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A Dynamic Diffserv Scheme for Mobile Terminals in Policy-based Mobile Networks

Sangjoon Park[1], Hyunjoo Mun[2], Jongmyung Choi[3], Jongchan Lee[4], Kwanjoong Kim[5], Gil-Cheol Park[6], and Byunggi Kim[2]
[1]Information &Media Technology Institute, Soongsil University
[2]Department of Computer, Soongsil University
[3]School of Information Engineering, Mokpo National University
[4]Department of Computer Information, Kunsan National University
[5]Department of Computer and Information, Hanseo University
[6]Department of Multimedia Engineering, Hannam University
e-mail : lub@archi.ssu.ac.kr

Abstract B3G (Beyond Third Generation) network consists of access networks to provide heterogeneous network services for mobile users. In this paper, we propose a hierarchical policy-based architecture model and the policy procedures based on access networks connected with B3G networks. We also present a dynamic traffic management scheme which uses DiffServ mechanism and SLA for the management of end-to-end QoS in access networks. At the end of this paper, we will analyze the performance of the proposed schemes through computer simulation.

Keyword: Multicast, Handover, HMIP, MAP, AR

1. Introduction

B3G network means a linked network system that is able to use not only each B3G access network's services but also other heterogeneous B3G access network services by structuring a unified convergence network [1][2]. Through these convergence networks, mobile users can use a variety of heterogeneous network services as well as existing network services. The research for B3G network is currently being progressed actively, but it is still at the beginning stage in which network connection models in some parts are just suggested. The prior considerations for the B3G networks are QoS guarantee for transmission services and service support schemes for the guarantee. The noticeable point of the QoS guarantee for the transmission services is that IP transmission techniques are used for network services [13]. Nowadays, mobile users require more various and more customized network services, so data application services such as Web, E-mail, or FTP are being extended over diverse multimedia services, which include Voice over IP, Video Phone services, Video/Audio Streaming services, and so forth. To provide stable and reliable support for B3G networks, therefore, end-to-end QoS mechanisms should be supported [3]. The research for the convergence network construction of heterogeneous B3G access network is made progress by applying policy-based structure, and three kinds of convergence network models are suggested. However, the suggested models don't place priority to the QoS management structure through policy agreement procedures among heterogeneous B3G access networks. They also don't consider any scheme for traffic control in network [8]. Two approaches, IntServ and DiffServ, have been proposed at IETF (Internet Engineering Task Force), one of the international internet standardization organizations, to provide end-to-end QoS support for existing IP traffic services [5]. IntServ has a limitation on expendability of service usage because it allocates resources for each user session based on RSVP (Resource Reservation Protocol). To solve this problem, DiffServ method, which provides services not through each session but through control for sets of service sessions, was proposed. On the other hand, as a service support method for end-to-end QoS guarantee, IETF suggested SLA (Service Level Agreement) method, which receives IP services through the agreement between service providers and service users. If SLA is entered into an agreement between service providers and service users, then SLS (Service Level Specification) is decided to provide SLA based services [9]. SLA is a descriptive parameter related to end-to-end QoS support for network services, therefore, a user can get a corresponding service based on the parameter. CADENUS and TEQUILA projects in Europe have actually applied the method that a user can use a service through SLA in a large IP network [4][6]. Consequently, SLA method should be considered for IP-based service support in B3G network, which is a heterogeneous network set.

In this paper, we propose a policy-based DiffServ QoS management structure referring PBMN (Policy-based Management Network), which is hierarchically structured to construct heterogeneous B3G access network convergence networks, and SLA, which is to control end-to-end QoS. Hierarchical PBMN means that PDP (Policy Decision Point) in core network controls lower PDPs by performing a role of controller through the communication with PDP in each B3G access networks to connect with other heterogeneous B3G access networks [10]. For this, we suggest total B3G network construction and control procedures. Policy-based DiffServ QoS management structure referring SLA is an approach that manages traffic classes by the policy definition information received from PDP of each B3G access network.

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It also distinguishes dynamically traffic classes by using the policy decision information of PDP, and refers a method that controls traffic classes by setting the critical values of output buffers. In this paper, we set two stages critical values. If the critical value of each stage is exceeded, the entrance into the output buffer for particular traffic class is limited, so the overload is reduced. Therefore, the services of higher traffic classes are guaranteed.

This paper consists of 5 sections. Section II describes the proposed policy-based DiffServ QoS management structure considering SLA and the communication model. Section III shows the policy-based DiffServ QoS control mechanism. Section IV explains the simulation environment and the performance evaluation of the proposed method, and Section V describes our conclusion.

2. Policy-based DiffServ QoS management

In this section, we describe the structure of our policy-based DiffServ QoS management structure, the relation among each network components, and policy control procedures to manage remote resources in B3G heterogeneous networks and to guarantee end-to-end QoS for each B3G access network users.

