IPv6/IPv4 Translation for SIP Applications-
Socket-Layer Translator and SIPv6 Translator

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Outline

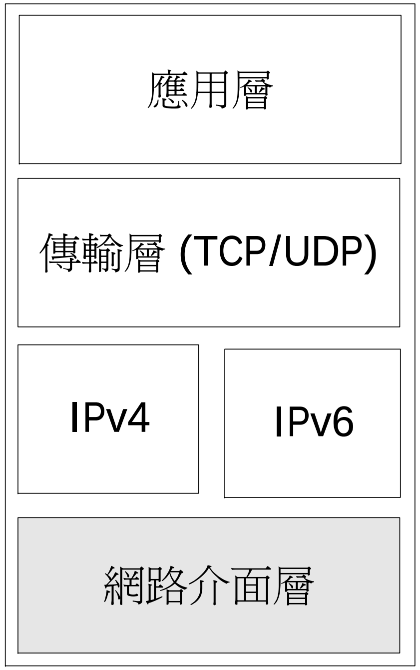
- Introduction to IPv6 Transition Mechanisms
- Socket-layer Translator
- SIPv6 Translator
- Conclusion

IPv4–to–IPv6 Transition Strategy

- Dual Stack
  - Reduce the cost invested in transition by running both IPv4/IPv6 protocols on the same machine .
- Tunneling
  - Reduce the cost in wiring by re-using current IPv4 routing infrastructures as a virtual link.
- Translation
  - Allow IPv6 realm to access the rich contents already developed on IPv4 applications

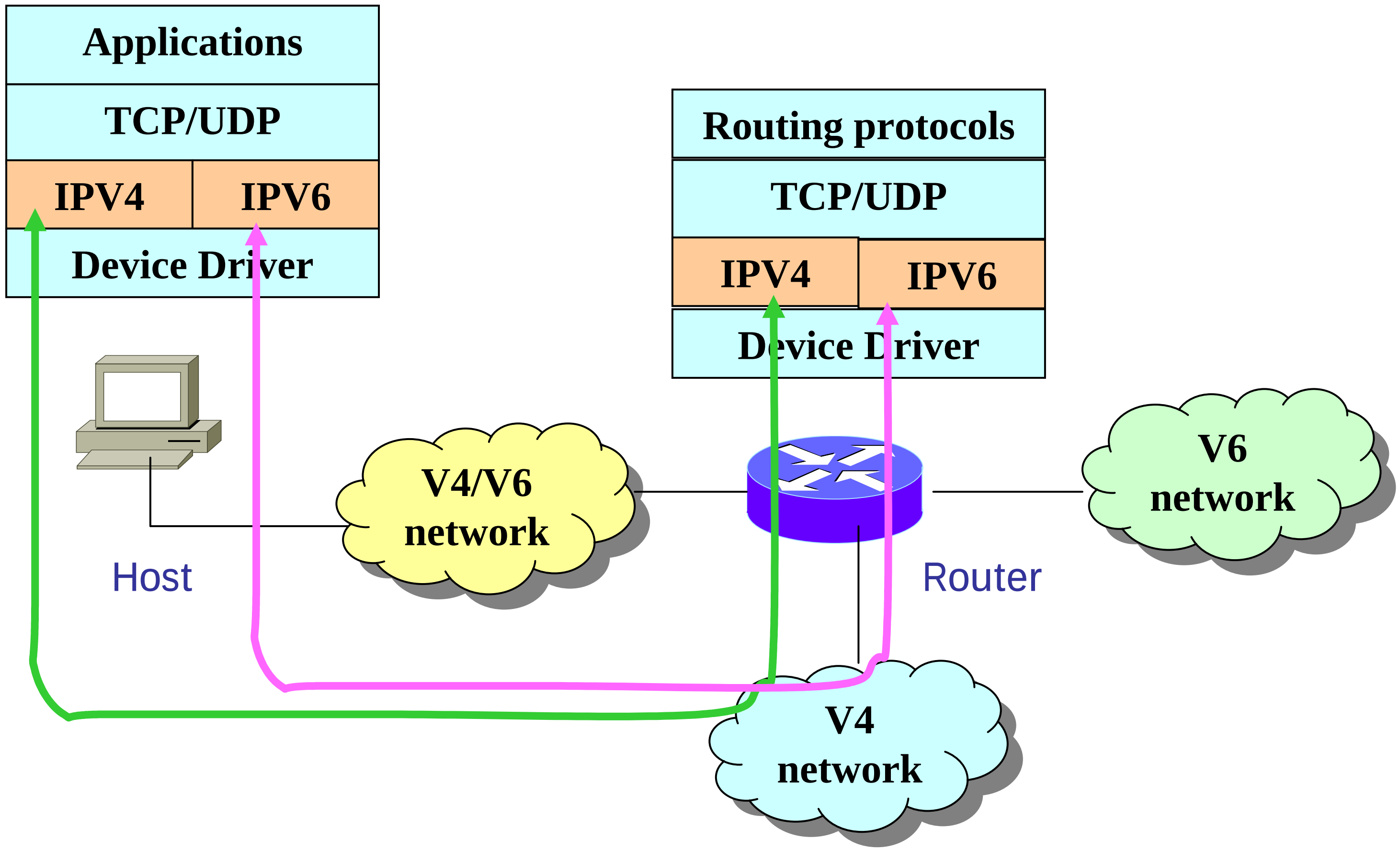
Dual Stack (RFC 2893)

Dual-stack



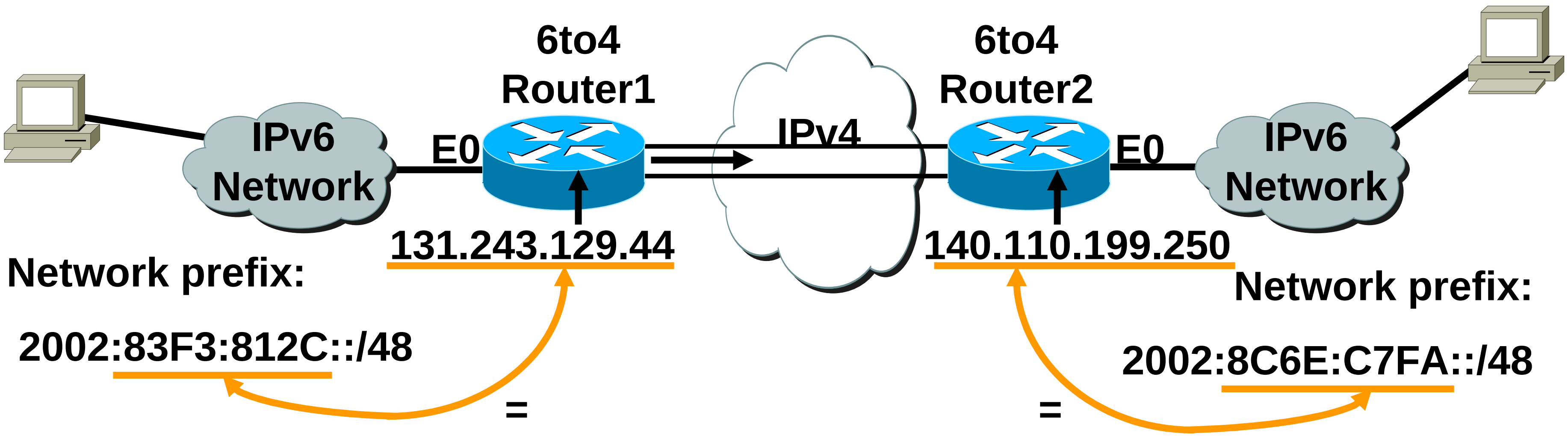
- Dual Stack表示同時裝有IPv4與IPv6兩個通訊協定堆疊。
- 當兩台機器通訊時，可以使用IPv4通訊，或是IPv6通訊。
- 當IPv6已經廣泛地被使用時，就可以移除IPv4通訊協定，而全面使用IPv6協定。

Dual Stack Example



■如果所有的機器都是Dual Stack，還需要其他的轉換機制嗎？

6to4 Tunnel (RFC 3056)



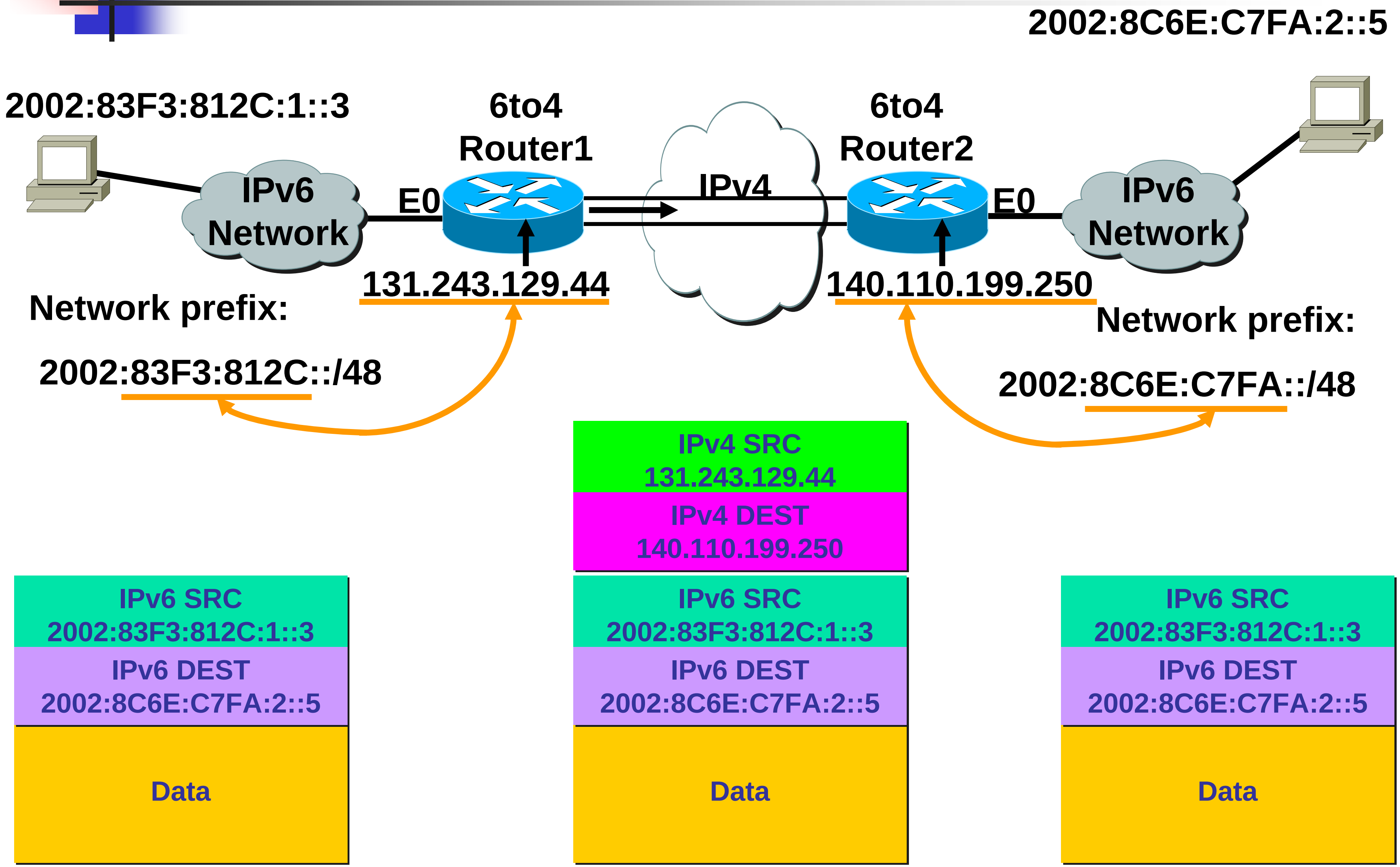
6to4 Tunnel:

- Is an automatic tunnel method
- Gives a prefix to the attached IPv6 network
- 2002::/16 assigned to 6to4
- Requires one global IPv4 address on each site

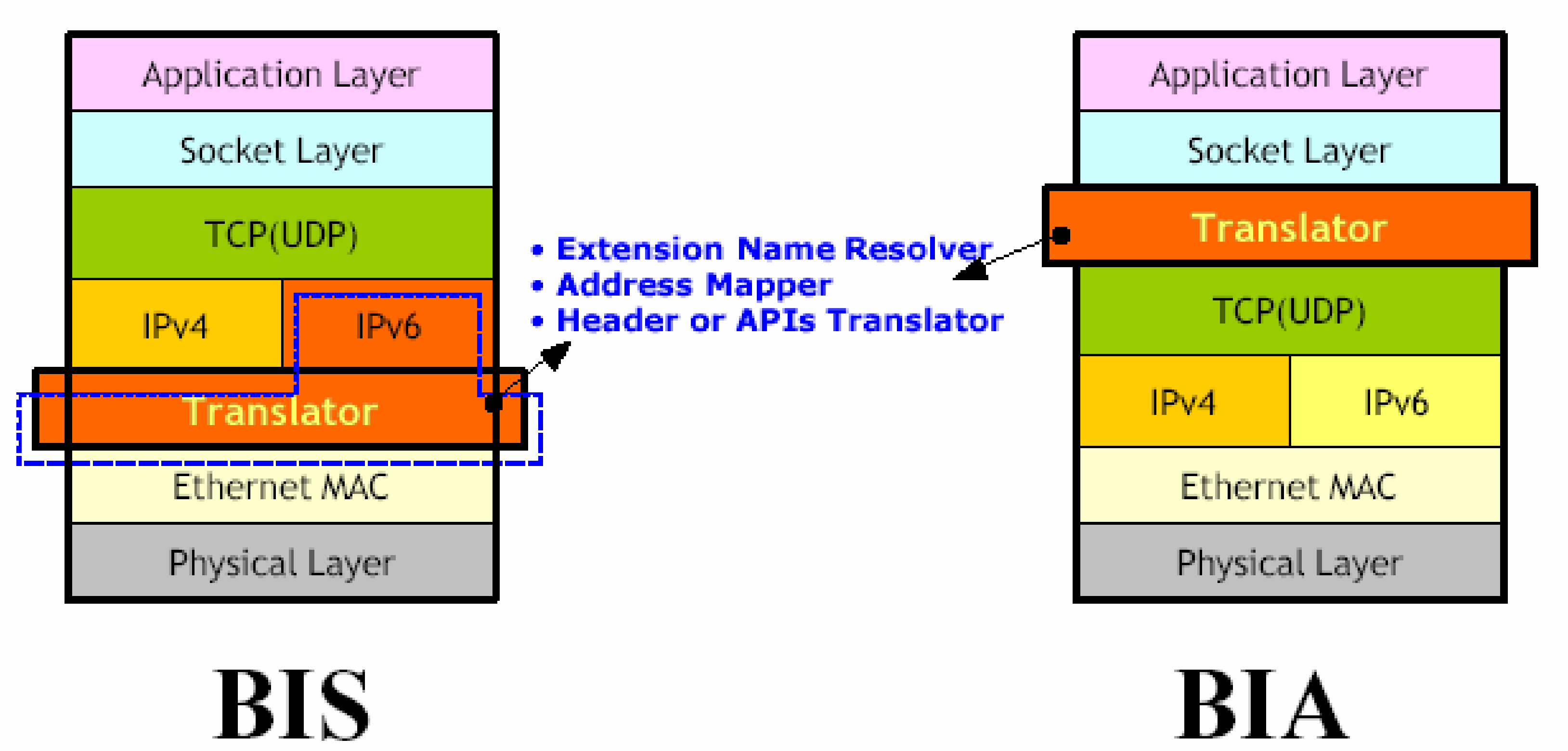
```
router2#
interface Ethernet0
 ip address 140.110.199.250 255.255.255.0
 ipv6 address 2002:8C6E:C7FA:1::/64 eui-64
interface Tunnel0
 no ip address
 ipv6 unnumbered Ethernet0
 tunnel source Ethernet0
 tunnel mode ipv6ip 6to4

ipv6 route 2002::/16 Tunnel0
```

