

IEEE TENCON 2008
Nov.17-21 ,2008
University of Hyderabad, India



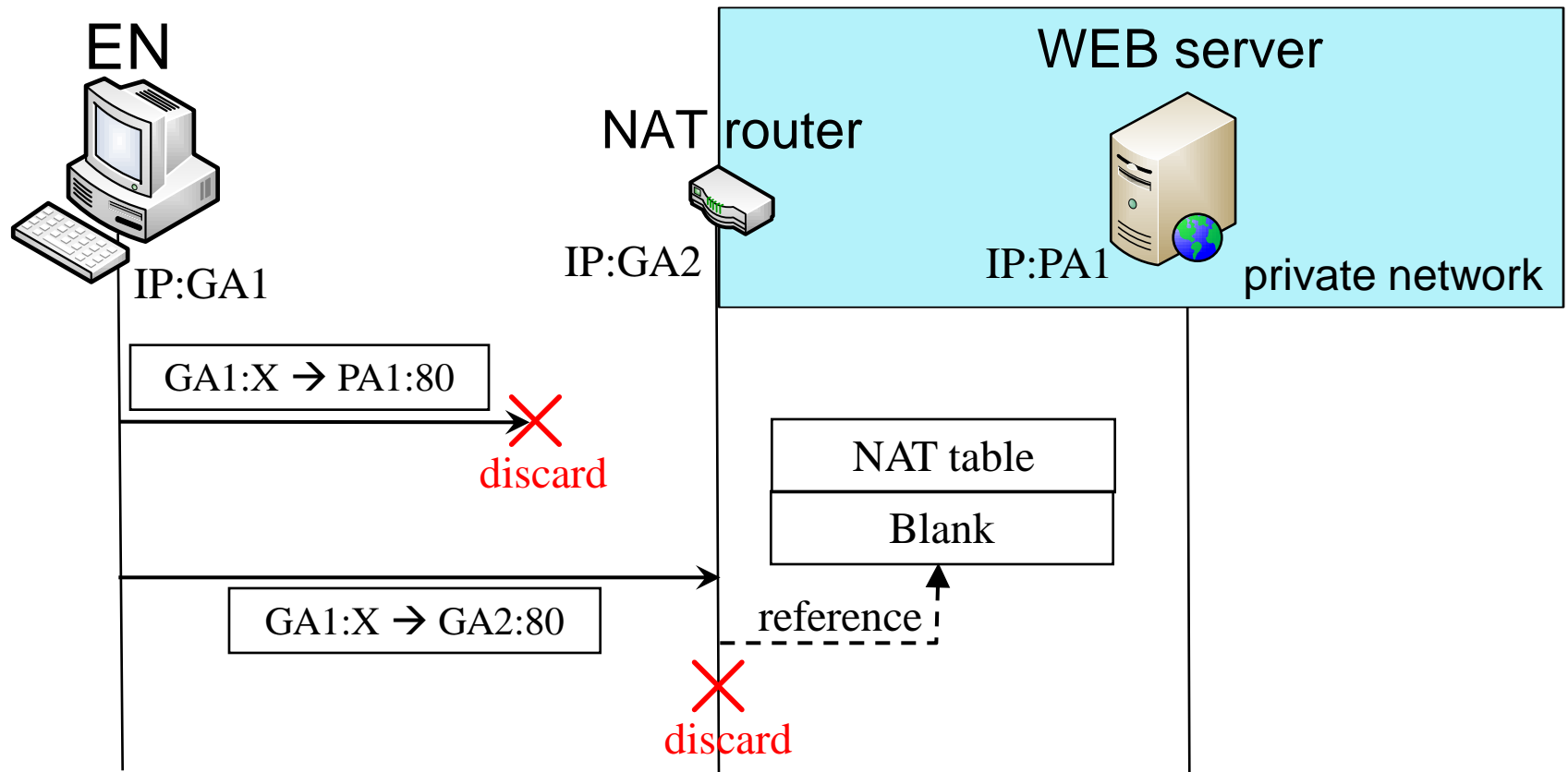
Proposal of a NAT traversal system independent of user terminals and its implementation

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Backgrounds

- with the spread of the Internet.
 - there are increasing demands of accessing networks at anytime from anywhere .
- Global IP addresses are exhausted in the Internet.
- general home networks are usually constructed with private IP addresses.
 - NAT (Network Address Translator) is needed.

NAT Operations (from outside to inside)



A NAT Traversal Problem

A Proposal for a NAT Traversal System

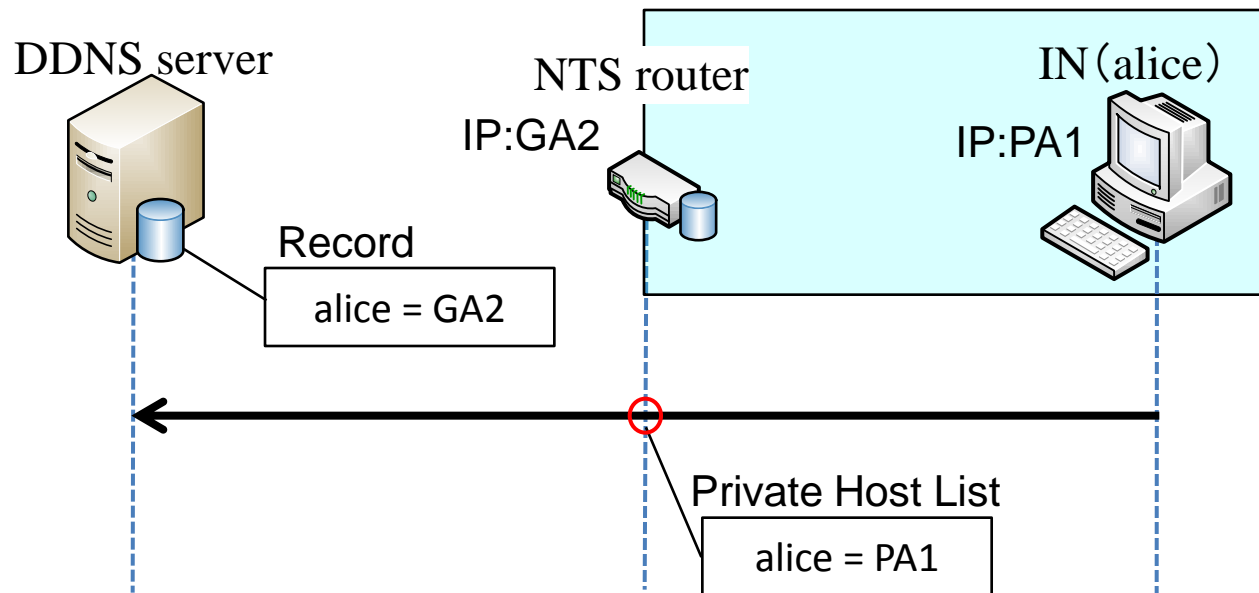
We have solved the problem without remodeling the end terminals.

In this system, a NAT router and a DNS server are modified to solve the NAT Traversal problem.

