Improving QoS using Cellular-IP/PRC in Hospital Wireless Network

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요 약

병원 무선망에서 호 수락 방식과 보다 적은 범위 셀 환경에서 QoS를 보장하기 위해 통합된 페이징과 루프 정보 관리 캐시를 사용하는 Cellular IP 특성을 가진 Cellular-IP/PRC 네트워크를 제안한다. 제안한 호 수락 방식은, 이동 노드의 홈 기지국 용량이 충분하고, 인접 셀 이동 노드가 홈 기지국에서 호가 수락되었다고 가정할 경우 받을 간섭의 증가량을 고려해 통화 품질이 보장될 때, 홈 기지국은 새로운 호를 이동 노드의 송신 전력 예측에 기반을 둔 호 수락 방식이다. 병원 무선망 내의 페이징과 라우터를 관리하기 위해 사용되었던 PC(Paging Cache)와 RC(Routing Cache)를 하나의 PRC(Paging Router Cache)로 통합 관리하고, 모든 노드 내에 구성하여 운용토록 하고, 이동 노드의 핸드오프 및 로밍 상태를 효율적으로 관리 할 수 있도록 이동 노드에 핸드오프 상태 머신을 추가하며, 노드에서 관련 기능을 수행하도록 연구한다.

시스템 환경에서 통화량에 영향을 주는 인자를 분석하고 각 링크 통화권 및 불균형 정도를 예측하여, 하향링크에 의해 통화권이 제한되었는지를 판단하여 호를 수락 또는 차단하는 알고리즘 이용 총 송수신 전력을 기반으로 제안한 알고리즘을 응용해서 QoS에서 가장 밀접하고 중요한 호 차단 확률과 호 탈락 확률, GoS(Grade of Service), 셀 용량의 효율을 예측 처리하여 QoS 성능 개선을 나타낸다.

ABSTRACT

In this paper, we propose for improving QoS in hospital wireless network using Cellular-IP/PRC(Paging Route Cache) with Paging Cache and Route Cache in Cellular-IP. Although the Cellular-IP/PRC technology is devised for mobile internet communication, it has its vulnerability in frequent handoff environment. This handoff state machine using differentiated handoff improves quality of services in Cellular-IP/PRC. Suggested algorithm shows better performance than existing technology in wireless mobile internet communication environment. When speech quality is secured considering increment of interference to receive in case of suppose that proposed acceptance method grooves base radio station capacity of transfer node is plenty, and most of contiguity cell transfer node was accepted at groove base radio station with a blow, groove base radio station new trench lake acceptance method based on transmission of a message electric power estimate of transfer node be. Do it so that may apply composing PC(Paging Cache) and RC(Routing Cache) that was used to manage paging and router in radio Internet network in integral management and all nodes as one PRC(Paging Router Cache), and add hand off state machine in transfer node so that can manage hand off of transfer node and Roaming state efficiently, and studies so that achieve connection function at node. Analyze benevolent person who influence on telephone traffic in system environment and forecasts each link currency rank and imbalance degree, forecast most close and important lake interception probability and lake falling off probability, GoS(Grade of Service), efficiency of cell capacity in QoS because applies algorithm proposing based on algorithm use gun send-receive electric power that judge by looking downward link whether currency book was limited and accepts or intercept lake and handles and displays QoS performance improvement.

Keywords

Cellular-IP, PC, RC, PRC, QoS, GoS, Hospital Wireless Network

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접수일자 : 2006. 10. 6

심사완료일자 : 2006. 11. 13

Ⅰ. Introduction

So that radio Internet transfer does height white heart's dream and connection focusing in various Internet service application technical development study. Approach on the Internet regardless of existence and nonexistence subscribe gill net using various terminal equipment and heights of several kind of application service need existence and nonexistence integration net of structure that can take advantage of family expense resource of existent wire authentication net, transfer authentication net, Internet, CATV net etc. maximum, and meet on subscriber request accommodating development and integration of service by technological progress effectively[1][2].

In this study, propose Cellular-IP/PRC network that use united paging and roof information administration kathy to guarantee QoS in such new lake acceptance mode and lesser extent cell environment and has Cellular IP special quality. And divide hand off state in state real-time, lock head time and traffic load is been less in network because QoS hand off action that become different according to these hand off state does as is attained, and node function condensation and simplification achieve paging function at all nodes at feasible solution and high speed paging of terminal does so that become real-time multimedia service.