2.1 Policy-based DiffServ QoS management structure

For end-to-end QoS support to heterogeneous B3G access network and for effective traffic control between heterogeneous networks, we suggest DiffServ QoS management scheme considering hierarchical policy-based QoS management scheme, resource status of each B3G access network, and SLA of subscribers [5]. Figure 1 shows the layout and components of proposed policy-based DiffServ QoS management structure considering SLA. As you can see in Figure 1, core network is the center of the structure, and B3G access networks are linked together through GER (Global Edge Router). LER (Local Edge Router) links a domain of B3G access network to another. Core network and each B3G access network consist of PDP (Policy Decision Point), PEP (Policy Enforcement Point), and PR (Policy Repository) to provide policy-based QoS management [10]. PDP decides the operation policy of each network by approaching PR of each network, and transfers it to PEP so that traffics can be controlled by the decided policy. PDP collects network resource status and information, which is necessary for policy decision, analyzes the collected information and policy information of PR, decides the execution, and performs the policy control. Information transmission for the policy control between PDP and PEP uses COPS (Common Open Policy Service) proposed at IETF [11]. COPS, a TCP/IP-based request/reply protocol, is designed to support a variety of clients without protocol change, and provides message-dimensioned secure for authentication and message integrity. SLA-DB is a database system that stores SLA between B3G access network providers and subscribers and performs information storage functions such as detail information for service usage between network providers and subscribers, authentication of subscribers, or service charges. If a B3G access network user asks connection service or particular service, PDP deduces user-level SLS considering network resource status and the subscriber's SLA by approaching SLA-DB and PR, and transmits it to the subscriber to create traffic based on SLS limited by PDP. Figure 2 describes the relation between SLS, which is assigned between B3G access network providers and users, and SLS [9]. SLS is a detail parameter used for end-to-end support of subscribers, and its priority can be different with the parameters used in each heterogeneous access network.

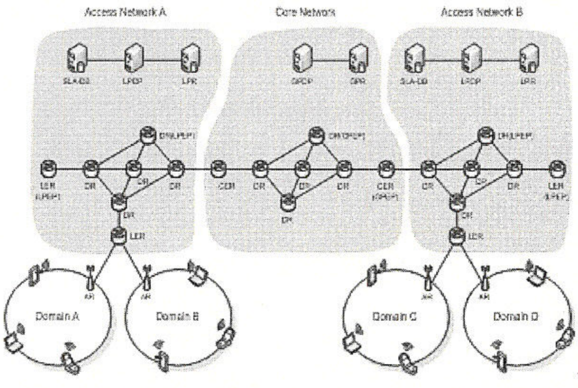


Fig. 1. Policy-based DiffServ QoS management structure considering SLA

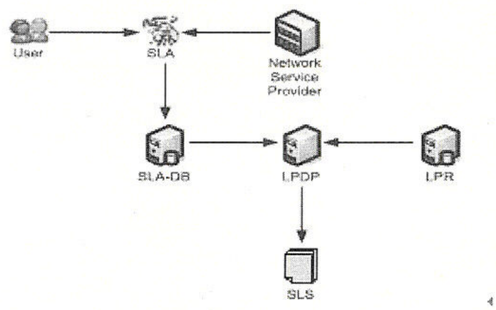


Fig. 2. Relation between SLA and SLS in the proposed structure

Therefore, to communicate between heterogeneous B3G access networks, a function which can changes SLS parameter to be suitable for each B3G access network is necessary. This function is performed by SLST (SLS Translator) included in GPDP of core network. GER of core network is a gateway for traffic entering to core network, and performs its functions as an interface between core network and each B3G access network. GER is an edge router of DiffServ, and includes packet tunneling and header change function for communication between heterogeneous networks. Edge routers of core network and each B3G access network classifies traffics into traffic class based on policy decision information which is received from their PDPs, and then the routers perform DSCP field marking of IP header. On the other hand, DR (DiffServ Router) is designed to refer policy decision information and DSCP field and to perform PHB (Per Hop Behavior) for the traffic control by DiffServ mechanism. In the structure proposed by this paper, core network and each access networks include PDP, PEP, and PR. That is, each network has policy and all rules for policy decision making which are necessary for operation and management of network services, and it means that independent operation at each network can be guaranteed without consideration of other network's situation. Additionally, end-to-end QoS is guaranteed and the procedures necessary for policy information exchange or negotiation are able to be simplified when core network's GPDP performs its role as a medium in a heterogeneous

B3G access network communication, so traffic is created by considering the characteristics and status of corresponding access network. In conclusion, our proposed structure in this paper can guarantee the extendibility and the independence of each B3G access network in heterogeneous B3G convergence networks.

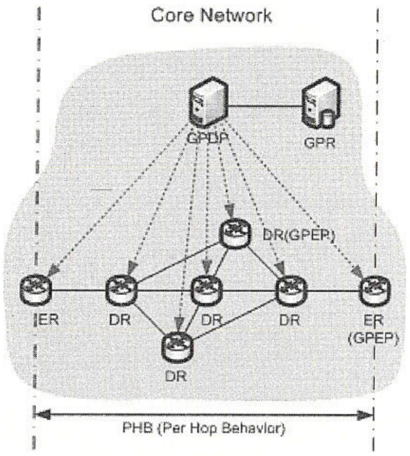


Fig. 3. Core networks

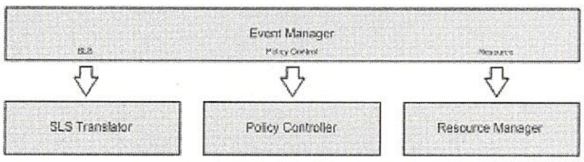


Fig. 4. Functional components of GPDP

2.2 Detail structure of each network and policy control procedures

Core network is an intermediate network organized for communication between heterogeneous B3G access networks, stores the policy used in each access network, and is designed to perform a medium role when a mobile user of another access network requests a network service. For this, core network's GPDP creates policy decision information based on the policy of core network, transfers it to GPEP to control traffics by corresponding policy decision information, and stores it in GPR (Global Policy Repository) to provide the policy information whenever each access network asks the information. The construction of core network, the relation between GPDP and GPEP, and the structure for traffic control are shown in Figure 3. Core network consists of GPDP, GPR, ER, and DR. ER and DR perform the role of GPEP (Global Policy Enforcement Point) [7][8]. In case that GPDP receives policy request message or policy control is necessary, GPDP receives information necessary for policy decision from GPR and creates the policy decision information. Then GPDP transmits the information to GPEP after translation of its form to be performed in GPEP. GPDP also perform SLS derivation function for communication support between heterogeneous B3G access networks. Figure 4 represents the functional components of GPDP, and the function of each component is shown below.