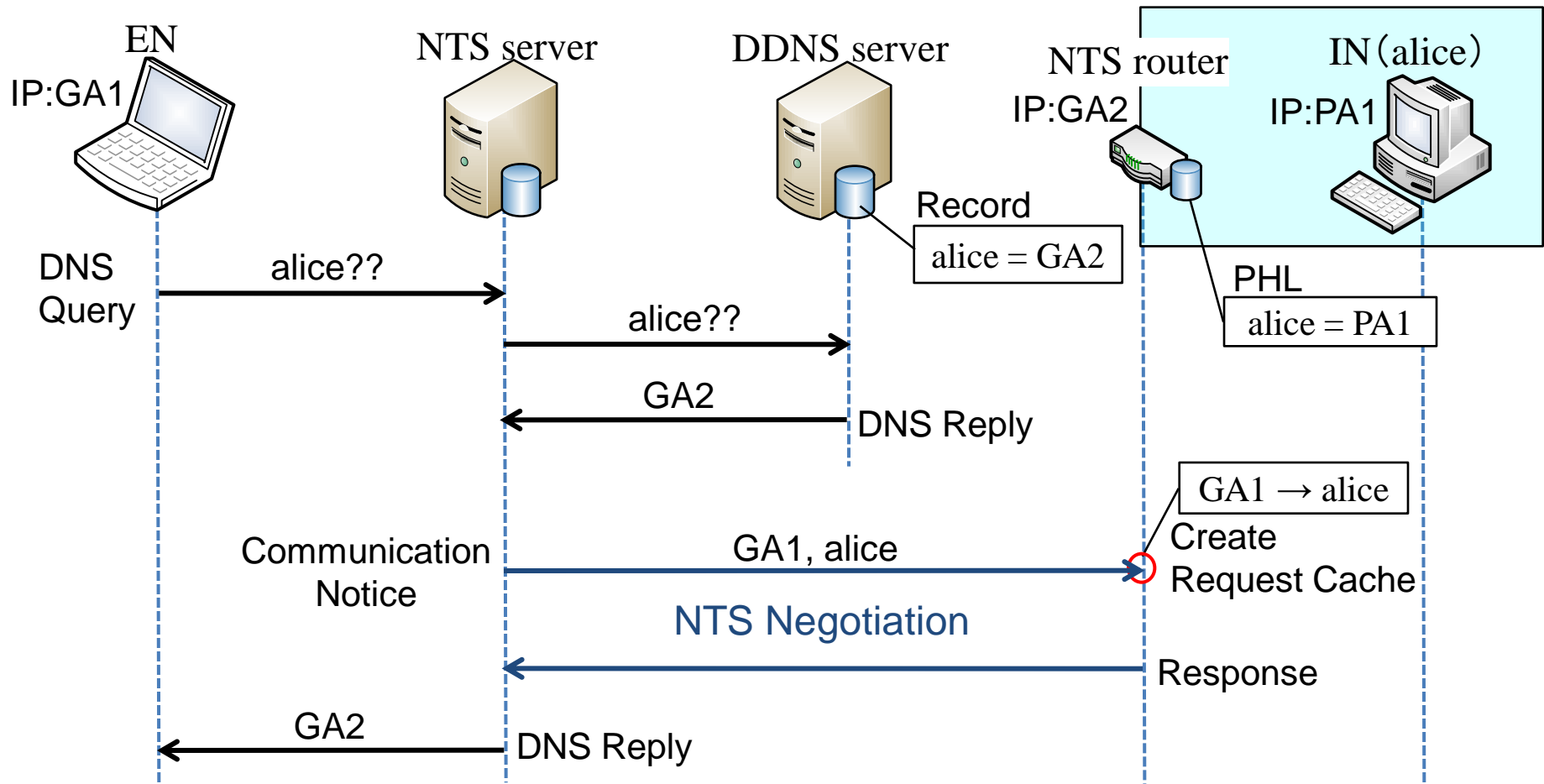
The modified DNS server → NAT-Traversal Support Server (NTS server)
The modified NAT router → NAT-Traversal Support Router (NTS router)

Proposal System : Advanced Setting

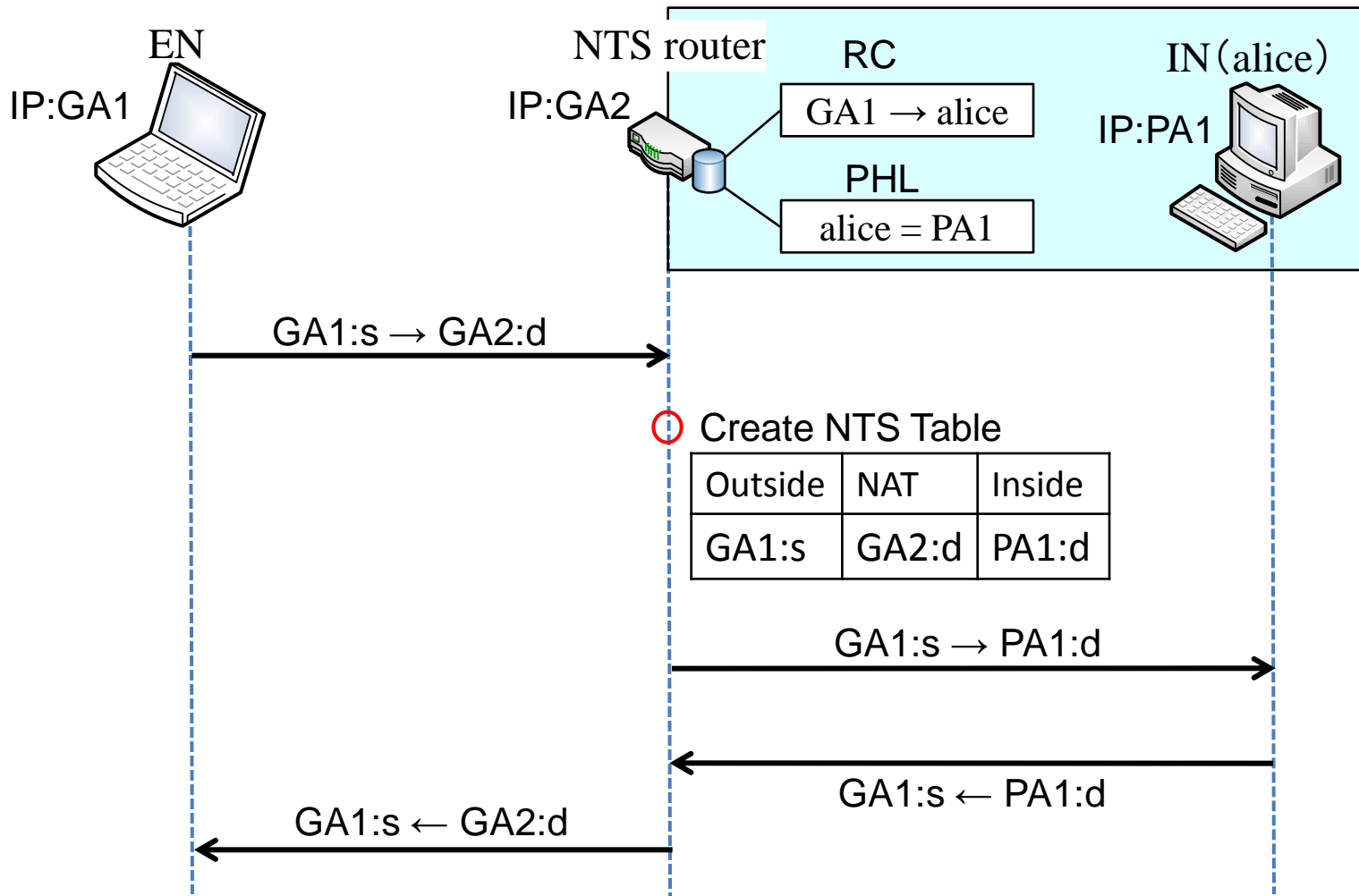
- ▶ User has to register “the IN’s name (FQDN)” and “The NAT router’s Global IP address” to a DDNS server in advance.
- ▶ The NTS router generates a Private Host List (PHL) at the time of the DDNS registration.



