Journal of Applied Sciences

ISSN 1812-5654

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal of Applied Sciences 13 (17): 3599-3603, 2013
ISSN 1812-5654 / DOI: 10.3923/jas.2013.3599.3603

Research on Charging Technology of Mobile Self-organizing Internet

Hongwei Li and Weidong Huang
Nanjing University of Posts and Telecommunications, Nanjing, 210046, Jiangsu, China

Abstract: Mobile Ad Hoc Network (MANET) can be applied into telecommunication access networks, so it is necessary to research the charging technology of Mobile Self-organizing Internet (MSOI: The convergence network of the MANET and the Internet). Firstly, the study concludes the charging mechanism of the traditional network can not be directly used in MSOI, because the information of online user can not be accurately collected. To solve this problem, the study designs user online state information management on AAA server used for recording the user online state, then proposes the MSOI charging mechanism based on the design. By the feasibility analysis of MSOI charging mechanism, it indicates that the mechanism can accurately collect the accounting data.

Key words: MANET, mobile self-organizing internet (MSOI), charging, AAA

INTRODUCTION

Driven by environment, market and technology, the next-generation networks (NGN) is a direction of development of the telecommunication network (Modarressi and Mohan, 2000; Knightson *et al*., 2005). ITU-T summarized the characteristics of NGN, including: Packet-based, IP-based, multi-service, open networks and etc. (ITU-T Recommendation Y, 2001). Mobile Ad Hoc Network (MANET) is a self-organizing network of mobile devices connected by wireless (Qin *et al*., 2013; Chen, 2003). It could be an access network of NGN.

The Mobile Self-organizing Internet (MSOI) is the convergence network of the MANET and the Internet. The MANET application in WLAN would strengthen network coverage, reduce the cost of fundamental network construction, solve the network congestion, strengthen the robust of network, promote the quality of the service and etc. (Yu, 2005).

The application of MANET is major in military, rescue and relief, which is immature in commercial field. The research on charging technology of MSOI will promote application in commercial field.

The aim of this research was to study the accurate accounting data collection in MSOI. The study firstly adopted the charging mechanism of the traditional network to collect the accouting data of MSOI, then discovered that the traditional mechanism can not be directly used in MSOI, because the information of online user can not be accurately collected, also the accurate accounting data can not be collected. To solve this problem, the study designed the user online state information management, then proposes the MSOI charging mechanism based on the design.

PROBLEM ANALYSIS

MSOI architecture: The MSOI is composed by MANET and WLAN, as shown in Fig. 1. The MANET is composed by the gateways and mobile-terminals (MT). The gateways and routers are part of WLAN. The access network of MSOI is composed by gateways and routers (Chen *et al*., 2003).

Traditional WLAN charging technology: The traditional network charging technology is composed by user access management model and WLAN charging mechanism:

User access management model: Usually, the user access management uses three-level mode: MT-Network Access Server (NAS)-AAA (Authentication, Authorization, Accounting) (Zou, 2003). The NAS is gateway, which controls the MT access to

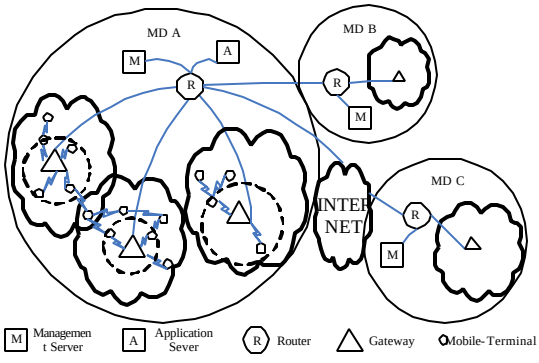

Fig. 1: MSOI (Mobile Self-organizing Internet) management model

Corresponding Author: Hongwei Li, Nanjing University of Posts and Telecommunications, Nanjing, 210046, Jiangsu, China

the internet, the AAA controls which services users are allowed to access and how much resources they have used

WLAN charging mechanism: The NAS controls the MT access to the internet, so in this situation, NAS can accurately obtain some accounting data during the MT accessing to the internet, such as start-time, end-time and traffic, which can be used for accounting of the resources the user used. The communication protocol between NAS and AAAS can use the RADIUS protocol (RFC 2139).

Analysis of MSOI charging: The MANET is a part of MSOI, which is an infrastructureless and muti-hop routing network. So there is traffic transfer in MSOI. For example, once a NAS down or overload, the MT which accessed to the Internet through it, would link to other normal or lower-load NAS through the self-organizing infrastructureless network. In this situation, if adopting the traditional WLAN charging mechanism, it will be impossible to obtain accurate accounting data, because the NAS can not grasp the online or offline information of user.