- Event Manager receives events from GPEP or LPDP of B3G access network, analyzes it, performs scheduling for that, and delivers the information to lower-level components.

- SLS Translator performs the function that deduces SLS of mobile users for interactive link with another heterogeneous access network.

- Policy Controller decides whether the policy control is performed or not. Policy Controller also perform the function that manages policy of each B3G access network.

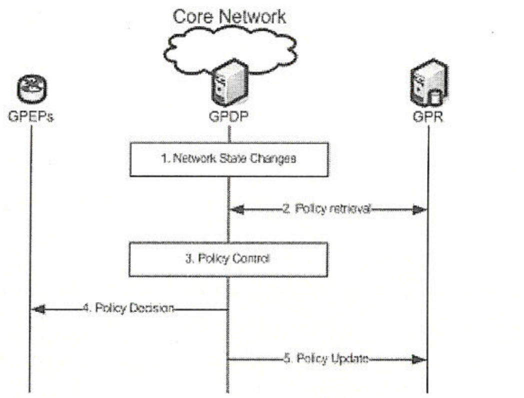


Fig. 5. Policy control procedure of core networks

When it performs policy control, it receives information related to policy decision from GPR and Resource Manager and creates policy decision information based on the received information. The created information is stored in GPR, and is translated to available form to be performed in GPEP.

- Resource Manager collects and analyzes the received information from GPEP, which is related to resources. If the analyzed result shows that policy control is needed, Resource Manager transmits policy control request message to Event Manager.

GPR is an independent database that stores data related to rules for reusable policy components, conditions/actions, and policy control. GPR stores recent policy data applied for B3G access network connected with core network. GPR also performs the role that provides information for policy control by answering for questions of GPDP.

GER, which performs the function of GPEP, and DR of core network control traffics by DiffServ mechanism based on the received policy decision information from GPDP. GER provides tunneling services for traffics that are transmitted through core network if it is necessary, and performs IP header exchange translation to distinguish traffics into traffic class based on policy decision information received from GPDP. In addition, if the traffic is not satisfied the traffic profile, GER also exchanges DSCP field marking or performs traffic deletion function by the policy of GPDP to deliver B3G access network traffics to destination smoothly. DR of core network constructs output buffers based on policy decision information received from GPDP, and the construction depends on DSCP field of traffic. DR also performs PHB of DiffServ mechanism and manages traffic dynamically depending on the policy decision information by classification that divides AF (Assured Forwarding) traffic class into AF1, AF2, AF3, and AF4. In core network, when GPDP requests information necessary for policy decision to GPR, decides the policy by using the information, and sends it to GPEP, message transmission procedure is shown in Figure 5.

- If GPDP detects resource status change of core network by resource status information received from GPEP or receives policy control request from GPEP, GPDP decides whether policy control is proceeded or not.
- GPDP requests information of rules for policy components, conditions, and actions. GPR replies to the request by searching corresponding information.
- GPDP decides whether the current policy should be updated or not by using the information received from GPR.

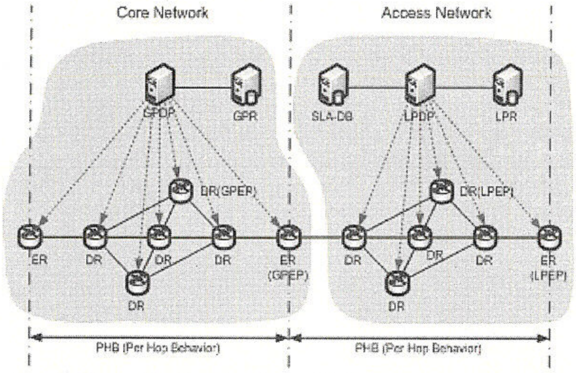


Fig. 6. Hierarchical policy-based QoS management structure

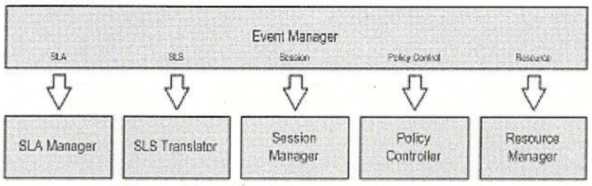


Fig. 7. Functional components of LPDP

If policy control is necessary, GPDP creates policy decision information and translates it to be performed in GPEP.

- GPDP transmits the policy decision information to GPEP which requests the policy control or a number of GPEPs.

- GPDP sends updated policy decision information to GPR to save it.