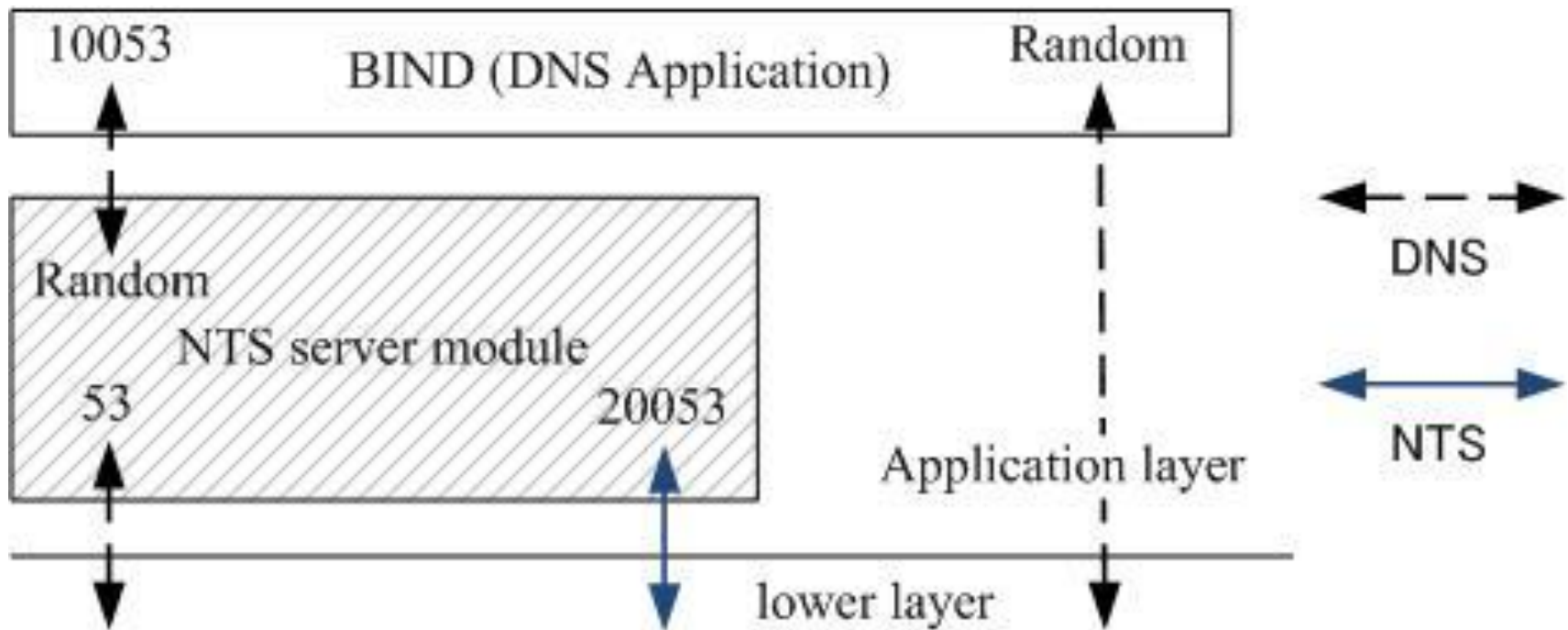
Proposal System : Name Resolution



Proposal System : Communication

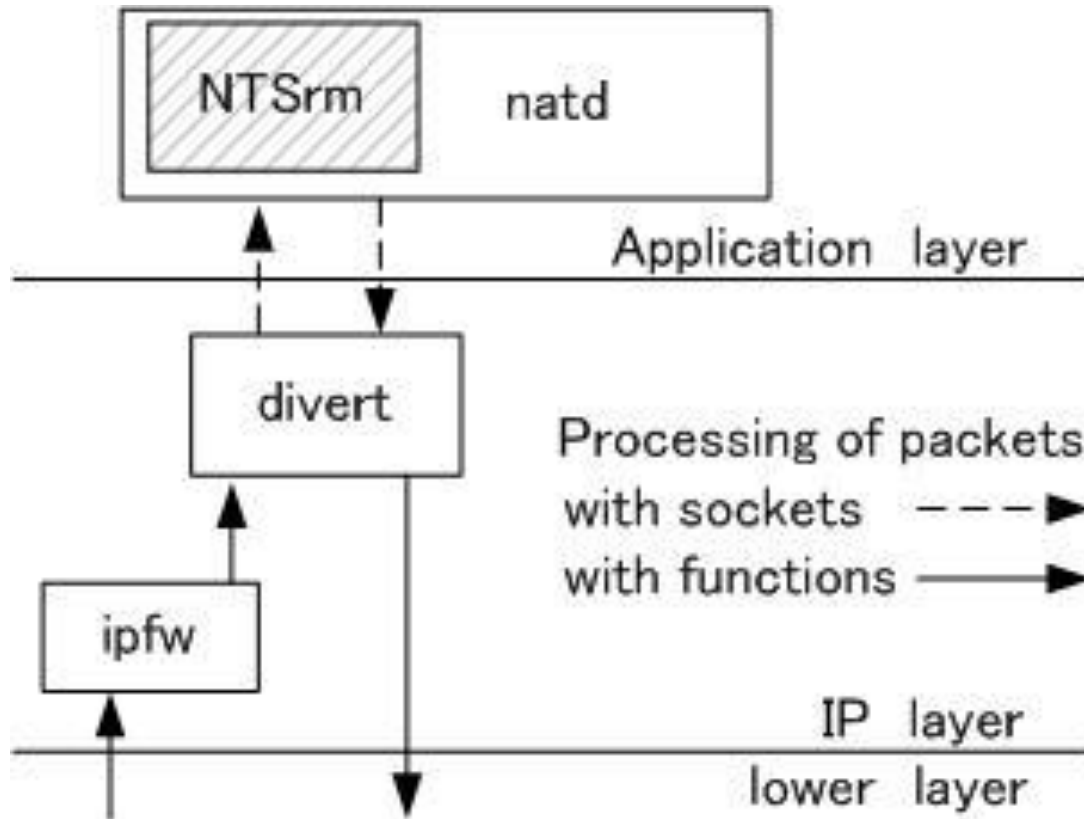


Implementation : NTS Server



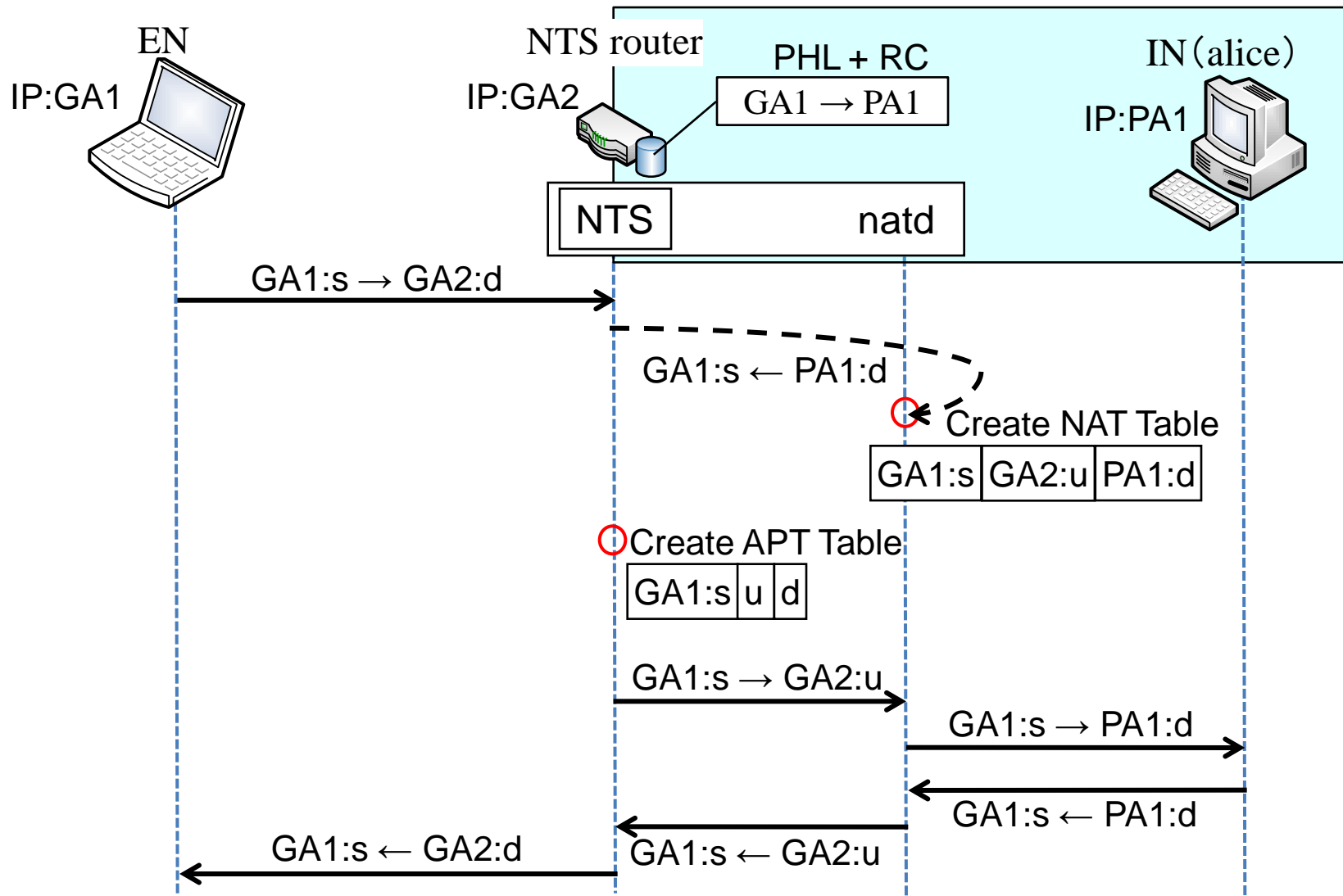
- DNS application listens to port 10053 and NTS server listens to port 53.