Based on the above analysis, it is obvious that the traditional WLAN charging mechanism can not be directly applied to MSOI. The NAS is the accounting data collection point, but the access control of the MT uses distributed management strategy in MSOI, NAS can not obtain accurate accounting data. So in order to obtain the accurate accounting data, the charging mechanism needs to grasp the online state of user.

MSOI MANAGEMENT STRATEGY

Management domain (MD): Just like other network management models, it is necessary to divide MANET into multiple management domains. The study delimits the MSOI management domain as follow:

- **Definition:** The MSOI management domain is composed by multiple gateways and mobile-terminals supported self-organizing technology, the IP address of mobile terminal do not changed in a management domain

In other words, the MD is a minimum MSOI, its area is determined by network service provider. Each MT belongs to a MD. The multiple MDs can be connected by internet. The MT can roam between MDs based on mobile IP technology.

Management strategy: In a MD, user account management uses centralized management strategy. With the growth in the number of user, the communication traffic increase too, then the access gateway would be the bottleneck of the network performance. So, the access control of MT uses distributed management strategy (Fig. 1). The study just researches the network charging while user accesses internet and keeps in a fixed MD, does not discuss the roaming charge.

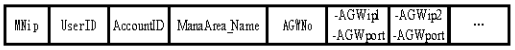

Fig. 2: Structure of online-list record

Design of MSOI charging

Design of user online state management: According to the architecture of MSOI, the realization of the user online state management needs two conditions: (1) Set the user online-list on AAAS, used for recording user online information; (2) The update operation of the online-list.

(1) Structure design of online-list.

The structure of online-list record is shown in Fig. 2. Fields description as follows:

- Mnip: IP address of MT; UserID, ID of user; AccountID, ID of accounting record, used for integrating accounting data submitted by multiple NAS; ManaArea_Name, the MD name of MT's current MD, used for saving roaming information; LocationNode is composed by AGWip and AGWport; AGWip, the IP address of NAS, through which the MT accesses to internet; AGWport, the communication port of NAS; AGWNo, the number of LocationNode. In MSOI, there is different route through different NAS for packet from MT to Internet, so there is at least one LocationNode in a record

When the user accesses to the network for the first time and passes authentication, a new record will be created in online-list. The value of fields will be filled according user information and NAS information, set the value of AGWNo to be 1. When AAAS receives active offline request from user, the record will be deleted.

Update operation of online-list: There are two types of update operation, online update operation (Fig. 3a) and offline update operation (Fig. 3b).

Online update operation: when a NAS participates in the service for MT, after the authentication to user, the NAS will build the access notification message according user information and NAS information and send it to AAAS. AAAS receives the message, searches the record of corresponding user in online-list, then inserts a new