GPDP of core network must creates traffics, which is delivered through GER to guarantee end-to-end QoS of heterogeneous access networks, to be suitable for the resource status or the policy of B3G access networks. For this, GPDP should receive regularly information of resource status and policy from LPDP, and save it in GPR. If LPDP of B3G access networks requests policy control and SLS derivation, then GPDP replies to the request by using the corresponding information. Figure 6 describes the structure of core network and B3G access network constructed hierarchically. Core network and B3G access network are structured hierarchically by forming the boundary of GER. LPDP of B3G access network performs similar function with GPDP of core network, but there are some additional functions. LPDP should transmit periodically information related to resource status or policy control to GPDP of core network to provide information for communication between heterogeneous B3G access networks. LPDP also should manage SLA for mobile users of B3G access networks, and perform the function that provides SLA of mobile users depending on the GPDP's request. Moreover, LPDP should reply to connection requests or service requests from mobile terminals and control dynamically mobile user traffics by the policy set based on resource status. To perform these functions, LPDP consists of six components, Event Manager, SLA Manager, SLS Translator, Session Manager, Policy Controller, and Resource Manager, as shown in Figure 7. Event Manager, Resource Manager, SLS Translator, and Policy Controller of LPDP perform the same function of GPDP's components, and additionally provide policy information and resource information to GPDP.

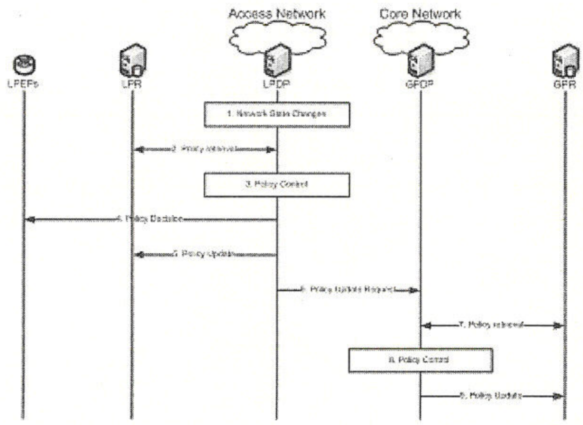


Fig. 8. Policy control procedure of LPDP

SLA Manager carries out control function for service requests by the SLA of mobile users, and executes SLA verification or update function depending on the change of service charge or SLA by approaching SLA-DB. Session Manager manages connection request or connection status of mobile terminals, and resets or updates the connection of mobile terminals by depending on the policy decision information received from LPDP or resource status. Figure 8 represents the policy control procedure when the policy control is performed depending on the resource status or LPDP of B3G access network receives policy control request.

- If LPDP detects the resource status change of access network or receives the policy control request from LPEP, then LPDP decides whether the policy control will be perform.

- LPDP requests rules for policy components, conditions, and information for actions, and LPR replies to the request by searching the corresponding information.

- LPDP decides whether current policy needs update by using the received information. If policy control is needed to change, LPDP creates policy decision information and translates it to be performed in LPEP.

- LPDP transmits the policy decision information to LPEP, which sent the request, or a number of LPEPs, which should applies the decided policy.

- LPDP transmits updated policy decision information to LPR to be saved.

- LPDP requests the policy information update by transmitting policy decision information to GPDP of core network.

- GPDP updates previous policy information by transmitting policy decision information received from LPR, and requests information necessary for policy change of core network depending on the policy change of LPDP.

- GPDP performs policy control of core network if it is necessary by using the policy decision information received from LPDP and the information received from GPR.

- GPDP transmits the updated policy decision information to GPR to be saved.

B3G access network is connected with domains that provide particular area services through LER, and receives mobile user traffics through AR (Access Router). AR is a component that performs AP (Access Point) or BS (Base Station) functions. AR provides physical interface with mobile terminals and delivers mobile user traffics to LER. Figure 9 shows the construction of B3G access network and the relation with domain.

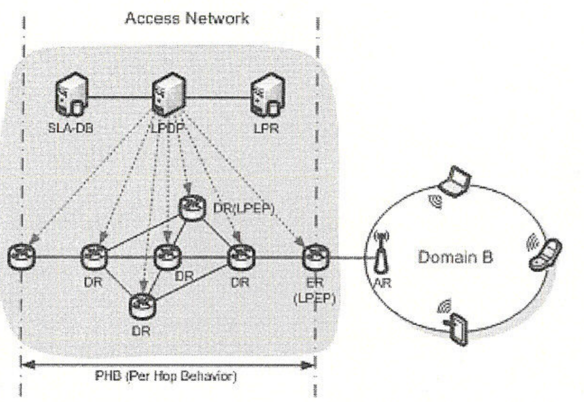


Fig. 9. Construction of B3G access network and service domain

In this paper, we propose the method that decides SLS based on SLA of LPDP and transmits service traffics for B3G access network users. For this, mobile terminals should perform subscriber authentication by communication with LPDP if connection is requested, and receive SLS that is available based on SLA. If LPDP receives connection request from a mobile terminal, LPDP requests SLA information of the subscriber. LPDP also deduce SLS for the mobile user by using the resource status of Resource Manager and the policy information which is currently being applied. SLS is transferred to the mobile terminal. If SLS of a mobile user should be changed depending on the resource status or policy change, new SLS is created by the SLS deduction procedure and is sent to the mobile terminal. (a) of Figure 10 represents message transmission procedure depending on the connection request of a mobile terminal, and (b) shows the message transmission procedure depending on the resource or policy change.

a. If LPDP receives connection request from a mobile terminal, LPDP performs mobile subscriber authentication. If there is policy change by resource status change, LPDP selects mobile users whose SLS should be changed.
b. LPDP requests information of rules for policy components, conditions, and actions to LPR, and LPR replies to the request by searching the corresponding information.
c. LPDP searches SLA of mobile users by approaching to SLA-DB.
d. LPDP deduces SLS by using the received policy components, resource status, and subscribers' SLAs.
e. LPDP transmits the deduced SLS to the mobile terminal.