Implementation : NTS Router



- add NTS router module in `natd` (NAT daemon)
 - `natd` has NAT functions in FreeBSD

Proposal System: Generation Method of Original NAT Table



Appendixes

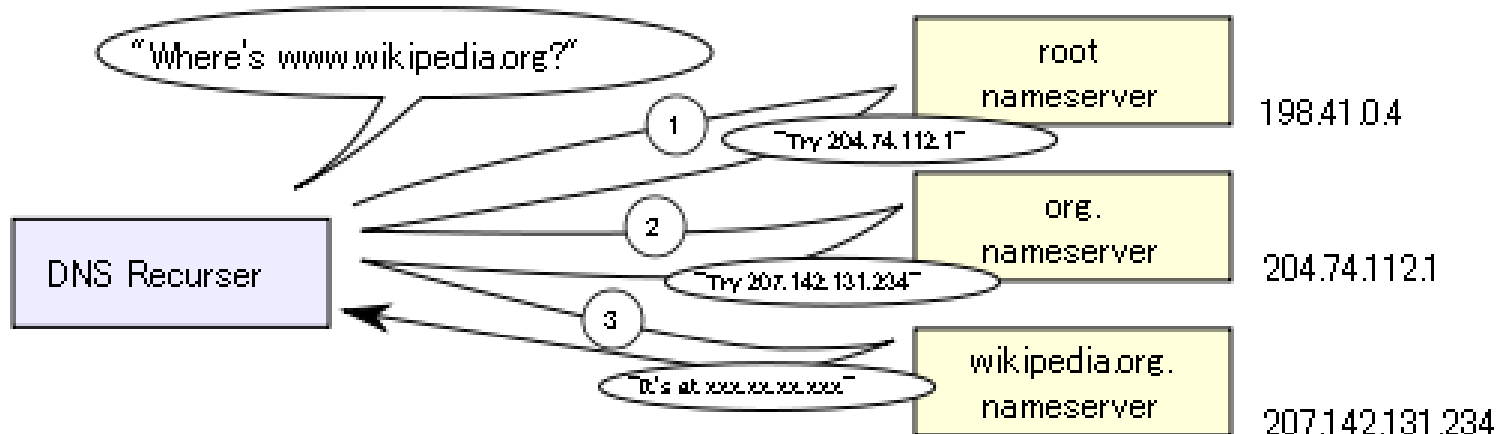
Conclusion

- The proposal system
 - It can solve the NAT Traversal Problem with the modified NAT router and the modified DNS server, NTS server, without modifying terminals.
 - The NAT router generates an original NAT table from PHL and RC made in the NAT router previously.
- Future
 - Evaluation of the proposal system

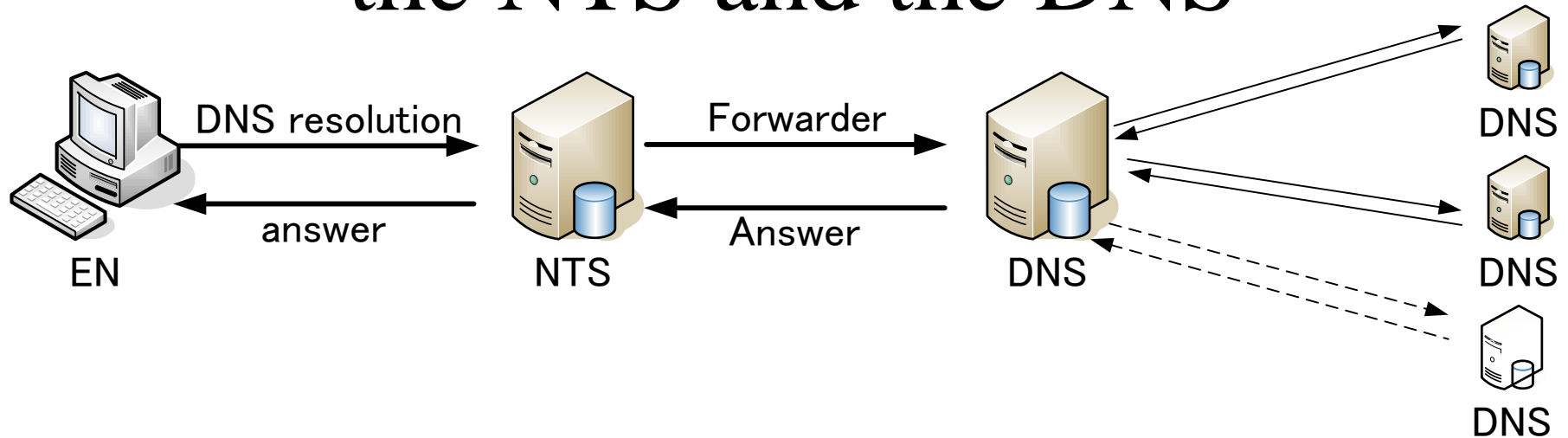
RFC1034,1035

DNS (Domain Name system)

- Port No. : 53/UDP and 53/TCP
- It serves as the "phone book" for the Internet.
- It translates human-readable computer hostnames into the IP addresses that networking equipment needs for delivering information.



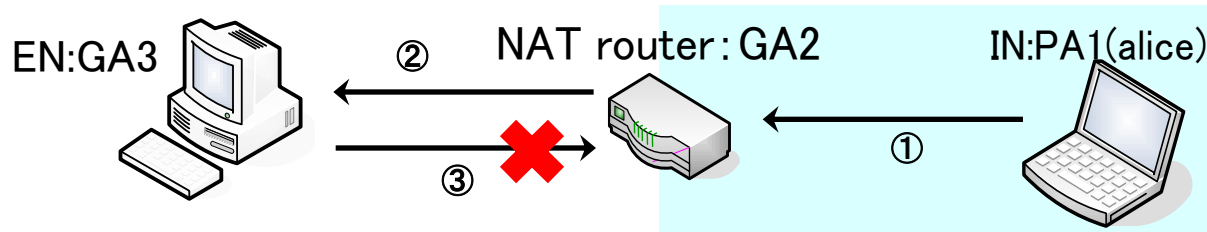
Relation between the NTS and the DNS



- The EN needs to set a NTS server as primary DNS previously.
→ The NTS server gets the IP address of the EN by performing communication with the GN directly.
- If the PN of a different address space increases, correspondence of the NTS server may worsen.
- If this system spreads, and the function to exchange with a router like NTS to a general DNS is mounted, a EN can be realized, without changing a primary DNS.

