Platform Planning & Development Dept., NW-AP Development Team, Team Leader

Kazuhiro Kawabe : IP Solutions Company, IP System Planning & Development Div., Application Platform Planning & Development Dept., NW-AP Development Team