PEPs of Core network and B3G access networks proposed structure in this paper don't store the status information of mobile terminals. It's an advantage because PEP's overhead for traffic control of mobile terminals can be reduced and mobile user traffic can be controlled by its policy.

3. Policy-based DiffServ QoS control scheme

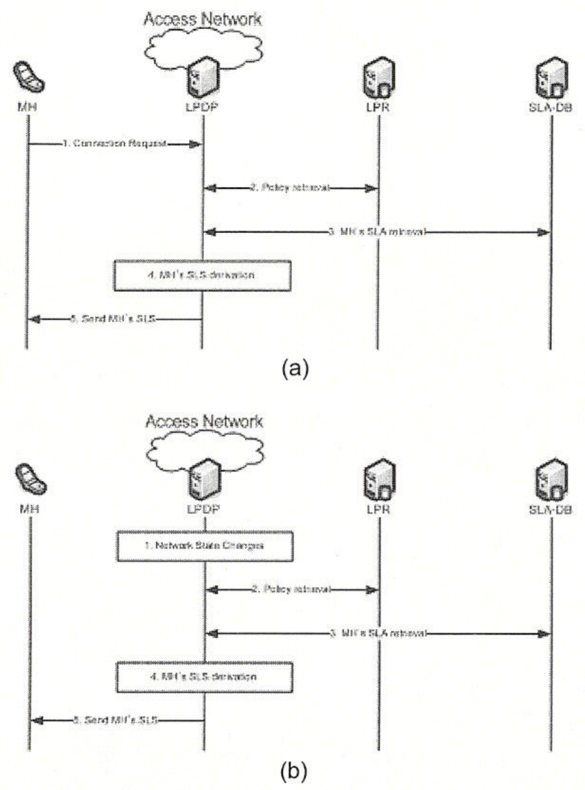


Fig. 10. SLS control procedure of mobile terminals

In this section, we describe the function of ER and DR, which are applied policy-based DiffServ QoS control scheme proposed in this paper to manage dynamic QoS, and the structure for traffic control. Dynamic QoS management means that if traffic overload is increased by bust traffic transmission, ER and DR manage traffic class dynamically to provide services to higher-level class prior to lower-level class by changing traffic class level. For this traffics transmitted to mobile terminals are divided into six traffic classes; EF (Expedited Forwarding), AF (AF1, AF2, AF3, AF4), and BE (Best Effort). In this paper we suggest a dynamic traffic control scheme through the traffic reset method or scheduling weight adjustment by network resource management policy. If a traffic transmitted from a mobile terminal has arrived to ER, then ER classifies the traffic depending on the policy decision information received from PDP, and transmits the information to DR. DR constructs output buffer using received traffic by CBWFQ (Class Based Weighted Fair Queue) and PQ (Priority Queue) depending on the network resource management scheme, and performs PHB [12].

3.1. Function and structure of ER

Figure 11 shows the detail structure of ER in policy-based DiffServ QoS management structure proposed in this paper. ER consists of four components; Classifier, Meter, Marker, and Policy Controller. Policy controller stores policy decision information received from PDP, and creates Filtering Rule, Traffic Profile, and Marking Rule for function accomplishment of Classifier, Meter, and Marker, and also creates threshold value for output buffer management. Table 1 describes parameters created by Policy Controller in ER for each component in detail. Classifier applies Filtering Rule of Policy Controller to classify traffics into three traffic classes, EF, AF, and BE, and delivers the information to Meter. Traffics classified into each traffic class are measured by traffic profile measurement.

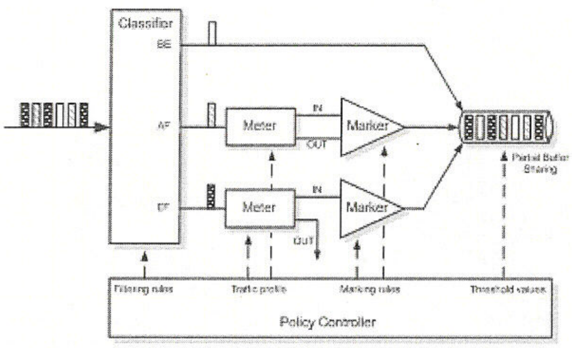


Fig. 11. Structure of policy-based ER

Table 1. Detail functions of Policy Controller in ER

Parameter	Detail content
Filtering Rule	Criteria that classifies traffics arrived to ER into traffic classes
Traffic Profile	Characteristics of traffic allowed in each traffic class
Marking Rule	Marking criteria using the metering result
Threshold Value	L1, L2 Weights for construction of output buffer

After that, Marker performs DSCP marking by applying Marking Rule depending on the metering result. If traffics classified into EF class by Classifier satisfy the traffic profile, then Marker performs marking. Otherwise Marker abandons corresponding traffic. If traffics classified into AF class can't satisfy the traffic profile, Marker doesn't perform marking, and change the traffic to BE traffic class. If the traffic profile is satisfied, Marker divides the metering result into AF1, AF2, AF3, and AF4 by Marking Rule. In case of BE class, the control of metering or marking is not performed. Output buffer uses PSE (Partial Buffer Sharing) method to provide services dynamically by referring traffic priority and overload classified by DiffServ mechanism. Output buffer applies L1, L2 weights provided by Policy Controller. If it is over the weights, particular traffic class is only queued in output buffer, and other traffic classes are abandoned.