ALG (Application Layer Gateway)

- Session establishment between the different-species networks with NAT.



	IP header		payload (data)	
	S	D		
①	PA1	GA3	PA1	
②	GA2	GA3	PA1	
③	GA3	PA1	GA3	

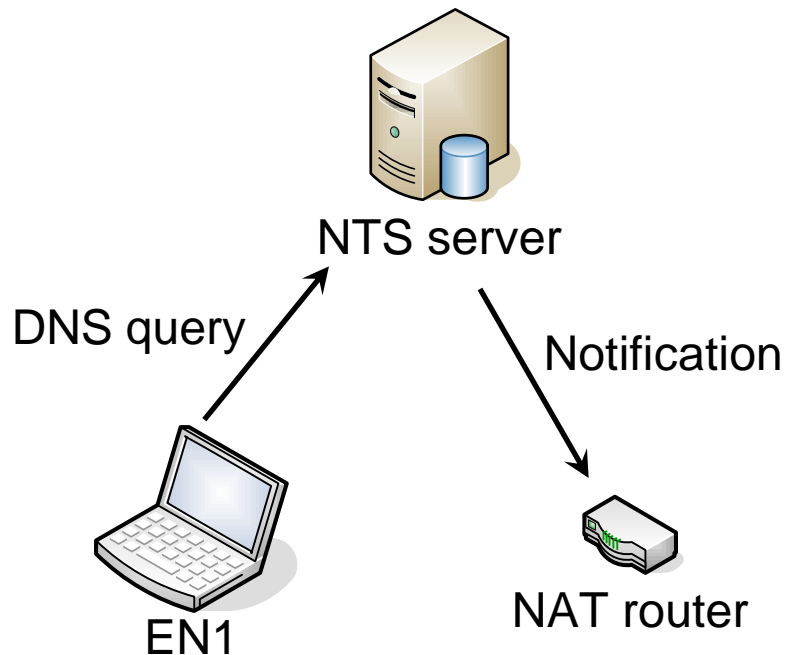
A red arrow points from the 'PA1' in the payload of row ② to the 'PA1' in the destination field of row ③.

- Although the address indicated to IP/TCP / UDP header is rewritten in NAT, it does not involve in payload part.
- The IP address in application is also rewritten by ALG.

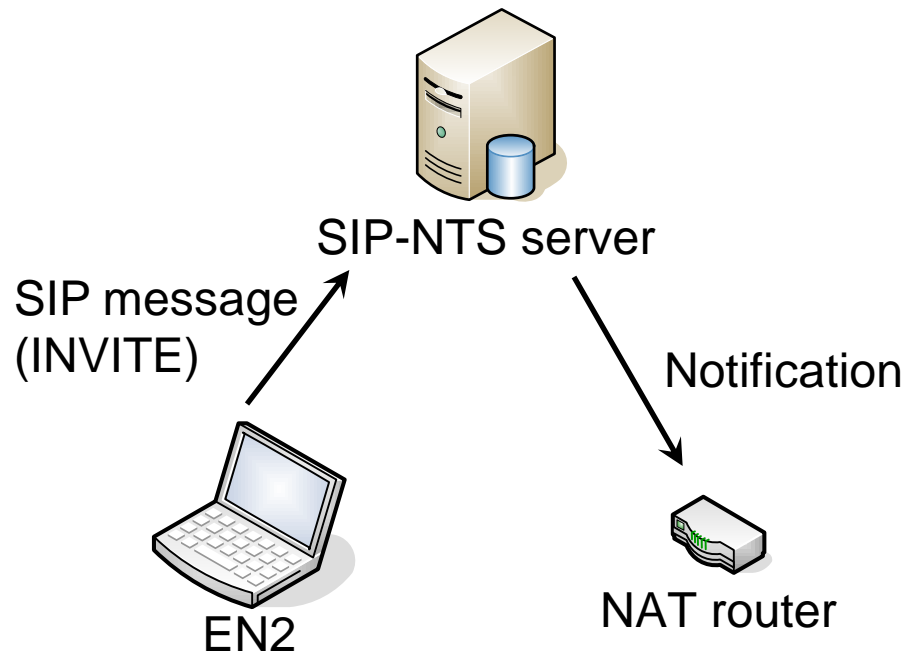
Can you use SIP Applications ?

- Proposed method does not support SIP
- Difference of the name resolution processes