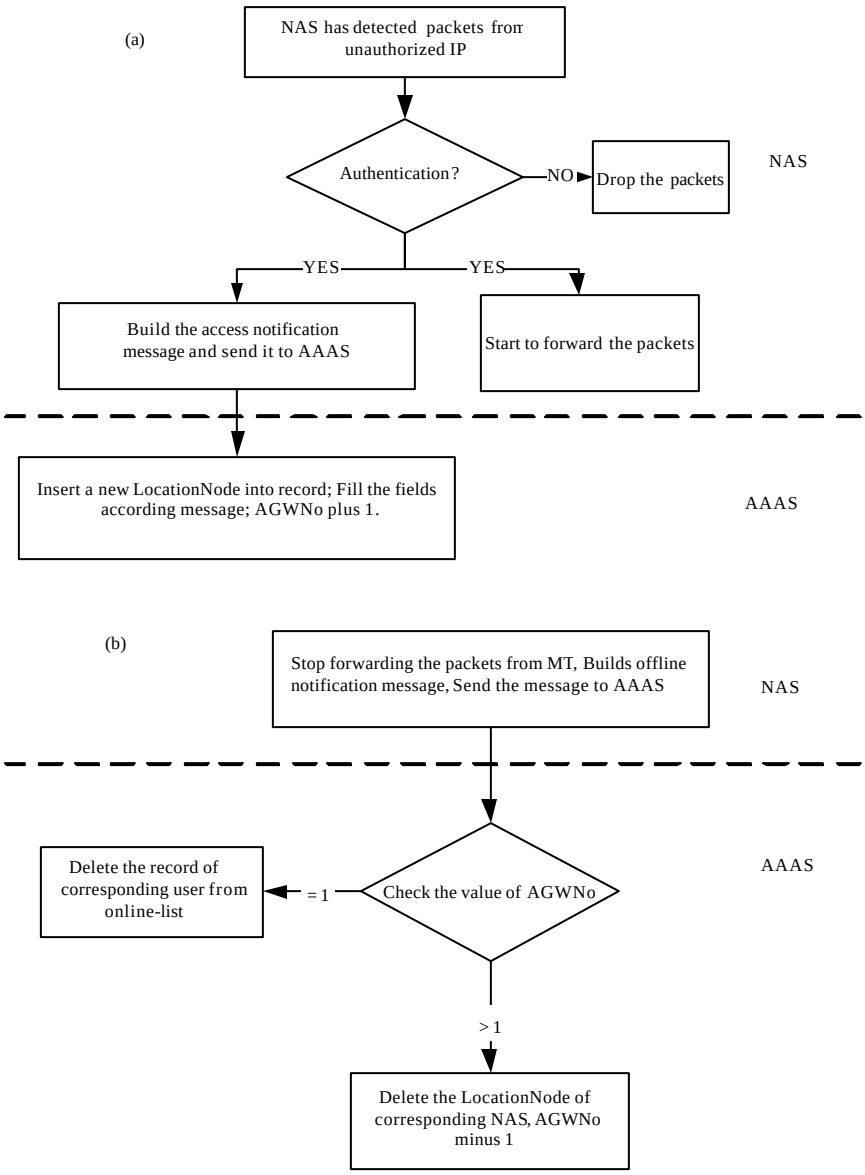

Fig. 3(a-b): Flowchart of update operation, (a) Online update operate, (b) Offline update operat

LocationNode into record, fills the AGWip and AGWport with the values from the message, AGWNo plus 1.

Offline update operation: when user is offline, the NAS will build offline notification message according user information and NAS information and send it to AAAS. AAAS receives the message, searches the record of corresponding user in online-list, determines the value of AGWNo, if AGWNo>1, then deletes the LocationNode of corresponding NAS and AGWNo minus 1, if AGWNo = 1, then deletes the record of corresponding user from online-list.

There are two types of offline update operation, they are active offline update operation and implicit offline update operation.

Active offline update operation: User sends the active offline request to NAS, then the AAAS receives the offline message from NAS, it does not check the value of AGWNo, directly deletes the record of corresponding user.

Implicit offline update operation: The implicit offline means when NAS can not detect the pulse of the MT, for

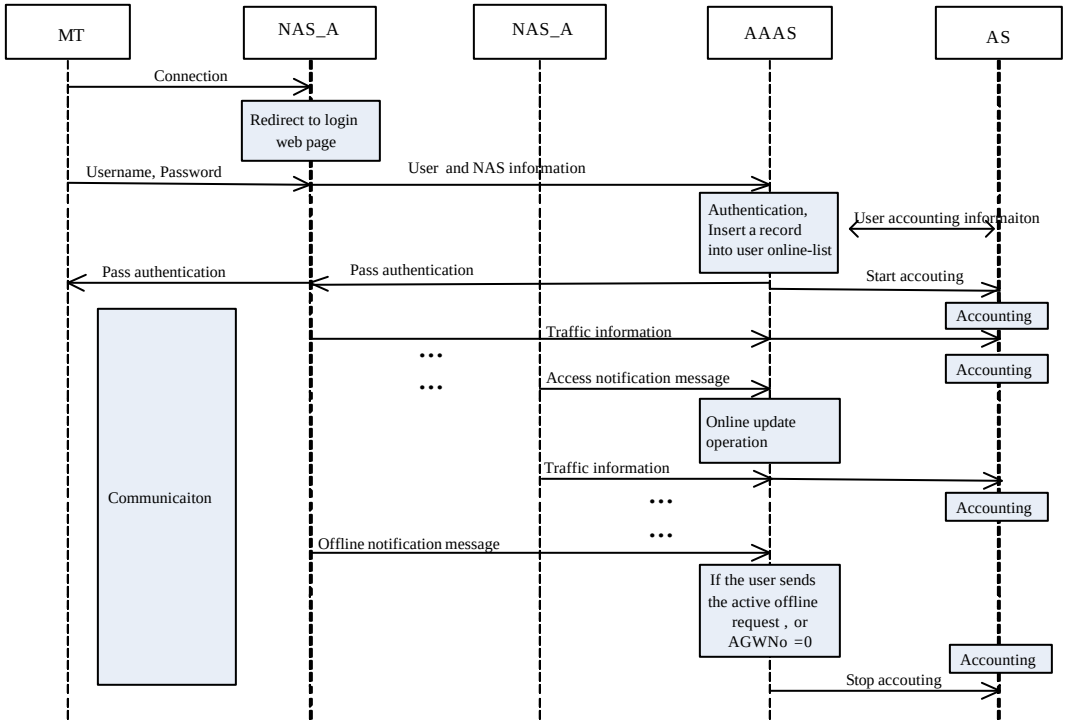

Fig. 4: Flowchart of MSOI charging

example, the MT retrieves a new route to Internet(traffic transfer in MSOI), the MT has moved to other area of the same MD where covered by other NAS, the MT is power off. In this situation, when the AAAS receives the offline message from NAS, it will finish the offline update operation.