As you can see in Figure 12, all traffic classes are allowed to be queued in buffer before the L1 weight, but EF and AF classes are only queued and other traffic classes are all abandoned if it is over of L1 weight.

If it is over beyond the L2 weight, only EF class is queued, and other traffic classes are all abandoned. As we apply PSB method, the overload of ER and DR by the continuous increase of traffics transmitted from mobile terminals can be reduced, and the service rate of higher-level traffic class can be guaranteed by providing traffic services depending on the priority of traffic classes.

If lower-level traffic class is continuously abandoned because of the continuous overcrowding from mobile terminals, ER requests policy control to PDP to manage QoS dynamically. Then PDP classifies lower-level traffic class as higher-level by changing Filtering Rule and Traffic Profile.

3.2. Function and structure of DiffServ Router

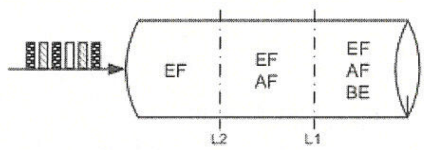


Fig. 12. Partial buffer sharing

Figure 13 describes the structure of DiffServ Router.

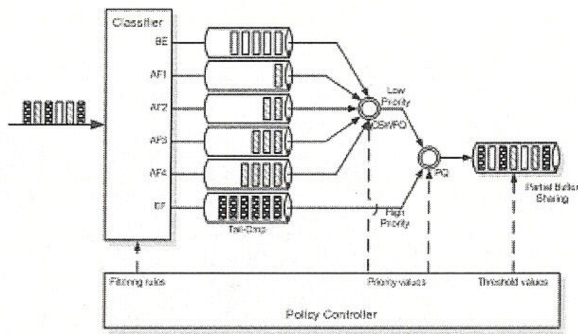


Fig. 13. Structure of policy-based DR

Table 2. Detail functions performed by Policy Controller of DR.

Parameter	Detail function
Filtering Rule	Criteria queuing up traffics arrived at DR in traffic class buffer
Priority Value	Priority information applied at CBWFQ and PQ
Threshold Value	L1, L2 weights for output buffer construction

DiffServ Router consists of four components; Classifier, CBWFQ, PQ, and Policy Controller. Policy Controller accomplishes the function that saves policy decision information received from PDP, and creates Filtering Rule for function accomplish of Classifier, CBWFQ, and PQ components, Priority Values, and Threshold Values for output buffer management. The parameters created for each component by Policy Controller are shown in Table 2. Classifier refers DSCP field of traffics and then delivers it to each class buffer. At that time, Filtering Rule of Policy Controller makes it possible to deliver the information to higher- or lower-level traffic class buffer without DSCP field change for particular traffic class. It's for dynamic traffic control in case that some traffics passing through particular area have a bottle-neck syndrome, or service rate of higher-level class should be increased. Traffics delivered to each traffic class buffer are queued up in output buffer by CBWFQ and PQ based on the priority information provided from Policy Controller. By applying CBWFQ and PQ in the proposed structure in this paper, traffic services can be increased by the traffic class priority of mobile terminal traffics and QoS of mobile users can be guaranteed. EF class is designed to be scheduled by PQ without passing CBWFQ, AF and BE classes are designed to be scheduled by CBWFQ and PQ considering priority information.

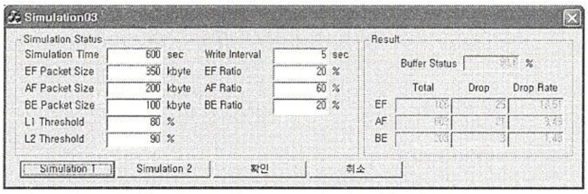


Fig. 14. Simulation program

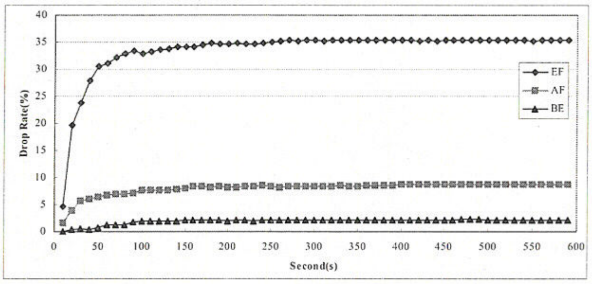


Fig. 15. Drop rates depending on the traffic classes

EF class has the lowest disposal rate, and AF has the priority levels and much lower disposal rates in this order: AF1, AF2, AF3, and AF4. BF has the lowest priority level and the highest disposal rate. If the threshold value applied PSB method used at ER is over the L1 or L2 weight, the lower-level traffic classes are abandoned. In case of continuous disposal of particular traffic class, dynamic QoS can be managed by requesting policy control to PDP.

4. Simulation and performance analysis

In this section, we will analyze the simulation environment and parameters for traffic control algorithm in our policy-based DiffServ QoS management structure, and the performance in case that this proposed algorithm is applied.

ER distinguishes traffic classes provided to mobile users into three classes; EF, AF, and BE. AF is divided into AF1, AF2, and AF3, so ER transmits these six traffic classes to DR. We produced 100 traffics per every second to evaluate the performance of proposed ER. The traffics consist of EF class 20%, AF class 60%, and BE class 20%. As you can see in Figure 14, the packet sizes of each traffic class are supposed as EF 350KB, AF 200KB, and BE 100KB. ER can process traffics in speed of 20MB/sec, and we measured the disposal rates (%) of each traffic class for 10 minutes by 5% overcrowding the transmitted traffics per every second.