DNS-based NTS



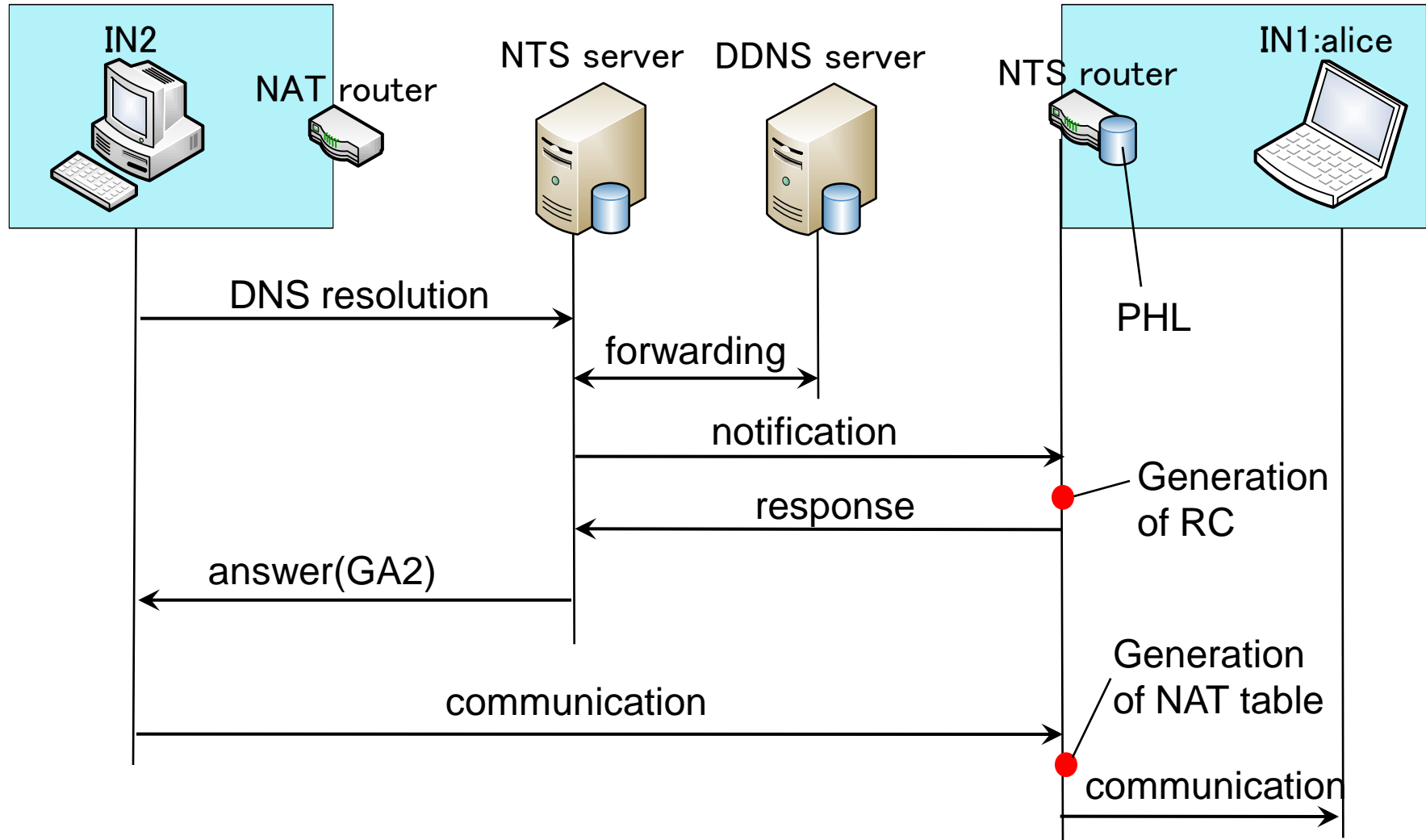
SIP-based NTS



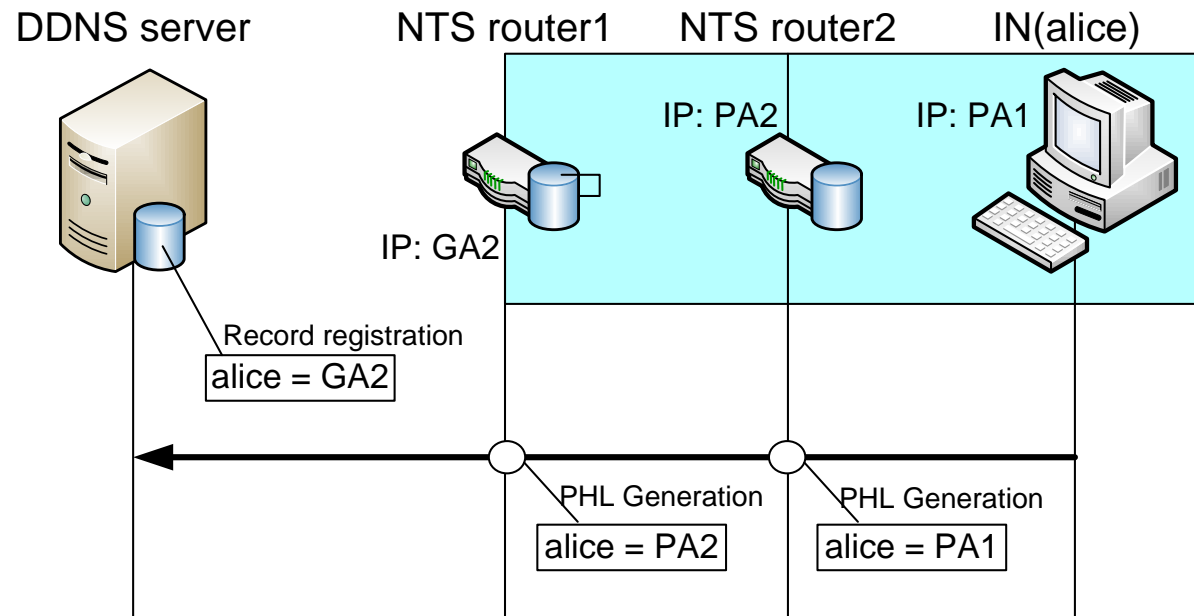
Future Works

- Collaboration with DLNA
(Digital Living Network Alliance)
 - A user can discover and download the contents in home devices from the internet or other home networks
- Security Considerations
 - Advanced authentication
 - Distributed Denial-of-Service attack

Private-to-Private Communication

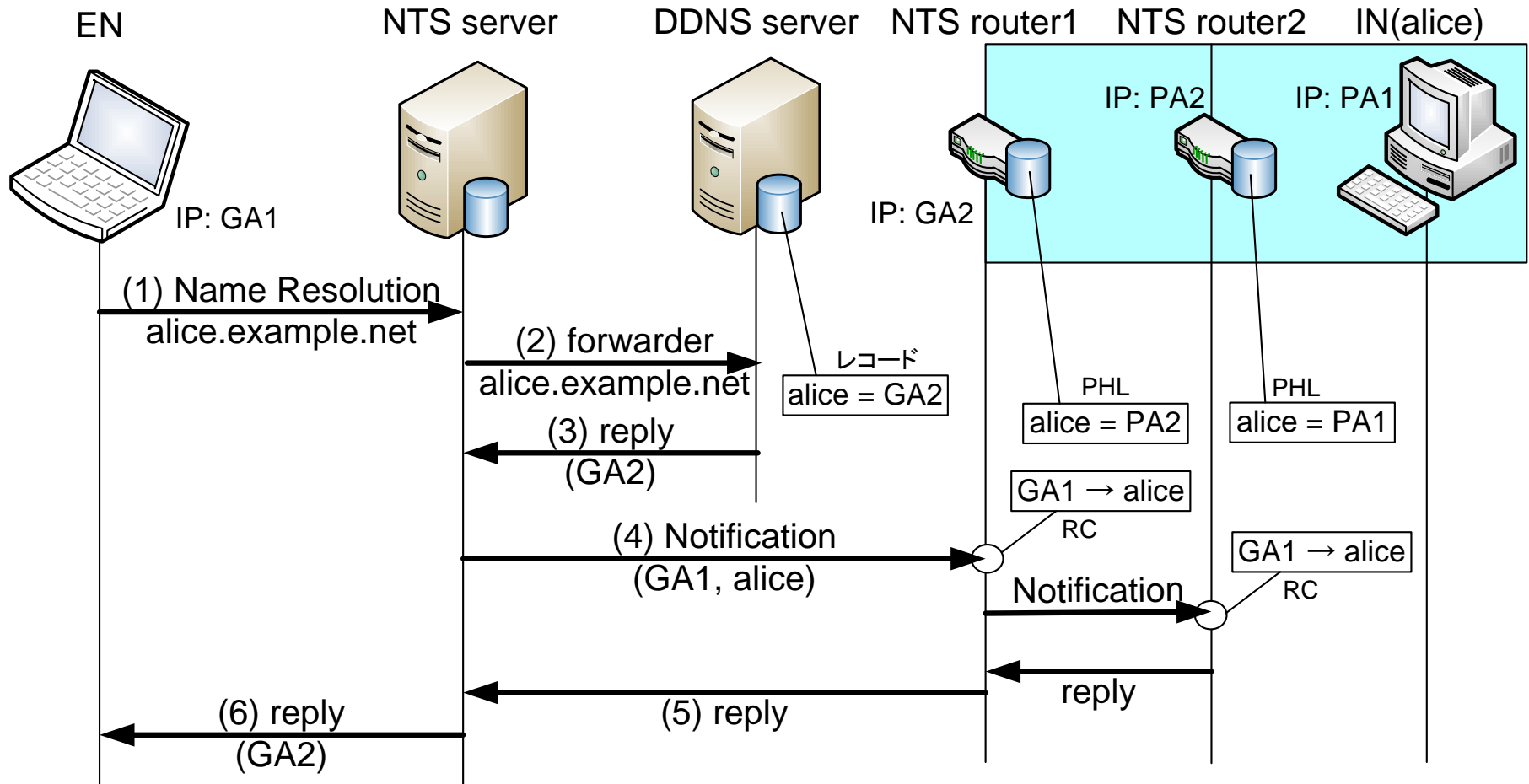


Double NAT (Name Registration)

