Priority Control Mechanism managed by Metadata

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Abstract

The priority control for specified communication was difficult because the design concept of the Internet was best effort, but QoS technology such as Diffserv has realized the priority control. In this paper, we propose a new priority control mechanism. that the policy of the behavior of the packets is described using metadata. The metadata is structured data about data and is able to describe policy. We use the emergency communications as an implementation of the proposed mechanism. In an emergency, the Internet is important as a communication infrastructure for getting information about victim and disaster areas. Metadata is able to describe that this information is emergency. Diffserv is able to transport information managed by a priority control mechanism. This mechanism is going to be included in ITU-T F.706 recommendation.

Keywords: *Metadata, Quality of Service, Dublin Core, Emergency Communication, ITU-T recommendation*

1 Introduction

The research about Metadata brought "structure" to the complicated information system. Metadata describes additional information about an object or resource whether it be a physical object or digital data. The content of information is not machine-unreadable but metadata makes it possible to process information by computers. Recently metadata has a become important concept on many multimedia service such as education or e-commerce.

In this paper, we propose and design the priority control managed by metadata on the communication system. It is a new metadata application. We found that Metadata is able to describe that this data is important. It is useful to transmit the data faster than other data.

On the communication system such as the Internet, a Quality of Service (Qos) was not guaranteed. Recently, QoS technology has developed and standardized at IETF [1] [4] such as Diffserv[8]. Diffserv is specified to implement priority control by defining the transport priority class from highest to lowest.

To operate QoS by Diffserv, Policy Framework is needed to classify the data for these service classes and setup the network equipments. Policy Framework is only designed to classify the specified applications such as stream.

We propose that Metadata define the service class policy by description about structure of the information.

In this paper, we use the emergency communications as an implementation of the proposed mechanism. Because the communications in an emergency is urgency and should be transport faster than other communications. We indicate that Metadata becomes possible to describe the emergency of the information and designs policy to transport urgent information efficiently on the emergency communications.

[1] The Internet Engineering Task Force

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Although Metadata and Priority Control mechanism are not related to each other. We emphasise that metadata has data needed by transport technology, and we construct a mechanism for appling it to priority control.

This mechanism is going to be included in ITU-T SG 16 [2] F.706 [3] recommendation. This recommendation will be published.

Dublin Core Metadata Element Set [3] [11] is de facto standard for the metadata of digital information. Since policy description for priority control is expected keeping international standard, in this research we use Dublin Core Metadata.

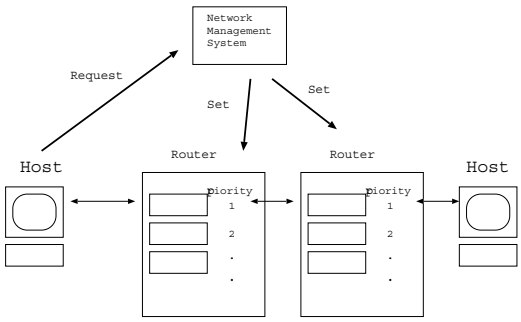

Figure 1. Priority control by Network Management System

2 Priority Control

Diffserv [8] [9] is the most important technology for guarantee of services, that are processed to standardization and implementation.

Diffserv classify data flow and define the behavior for each class to implement priority control. Priority information is given to the header of data packets (IP packets) by each class. The equipments such as routers on the Internet and Intranet relay these packets managed by priority information.

The description about packet behavior is called PHB (Per Hop Behavior) specified valuable priorities and configuration of buffer assignment for data transmission. Assured Forwarding (AF) [5] and Expedited Forwarding (EF) [10] are standardized as standard PHB.

In order to manage the priority in a certain domain, the management system called NMS (Network Management System) such as BB (Bandwidth Broker) to control the network equipments on the network correspond to priority requirement and assign the network resources.

Fig 1 shows priority control mechanism managed by Network Management System.

At present, an data monitoring system supervises Data flow and negotiate priority by flow to implement the Policy framework. Additionally, some people researches priority guarantee mechanism that an application such as streaming require priorities to NMS to get high priority. [1]

3 The Emergency Communications

When a large-scale disaster occurs, communication infrastructure as a lifeline is often damaged. Although the function is not stopped completely, it often fall off influenced by cutting and congestion lines. It is difficult to guarantee the whole common communication function in an emergency. Communication infrastructure covers important function specially in an emergency because victims need many information for their life.

The important communication function in an emergency is keeping information services. In an emergency, since exchanged information is urgent, there must not to be no data packet loss. Additionally, the urgent data is transmitted faster than other general data.

The WIDE (Widely Integrated Distributed Environment) project [12], a well-known research consortium on the Internet technology in Japan, has been developed an emergency communication system called the IAA (”I am alive”) system [15, 6] and conducting field practices since 1995. This system consists of various user interfaces (WWW, Cellular phone, Facsimile and so on), and scalable and robust distributed database systems, and supports registration and retrieval of information on victims in a disaster area.

Since 1999, Communications Research Laboratory (CRL) has participated in the research and development of this system and has proved its validity through the experiments in the actual natural disasters such as volcanic eruption and earthquake.

4 Priority Control managed by Metadata

In this section, we indicate that metadata has information that is needed by communication system and we propose the mechanism to use metadata for priority control. This mechanism makes possible that emergency information having standard metadata is transported efficiently by means of getting high priority in an emergency.

At first, we indicate two advantages that the information that is exchanged in an emergency has metadata.

Firstly, the information in an emergency become possible to exchange in any country and any system. It

[2] International Telecommunication Union Telecommunication Standardization Sector, Study Groups 16: Multimedia services, systems and terminals

[3] Service Description for an International Emergency Multimedia Service

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is also possible to retrieve information across to many system. This is basic feature about metadata.