Figure 15 describes the disposal rates of each traffic class in case of traffic overcrowding if the proposed structure is not applied. In the result of Figure 15, we can see that about 3% traffics of BC class is abandoned, but about 35% traffics of EF class and 9% traffics of AF class are abandoned. We analyzed and concluded that EF and AF class traffics, which have much bigger packet size than BE class's, couldn't enter to buffer because of traffic overcrowding, and increased the service lowering by being abandoned.

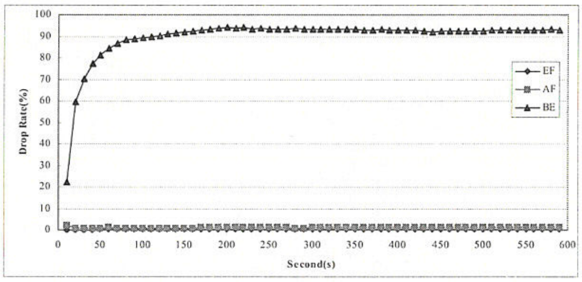
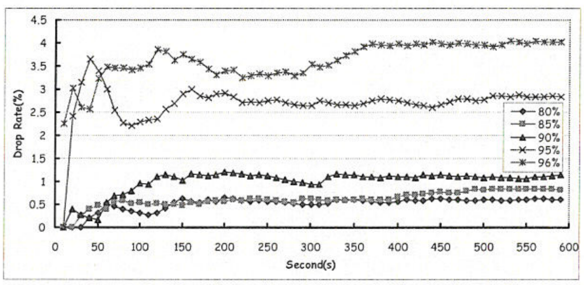
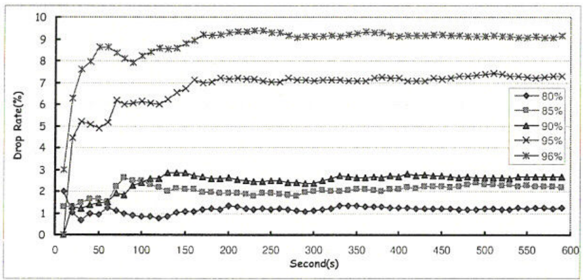


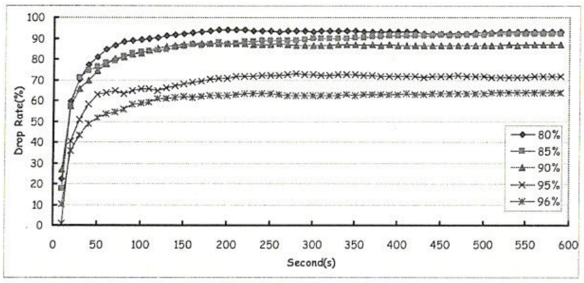
Fig. 16. Drop rates per traffic classes in case that L1 weight is set as 80%



(a) EF traffic class



(b) AF traffic class



(c) BE traffic class

Fig. 17. Drop rates of each traffic class depending on L1 weight setting

Figure 16 shows the result of simulation in which the proposed structure is applied but the situation is same with Figure 15. When we set L1 weight as 80%, the figure shows disposal rates of each traffic class. As you can see in the figure, the result shows that the disposal rate of BE class which doesn't guarantee its service rate is increased from 3% to 90%. We also can see that the disposal rates of EF and AF classes which guarantee their service rates are seriously increased from 3.5% and 9% to 0.6% and 1.2%. Through the Figures 15 and 16, we could sure the fact that our B3G convergence model and traffic control structure have effective performance for the service lowering caused by traffic overcrowding. Additionally, if policy control is requested because of continuous BE class disposal shown in Figure 16, ER or DR can manages traffics dynamically through the weight resetting by requesting policy control to PDP.

Figure 17 shows the change of disposal rates of each traffic class when we simulated depending on L1 weight change in the proposed method in this paper. When L1 weight is set as 96%, we can see that the disposal rate of BE traffic class is kept at 60% as you can see in Figure 17 (c), while the disposal rates of EF and AF classes are kept at 4% and 9% as you can see in Figure 17 (a) and (b). Weight management of output buffer is an important element for traffic control, and it should be managed dynamically through continuous monitoring. Consistence rate in each class of produced traffics and average size of packet are also important elements to have influence directly on the disposal rate and service rate. These elements are provided resource status information from ER and DR, which performs the role of PEP, to PDP. PDP manages traffics dynamically by the policy decision information referring corresponding information, and provides end-to-end QoS.

5. Conclusions

B3G network is a convergence network that provides heterogeneous B3G access network services as a form of service to mobile users of each B3G access network. To construct this B3G network, a number of researches are proceeding in the world. However, it is still in the beginning stage and is for the partial work for heterogeneous access networks. This paper doesn't suggest a model for the linkage of particular access network. This paper suggests a model using hierarchical policy-based structure by generalizing access network structure which will be linked with B3G network, message transmission procedures for policy control, and dynamic buffer management method for traffic control in network components.

If hierarchical policy-based structure and dynamic buffer management method proposed in this paper are applied for B3G access networks, then we expect that network extendibility, end-to-end QoS management between heterogeneous access networks, and management independence of each B3G access network can be guaranteed. In addition, we regard it as a proper model for B3G network construction by providing dynamic traffic services through policy-based DiffServ QoS control method which considers SLA, and by reducing service delay and network overload caused by traffic overcrowding.