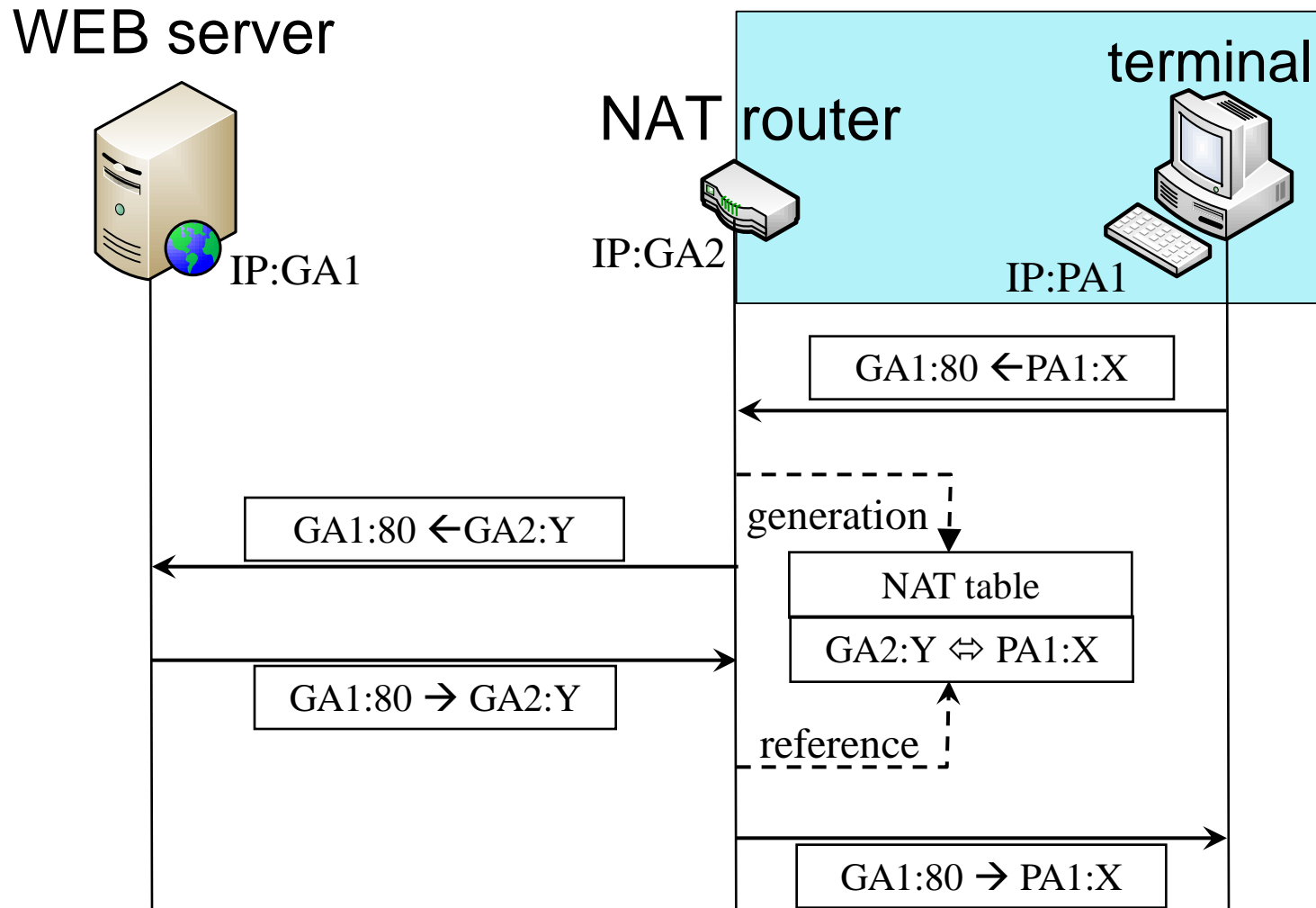


- The NTS router generates a PHL, when each name registration packet passes from the inside.
- After The NAT changes the source of the packet from the inside into an effective IP address on its outside, it is relayed.
- So, in NTS router1 and 2, the PHL of the address corresponding to each network is generated.

Double NAT (Name Resolution)

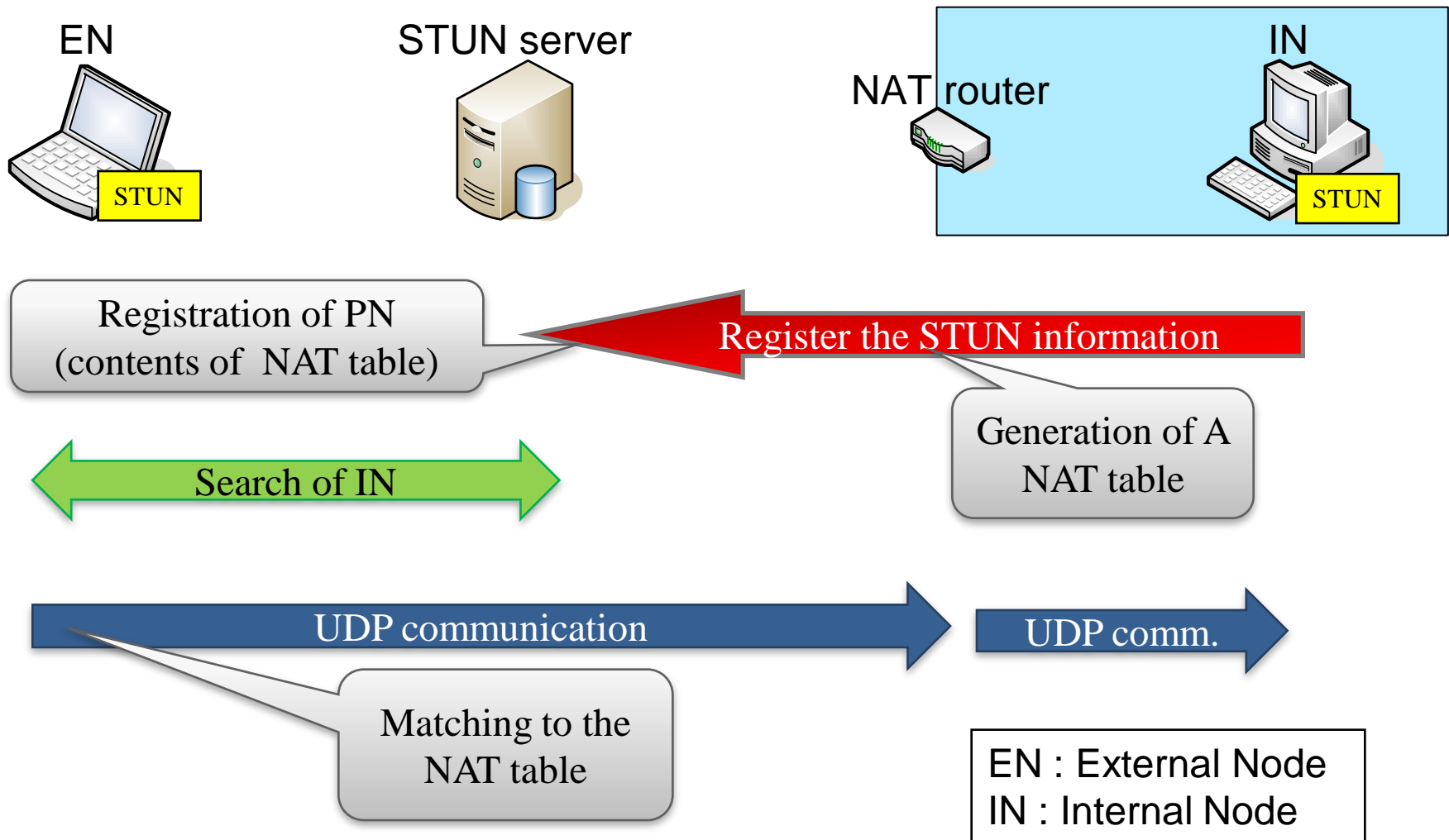


NAT Operations (from inside to outside)

