WATMIN (Wireless ATM INterconnection)

Selector usage versus ATMARP server modifications for mobility management

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ATMARP MECANISM

The purpose of this document is to describe the solutions studied to modify the ATMARP mechanism for Watmin. Two main solutions have been studied :

1. Modification of the ATMARP server
2. Use of SEL field of ATM address

1. Use of SEL field of ATM address

This solution is based on the use of the SEL field of ATM address. This field is the last bytes of the User Part of the address.

OSI NSAP address :

- 13 bytes for the network prefix
- 7 bytes for user side :
  - 6 for ESI (End System Identifier)
  - 1 for SEL (selector)

ATM Forum definition :
*« **Selector (SEL)** A sub-field carried in SETUP message part of the ATM endpoint address Domain specific Part (DSP) defined by ISO 10589, not used for ATM network routing, used by ATM end systems only. »*

1.1. Use of SEL sub-field

SEL field is used in both Classical IP and LANE environment.

1.1.1. CLASSICAL IP

RFC 1577 :

In the LIS scenario, each separate administrative entity configures its hosts and routers within a closed logical IP subnetwork. Each LIS operates and communicates independently of other LISs on the same ATM network. Hosts connected to ATM communicate directly to other hosts within the same LIS. Communication to hosts outside of the local LIS is provided

via an IP router. This router is an ATM Endpoint attached to the ATM network that is configured as a member of one or more LISs.

All the members of a LIS have the same IP network number. The ATMARP resolution in a LIS is made via a ATMARP server located within the LIS.

There is a possibility for interconnecting several LISs using routers.

RFC 1577 :

It is RECOMMENDED that a router be able to provide this multiple LIS support with a single physical ATM interface that may have one or more individual ATM endpoint addresses.
Note: this does not necessarily mean different End System Identifiers (ESIs) when NSAPAs are used. The last octet of an NSAPA is the NSAPA Selector (SEL) field which can be used to differentiate up to 256 different LISs for the same ESI.

The router then manages the IP addresses of the different LIS by associating a selector value for each of them.

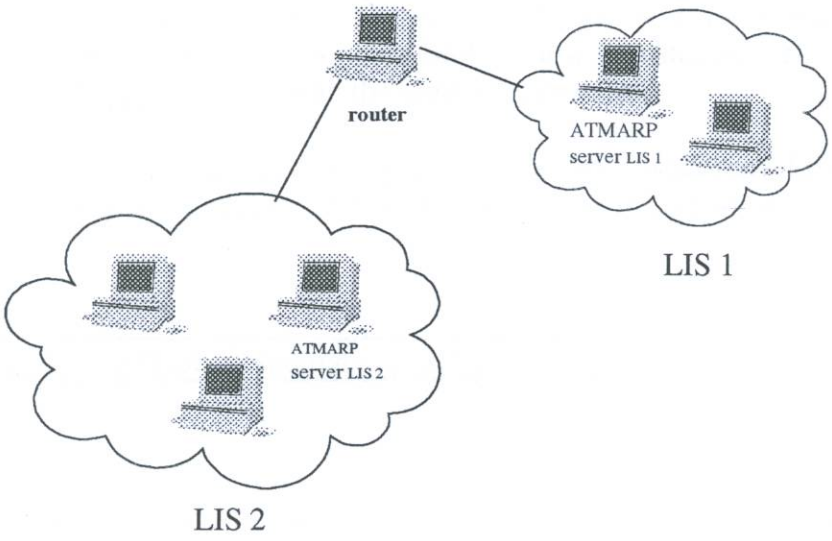
RFC 1755 :

If an IP router does this association, then its signaling entity MUST carry in the SETUP message the ATM addresses corresponding to the particular IP entity requesting the call, and the IP entity it is requesting a call to. These ATM addresses are carried in the Calling and Called Party Number IEs respectively.

As native E.164 addresses (for ISDN, including telephone numbers) do not support a SEL field, the way to support multiple LISs must be adapted.

RFC 1755 :

Note: multiple LIS support is the only recommended use of the SEL field. Use of this field is not recommended for selection of higher level applications.