Ⅱ. Hospital Wireless Network

2.1 Mobile IP Structure

Because must keep state that all computers always can communicate because subscriber terminals are connected to network in floating state Mobile IP method internet protocol in IETF Mobile IP recommendation RFC2002 refer to [3][4]. Keep communication with different nodes continuously even if change link that Mobile IP is joined on the Internet to transfer node in figure 1. It is Mobile IP which is mobility offer plan of doing IP base so that necessary ashes connection may occur automatically without existent nodes and interaction having IP protocol using Internet Protocol Address continuously[4][5][6].

Agent that transfer node information of Mobile IP base is registered is HA. Agent that move by other net leaving network with HA that transfer terminal registers own information and registers newly own position information is FA. Appeared by basic component groove network HA (Home Agent) of Mobile IP, bract scale network and FA (Foreign Agent), MN(Mobile Node) and CN(Correspondence Node)[7]. Because Mobile IP uses HA and FA, IP supports packet transmission between CN and transfer node. Packet transmission is made through tunneling between HA and FA [8]. It is method that make simulated tunnel between FA with HA and does so that pass data. HA has information for current position of transfer node after pass through registration process. HA is IP packet that grow to groove address of transfer node after [9]. '(Correspondent of Address) by purpose is being capsule ration(Encapsulation). Through such being capsule ration process HA sauce address and new packet that do CoA to destination Adrs create [9][10].

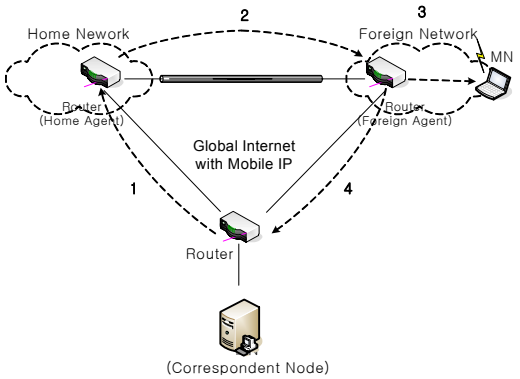

Fig. 1 Architecture of mobile IP

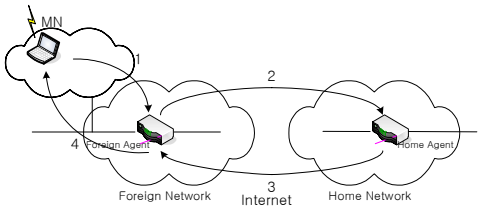

Fig. 2 Process of agent registration

2.2 Cellular IP Mobility

Cellular IP suggests effective access with local mobility administration for transfer base radio station. Cellular IP is transfer node that is consisted of sun network of form of local in urbane scale. It is protocol that is optimized so that frequent mobility administration who produce whole terminal mobility by hand off by protocol that form supplementing Cellular IP protocol function may be suitable to necessary radio access network. Cellular IP supports paging function or fast hand off function that do not offer from Mobile IP and passes packet based on IP protocol, and minimizes load which happen by signal and is kept to position information database information.

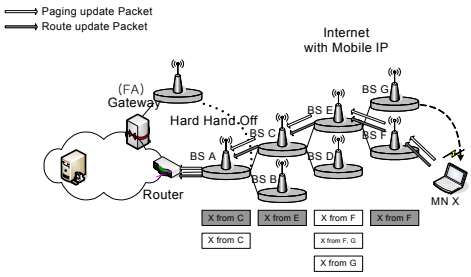

Fig. 3 Process of paging-update and route-update packet

Figure 3 shows update state of paging Cache when transfer node X moved from G cell to F cell. Paging packet to do Routing A from transfer node X that have been arrived recently via port that check its Cache and turns node C paging update packet find. Next, pass to all directions if A passes paging packet to C and C does not have some information for node. Paging packet that send by D is abolished automatically after time-out but because it knows that D is no node for own cell. On the other hand, E finds X that check its Cache and sends packet through F. Therefore, E passes paging packet to F and X. If transfer node receives paging packet, nodes that pass sending by router with paging update packet because create Routing update packet make Routing Caches form Mapping. When Routing update packets are carried on gateway, Routing Caches of all paths equip form, and normal packet transmission is achieved as temporary store packets are passed to transfer node on gateway.