6to4 Tunnel Example



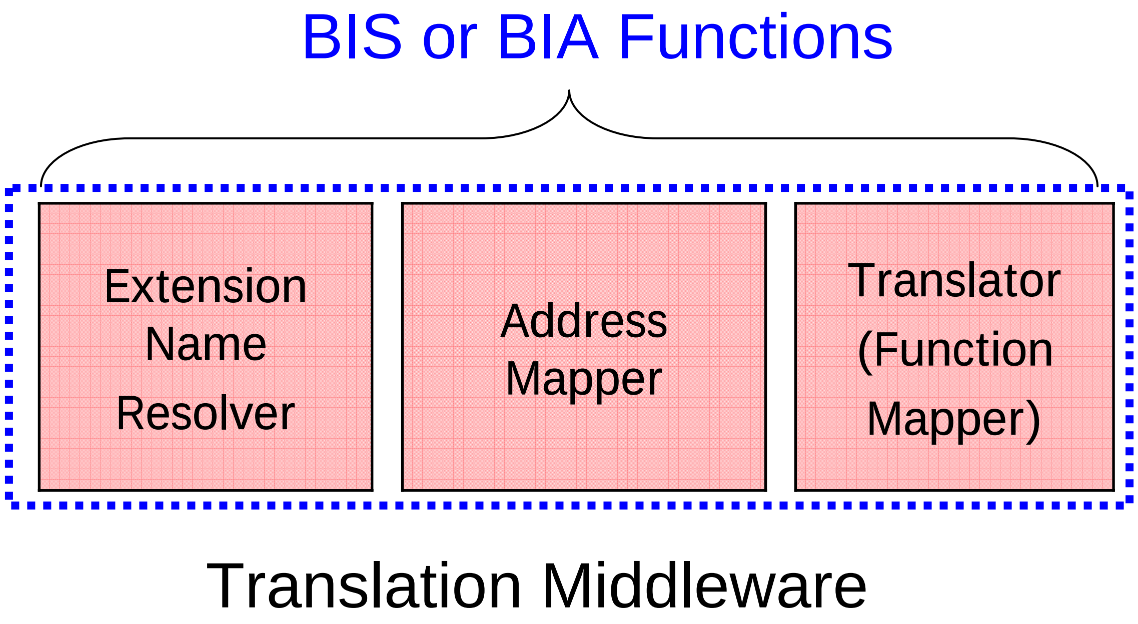
Address Translations



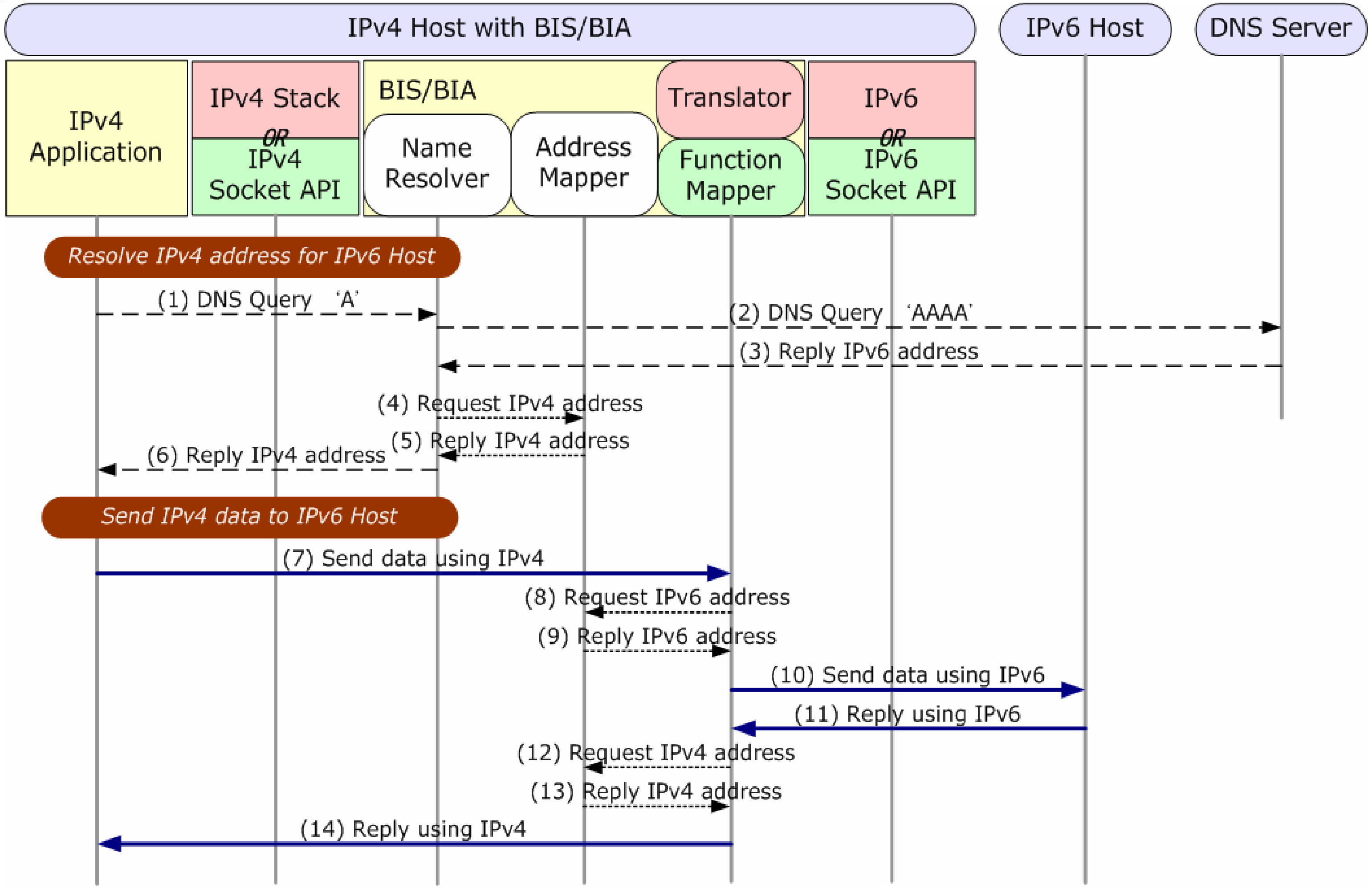
Bump-In-the-Stack

Bump-In-the-Application

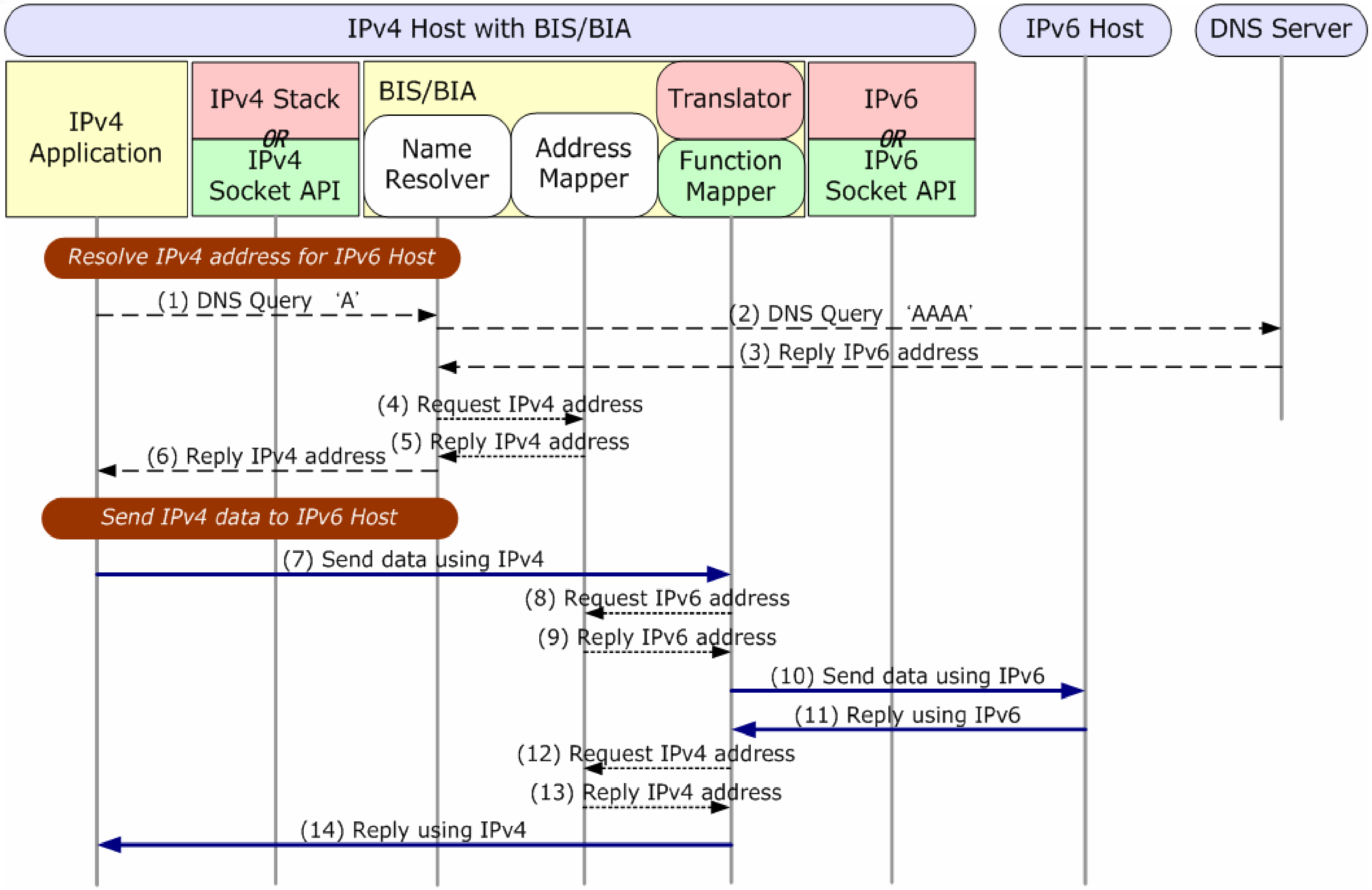
Key Components for BIS/BIA



BIS/BIA name resolving flow



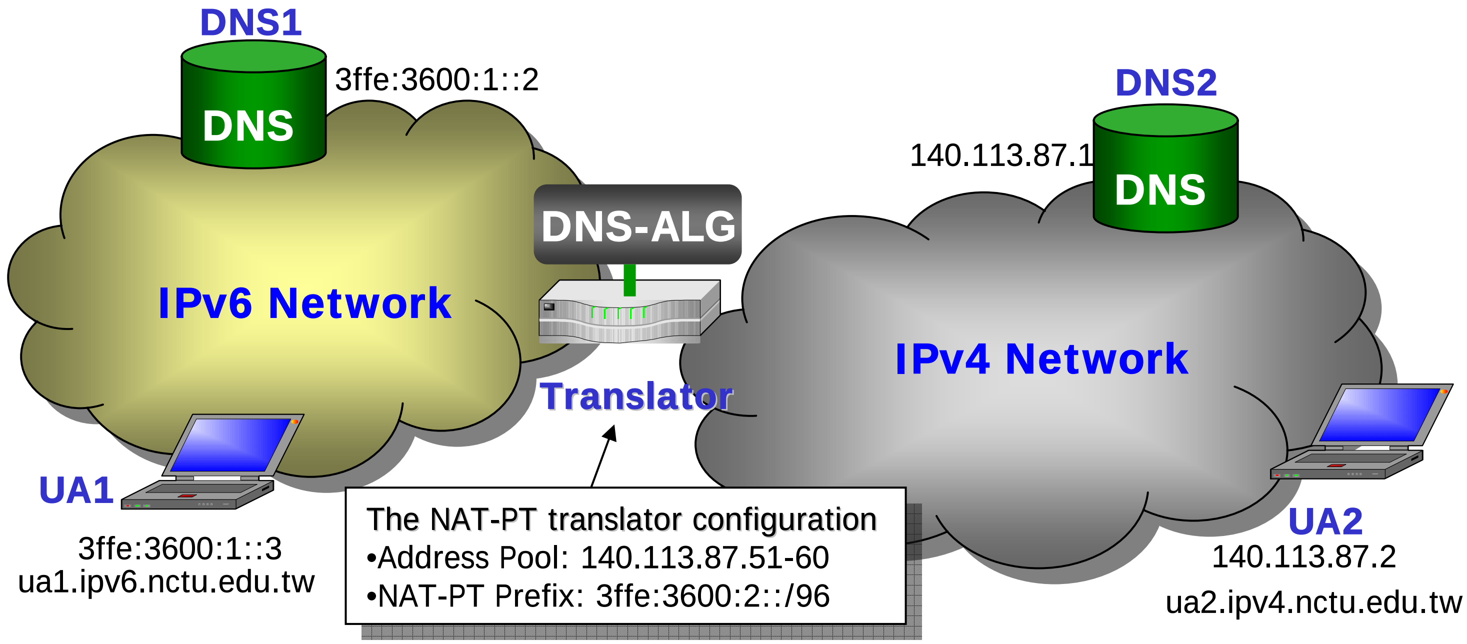
BIS/BIA Translation flow



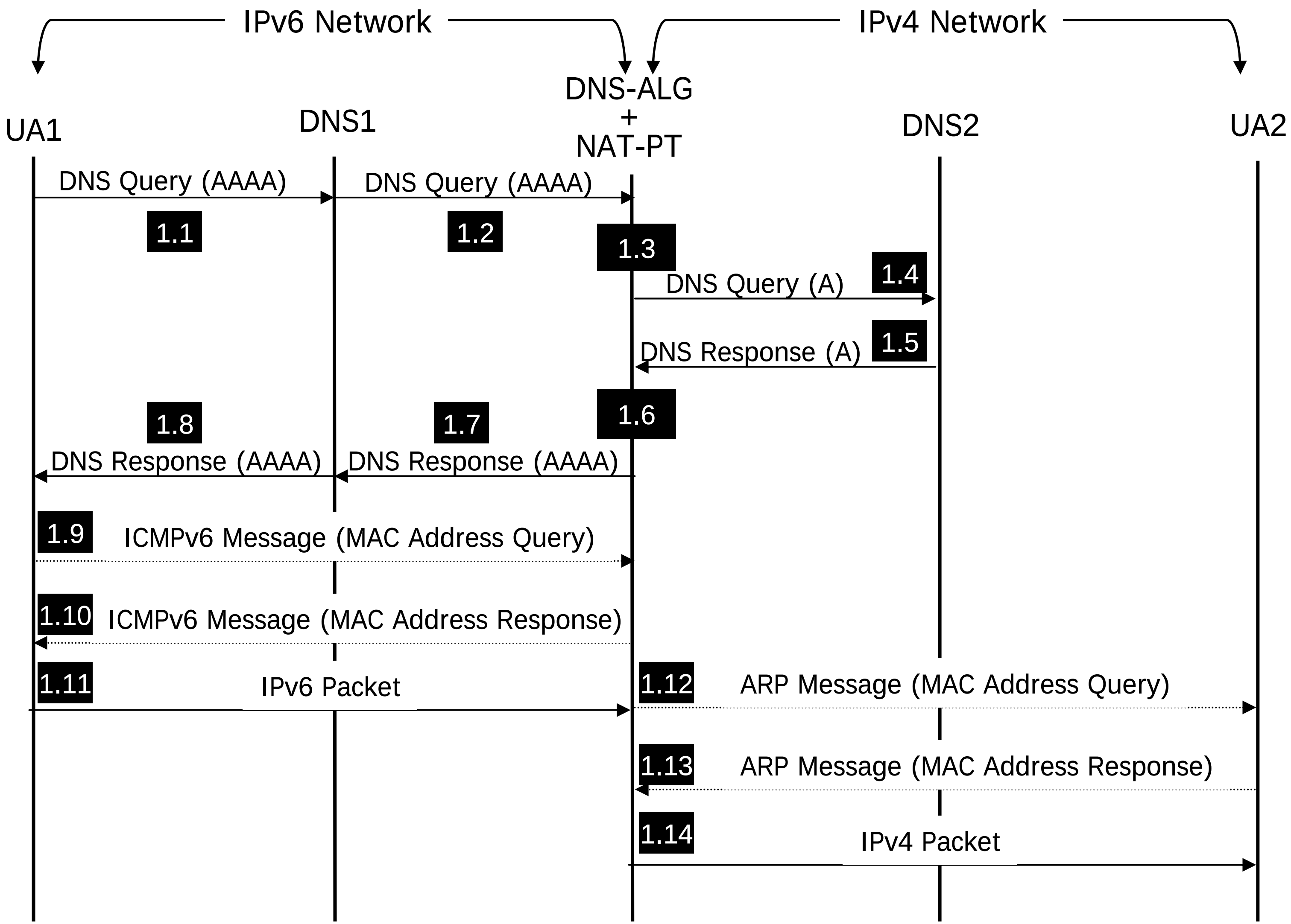
Introduction to NAT-PT

- NATPT (Network Address Translation and Protocol Translation)
  - Translate IPv6 to IPv4 headers, and vice versa.
  - Also includes ICMP headers
- NAPTPT (NATPT with Port translation)
  - Network Address and Protocol Translation with Port Translation
  - Various IPv6 clients can utilize one IP to connect Internet
- ALG (Application Layer Gateway)
  - ALG assists NAT to deal with upper-layer protocols
  - Translate Upper-layer protocols (such as: DNS, FTP)
  - Also called DNS_ALG and FTP ALG

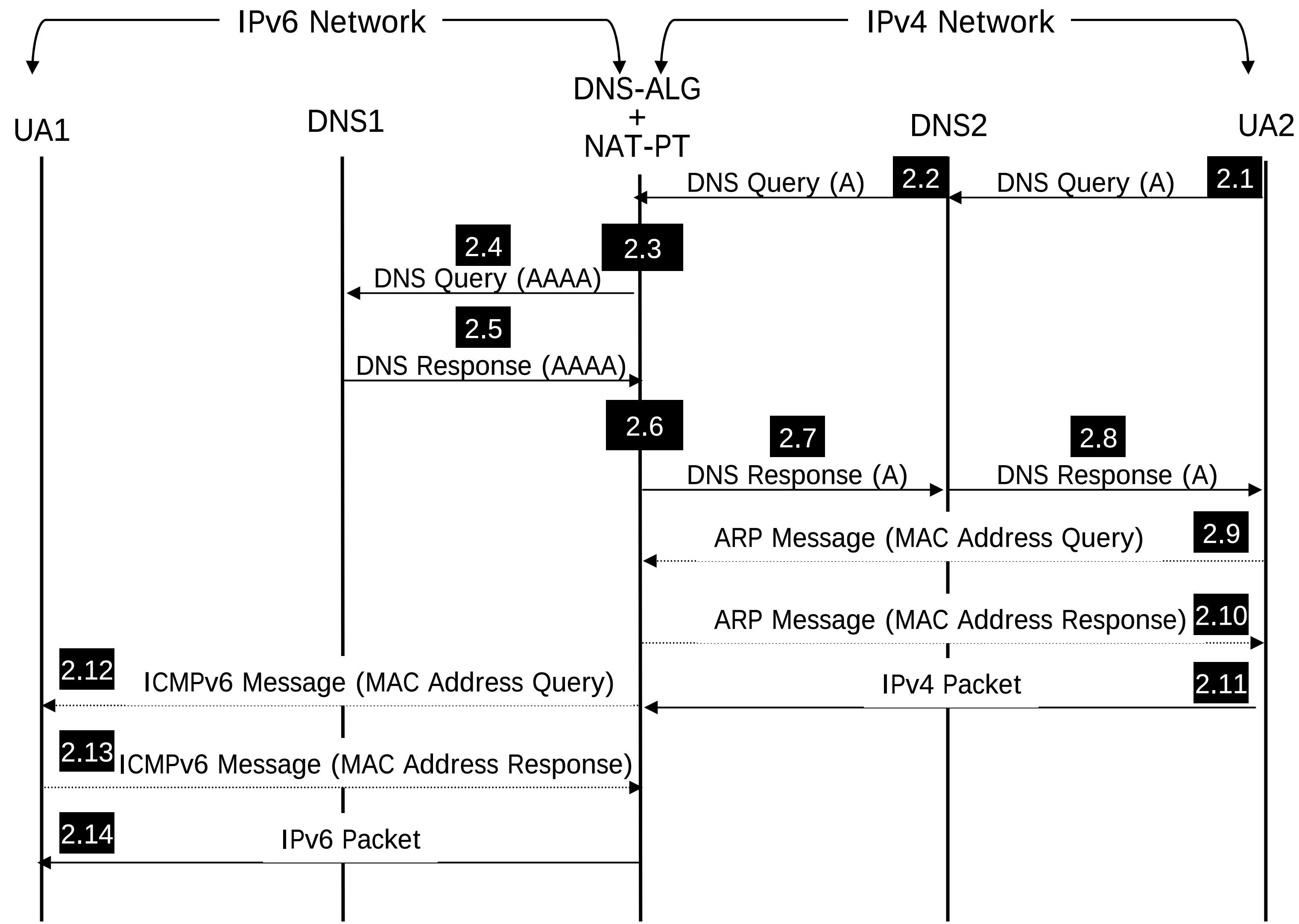
Network Architecture for IPv6 Translation