1.1.2. LANE

SEL field has a special meaning in the context of LAN Emulation (refer to [1] for more details) :

> *« ATM addresses that differ only in the selector (SEL) octet are recognized as different ATM addresses in the context of LAN Emulation. »*

The way the SEL field is managed it is not clear for the moment, so, we will study this aspect later. The important think to have in mind is that the selector value is not always 0 in the context of LANE, so we can not ensure that our system will be compatible.

1.2. WATMIN application

In the Watmin project, the selector can be used to avoid modifying the ATMARP server (at both kernel and user level). The main goal is that the Access Point acts, for the rest of the ATM network, as if it was each of the Mobile Hosts it manages : the ATM address of each Mobile Hosts is the Access Point one (except the last SEL byte), and all ATMARP registrations are sent directly by him.

The basic idea is to affect a different selector value for each Mobile Host managed by an Access Point. The Access Point manages an association table between the IP address of each mobile host and a selector value.

Hereafter is a table example :

IP address of Mobile Host	Selector value

192.168.4.10	01
192.168.4.11	02
192.168.4.20	03

The important think is that the selector value represents a unique number which can identify, for a given Access Point, the corresponding Mobile Host it manages, i.e., for one Access Point, there can not be several hosts with the same selector value.

Such an information can be stored directly in the Watmin Association Table described in document [2] so the Watmin Association table will have the following format :

IP address of Mobile Host	Interface	Selector Value

In fact all the ATMARP function is delegated, for the Mobile Hosts, to their attached Access Point. We describe in the following paragraphs the way the Access Point has to manage this.

1.3. Mobile Host registration in the Access Point

This phase is described in report [3]. The only modification concerns the selector choice and storage for each new Mobile Host : AA Watmin table update (WAT module in kernel mode) is modified as follows :

1. Find out a free selector value to affect to the Mobile Host
2. Update the Association Agent Watmin table

Up to now, we have to check the first step as it does not appear quite simple to ensure that a selector is not used by another ATM mechanism (see paragraph 1).

1.4. Access Point registration in the ATMARP server

When joining the ATM network, the Access Point registers to the ATMARP server via the signalisation Vpi : 0 Vci : 15. The corresponding elements stored in the ATMARP server table are :

ATM @ of Access Point	IP @ of Access Point

ATMARP server, when receiving InATMARP reply (InARP_REPLY) from the Access Point (as for all stations) examines the IP and the ATM address, and adds or updates the map entry into its table.

1.5. Mobile Host registration in ATMARP server

For each Mobile Host registration, the ATMARP client daemon opens a new signalisation connection with the ATMARP server (it acts for the ATMARP server as if a new ATM host was joining the network). This connection is a SVC whith Vpi Vci 0, 15 opened between the Access Point and the ATMARP server machine. To identify specifically the Mobile Host concerned, the SVC is opened with selector field set to the one affected to the MH.

Note : as the selector is not used for routing purpose, such a message will reach the ATMARP server as every frame sends by the Access Point.

The corresponding elements stored in the ATMARP server table are :

ATM @ of Mobile Host	IP @ of Mobile Host

The ATM address of the Mobile Host can be devised in two parts :

1. The first part which includes all the address fields except the end SEL sub-field is exactly the same as the one for Access Point ATM address (network side prefix + first 6 bytes of End System Identifier).
2. The second part contains the SEL sub-field. Its value is the one associated by the Access Point to the Mobile Host (see Mobile Host registration in paragraph 1.3).

The IP address is directly the Mobile Host's one.

For example, the ATMARP server table should be :

AP@ATM.ESI.00	192.168.4.1
AP@ATM.ESI.01	192.168.4.10
AP@ATM.ESI.02	192.168.4.11
AP@ATM.ESI.03	192.168.4.20

Note : in this example, we have supposed that the Access Point has 00 for its own selector (which can be the case for the first LIS in a Classical IP paradigm). The three other selectors have been selected by the Access Point when registering Mobile Hosts.

The ATMARP server receives the request, and sends to the originating ATM station a InATMARP request (InARP_REQUEST) for each LIS it is configured to serve (one in our study case). It then receives a InARP_REPLY from the station (i.e. in fact, the Access Point), and examines the IP and ATM addresses.