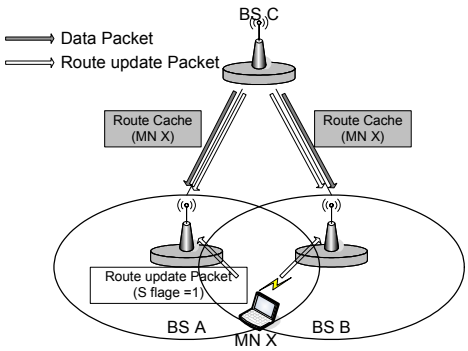

Fig. 4 Soft handoff of cellular-IP

Figure 4 sent ups to up-link establishing value of S flag of route update packet by 1 if arrive in the hand off point while transfer node exchanges and moves data packet from A cell to B cell by Cellular IP's soft hand off method. Base radio station in up-link records all base radio station informations about B to be belonged forward with A that transfer node belongs to route Cache and sends data to both base radio station. Data packet that send route update packet at base radio station ago if it is uplink because transfer node establishes value of S flag by 0 after transfer to new base radio station is not been coming to time-out after

given time and receives data packet from new base radio station. In so doing, transfer node can achieve fast and soft hand off receiving data packet without some damage or delay from all of the new base radio station and move base radio station hand off interval. If Cellular IP's soft hand off arrives in the new base radio station own data packet establish multiplex route by transmitting transmission and Routing update packet and accomplishes smooth hand off and cancellation is attained by Routing expiration sight by area secession of base radio station which path cancellation is receiving service present. Accomplish soft transmission by establishing multiplex route at current Cellular IP's soft hand off, but because do not terminate path, give strain to network with waste of system resource.

Ⅲ. Cellular-IP/PRC Handoff

In this paper, propose Cellular-IP/PRC to guarantee QoS in Cellular network. Cellular- IP/ PRC is doing based on Cellular IP environment to offer micro mobility, and added PRC and hand off state machine to guarantee QoS. Cellular- IP/ PRC is position mobility of transfer node in micro Cellular network as proposed succor to offer micro mobility. Cellular-IP/PRC hands off processing is fast and controls position transfer of transfer node rapidly and worms with existent Cellular IP network for macro mobility support.

Cellular - IP/PRC environment is consisted of Cellular IP network that one Cellular- IP/PRC gateway manages, and Cellular- IP/PRC gateway takes charge of role of FA in Cellular IP environment, and gateway or Cellular IP node is added to access network for mobility that Cellular-IP/PRC net supports Cellular IP. Transfer node in Cellular-IP/PRC has 3 state machine in hand off state with figure 5 except active state and idle. Action process in idle and active state is equal in Cellular-IP. But, transfer node transmits "Paging-Route-update packet" in cycle "Paging-Route-update time" about all of the active state and idle to supply Rauteu information in network in Cellular-IP/PRC. Also, when move position for transfer node of idle in case of hand off for transfer node of active state arises in hand off state, transmit in "Hand off-state-update time" cycle of short interval breeding as soon as move "Hand off - state packet" to supply relevant information.

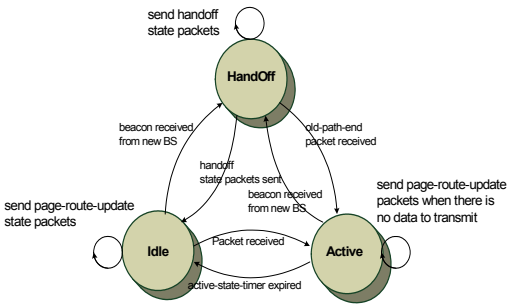

Fig. 5 Handoff state machine cache management state diagram

Ⅳ. QoS of Cellular-IP/PRC Hospital Network

When new moat was accepted at base radio station of cell K at QoS Routing algorithm, consider quantity of interference, and can appear with way(1) if endure and applies QoS_{IP} in a bibliography[10] in base radio station h_i.

$$QoS_{IP} = G \cdot \frac{P}{(M-1)vP + I_{other} + \Delta I} \geqq QoS_{PRC} \quad (1)$$