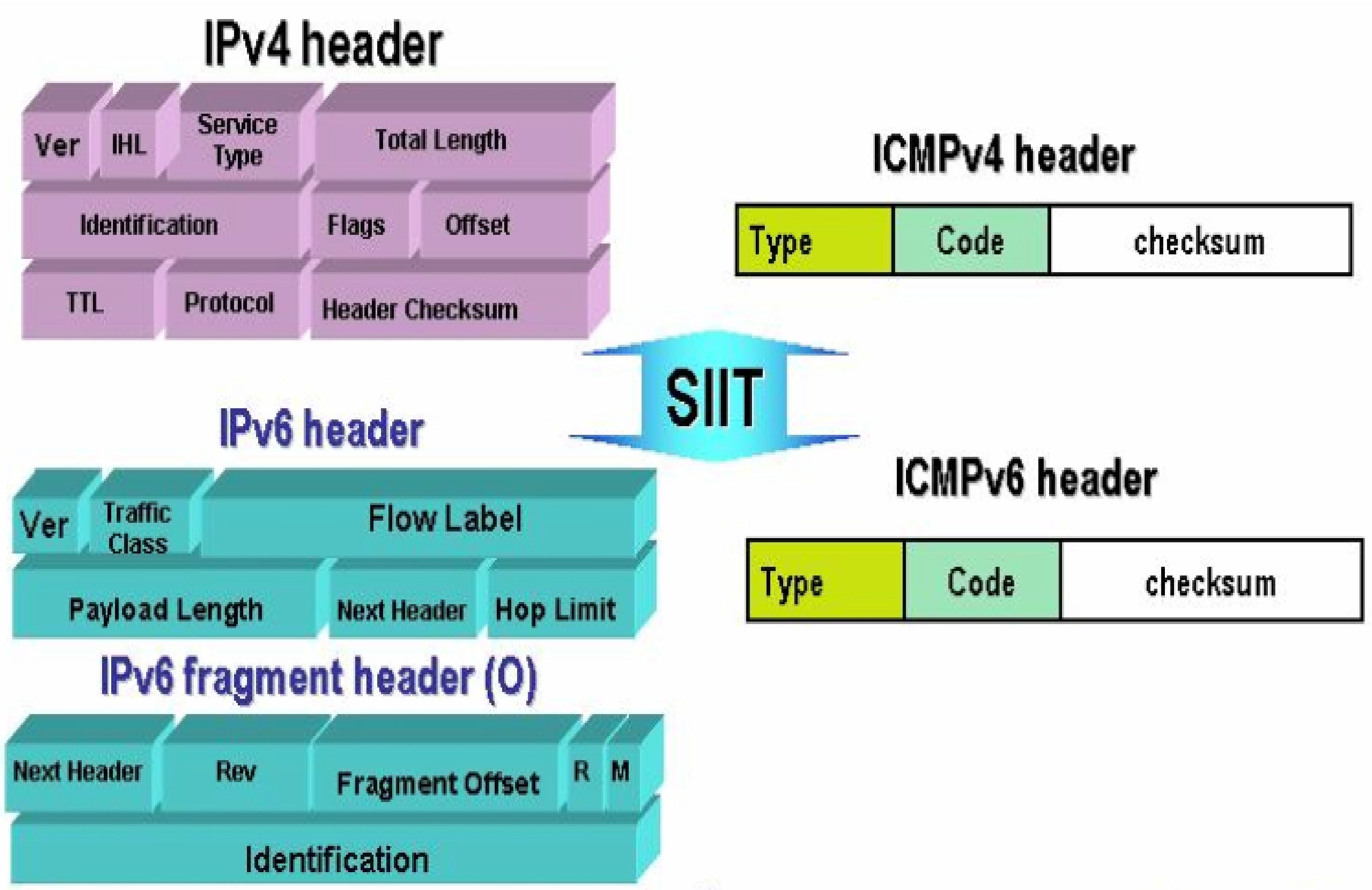
NAT-PT operations with DNS-ALG (IPv6→IPv4)



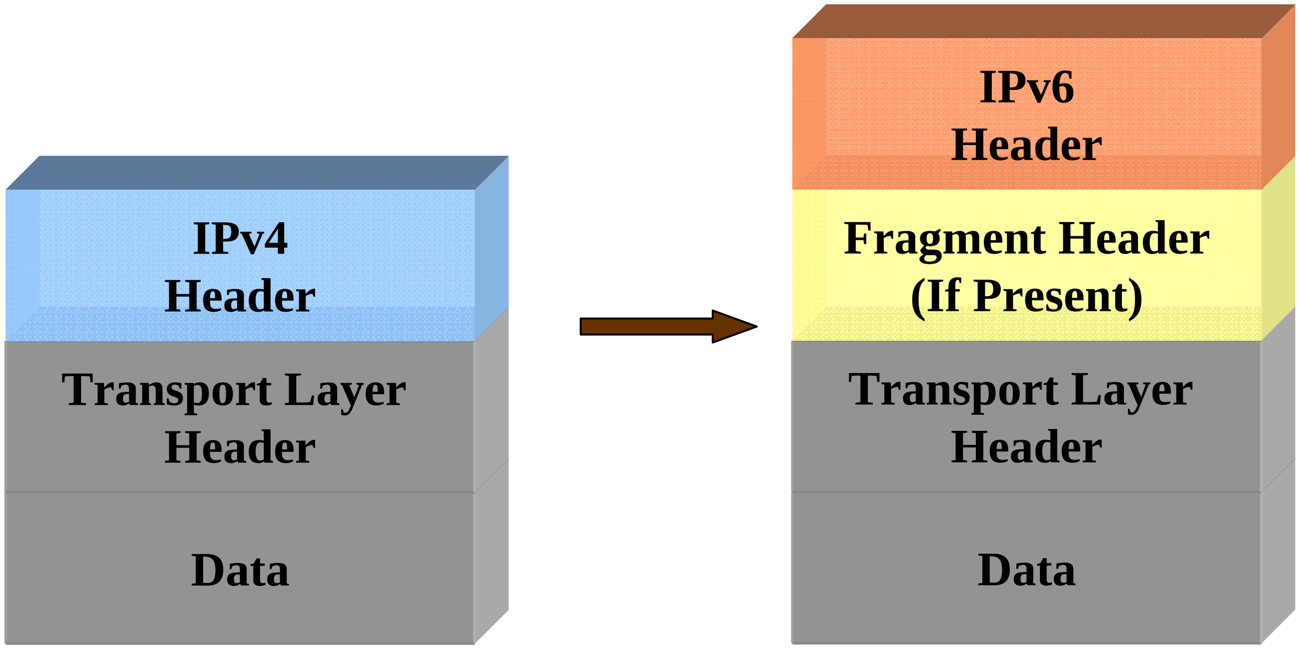
NAT-PT operations with DNS-ALG (IPv4→IPv6)



SIIT (Stateless IP/ICMP Translation) RFC 2765



Translating from IPv4 to IPv6



Translating IPv4 Headers into IPv6 Headers - If IPv4 DF is set.

IPv6 Header Fields	Value
Version	6
Traffic Class	0
Flow Label	0
Payload Length	IPv4 Total length – IPv4 IHL
Next Header	IPv4 Protocol field
Hop Limit	IPv4 TTL - 1
Source Address	High-order 96 bits = IPv6 prefix Low-order 32 bits = IPv4 source address
Destination Address	IPv6 in NAT-PT Mapping table

Translating IPv4 Headers into IPv6 Headers - If IPv4 DF is set.

<table>
<tr><td rowspan="5">IPv4 Header</td><td>Version</td><td>IHL [4]</td><td>TOS [8]</td><td colspan="4">Total Length [16]</td></tr>
<tr><td colspan="3">Identification [16]</td><td>0</td><td>DF</td><td>MF</td><td>Fragment Offset [13]</td></tr>
<tr><td colspan="2">TTL [8]</td><td>Protocol [8]</td><td colspan="4">Header Checksum [16]</td></tr>
<tr><td colspan="7">Source Address [32]</td></tr>
<tr><td colspan="7">Destination Address [32]</td></tr>
</table>

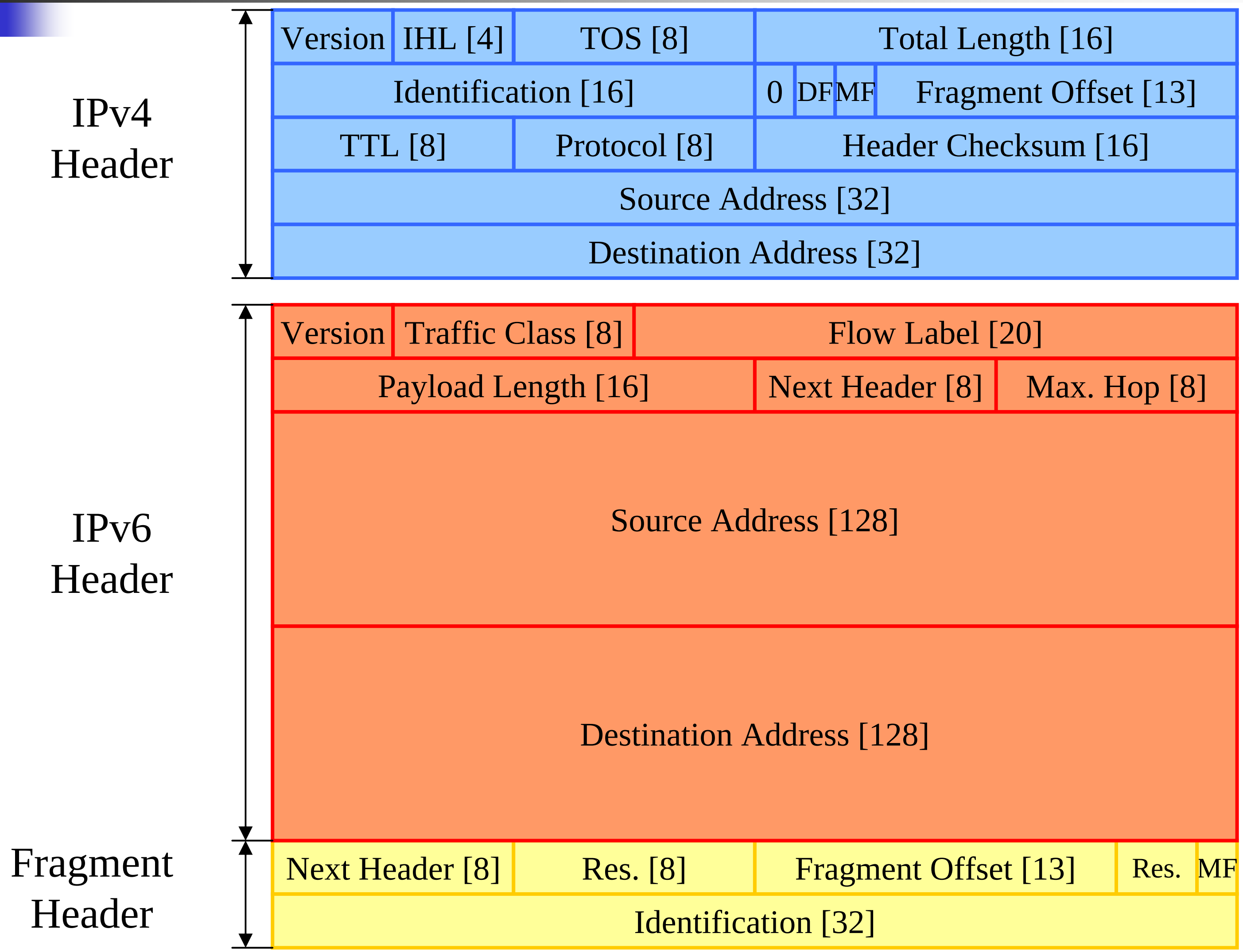
<table>
<tr><td rowspan="4">IPv6 Header</td><td>Version</td><td>Traffic Class [8]</td><td colspan="3">Flow Label [20]</td></tr>
<tr><td colspan="3">Payload Length [16]</td><td>Next Header [8]</td><td>Max. Hop [8]</td></tr>
<tr><td colspan="5">Source Address [128]</td></tr>
<tr><td colspan="5">Destination Address [128]</td></tr>
</table>

Translating IPv4 Headers into IPv6 Headers - If IPv4 DF is not set.

IPv6 Header Fields	Value
Payload Length	IPv4 Total length – IPv4 IHL + 8 (Fragment Header)
Next Header	Fragment Header

Fragment Header	Value
Next Header	IPv4 Protocol field
Fragment Offset	IPv4 Fragment Offset field
M Flag	IPv4 More Fragment(MF) bit
Identification	High-order 16 bits = 0 Low-order 16 bits = IPv4 Identification

Translating IPv4 Headers into IPv6 Headers - If IPv4 DF is not set.



Translating ICMPv4 Headers into ICMPv6 Headers - ICMP Query Message

ICMP Header

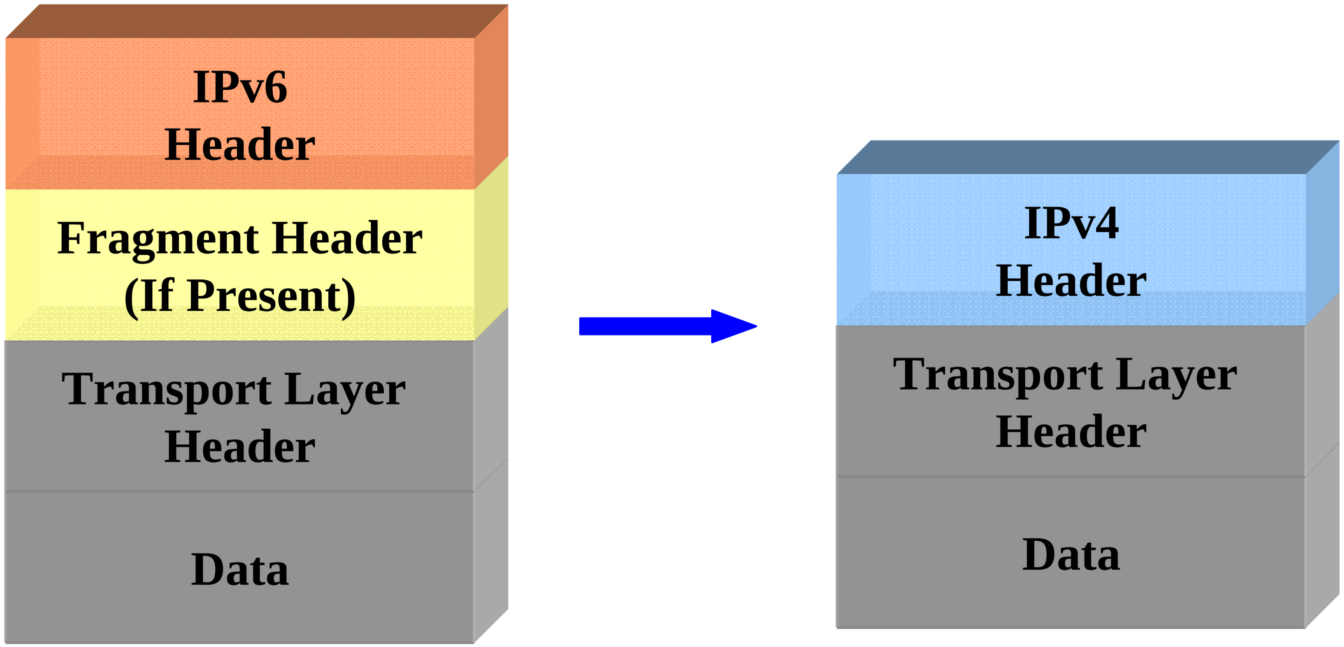
Type [8]	Code [8]	Checksum [16]
Message Body [32] :		

ICMPv4(Type)	ICMPv6(Type)
Echo Request(8) / Reply(0)	Type = 128/129
Information Request(15) / Reply(16)	Silently drop (Undefine)
Timestamp Request(13) / Reply(14)	Silently drop (Undefine)
Address Mask Request(17)/ Reply(18)	Silently drop (Undefine)
ICMP Router Adver.(9)	Silently drop (Single Hop)
ICMP Router Solicit.(10)	Silently drop (Single Hop)
Unknown ICMP4 types	Silently drop

Translating ICMPv4 Headers into ICMPv6 Headers - ICMP Error Message

ICMPv4(Type)	Code	ICMPv6
3 (Destination Unreachable)	0/1	Type = 1, Code = 0 (no route to destination)
	2	Type = 4, Code = 1, Pointer to 6NexHead
	3	Type = 1, Code = 4 (port unreachable)
	4	Type = 2, Code = 0 (Packet too Big)
	5	Type = 1, Code = 0
	6/7/8	Type = 1, Code = 0
	9/10	Type = 1, Code = 1 (Administratively Prohibited)
	11/12	Type = 1, Code = 0
5 (Redicrect)		Silently drop (Single Hop)
4 (Source Quench)		Silently drop (Obsoleted in ICMPv6)
11 (Time Exceed)	0/1	Type = 3, Code=0/1
12 (Parameter Problem)	0	Type = 4, Code=0, Pointer to the correspon. Field
Unknow error message		Silently drop

Translating from IPv6 to IPv4



Translating IPv6 Headers into IPv4 Headers - If there is no IPv6 Fragment header.

IPv4 Header Fields	Value
Version	4
Internet H. L.	5 (no IPv4 option)
ToS and Precedence	0
Total Length	Payload Length + IPv4 IHL
Identification	0
Flags	MF = 0, DF = 1
Fragment Offset	0
Time to Live	IPv6 Hop Limit – 1
Protocol	IPv6 Next Header
Header Checksum	Recompute
Source Address	IPv4 in NAT-PT Mapping table
Destination Address	Destination address of IPv6 Low-order 32 bits

Translating IPv6 Headers into IPv4 Headers - If there is a IPv6 Fragment header.