References

[1] Mario Munoz et, al., "A New Model for Service and Application Convergence in B3G/4G Networks," IEEE Wireless Communication, vol.11, no.5, pp.6-12, Oct. 2004.

[2] Christos Politis et, al., "Cooperative Networks for the Future Wireless World," IEEE Communications Magazine, vol.42, no.9, pp.70-79, Sep. 2004.

[3] Michael L. Needham and Nat Natarajan, "QoS in B3G Networks – an Overview," In Proc. of ICCT'03, pp.1369-1372, April, 2003.

[4] Eleni Mykoniati et, al., "Admission Control for Providing QoS in Diffserv IP Networks: The TEQUILA Approach," IEEE Communications Magazine, vol.41, no.1, pp.38-44, Jan. 2003.

[5] S. Blake et. A., "An Architecture for Differentiated Service," IETF RFC 2475, Dec. 1998.

[6] Giovanni Cortese et, al., "CADENUS: Creation and Deployment of End-User Services in Premium IP Networks," IEEE Communications Magazine, vol.41, no.1, pp.54-60, Jan. 2003.

[7] Wei Zhuang et, al., "Policy-Based QoS Architecture in the IP Multimedia Subsystem of UMTS," IEEE Network, vol.17, no.3, pp.51-57, May/June, 2003.

[8] Wei Zhuang et, al., "Policy-Based QoS Management Architecture in an Integrated UMTS and WLAN Environment," IEEE Communications Magazine, vol.41, no.11, pp.118-125, Nov. 2003.

[9] Emmanuel Marilly et, al., "Service Level Agreements: A Main Challenge for Next Generation Networks," In Proc. of IEEE ECUMN'02, pp.297-304, April, 2002.

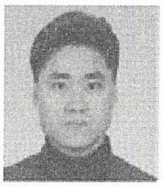
[10] R. Yavakar et, al., "A Framework for Policy-based Admission Control," RFC2735, Jan. 2003.

[11] K. Chan et, al., "COPS Usage for Policy Provisioning," RFC 3084, March, 2001.

[12] Antonio Garcia-Macias et, al., "Quality of Service and Mobility for the Wireless Internet," Wireless Networks, vol.9, Issue 4, pp.341-352, July, 2003.

[13] Mahbubul et, al., "Quality of Service among IP-based Heterogeneous Networks," IEEE Personal Communications, vol. 8, no.6, pp.18-24, Dec, 2001.

Authors



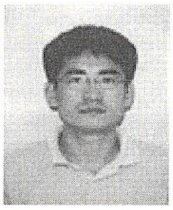
Sangjoon Park

Received the M.S., and Ph.D. degrees in computer science from Soongsil University, Korea, in 1998 and 2002, respectively.From December 2000 to May 2002, he was a research engineer in Korea Information Security Agency. From September 2002 to August 2003, he was a visiting postdoctoral research fellow at the Information Security Group (ISG), Royal Holloway the University of London. Since September 2003, he has been a senior research staff in the Information & Media Technology Institute at Soongsil University. His research interests include Multicast, B3G networks, mobile IP and ubiquitous digital broadcasting.

Hyunjoo Mun

Received the M.S. in computer science from Soongsil University, Korea, in 1993. She is working toward the Ph.D. degree in computer science at Soongsil University. Her research interests include Multicast, system software and ubiquitous sensor networks.

Jongmyung Choi received the M.S., and PhD degrees in Computer Science from Soongsil University, Korea, in 1992, 1996, and 2003. He is currently a Assistant Professor in the School of Information Engineering, Mokpo National University, Korea. His research interests are the Multi-Paradigm Programming, XML processing, and Ubiquitous Computing.

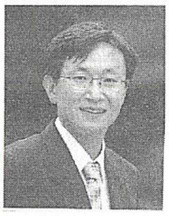


Jongchan Lee

Received the M.S., and Ph.D. degrees in computer science from Soongsil University, Korea, in 1996 and 2000, respectively. From July 2000 to June 2005, he was a senior member of engineering staff in Mobile Telecommunications Research Lab at Electronics and Telecommunications Research Institute (ETRI). He is currently an Assistant Professor in Department of Computer Information at Kunsan National University. His research interests include Mobile IP, B3G networks and sensor networks.

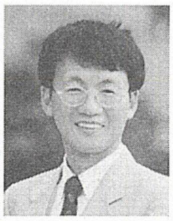
Kwanjoong Kim

Received the M.S., and Ph.D. degrees in computer science from Soongsil University, Korea, in 1988 and 1998, respectively. He is currently an Associate Professor in Department of Computer and Information at Hanseo University. His research interests include Multicast mobile network, computer architecture, B3G networks and sensor networks.



Gil-Cheol Park

Received M.S In computer science in SoongSil University in1983. and receiver Ph.D in Information Engineering from SungKunKwan University, Korea, in1998, respectively. He is currently an Professor in Department of Multimedia Engineering at Hannam University. He research interests include multimedia and mobile communication, network security.



Byunggi Kim

Received M.S., and Ph.D. degrees in Electronic Engineering from the Korea Advanced Institute of Science and Technology, Korea, in 1979 and 1997, respectively. He is currently a Professor at School of Computing, Soongsil University. His research interests include computer simulation, wireless networks, mobile IP protocol and ubiquitous broadcasting.