Web Gateway System Supporting Network-type Contents Business

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OVERVIEW: The digital contents business market is growing rapidly owing to the advancement of broadband and mobile Internet technologies. Hitachi has developed high-performance original proxy technologies and has been using them to create web gateway systems that can provide reliable, high-performance, value-added contents services. The web gateway system can be used for various applications such as mobile Internet, contents delivery and web front-end systems. We are currently working to enhance streaming services, security features and inter-working between multiple service providers.

INTRODUCTION

THE contents business is rapidly growing thanks to the introduction of network technologies like mobile Internet and broadband access. Currently, networks operators and service providers are struggling to ensure that their platforms can support the growing variety of contents business by providing features such as content and user management and content charging.

Increases in transmission capacity and router performance, as well as the expansion of network address domains by IPv6 (Internet protocol) technology, will expand networks and their services through the rapid growth of connecting terminals and data transfer capabilities. Thus, for a platform to be considered universal in the sense that it can support virtually any contents service, it is most important for it to have high scalability.

Web access traffic over the Internet tends to focus on certain popular sites and often surges at certain times of the day, on-line ticket sales sites being a perfect example of this phenomenon. Therefore, it is also important to have appropriate congestion control methods for dealing with such traffic to ensure stable operation of the whole network.

Thus, a web gateway system needs to: 1) support various value-added services; 2) have high scalability and high cost performance; and 3) provide stable services under congested traffic conditions.

Hitachi's web gateway solutions use original proxy technologies (FWGS: flexible web gateway server)[1]. Fig. 1 shows the basic system configuration of a web gateway system. This paper describes the service concept and potential applications, as well as planned enhancements to the system.

SERVICE CONCEPT OF WEB GATEWAY SYSTEM

Fig. 2 shows an example of service provision in relation to the technical issues mentioned above.

Scalable Distribution Service Using Cache

Contents providers want to start up their businesses quickly and easily, and most begin with a small-scale system. To fulfill these needs, the web gateway system incorporates cache functions in multiple FWGSs, which store contents for quick delivery to users. A FWGS in combination with load balancers makes it possible to offer scalable services depending on traffic characteristics. In this way, even a small-scale server system becomes competent enough to deliver contents to as many as 10 million users. Another cache function handles highly accessed contents that have priority in the cache of the FWGSs. This function ensures efficient delivery of services and a short response time.

Stable Service with Congestion Control

The usual effect of burst access, in which the number of accesses handled by the web gateway system rises rapidly within a short period of time, typically right after new services are released, is inconvenient to users. To avoid such a situation, the web gateway system has congestion control functions that prevent adverse congestion effects in specific servers from spreading to other services.

(1) Request aggregation feature

The web gateway system aggregates multiple outstanding requests for the same content into a single request and multicasts the response to all the requesting users.