IPv4 Header Fields	Value
Total Length	Payload Length - IPv4 IHL + 8(Fragment header)
Identification	Identification in Fragment header
Flags	MF = M in the Fragment header, DF = 1
Fragment Offset	Fragment Offset in Fragment header
Protocol	Next Header in Fragment header

Translating ICMPv6 Headers into ICMPv4 Headers - ICMPv6 Query Message

ICMPv6(Type)	ICMPv4(Type)
Echo Request(128) / Reply(129)	Type = 8/0
MLD Multicast Listener Query/Report/Done (130/131/132)	Silently drop (Single Hop & Undefine)
Neighbor Discover messages (133 – 137)	Silently drop (Single Hop)
Unknown ICMP6 types	Silently drop

Translating ICMPv6 Headers into ICMPv4 Headers - ICMPv6 Error Message

ICMPv6(Type)	Code	ICMPv4
1 (Destination Unreachable)	0	Type = 3, Code = 1 (host unreachable)
	1	Type = 3, Code = 10 (Admin. Prohibited)
	2	Type = 3, Code = 1 (host unreachable)
	3	Type = 3, Code = 1 (host unreachable)
	4	Type = 3, Code = 3 (port unreachable)
2 (Packet Too Big)	0	Type = 3, Code = 4 (fragmentation needed)
3 (Time Exceeded)	0/1	Type = 11, Code = 0/1
11 (Parameter Problem)	1	Type = 3, Code = 2 (protocol unreachable)
	other	Type =12, Code = 0
Unknown error message		Silently drop

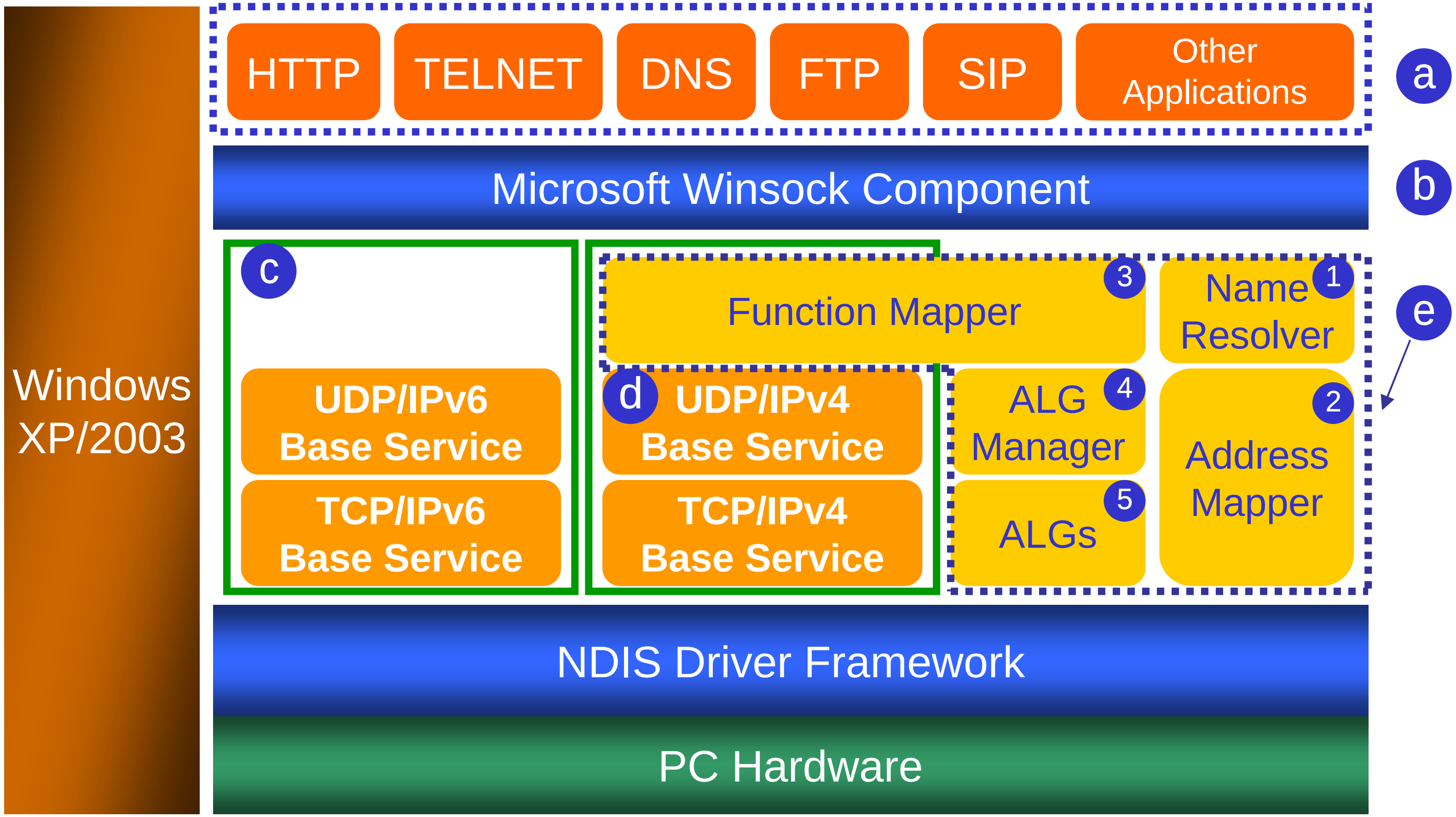
Checksum Modification

- Internet checksum use 16-bits 1's complement checksum
- 2 kinds of policy
  - Re-Compute Algorithm
  - Adjustment Algorithm

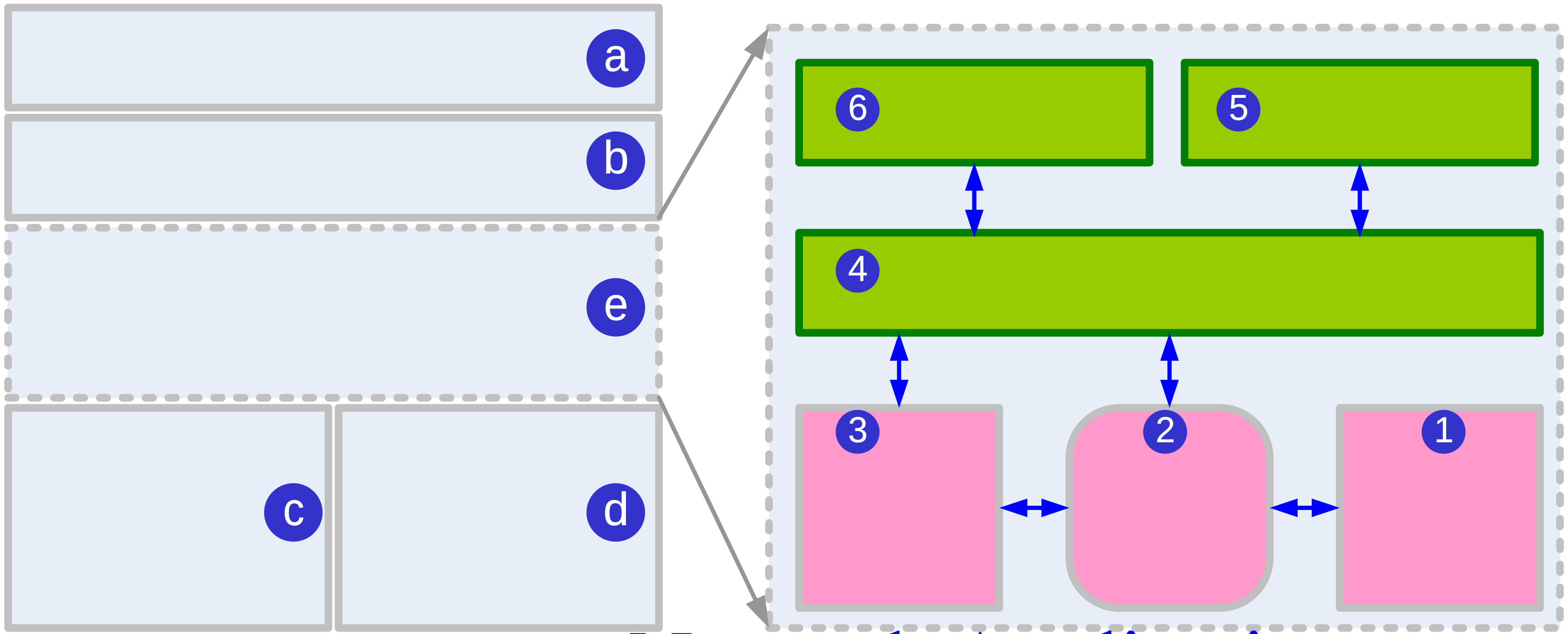
Case	Policy
IPv6 Header ←→ IPv4 Header	Re-Compute Algorithm
ICMPv6 Header ←→ ICMPv4 Header	Adjustment Algorithm
TCP	Adjustment Algorithm
UDP	Adjustment Algorithm