MSOI charging mechanism: The design of user online state management ensures that the AAAS can accurately get the online state of user. Based on the design, the NAS and the AAAS are both accounting data collection points, which is different from the WLAN charging mechanism. Specifically, when the user accesses to the network for the first time and passes authentication, the AAAS will send the start-time and AccountID to accounting server (AS), inform AS of starting accounting; when AAAS confirms that user is offline, it will send the end-time and AccountID to AS, inform AS of stopping accounting. In WLAN charging mechanism, the AS is only informed by NAS. The specific process flow as follows (Fig. 4):

- User requests accessing to Internet, NAS_A redirects the request to login web page, user submits the user name and password to NAS_A, NAS_A builds the access notification message according user information and local information, then sends it to AAAS
- AAAS authenticates the user, if passes, it will ?1 insert a record into user online-list; ?2

Inform AS of starting accounting; ?3 response to NAS_A with the pass result of the authentication.

NAS_A starts to forwarding user's packets. If not passes, NAS_A will reject the accessing request from user and step returns to (1):

- Once NAS_B participate in the service for MT, it will build the access notification message according user information and NAS_B information and send it to AAAS. AAAS receives the message, executes the online update operation and responses to NAS_B with pass message. If AAAS does not find the record of corresponding user in online-list, then it will response to NAS_B with failure, NAS_B will reject the accessing request from user and step returns to (1)

- NAS forwards the packets from authorized IP, records the traffic of the MT and submits the records to AAAS periodicity
- Once NAS can not detect the pulse of the MT, it will submit the traffic records to AAAS and start the implicit offline update operation. If AGNo=0, then AAAS will delete the user record in the online-list and inform the AS of stopping accounting at the same time
- Once user sends the active offline request to NAS, it will submit the traffic records to AAAS and start the active offline update operation. Before AAAS deletes the user record in the online-list, it needs to check the AGWNo, if AGWNo>1, the AAAS will ask other NAS submit the traffic record to AAAS, then inform the AS of stopping accounting
- During the user accessing to the Internet, the AS realizes the real-time charging for user according to the accounting data

FEASIBILITY ANALYSIS

Firstly, the realization of user online state update is the key point of the MSOI charging implementation. Chen (2003) extends the RADIUS protocol, adds the query interaction between the client and the server. Specifically, the author adds two types of RADIUS packet, they are Query-Request and Query-ACK and defines a new attribute called Query-Status-Type, used for marking the type of request message. The attribute value range is: check-in and check-out, denote the access notification message and offline notification message. So the access notification message can be used as online update message and the offline notification message can be used as offline update message in this study.

Secondly, the AAAS triggers the AS starting and stop accounting also can be implement by extending the RADIUS. The user's accounting data submitted by multiple NAS and AAAS can be integrated by the AccountID.

CONCLUSION

The study analyzes the possibility of MANET applied in Internet, researches the charging technology of MSOI based on user access management mode. In order to obtain the accurate accounting data, the study proposes the MSOI management strategy and the design of user online state management. The RADIUS extension has been researched in others' studys. Furthermore, the research work will realize the design based on RADIUS extension.

ACKNOWLEDGEMENTS

This study is supported by the National Natural Science Foundation of China (Grant No.71171117) and supported by the NUPT Research Foundation of China (Grant No.NY210056).

REFERENCES

Chen, L., 2003. User management of wireless mobile self-organizing network. Master Dissertation, University of Electronic Science and Technology of China, ChenDu, China.

Chen, Y.H., Z.Y. Wei and J.D. Li, 2003. Wireless mobile self-organization of the Internet. Telecommun. Technol., 10: 28-31.

ITU-T Recommendation Y, 2001. General overview of NGN. International Telecommunication Union. http://www.itu.int/rec/T-REC-Y.2001-200412-I/en

Knightson, K., N. Morita and T. Towle, 2005. NGN architecture: Generic principles, functional architecture and implementation. Commun. Mag., 43: 49-56.

Modarressi, A.R. and S. Mohan, 2000. Control and management in next-generation networks: Challenges and opportunities. IEEE Commun. Mag., 38: 94-102.

Qin, D.Y., H.W. Wang, L. Ma and D. Qun, 2013. Research on topology property for wireless Multi-hop communication network. Indonesian J. Electr. Eng., 11: 351-361.

Yu, H.Y., 2005. Wireless Mobile Self-Organizing Network. Post and Telecom Press, China.

Zou, C.G., 2003. User access management of wireless mobile self-organizing network. Master Dissertation, University of Electronic Science and Technology of China.