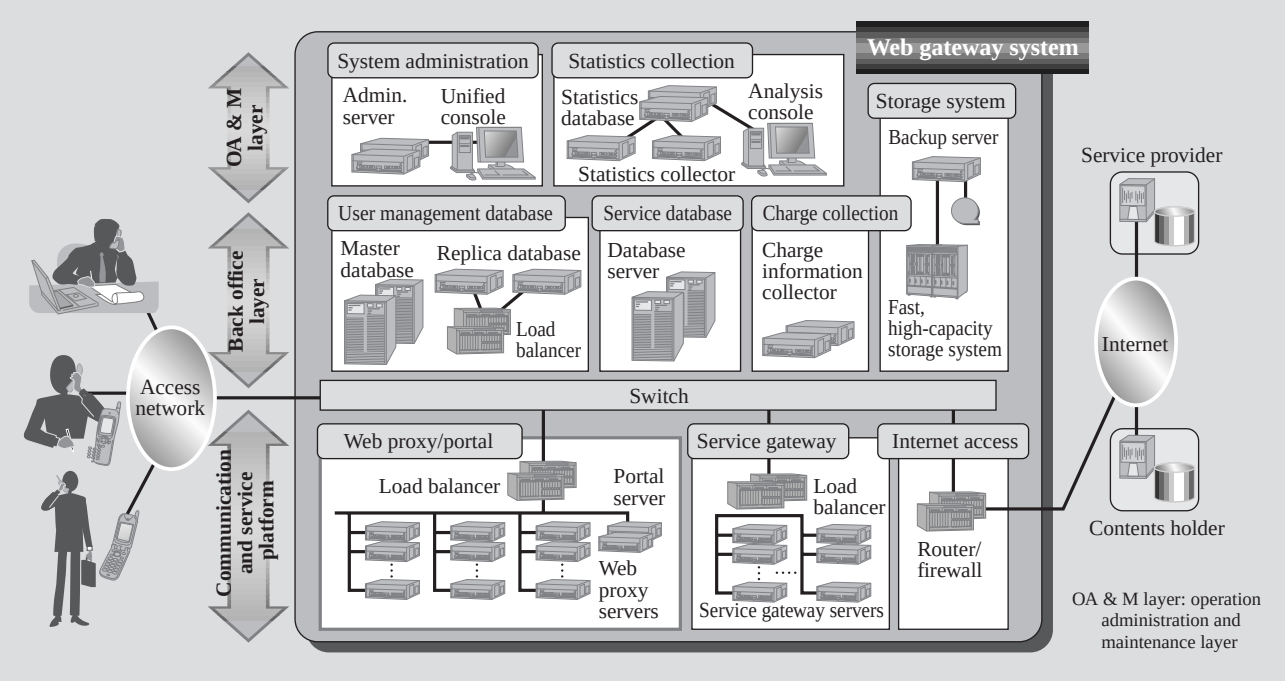

Fig. 1—Web Gateway System Configuration Example.
The web gateway system, located between wired and wireless access networks and the Internet, controls the network traffic and provides value-added services. Hitachi provides web gateway system solutions by using its original high-performance proxy technologies.