Socket-Layer Translator

System Architecture of SLT and ALGs



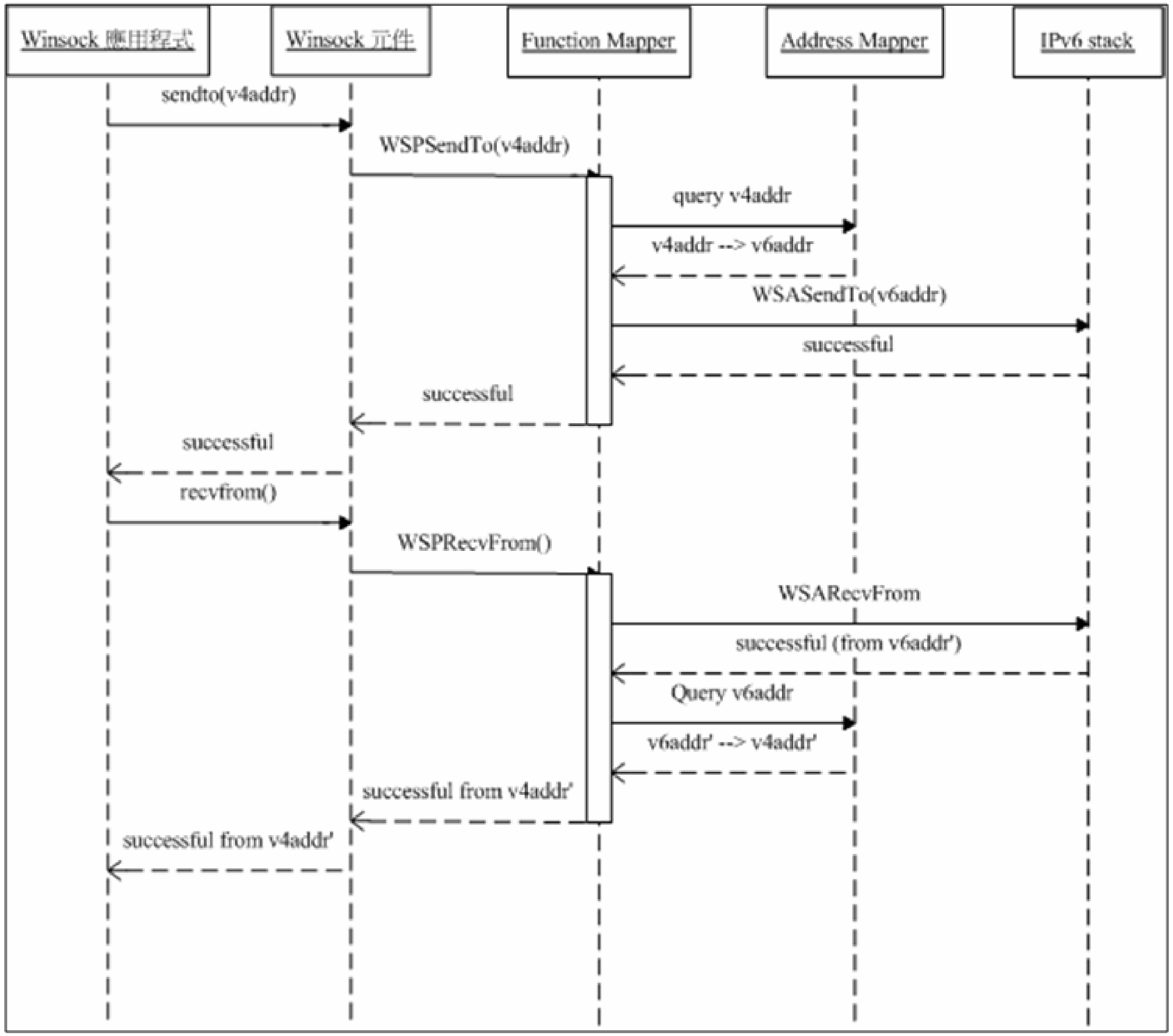
System Architecture of SLT and ALGs



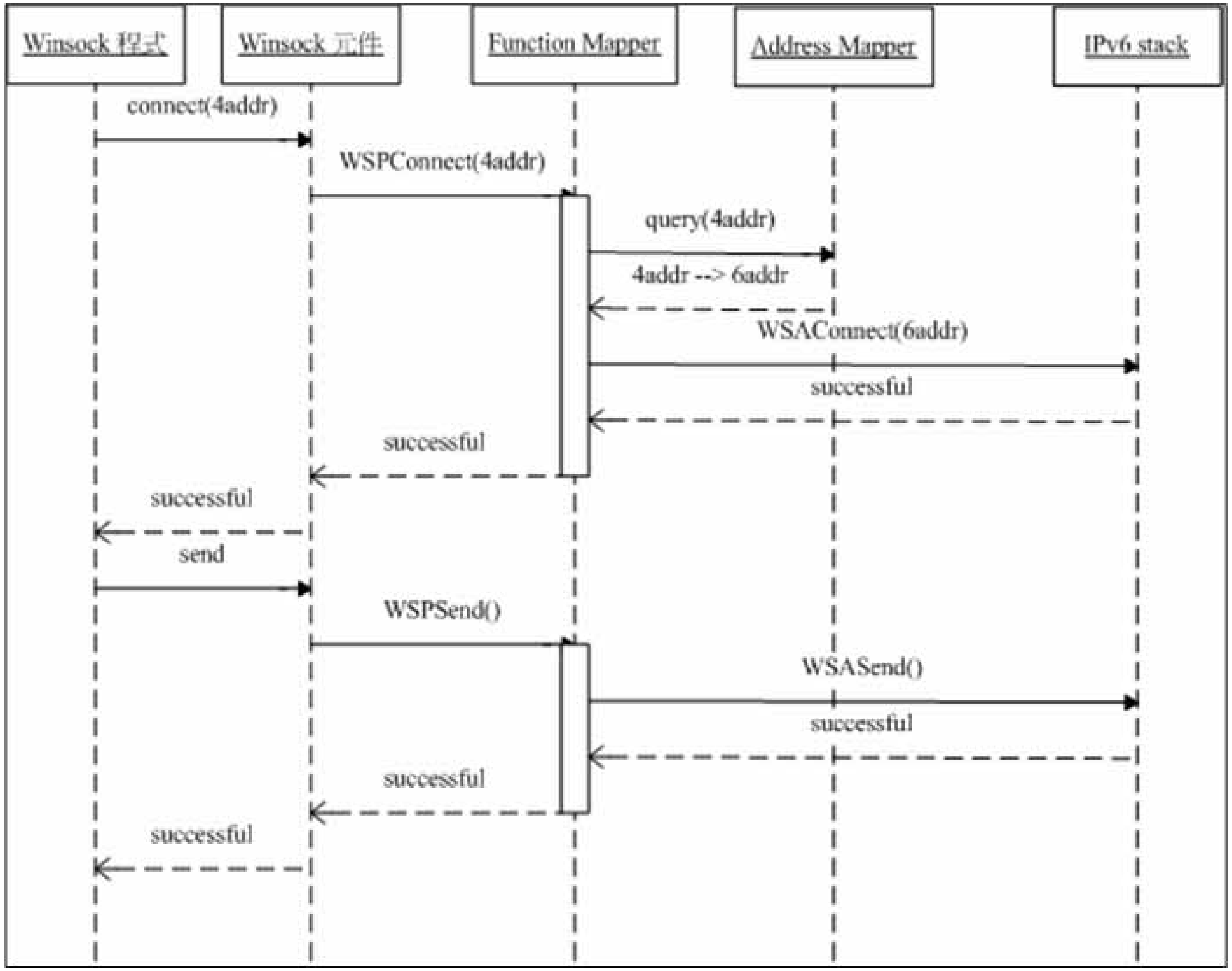
Network Applications

Winsock Component

Example of UDP Call Flow



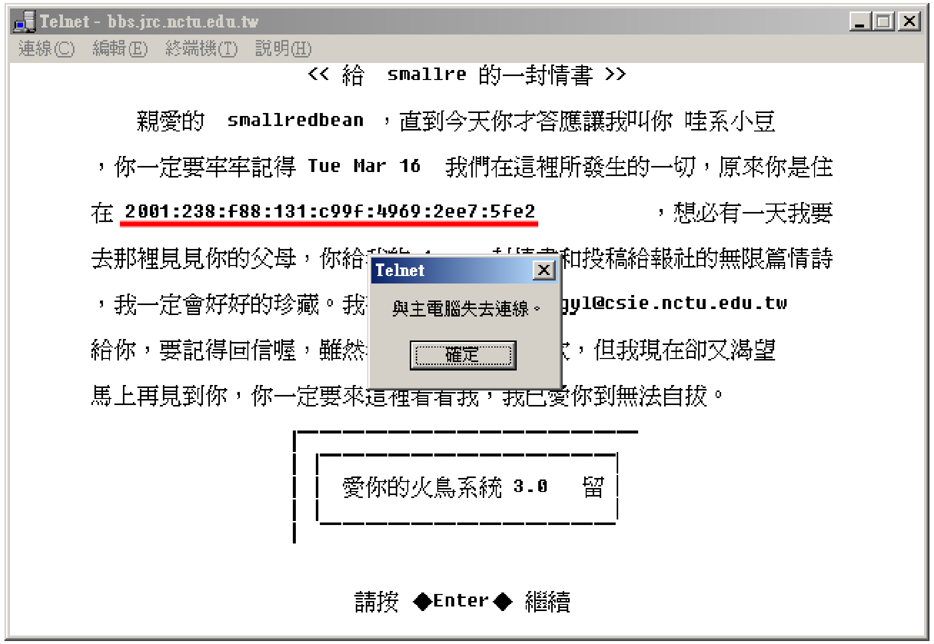
Example of TCP Call Flow

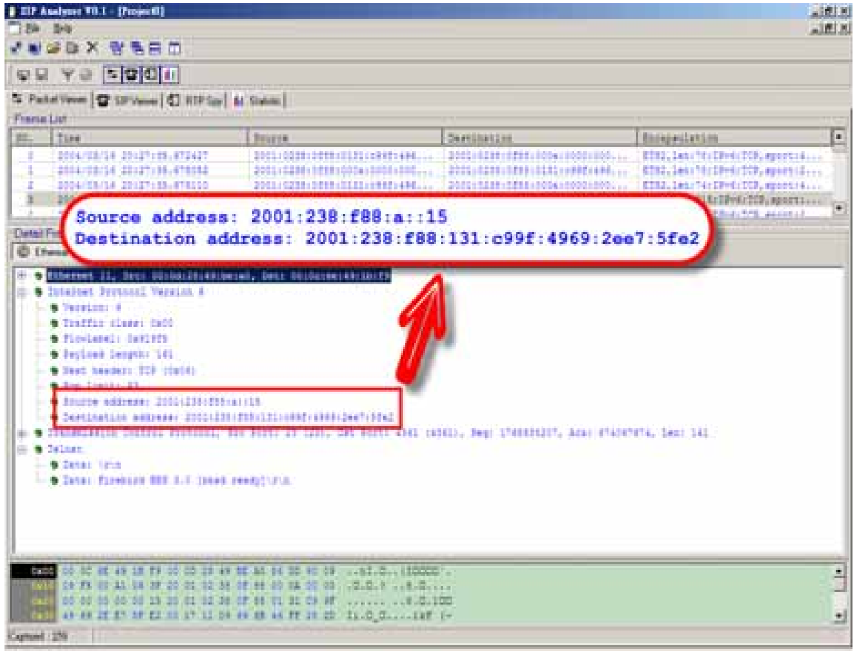


Development Status

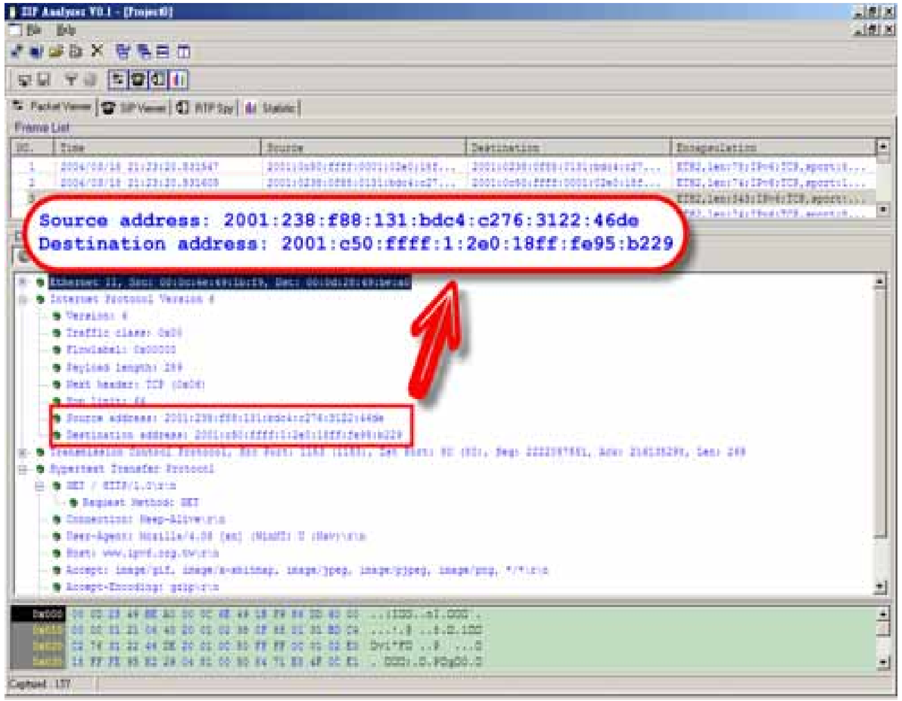
- *Socket-layer Translator* can translate most Winsock applications using NAT-friendly protocol
- *FTP-ALG* and *SIP-ALG* can translate FTP and SIP applications respectively.
- Tested Applications
  - NAT-friendly: Netscape (HTTP), Telnet
  - DNS
  - FTP: CuteFTP, FileZilla, SmartFTP
  - SIP: CCL SkinUA 0.8

Snapshot of TELNET and Analyzer

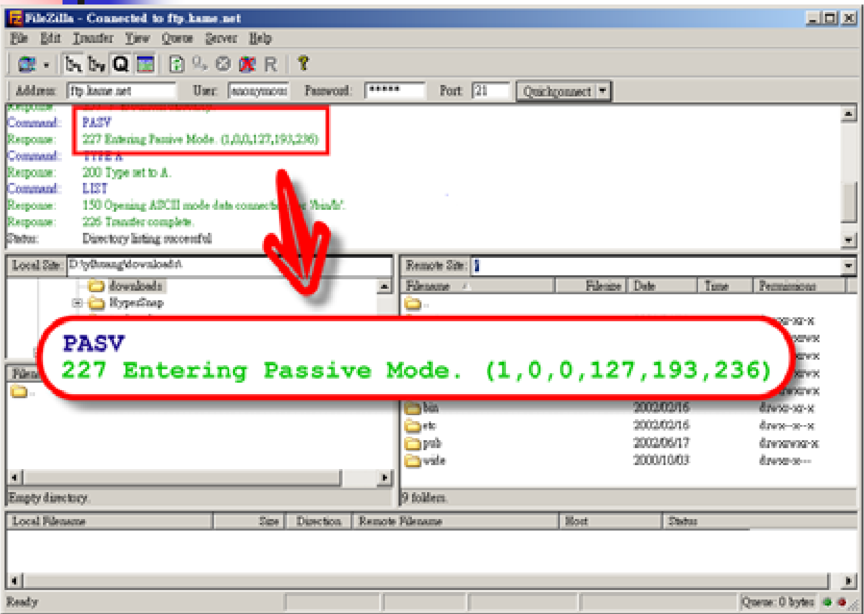


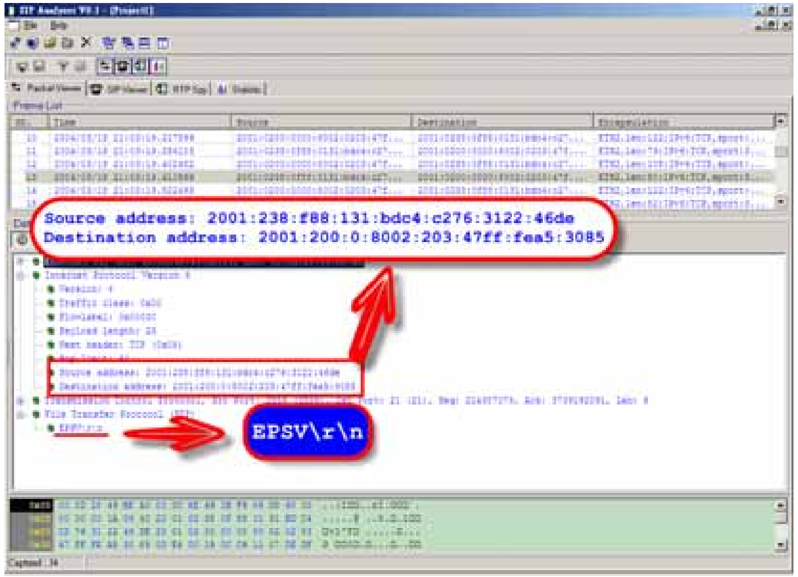


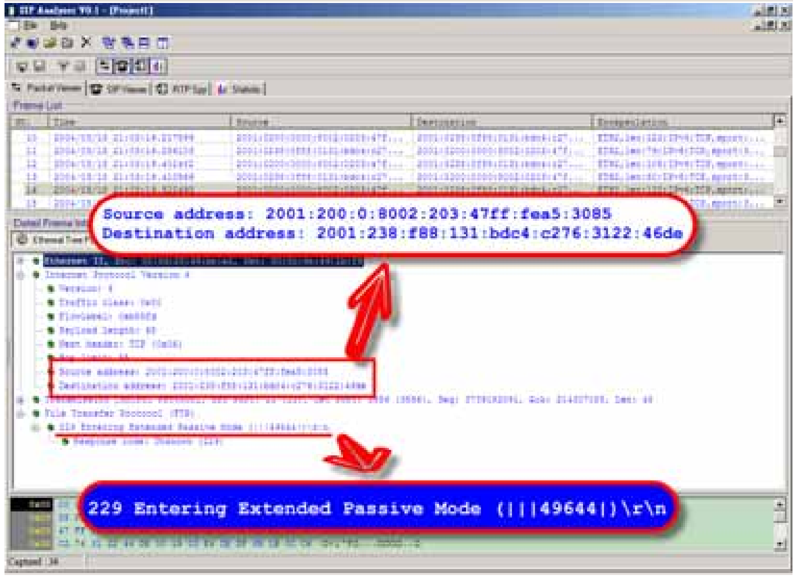
Snapshot of NETSCAPE and Analyzer



Snapshot of FileZilla and Analyzer







Compare IPv4 and IPv6 FTP Commands

Item / Reference	FTP Command	Successful Response
RFC-959	PORT a1,a2,a3,a4,p1,p2	200 OK
RFC-2428	EPRT |<net-prt>|<addr>|<port>|	200 OK
RFC-959	PASV	227 Entering…(a1,a2,a3,a4,p1,p2)
RFC-2428	EPSV	229 Entering…(|||<port>|)

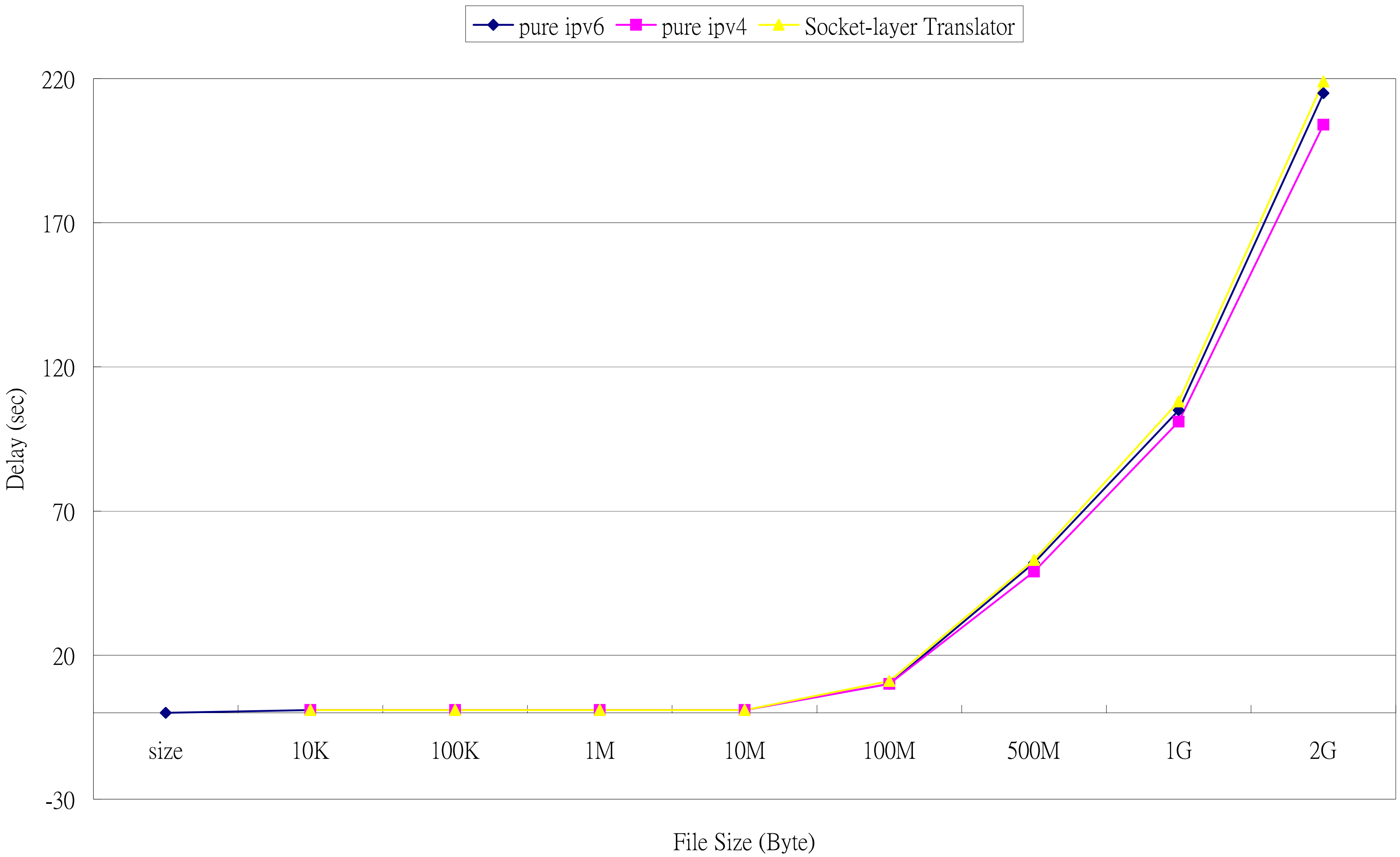
Performance Evaluation of SLT and FTP-ALG

- Client
  - OS: Windows XP SP1
  - FTP Client
    - SmartFTP IPv4 mode
    - SmartFTP IPv6 mode
    - SmartFTP IPv4 mode with SLT and FTP-ALG
  - Actions: Download files with size from 10KB to 2G
- Server
  - OS: linux Fedora Core 1
  - FTP Server: vsftpd

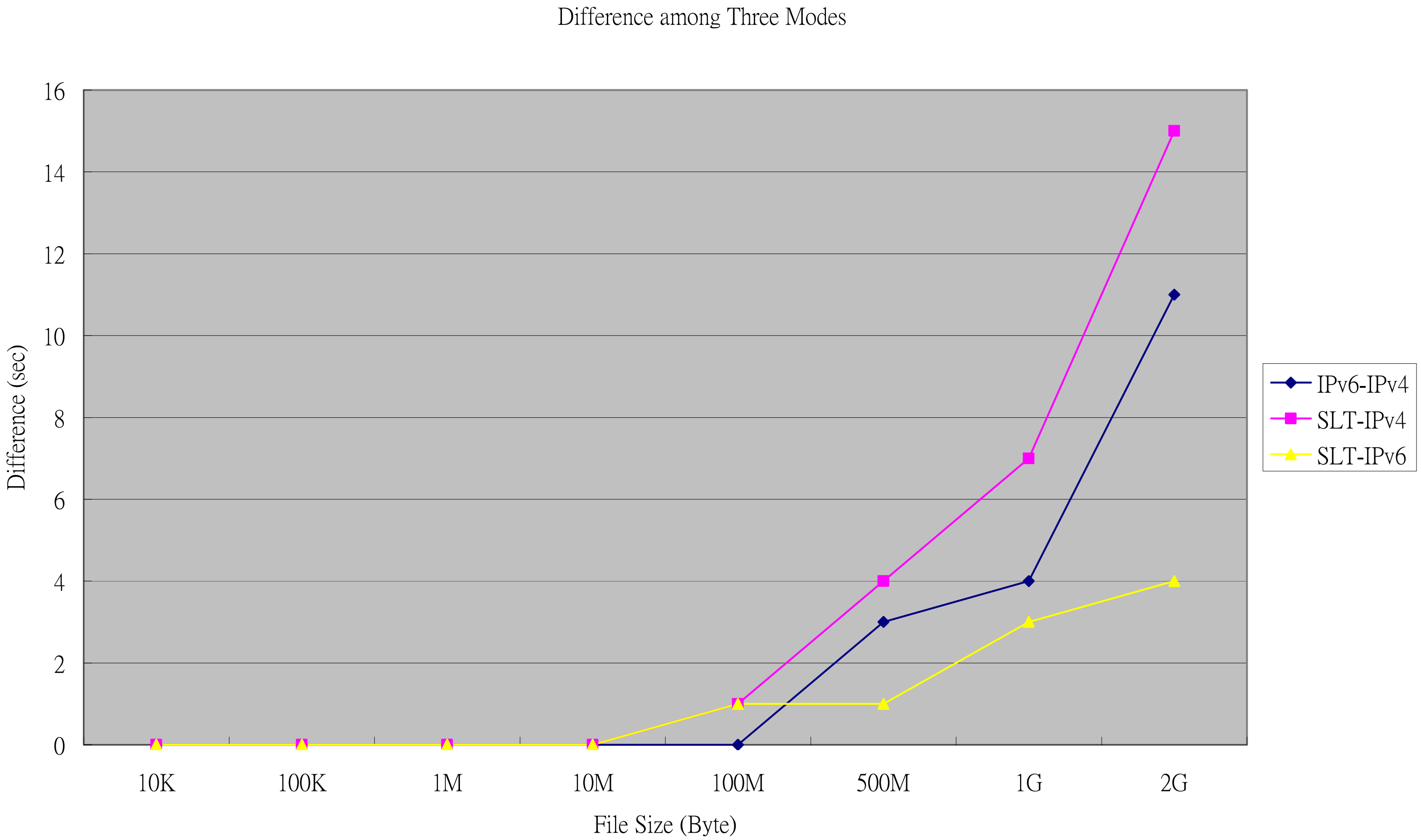
Transmission Delay (sec)

Mode \ Size	10KB	100KB	1MB	10MB	100MB	500MB	1GB	2GB
IPv4	1	1	1	1	10	49	101	204
IPv6	1	1	1	1	10	52	105	215
SLT	1	1	1	1	11	53	108	219

Transmission Delay



Performance Test (FTP) cont.