Secondly, the priority control mechanism is implemented managed by metadata proposed in this paper. Although metadata and priority control mechanism had no relation each other, we found that the information described by metadata is important to define the communication policy. This relation become possible that specified information having high priority and transmitted faster than other information.

The problem is that it is not able to expected what application is used and where the data is transmitted. If network infrastructure is damaged by disaster, the communication system may be established by all alternative equipments and alternative route. It is impossible that configuration is changed when disaster occurs because access may come from all country and whole world.

The one feature on the emergency communications is not long time occupation of communication path by the one communication but short time and small size data communication by large amount of communication. Thus, it is not efficiently to require changing configuration each time at every communication.

It is difficult to implement the requirement of the conventional priority control function, the new mechanism that define the packet behavior by specifying that the data is urgent data. In that case, it is important that information creator define the data priority and reflect the packet behavior as a policy on the data transmission. To implement this mechanism, Metadata is important.

The structured information include many function, some information is useful for display the information, record management and communication functions such as format, since all data is useful for information retrieval and management. The function for the communications is not necessarily defined by one element but defined by combination of some elements. It is possible to implement the priority control mechanism by means of description priority policy the packets that is defined by metadata elements.

5 System Design

In this section, we describe the design of priority control system using metadata.

Figure 2 show the system overview of policy control mechanism managed by metadata.

This system consists of three components: Metadata Creating, Implementation of Priority Control and the mechanism that specify the priority defined by information in the metadata to the IP packets.

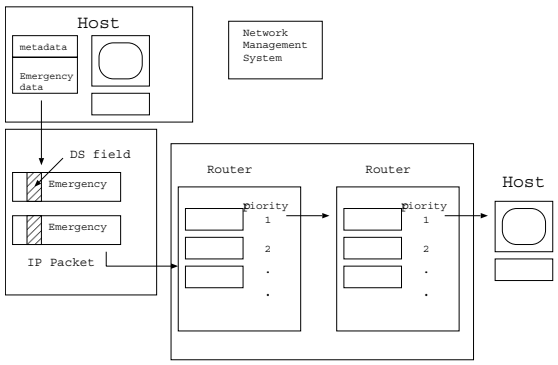

Figure 2. Priority control managed by metadata

5.1 Metadata Creating

Since there is not standard for emergency information, Dublin Core Metadata Element set is appropriate as base design because the information might be exchanged frequently. Metadata is generally specified using RDF[14] and implemented by META tag in the HTML text or XML [13] and applicaion profile [7] [2].

5.2 Implementation of Priority Control

Diffserv is appropriate for realization the priority control because the standardization and implementation is processing [9]. Diffserv is implemented on the network equipments such as router that check PHB and control the transmission priority by changing behavior. This system uses the router which Diffserv is implemented to operate. The priority is marked at end user (information creator) by defined metadata.

5.3 Metadata and Policy Management

The mechanism for corresponding metadata to priority policy for implementation the system. When the information is created, the metadata element for priority policy is described that decide based contents of information. We implement exchange transform mechanism for corresponding metadata to PHB.

Dublin Core Elements and policy are described in the policy table. The information having Metadata implemented by XML is analyzed structure by means of XML parser. The analyzed structure is verified to policy table, then PHP is defined. PHB is set to packet header using Diffserv interface.

6 Discussion

The proposed mechanism issues advantages from two points of view.

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The first is original metadata technology for resource discovery and information exchange. In an emergency, since the information about disaster area and victim is often complicated and changed frequently every moment, information management technology is important. The managed information about update time and creator improve reliability of information, and it makes possible to retrieve information efficiently. Even if different system is used by each country or area that have standard metadata, information is able to exchange each other.

The Second is that standard metadata is useful to control priority on data transmission. Metadata is able to describe contents of information, for example, this information is urgent. It provides new mechanism to define transport policy for QoS by Diffserv by means of description policy specified by metadata. As a result of development and standardization for information description such as metadata, RDF [14], XML [13] and so on, "structure" is brought to complicated digitalized information. There is not relation completely between digitized information and communication. Though structured digital data has useful information for efficient communication, this data is discarded. If contents of data is bring communication layer as a policy transformed from metadata, communication system work more effective.

If all host marks highest priority to all information, congestion will occur on the communication infrastructure. This is the most significant problem the mechanism has. But the announcement and prevention in an emergency is generally judged by government or admission organization, the system is operated by this indication. Specially, important information such as disaster warning is generally announced by admission organization and gather to these organization. Thus, priority policy might be classified by contents such as creator and organization. Additionally, if ITU-T SG16 F.706 recommendation is published, communication carrier and ISP(Internet Service Provider) start to save the high priority service for the urgent information in an emergency. The situation has been prepared to support emergency communication on the communication infrastructure.

The future work is implementation and evaluations.

Additionally, security consideration is required in this system. In an emergency, the disaster area is capable to in confusion and privacy preservation is important problem. Security system is necessary for protection from attack, violence, tapping and so on.

7 Conclusion

In this paper, we focused metadata and priority control and proposed mechanism priority control managed by metadata.

Since the priority control was needed but not implemented on the emergency communication, we indicate that Metadata can describe policy for the priority control by using information such as creator or format. The emergency information that has metadata is also useful to exchange information other systems. We designed Metadata based Dublin Core Metadata Element Set because DC is international standard and adequate to use on the network environment.

We designed and implemented the proposed mechanism. In the future, we are going to evaluate this mechanism on the practical system for applying the Internet.

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