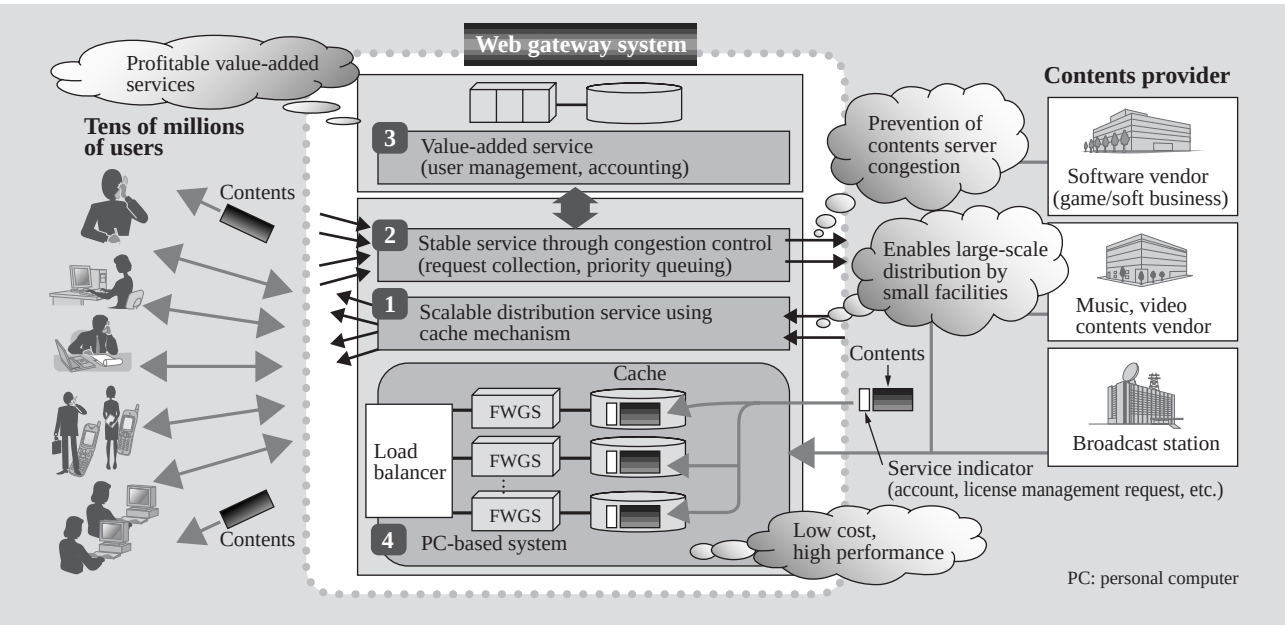

Fig. 2—Web Gateway System.
The web gateway system makes it possible for contents providers to provide stable services to tens of millions of users with a small-scale server system. It also allows network carriers and service providers to create revenue-increasing value-added services.

(2) Priority queuing and auto-access restriction

To control traffic, the FWGS sets up internal queues for each request for certain contents or to certain destination sites. It regulates the number of simultaneous requests for each queue so that it keeps the traffic volume under the processing capacity of the content provider. By assigning a service level to each queue, it is possible to provide higher priority service during congested periods. The FWGS monitors the state of the queues and restricts requests by sending

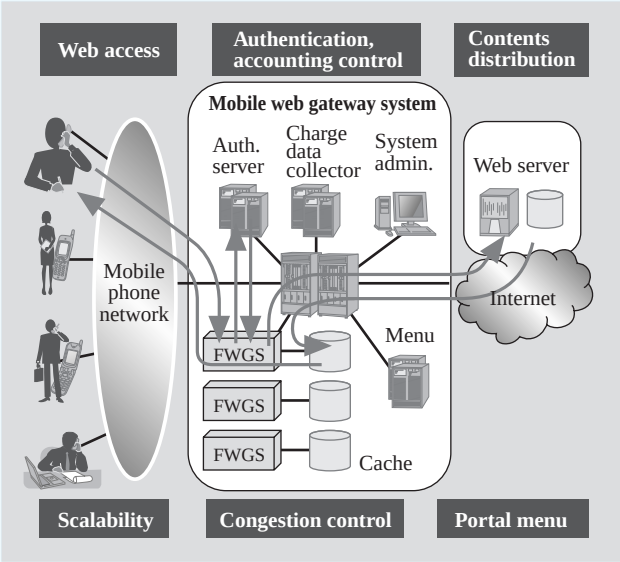

Fig. 3—Mobile Web Gateway.
Example of Internet accesses from mobile browser phones.

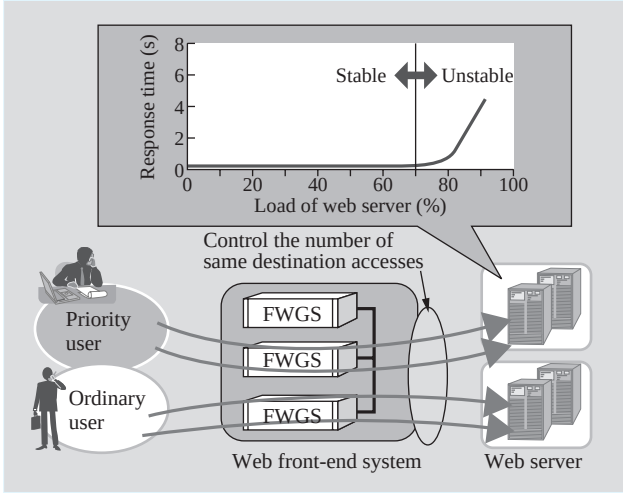

Fig. 5—Functions of Web Front-end System.
Example of the web front-end system that provides stable services to multiple service sites by controlling the requests for the same service.

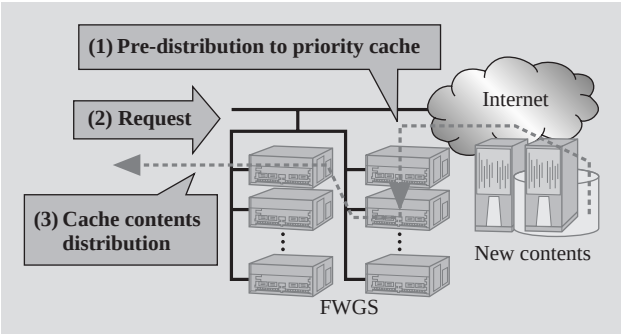

Fig. 4—Functions of Contents Distribution System.
Example of contents delivery for effective network operation with cache control features.

congestion notices to users in long queues.