Comparison of Transition Mechanisms

Mechanisms / Items	Manual Modification	BIA	BIS	Socket-layer Translator
Source Codes	Required	Not required	Not required	Not required
Applicability	Modified codes	All socket-based programs	All IP-based Programs	All socket-based programs
P2P Security Support	Yes	Yes	No	Yes
Translation of NAT friendly protocols	Yes	Yes	Yes	Yes
Support of SIP and FTP	Yes	No	No	Yes

SIPv6 Translator

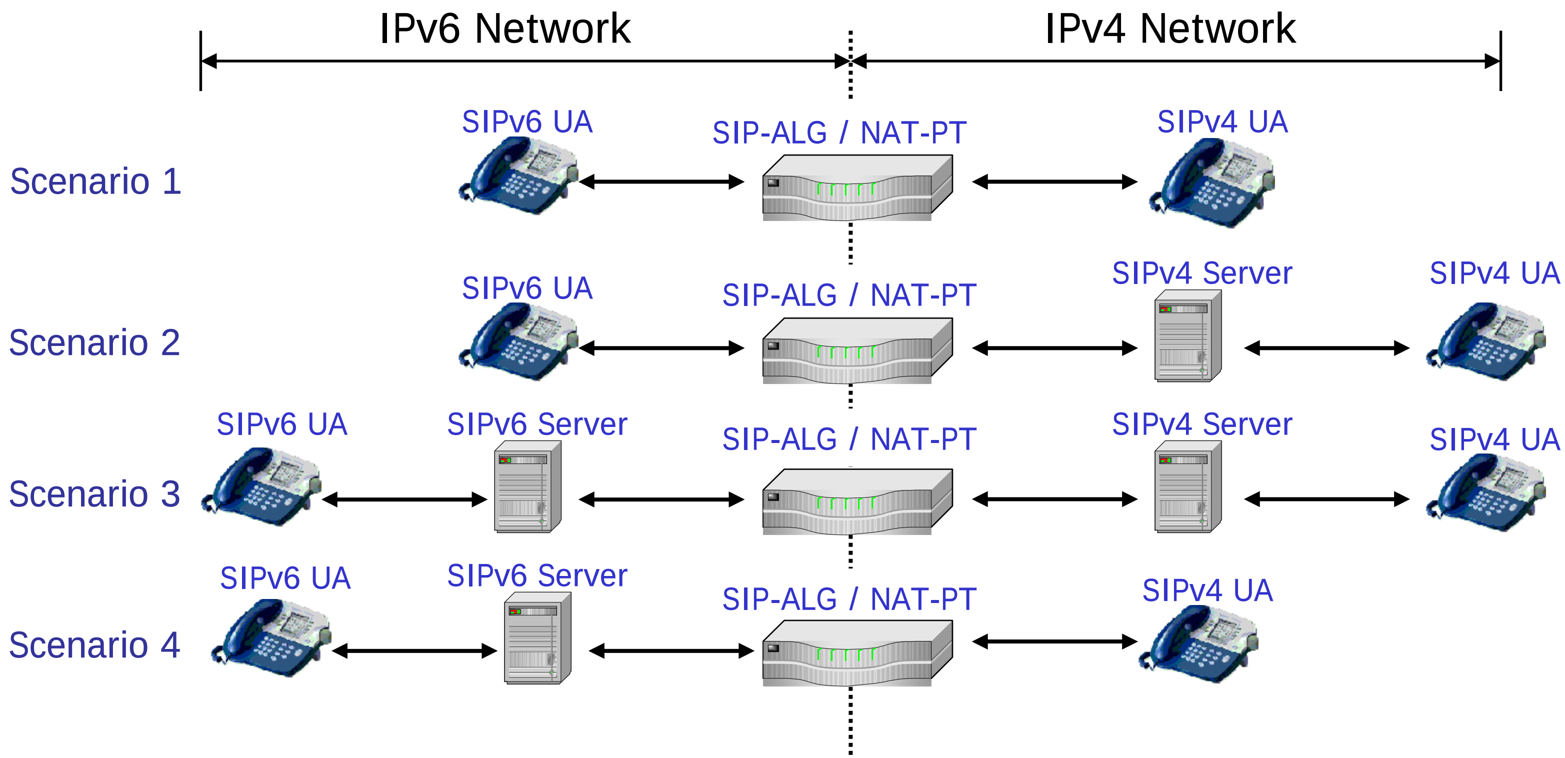
Abstract

- Since Voice over IP (VoIP) phones can efficiently utilize the network and save a lot of money for users, there are increasingly people employ personal computers, notebooks, and PDA with VoIP Phone to communicate with each other.
- VoIP is a peer-to-peer service, and connecting through Internet requires large number of global Internet identifiers.
- Though network address translation (NAT) can help to reduce the address requirements, NAT cannot offer incoming calls directly.
- IPv6 provides large addressing space and is the best choice for VoIP phones.
- However, VoIPv6 phones should be able to communicate with existing VoIPv4 systems.
- Consequently, we will propose an VoIPv6 translator to connect VoIPv6 phones with popular Internet.

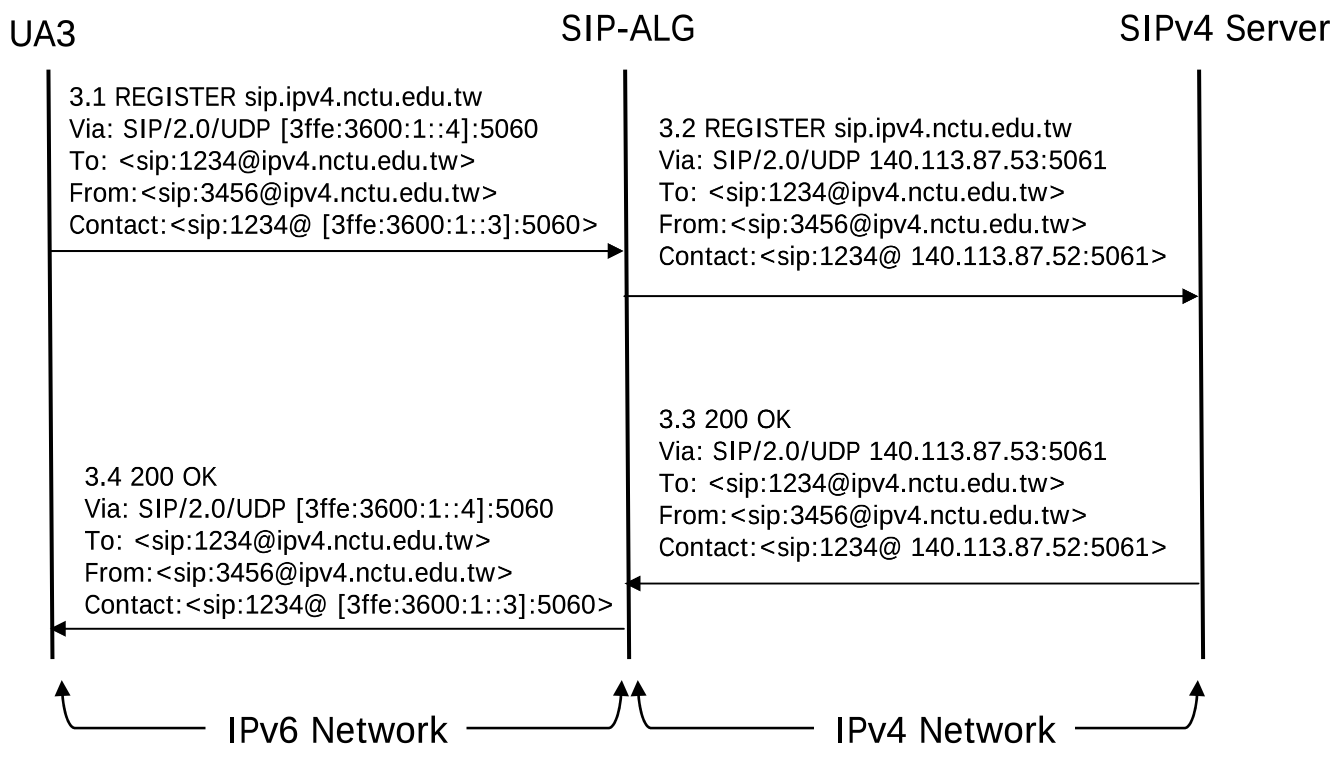
Proposed VoIPv6 Solutions

- Since IP addresses are not enough for peer-to-peer service such as VoIP, the IPv6 is the best answer for next generation Internet.
- Though VoIPv6 phones hold global identifications, VoIPv6 phones cannot directly connect VoIPv4 phones through Internet.
- Therefore this paper proposed an NAT-PT translator with SIP-ALG to assist VoIPv6 phones in communicating with VoIPv4 phones.
- The target of the proposed translator should be capable of handling incoming and outgoing calls within IPv6 domain and simultaneously providing transparent translation for users.
- The SIP-ALG should cooperate with existent modules such as DNS-ALG and FTP-ALG.

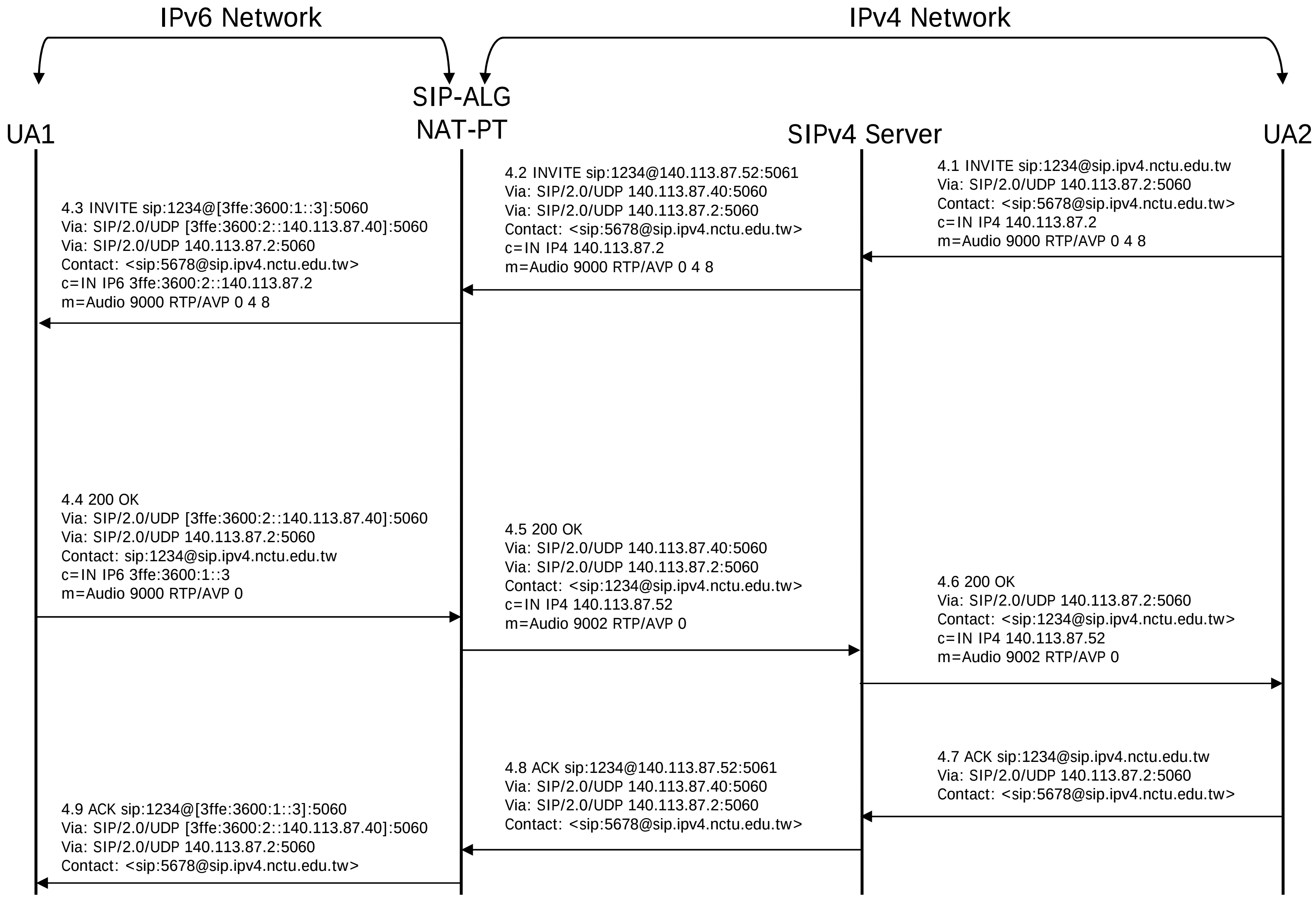
SIP-based VoIPv6 Evolution Scenarios



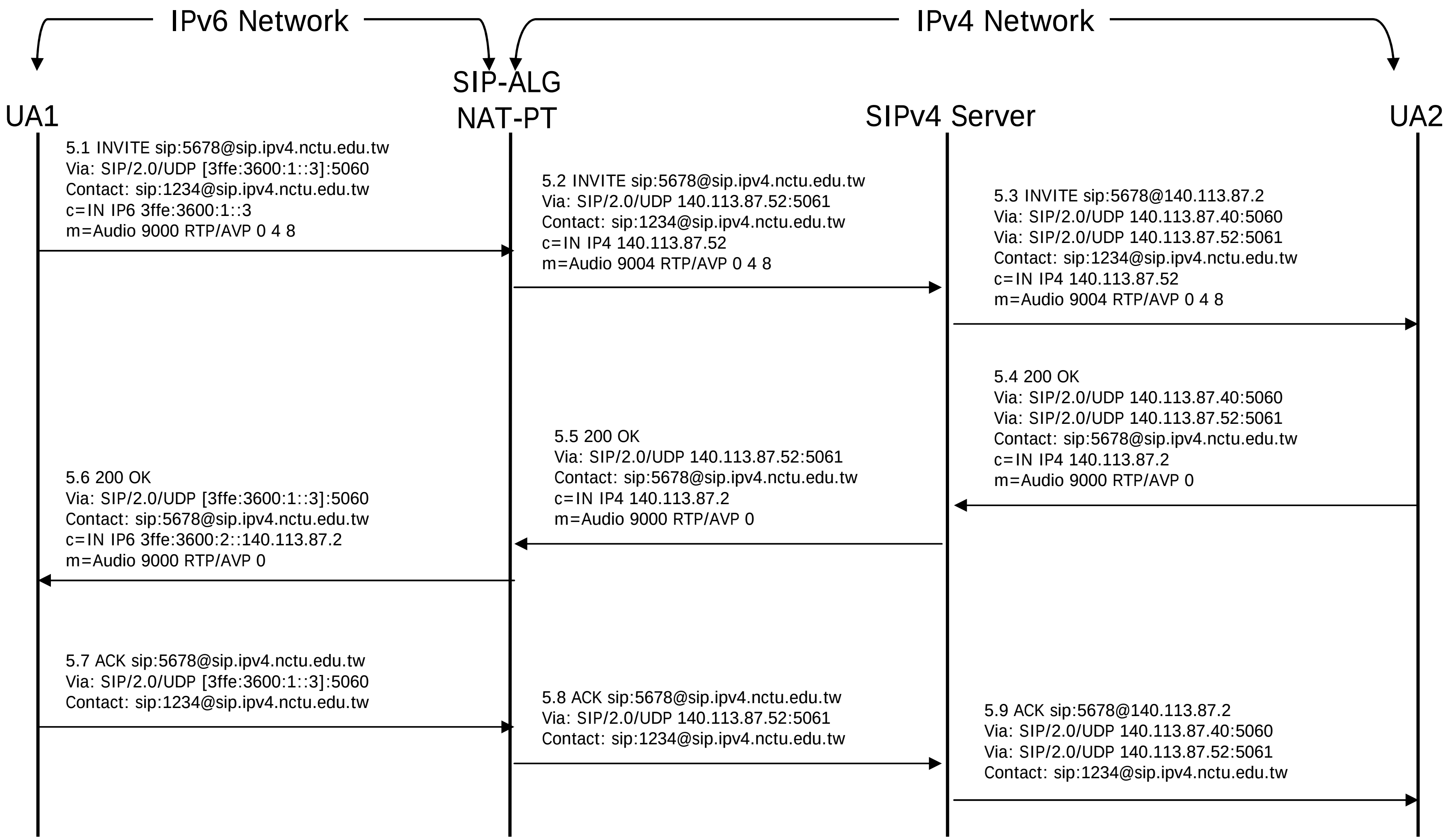
SIP UA registration while Initiating



(IPv4->IPv6)


IPv6 Network
IPv4 Network
UA1
SIP-ALG
NAT-PT
SIPv4 Server
UA2
4.1 INVITE sip:1234@sip.ipv4.nctu.edu.tw
Via: SIP/2.0/UDP 140.113.87.2:5060
Contact: <sip:5678@sip.ipv4.nctu.edu.tw>
c=IN IP4 140.113.87.2
m=Audio 9000 RTP/AVP 0 4 8
4.2 INVITE sip:1234@140.113.87.52:5061
Via: SIP/2.0/UDP 140.113.87.40:5060
Via: SIP/2.0/UDP 140.113.87.2:5060
Contact: <sip:5678@sip.ipv4.nctu.edu.tw>
c=IN IP4 140.113.87.2
m=Audio 9000 RTP/AVP 0 4 8
4.3 INVITE sip:1234@[3ffe:3600:1::3]:5060
Via: SIP/2.0/UDP [3ffe:3600:2::140.113.87.40]:5060
Via: SIP/2.0/UDP 140.113.87.2:5060
Contact: <sip:5678@sip.ipv4.nctu.edu.tw>
c=IN IP6 3ffe:3600:2::140.113.87.2
m=Audio 9000 RTP/AVP 0 4 8
4.4 200 OK
Via: SIP/2.0/UDP [3ffe:3600:2::140.113.87.40]:5060
Via: SIP/2.0/UDP 140.113.87.2:5060
Contact: sip:1234@sip.ipv4.nctu.edu.tw
c=IN IP6 3ffe:3600:1::3
m=Audio 9000 RTP/AVP 0
4.5 200 OK
Via: SIP/2.0/UDP 140.113.87.40:5060
Via: SIP/2.0/UDP 140.113.87.2:5060
Contact: <sip:1234@sip.ipv4.nctu.edu.tw>
c=IN IP4 140.113.87.52
m=Audio 9002 RTP/AVP 0
4.6 200 OK
Via: SIP/2.0/UDP 140.113.87.2:5060
Contact: <sip:1234@sip.ipv4.nctu.edu.tw>
c=IN IP4 140.113.87.52
m=Audio 9002 RTP/AVP 0
4.7 ACK sip:1234@sip.ipv4.nctu.edu.tw
Via: SIP/2.0/UDP 140.113.87.2:5060
Contact: <sip:5678@sip.ipv4.nctu.edu.tw>
4.8 ACK sip:1234@140.113.87.52:5061
Via: SIP/2.0/UDP 140.113.87.40:5060
Via: SIP/2.0/UDP 140.113.87.2:5060
Contact: <sip:5678@sip.ipv4.nctu.edu.tw>
4.9 ACK sip:1234@[3ffe:3600:1::3]:5060
Via: SIP/2.0/UDP [3ffe:3600:2::140.113.87.40]:5060
Via: SIP/2.0/UDP 140.113.87.2:5060
Contact: <sip:5678@sip.ipv4.nctu.edu.tw>

(IPv6->IPv4)