When there is no ΔI in denominator of right side of way(1) here, when new moat is not accepted, it must be $QoS_{IP} \geqq QoS_{PRC}$ to satisfy speech quality. By increment ΔI of interference by

that new transfer node x is accepted at cell k base radio station is added, expression(1) can become $QoS_{IP} \geqq QoS_{PRC}$. This time, cell h_i is lost subscriber's bunker among specification currency for busy many subscribers. Therefore, cell h_i's base radio stations must transmit signal(NOK_{h_i}) so that do not accept new moat to cell k base radio station so that occasion that lose such busy bunker may not occur. Therefore, lake acceptance control algorithm is as following because accept new moat of transfer node x though cell k base radio station be, and receives all OK_{h_i} signal from contiguity base radio stations composure enough to own QoS_{PRC} accepts new moat enough.

① It is base radio station Φ={1, 2, …K), and base radio station $k(k \in \Phi)$ and contiguity base radio station $h)i$ (I=1, 2, …l), ($h_i \in \Phi$, $l \leq K$) measure and update PRC periodically.

② Send a letter file Lot electric power century $z_{k,}$ z_{h_i} that receive from base radio stations moment transfer node x in base radio station k requires new trench by base radio station k.

③ Base radio station k supposes it when moat of transfer node x was accepted and calculates QoS_{PRC}..
This time, if it is $QoS_{IP} \leqq QoS_{PRC}[7dB]$, intercept new trench, or calculates transmission of a message estimate electric power P_t of transfer node, and transmits with z_{h_i} at contiguity base radio stations.

④ Contiguity base radio station h_i recasts whole QoS that calculate ΔI, and uses this to use transmission of a message estimate electric power P_I and z_{h_i} of transfer node x that receive.
This time, transmit by $QoS_{IP} \leqq QoS_{PRC}$ two faces NOK_{h_i}, or OK_{h_i} base radio station k.

⑤ Accept transfer node x if base radio station k receives all OK_{h_i} from contiguity base radio station h_i, otherwise intercept new trench.

Ⅴ. Simulation Result

Transmission cost Q_{PUP} of "Paging-update packet" appears with way(2) in Cellular- IP/PRC within access network for T time of 1 transfer nodes when transfer node is idle.

$$Q_{PUP} = \frac{S_{PUP} \times C_{PUP} \times T}{T_{PU}} \quad (2)$$

Here, C_{PUP} is number of farewell party of "Paging-renewal packet", and in size of "Route-update packet" and cycle of "Paging-update time" QoS improve. According to figure 6, the data packet amount decreases as number of transfer node increases from both Cellular IP and Cellular-IP/PRC. In case Cellular-IP and Cellular-IP /PRC are below 100 with base radio station or node within paging area in case of decrease being inverse proportion by same form, and are equal condition in case of transfer node increases, data packet amount in Cellular-IP/PRC was much smaller with simulation with Cellular-IP. m compares with Cellular IP because is seldom big preferably usually although if synthesize this, paging territory is consisted according to network topology effect from Cellular IP and is showing that CIP_{PRC} improves. Figure 7 displays ratio of node that have PC at whole node in access network that display control packet in network by transfer node change, and the control packet amount decreases

control packet rapidly than data packet as number of transfer node increases from both Cellular IP and Cellular-IP/PRC. Also, control packet decreases rapidly in Cellular-IP/PRC, but Cellular IP reduced similarly with the data packet amount. This result can know that control packet can increase sharply being proportional hereupon as idleness transfer node increases within network from Cellular IP.

On the other hand, QoS of Cellular-IP/PRC improved stably in 60Mbit in the data packet amount more because distribution availability of transfer node hardly be influenced in vitality or idle in network in Cellular- IP/PRC.