A Variety of Value-added Services

The web gateway system provides various value-added services such as user and license management, content charging, delivery with priority control and access reports. It also gives contents providers a means of selecting value-added services by attaching service indicator tags on the contents.

High Cost-performance Platform

PC Linux* is used in the FWGS base machine where the system size grows in accordance with the volume of traffic. The reasons for choosing PC Linux are: 1) recent PC Linux offers workstation levels of performance at less cost, and 2) future PC servers will have even greater cost performance.

Reliability is ensured by the use of multiple FWGSs and load balancers supporting congestion control functions.

*: Linux is a registered trademark of Linus Torvalds in the United States and other countries.

APPLICATION EXAMPLES

Mobile Web Gateway

Fig. 3 outlines the functions of a mobile web gateway. This system consists of FWGS, a subscriber database, and backend servers including charge information collector server and system management server. It provides gateway functions for users of cell phones with web browsers. This system provides congestion control features, portal menu features, user authentication features, billing settlement features for charged contents, etc.

Contents Distribution

Fig. 4 shows the functions of a contents delivery system. This system, using the priority caching features of distributed FWGSs, stores new or popular contents in the priority cache area of the FWGS. New or popular contents can be retrieved from the cache area without accessing the web servers holding them. This results in convenient web access services for users. Additionally, content providers can avoid the service degradation caused by access concentration.

Web Front-end System

Fig. 5 shows how the web front-end system works. This system controls the number of user web accesses before transferring them to the group of web servers.

Generally, the response of web servers drastically slows when the number of accesses exceeds a certain level. Thus a stable response can be guaranteed by controlling the number of accesses to the same destination.

FUTURE ENHANCEMENTS

The web gateway system is indispensable to network-type contents services. Network-type contents services, in the near future, will support rich contents and ubiquitous services. To enable such services, the following studies are now underway.

Streaming Services

Streaming services for audio and video include services for delivering multimedia data on a real-time basis and services for downloading multimedia files during a web access. The former is a broadcasting-type service provided by dedicated stream servers. In the latter, ordinary web servers provide streaming services such as short video clips.

For the broadcasting-type services, value-added services will be realized in cooperation with the stream servers. For the download-type services, improvements to the web gateway system will be necessary if it is to handle larger video contents. We are planning to provide solutions for streaming services by having the interfaces with existing stream servers, and by enhancing the functions such as cache capability, bandwidth control, and congestion control for dealing with large contents.

Security Services

When access to various contents is granted under ubiquitous conditions, there is a danger of spreading harmful contents (computer viruses) or illegal ones violating copyrights. To prevent this from occurring, a security enforcement system is being developed so that the system will guarantee the validity of the contents and ban access to contents whose validity has not been confirmed.

Value Added Services

Various kinds of value-added services, such as an automatic advertisement inserting service and virus checkers, are being studied. These services will be realized with additional application servers placed in the relay path of the web gateway system.

AAA Gateway

A new distribution platform, called the AAA gateway system, is also being studied. It is intended for authentication and billing control among multiple networks or service providers in the contents distribution network. AAA is an acronym for authentication, authorization and accounting. It is hoped that this system will let a user receive services from two or more providers with a single sign-on.

CONCLUSIONS

This paper has reviewed services that will be available from a new web gateway system based on Hitachi's FWGS technologies. As a scalable and reliable service platform for the rapidly growing web contents business, the web gateway system is evolving along with the IP (Internet protocol) network.

REFERENCE

(1) T. Nishikado et al., "Large-Scale and High-Quality Service Solutions Using Active Network Technology," *Hitachi Hyoron* **82**, pp.37-40 (Dec 2000) in Japanese.

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