IPv6 Network
IPv4 Network
UA1
SIP-ALG
NAT-PT
SIPv4 Server
UA2
5.1 INVITE sip:5678@sip.ipv4.nctu.edu.tw
Via: SIP/2.0/UDP [3ffe:3600:1::3]:5060
Contact: sip:1234@sip.ipv4.nctu.edu.tw
c=IN IP6 3ffe:3600:1::3
m=Audio 9000 RTP/AVP 0 4 8
5.2 INVITE sip:5678@sip.ipv4.nctu.edu.tw
Via: SIP/2.0/UDP 140.113.87.52:5061
Contact: sip:1234@sip.ipv4.nctu.edu.tw
c=IN IP4 140.113.87.52
m=Audio 9004 RTP/AVP 0 4 8
5.3 INVITE sip:5678@140.113.87.2
Via: SIP/2.0/UDP 140.113.87.40:5060
Via: SIP/2.0/UDP 140.113.87.52:5061
Contact: sip:1234@sip.ipv4.nctu.edu.tw
c=IN IP4 140.113.87.52
m=Audio 9004 RTP/AVP 0 4 8
5.4 200 OK
Via: SIP/2.0/UDP 140.113.87.40:5060
Via: SIP/2.0/UDP 140.113.87.52:5061
Contact: sip:5678@sip.ipv4.nctu.edu.tw
c=IN IP4 140.113.87.2
m=Audio 9000 RTP/AVP 0
5.5 200 OK
Via: SIP/2.0/UDP 140.113.87.52:5061
Contact: sip:5678@sip.ipv4.nctu.edu.tw
c=IN IP4 140.113.87.2
m=Audio 9000 RTP/AVP 0
5.6 200 OK
Via: SIP/2.0/UDP [3ffe:3600:1::3]:5060
Contact: sip:5678@sip.ipv4.nctu.edu.tw
c=IN IP6 3ffe:3600:2::140.113.87.2
m=Audio 9000 RTP/AVP 0
5.7 ACK sip:5678@sip.ipv4.nctu.edu.tw
Via: SIP/2.0/UDP [3ffe:3600:1::3]:5060
Contact: sip:1234@sip.ipv4.nctu.edu.tw
5.8 ACK sip:5678@sip.ipv4.nctu.edu.tw
Via: SIP/2.0/UDP 140.113.87.52:5061
Contact: sip:1234@sip.ipv4.nctu.edu.tw
5.9 ACK sip:5678@140.113.87.2
Via: SIP/2.0/UDP 140.113.87.40:5060
Via: SIP/2.0/UDP 140.113.87.52:5061
Contact: sip:1234@sip.ipv4.nctu.edu.tw

SIP Message (initiated from SIPv6 UA)

SIP Signaling

INVITE sipv4@[3ffe:3600:2::10.113.131.4]:5060 SIP/2.0
Expires: 180
Content-Type: application/sdp
Via: SIP/2.0/UDP [3ffe:3600:1:0:20c:6eff:fe1e:55da]:5060;branch=1FV1xhfvxGJOK@rWckdAKOA
To: <sipv4@[3ffe:3600:2::10.113.131.4]>
From: sipv6@[3ffe:3600:1:0:20c:6eff:fe1e:55da]
Call-ID:
CSeq: 100 INVITE
Contact: sipv6@[3ffe:3600:1:0:20c:6eff:fe1e:55da]:5060
Content-Length: 249
User-Agent: CCL's SIPv6 UA
Accept: application/sdp

SIP的標頭中，
含有Callee的IPv6位址,
3ffe:3600:2::10.113.131.4

SDP Signaling

v=0
o=CCL'sSIPv6UA 17045 11864 IN IP6 3ffe:3600:1:0:20c:6eff:fe1e:55da
s=SIP Call
c=IN IP6 3ffe:3600:1:0:20c:6eff:fe1e:55da
t=0 0
m=audio 29118 RTP/AVP 0 101
a=rtpmap:0 pcmu/8000
a=rtpmap:101 telephone-event/8000

SIP與SDP標頭中，
含有Caller的IPv6位址,
3ffe:3600:1:0:20c:6eff:fe1e:55da

SIP Message (translated by SIP-ALG)

SIP Signaling

INVITE sipv410.113.131.4:5060 SIP/2.0
Expires: 180
Content-Type: application/sdp
Via: SIP/2.0/UDP 10.113.131.101:5060;branch=1FV1xhfvxGJOK@rWckdAKOA
To: <sipv4@10.113.131.4>
From: sipv6@10.113.131.101
Call-ID:
CSeq: 100 INVITE
Contact: sipv6@10.113.131.101:5060
Content-Length: 196
User-Agent: CCL's SIPv6 UA
Accept: application/sdp

SIP的標頭中，
Callee經過SIP-ALG轉換的IPv4位址,
10.113.131.4

SDP Signaling

v=0
o=CCL'sSIPv6UA 17045 11864 IN **IP4 10.113.131.101**
s=SIP Call
c=IN **IP4 10.113.131.101**
t=0 0
m=audio **2918** RTP/AVP 0 101
a=rtpmap:0 pcmu/8000
a=rtpmap:101 telephone-event/8000

SIP與SDP標頭中，
Caller經過SIP-ALG轉換的IPv4位址,
10.113.131.101

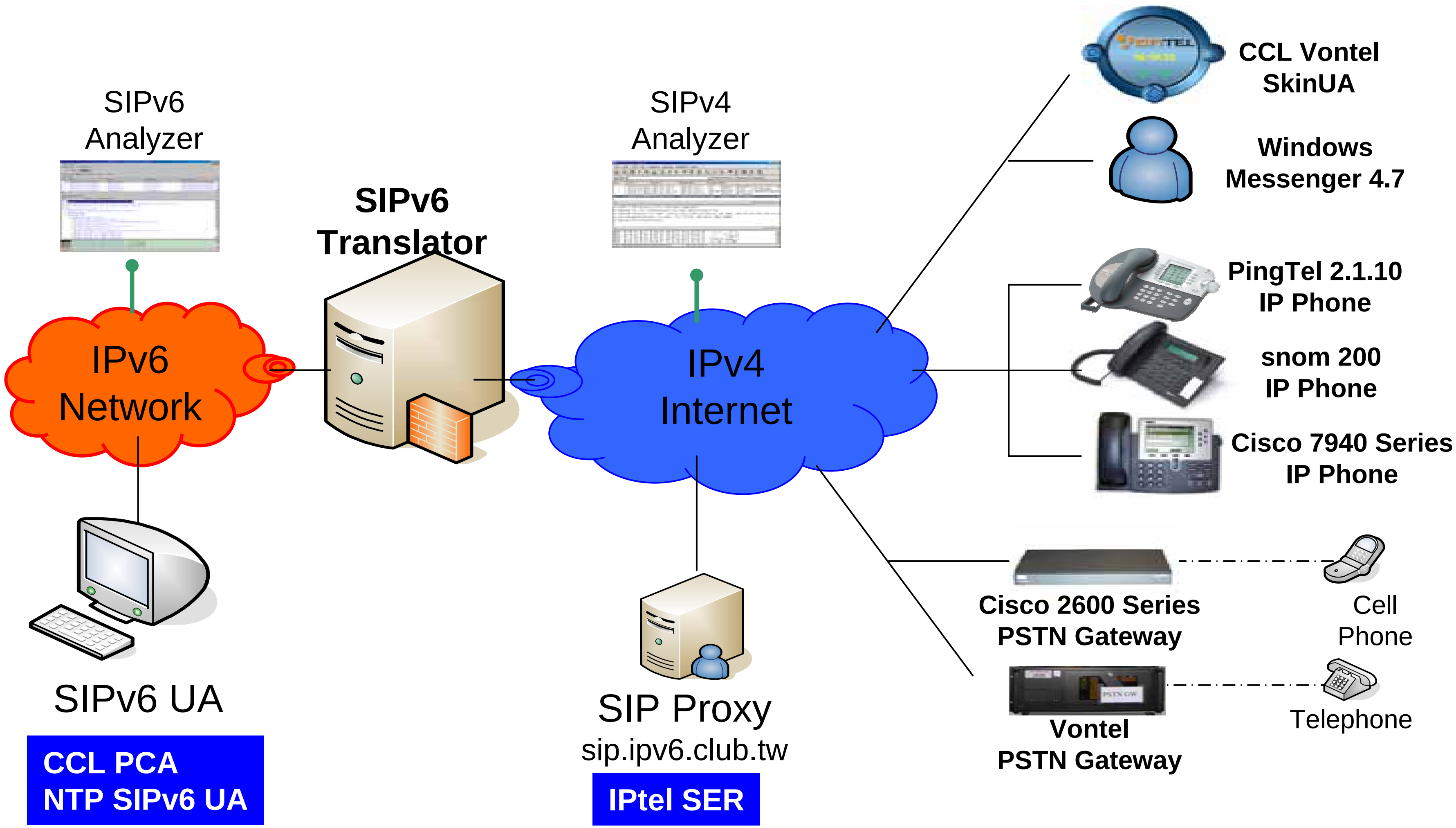
SIPv6 UA Initiated Registration

Header	REGISTER	200 OK (REGISTER)
Request-URI	Domain Name (No Action) Or IP Address (IPv6->IPv4)	--
Via	IP Address (IPv6->IPv4)	IP Address (IPv4->IPv6)
Contact	Domain Name (No Action) Or IP Address (IPv6->IPv4)	Domain Name (No Action) Or IP Address (IPv4->IPv6)
To	Domain Name (No Action) Or IP Address (IPv6->IPv4)	Domain Name (No Action) Or IP Address (IPv4->IPv6)
Content-Length	Value is 0	Value is 0
c	--	--
m	--	--

SIPv6 UA Session Setup

Header	INVITE	200 OK (INVITE)	ACK
Request-URI	Domain Name (No Action) Or IP Address (IPv6->IPv4)	--	Domain Name (No Action) Or IP Address (IPv6->IPv4)
Via	IP Address (IPv6->IPv4)	IP Address (IPv4->IPv6)	IP Address (IPv4->IPv6)
Contact	Domain Name (No Action) Or IP Address (IPv6->IPv4)	Domain Name (No Action) Or IP Address (IPv4->IPv6)	Domain Name (No Action) Or IP Address (IPv6->IPv4)
Content-Length	Re-calculate	Re-calculate	Value is 0
c	Domain Name (No Action) Or IP Address (IPv6->IPv4)	Domain Name (No Action) Or IP Address (IPv4->IPv6)	--
m	No Action	Change Port Number	--

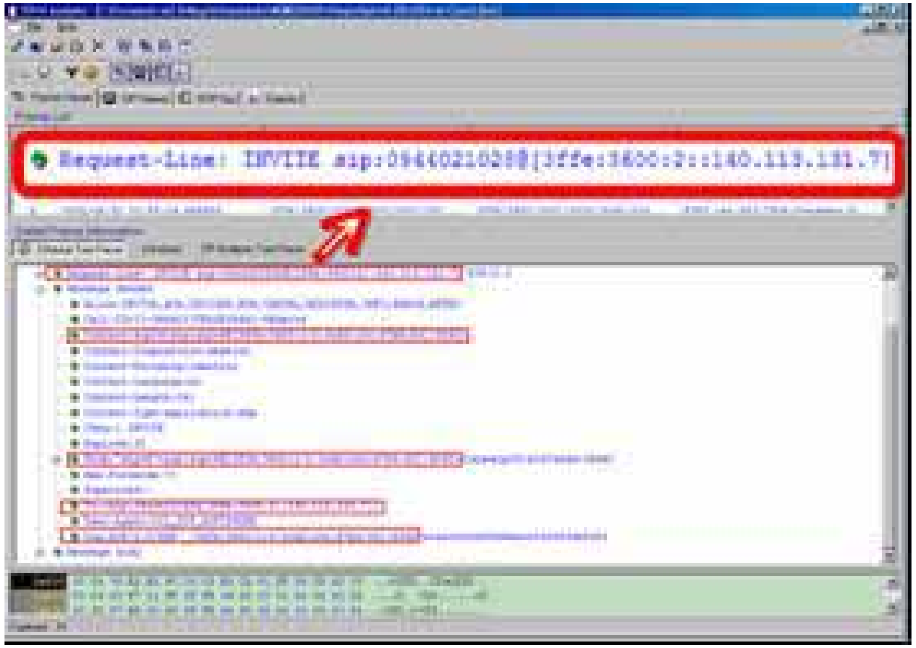
Network Architecture of SIPv6 Translator

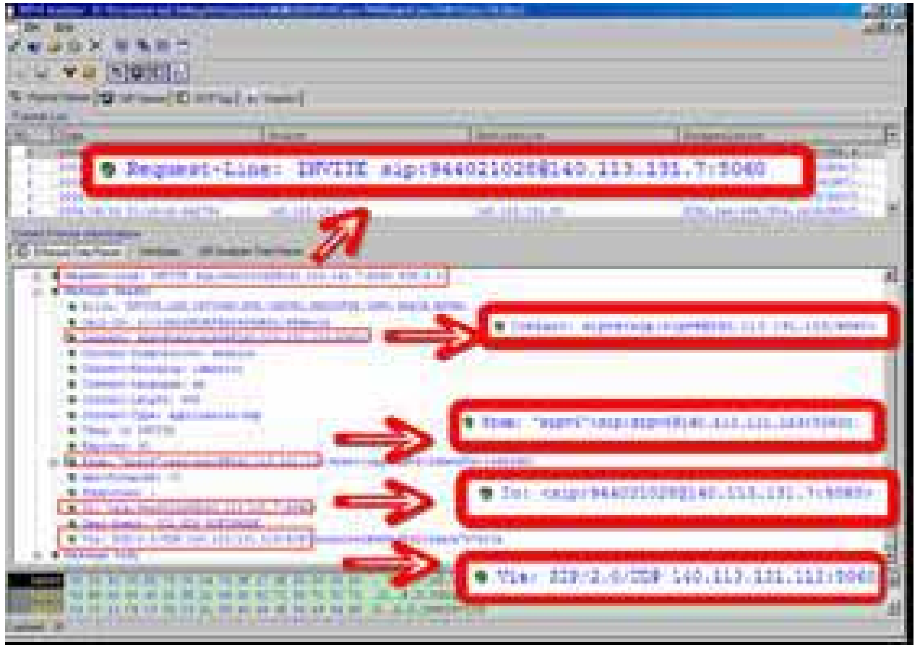


SIP User Agents and SIPv6 Translator

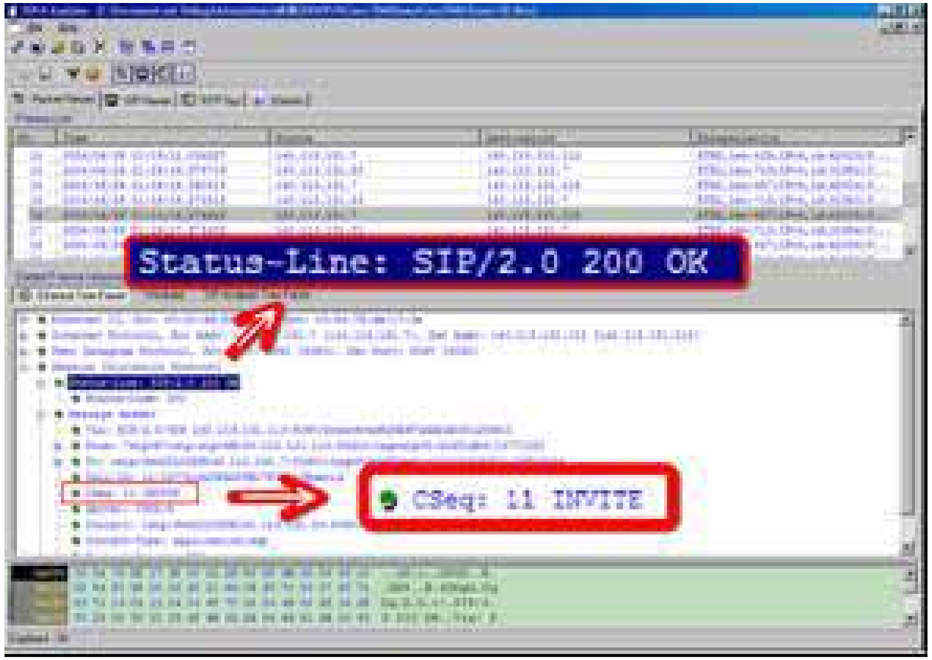
PSTN Gateways

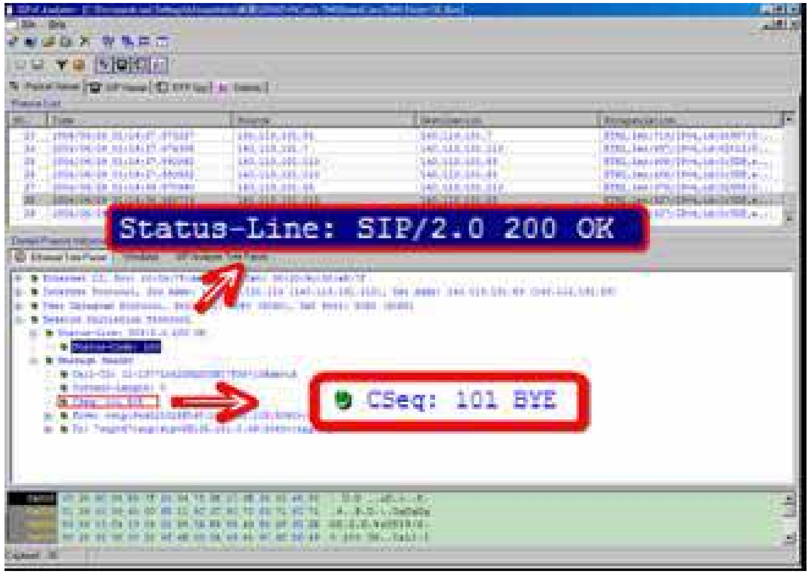
SIP/SDP Translation



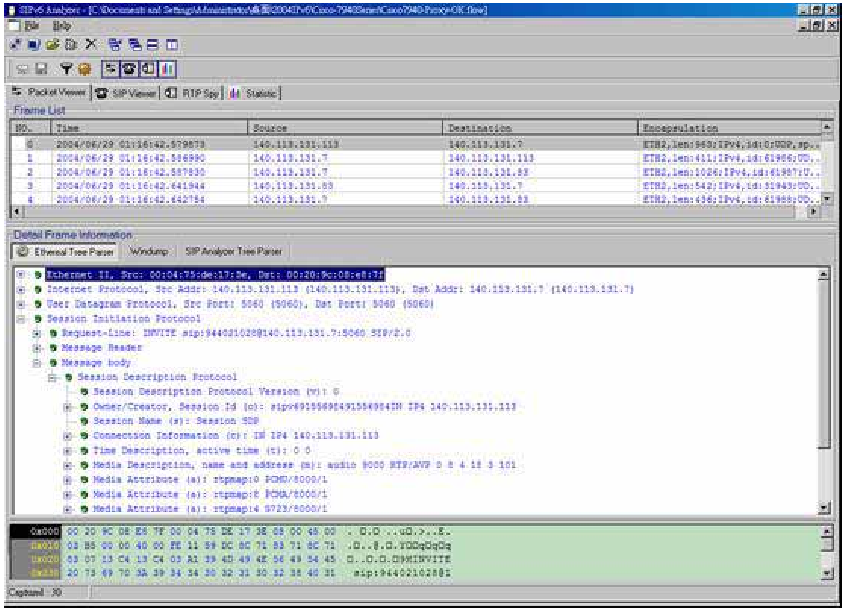


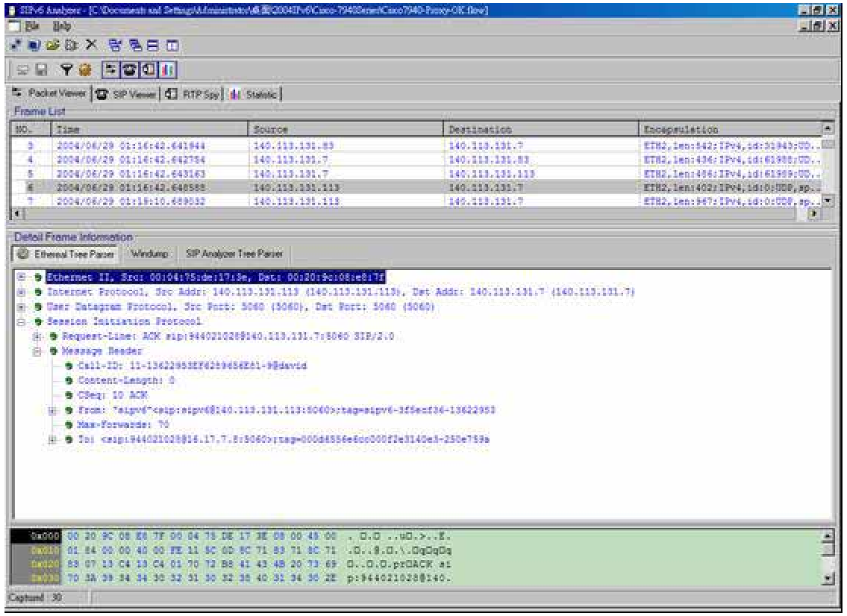
SIPv6 UA to Pingtel (IPv6 SIP UA)