The only case where a new entry is not created as explained in RFC 1577 is :
« *If the InATMARP IP address duplicates a table entry IP address and the InATMARP ATM address does not match the table entry ATM address and there is an open VC associated with that table entry, the InATMARP information is discarded and no modifications to the table*

are made. ATMARP table entries persist until aged or invalidated. VC call tear down does not remove ATMARP table entries. »

In the case of a Mobile Host joining the LIS for the first time, its IP address will not yet be in the table, so, a new entry will be created. In case of mobility between two cells of the same IP network (Watmin phase 1), the Mobile Host moves from one Access Point to another one. When the Mobile Host arrives in the new cell, it registers into the new Access Point which has to opens a new signalisation connection with the ATMARP server to make a new ATMARP entry for the Mobile Host (new_AP@ATM.SEL, MH @IP) .

The request is then checked by the ATMARP server :

MH@IP already matches a table entry

ATM @ of table entry <> new_AP@ATM.SEL

So, the new request is discarded and the table is not modified : ATMARP server still have the entry (old_AP@ATM.SEL, MH@IP).

This mechanism implies that, when a mobile host moves from one cell to another, it will be registered in its new cell only after the maximum delay for ATMARP table entries validation (15 minutes for the ATMARP client (Access Point) and 20 minutes for the server). This delay appears quite long.

Because the ATMARP server entry will not be updated with good response time and that the use of SEL is not recommended by the normalization organism, we think that, in the context of Watmin mobility, the use of the SEL value to register entries into the ATMARP server without modifying the server itself is not appropriate. We propose then to modify ATMARp server (refer to paragraph 2 on page 8 for more details).

Note : as the conclusion of SEL use appears quite clear, the two following points have not been detailed :

- Check if there is the same mechanism for the ATMARP client. If yes, problem, even if the there are different ATMARP servers for each LIS : when the Mobile Node moves from one LIS to another, the ATMARP table of the Access Point will not be updated.

- Ensure that, in the context on Classical IP, the ATMARP server manages several entries when the ATM address differs only by the SEL field.

1.6. Mobile Host communication

When establishing a communication from the Mobile Host to an ATM host, a In_ARP_req is issued from the Mobile Host to the Access Point. Such a request is transmit to the ATMARP server by a In_ATMARP_req where the ATM address field is the one of the Mobile Host, i.e., ATM address of the Access Point except for the selector field, which is the one affected to the MH.

The ATMARP server responds as usual to such a request by a In_ATMARP_rep. The answer is transmitted to the Access Point which acts as a proxy for the Mobile Host :

1. It checks if the selector field is one of those stored in its Association Agent Watmin table
2. It substitutes in InATMARP_reply the source IP address by the Mobile Host IP address (instead of its own address).

From the point of view of the ATM network, including the ATMARP server, there is no difference between any ATM machine and the Access Point. The Access Point is the only part of the ATM network which knows that is acts as a proxy and has many Mobile Hosts to manage.

1.7. Conclusion

Above paragraphs have shown that the SEL field cannot be used in the context of host mobility between cells among the same LIS : ATMARP server entries would not be updated when a Mobile Host moves from one cell to another.

The SEL use is not a way to avoid ATMARP server modifications. We propose to study the best way it can be changed in term of behavior and also modifications usability.

2. ATMARP server modification

The first solution studied in this project is described in the document [3]. It consists in modifying ATMARP server in a way that, when a Mobile Host registers to an Access Point a Watmin message (ASSOCIATION_LOG) is sent to the ATMARP server which creates a new entry for the Mobile Host.

In such a case, all the Mobile Hosts registered into the same cell will have, in ATMARP server the same ATM address (the Access Point one).

3. Bibliography

[1] « The ATM FORUM technical committee. LAN Emulation over ATM Version 2 - LUNI specification. AF-LANE-0084.000. July 1997 »

[2] « Phase 1 Implementation document » N Tavier, C Bonnet, D loisel, September 1997

[3] « Phase 1 design document, D. Boswarthick, C. Bonnet, D. Loisel, August 1996 ».