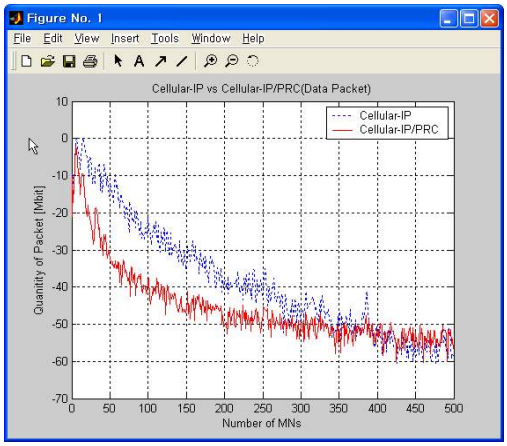

Fig. 6 Data packets rate on the increase mobile node

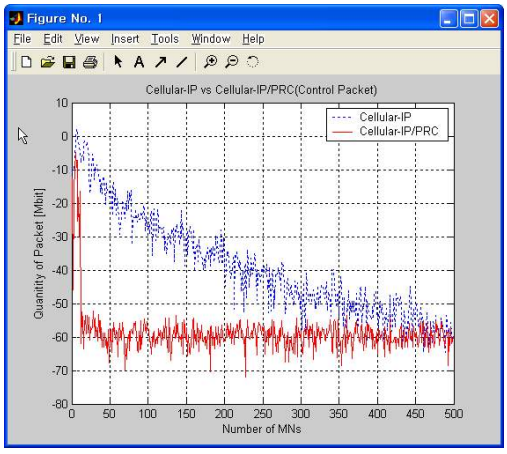

Fig. 7 Control packets rate on the increase mobile node

Ⅵ. Conclusion

Study radio access network QoS such as Selrulra IP improvement because service offer and hand off position management that Internet artery of communication and transfer communication are extensity on the radio Internet connote several problems with transfer IP Routing. Mobile IP which protocol that is used in wire net wire net because was designed to base in radio transfer network QoS guarantee problem have, and does fetters in wire transfer improved QoS in radio transfer network because did not consider QoS. Used united paging roof information administration cache to guarantee QoS in new lake acceptance mode and cell environment to register this to HA because Cellular IP is allocated new dependence address whenever move cell liver in case of Internet Protocol Address is allocated in the base radio station and solves problem. When propose Cellular- IP/PRC network with Cellular IP special quality and compares Cellular- IP/PRC with Cellular IP, paging-renewal withdrawal is big, but in access network all in copper node quick and correct paging possible. Also, high speed Routing of data packet that is received newly was available. Because when achieve Routing for the first received data packet from the Internet, electric wave of control packet or data packet becomes unnecessary, signal traffic load reduced stably within network. To decrease of transmission lag because process time is shortened in node by Cellular-IP/PRC node Cellular IP node and composition and use method are simple, and search a kathy QoS - improved in 60 Mbiit. Cellular-IP/PRC could solved problem of transfer IP's hand off and position administration effectively and achieve different improving fast and softly as that transfer node receives data to both in done hand off interval.

References

[1] Xiao XP and Ni LM, "Internet QoS: A big picture", IEEE Network, Vol. 13, No. 2, pp.8-18.

[2] R. Koodli, et. al., "Fast Handovers for Mobile IPv6", draft IETF mipshop fast MIPv6 01. txt, Jan. 2004.

[3] D. Johnson, C. Perkins and J. Arkko, "Mobility Support in IPv6", RFC 3775, Jan. 2004.

[4] 3GPP, TS 23.002, "Network architecture (Release 6)", 3GPP Standards, Vol. 6.5.0, Jun. 2004.

[5] 3GPP2, X.S0013, "All-IP Core Network Multimedia Domain", 3GPP2 Standards, Dec. 2003.

[6] IEEE WG, "Part 11:Wireless LAN Medium Access Control (MAC) and Physical Layer(PHY) Specifications", IEEE 802.11 standard, Dec. 1999.

[7] IEEE 802.11e, "Draft Supplement to Standard for Telecommunications and Information Exchange Between Systems Part 11: Wireless Medium Access Control(MAC) and physical layer (PHY) specifications : Medium Access Control(MAC) Enhancements for Quality of Service (QoS)", IEEE Standards, May 2002.

[8] 3GPP, TS 22.934, "Feasibility study on 3GPP system to Wireless Local Area Network (WLAN) interworking (Release 6)", 3GPP Standards, Vol. 6.2.0, Sep. 2003.

[9] IEEE 802.15.1, "Part 15.1: Wireless Medium Access Control (MAC) and Physical Layer(PHY) Specifications for Wireless Personal Area Networks (WPANs)", IEEE Standards, Jun. 2002.

[10] IEEE 802.15.3, "Part 15.3: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for High Rate Wireless Personal Area Networks (WPANs)," IEEE Standards, Sep. 2002.

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