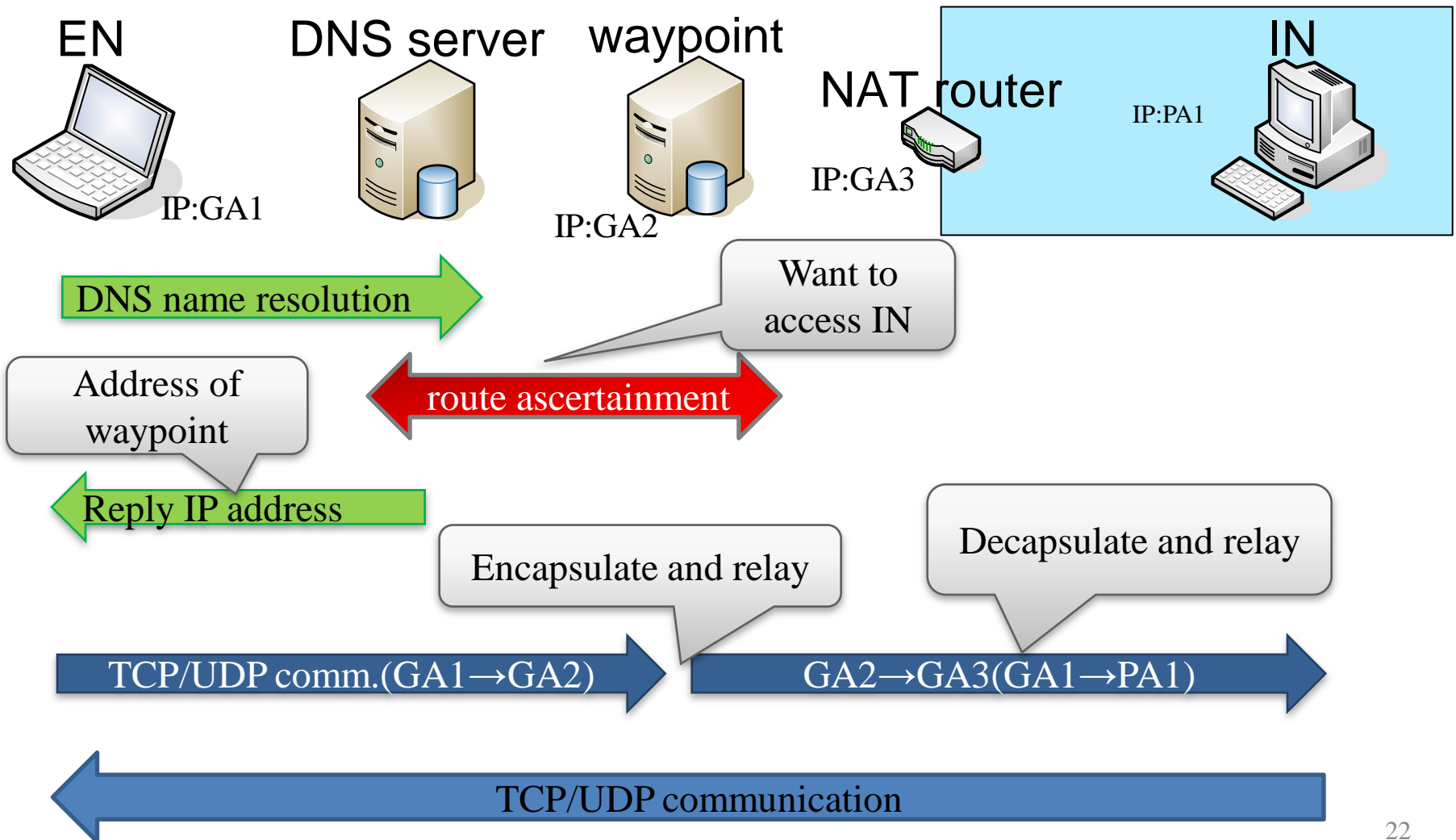


STUN (Simple Traversal of UDP Through NATs)

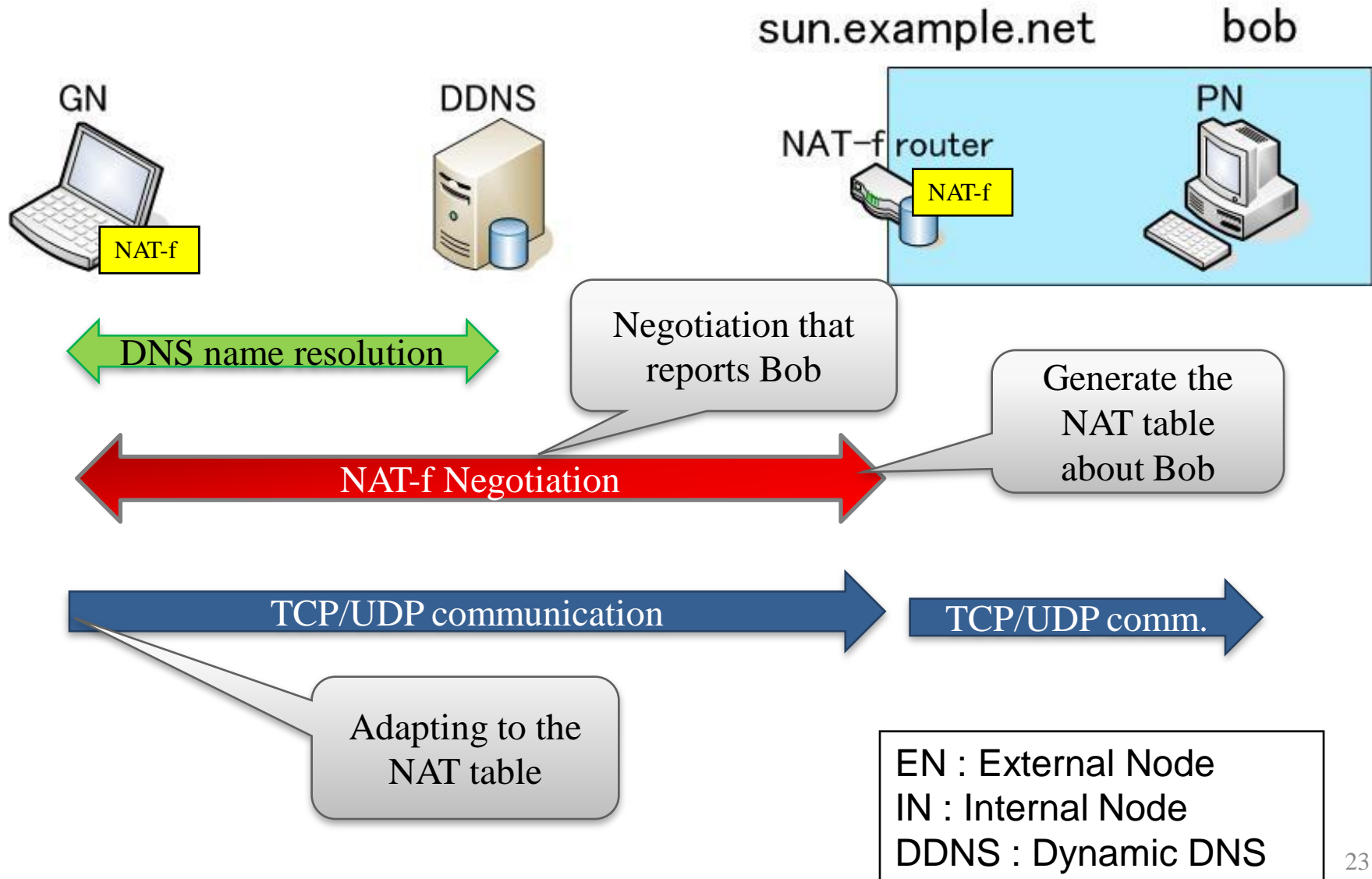
is defined in RFC 3489



AVES (Address Virtualization Enabling Service)



NAT-f (NAT-free protocol)



Use scene

- users can start communication without being conscious of the NAT router and it is not needed to modify the terminals.