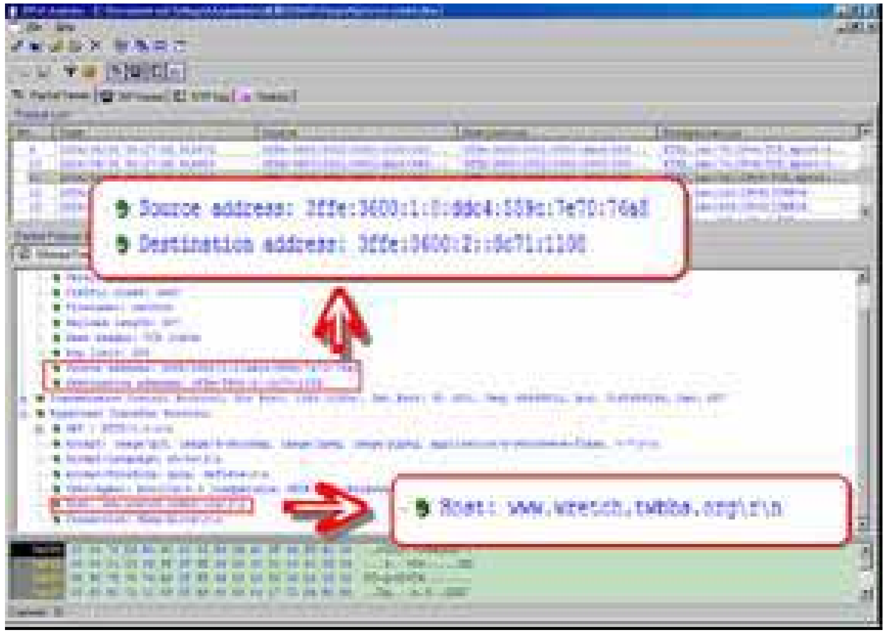
SIPv4 UA (Pingtel) to SIPv6 UA





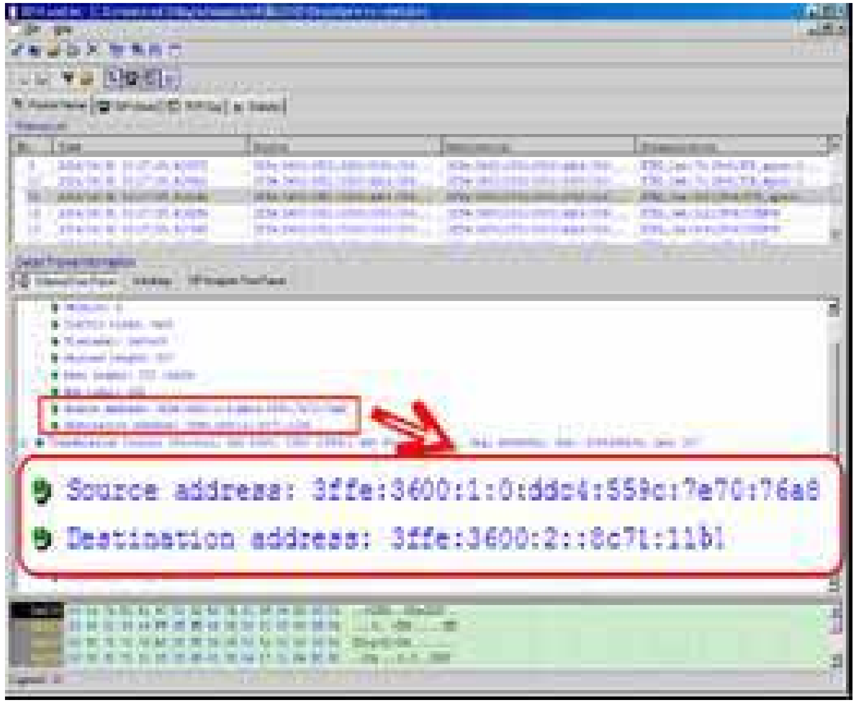
HTTP Test


WRETCH

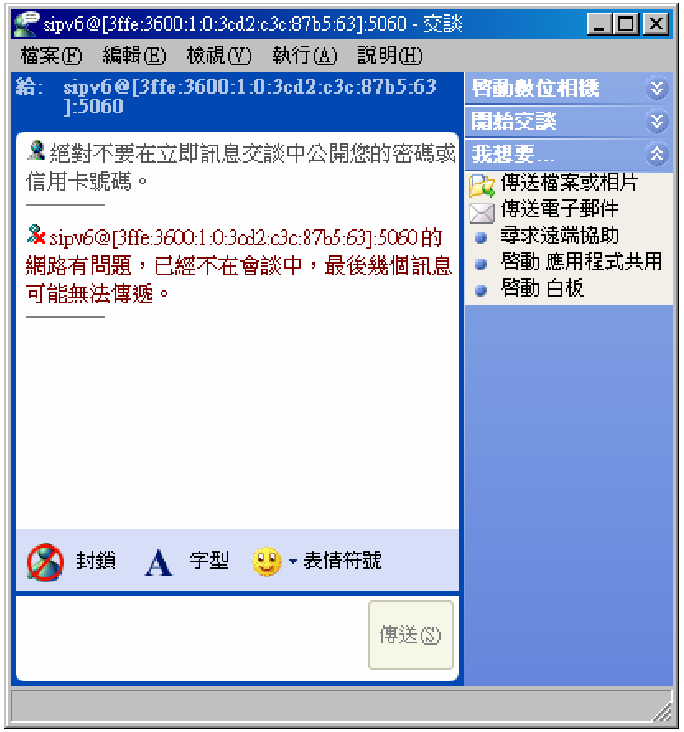

Source address:
Destination address:
Host: www.wretch.twbbs.org\r\n

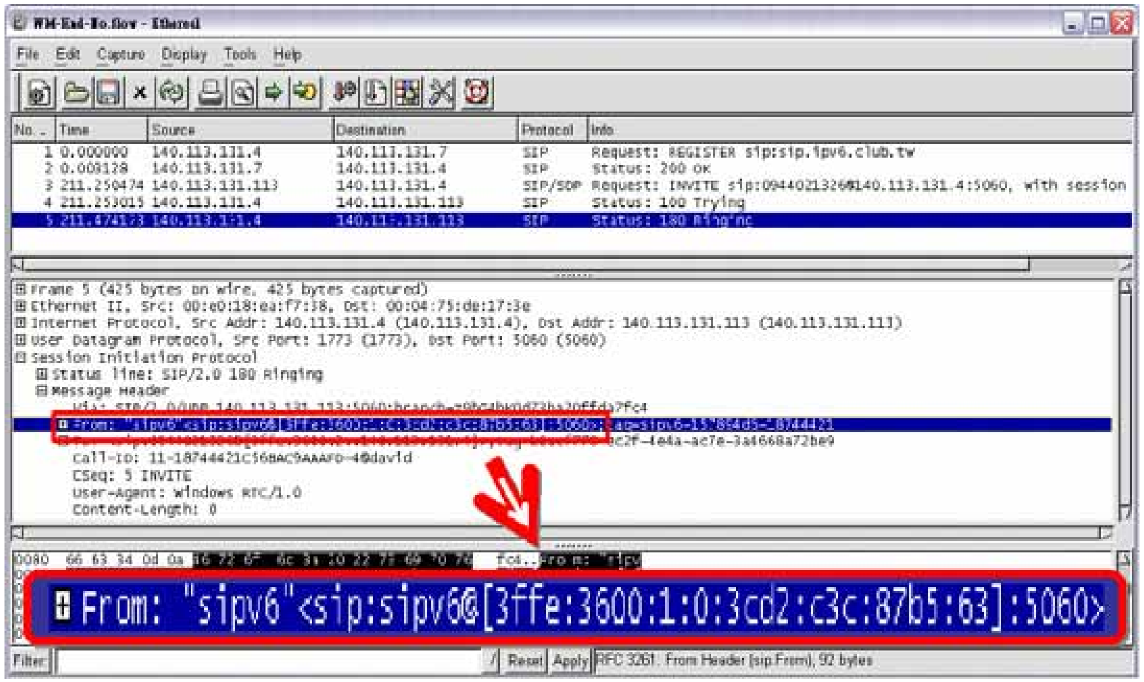
Telnet Test


wretch.twbbs.org


Source address: 3ffe:3600:1:0:ddc4:559c:7e70:76a8
Destination address: 3ffe:3600:2::8c71:11b1

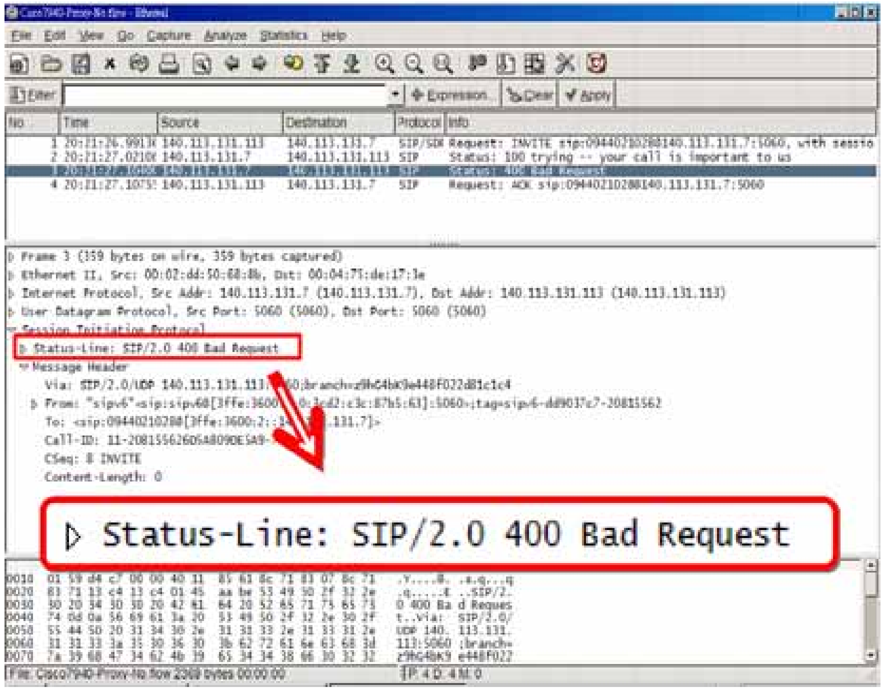
Windows Messenger 4.7





- Solution：modified “**From**” header field in SIP.

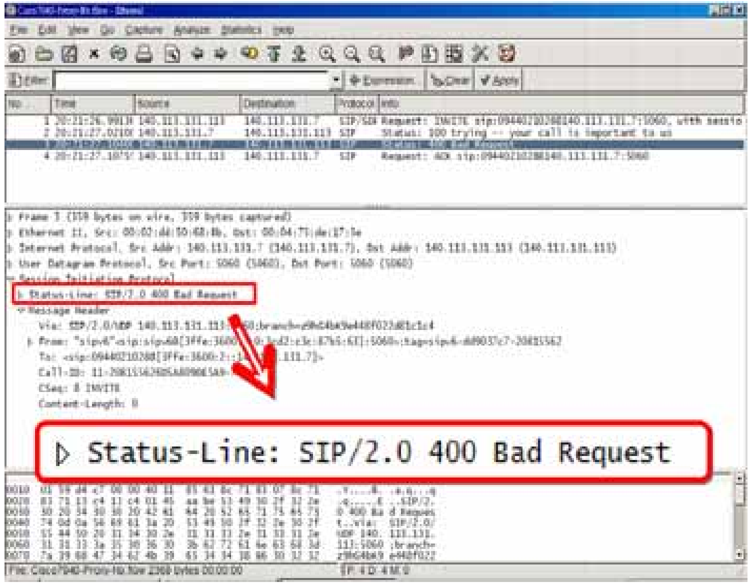
Cisco IP Phone 7940 Series



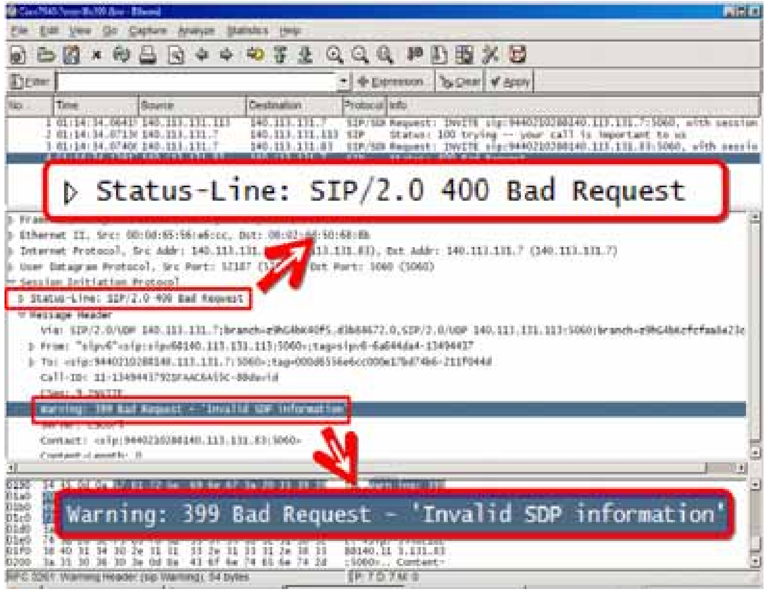
* 未修改SIP訊息中的From與To欄位

- Solution：modified **“From**” and “**To**” header fields in SIP.

Cisco PSTN Gateway



* 未修改SIP訊息中的From與To欄位



* 未修改SDP訊息中的o欄位

- Solution : modified “**From**”&”**To**” header fields in SIP and “**o**” header field in SDP.

Problem: when SIPv6 UA dials my cellular phone number, Cisco PSTN Gateway returns “200 OK” to SIPv6 UA. But SIPv6 UA doesn’t send “ACK” to PSTN Gateway.

Test Results

- Modified SIP and SDP header fields for SIP routing
  - Request-URI、Contact、Via
  - c、m
- Success: SIP message flow is correct and RTP sessions are set up.
  - CCL SkinUA, Pingtel 2.1.10, snow 200, CCL PSTN Gateway
- Fail: different error message for each case
  - Windows Messenger 4.7 (show Error Message in Windows Messenger but no response)
  - Cisco IP Phone 7940 Series (return “400 Bad Request”)
  - Cisco PSTN Gateway (return “400 Bad Request” and “399 Invalid SDP Information”)

Testing Results

		SIP Message					SDP Message		
		Request URI	Contact	Via	From	To	c	m	o
IP Soft Phone	CCL Skin UA	✓	✓	✓			✓	✓	
	Windows Messenger 4.7.2009	✓	✓	✓	✓		✓	✓	
IP Hard Phone	PingTel 2.1.10	✓	✓	✓			✓	✓	
	snom 200	✓	✓	✓			✓	✓	
	Cisco IP Phone 7940 Series	✓	✓	✓	✓	✓	✓	✓	✓
PSTN Gateway	Vontel PSTN Gateway	✓	✓	✓			✓	✓	
	Cisco PSTN Gateway	✓	✓	✓	✓	✓	✓	✓	✓

Conclusions

- Currently, NTP SIPv6 UA can communicate with all SIPv4 UAs and CCL PSTN gateway that are deployed in NTP VoIP platform.
- However, NTP SIPv6 UA cannot communicate with CISCO PSTN gateway, and CCL PCA (IPv6 SIP UA) cannot communicate with CISCO PSTN gateway and Pingtel hardware-based SIP phone.
- In next week, we will have more tests and find out the problems. Then we will fixed the problems in one week.
- Finally, the *SIPv6 Translator* can bridge the traffic between SIPv6 network and SIPv4 network (i.e., NTP VoIP platform), and we will start to write down our contributions as a paper.

Reference (1)

[1] J. Postel, *"Internet Protocol"* , STD 5, IETF RFC 791, Sep-01-1981. (Standard)

[2] J. Postel, *"Internet Control Message Protocol"* , STD 5, IETF RFC 792, Sep-01-1981. (Standard)

[3] S. Deering, R. Hinden, *"Internet Protocol, Version 6 (IPv6) Specification*", IETF RFC-2460, 1998/12. (Draft Standard)

[4] A. Conta, S. Deering, *"Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification"*, IETF RFC-2463, December 1998. (Draft Standard)

[5] S. Thomson, T. Narten, *"IPv6 Stateless Address Autoconfiguration"*, IETF RFC-2462, December 1998. (Draft Standard)

[6] T. Narten, E. Nordmark, W. Simpson, *"Neighbor Discovery for IP Version 6 (IPv6) "*, IETF RFC-2461, December 1998. (Draft Standard)

[7] R. Draves, *"Default Address Selection for Internet Protocol version 6 (IPv6)*", IETF RFC-3484, February 2003. (Proposed Standard)

[8] Nordmark, E., *"Stateless IP/ICMP Translator (SIIT)"*, IETF RFC-2765, February 2000. (Proposed Standard)

Reference (2)

[9] G. Tsirtsis, P. Srisuresh, *"Network Address Translation - Protocol Translation (NAT-PT)"*, IETF RFC-2766, 2000/2. (Proposed Standard)

[10] Mockapetris, P., *"Domain Names - Concepts and Facilities"*, STD 13, IETF RFC-1034, November 1987. (Standard)

[11] Mockapetris, P., *"Domain Names - Implementation and Specification"*, STD 13, IETF RFC-1035, November 1987. (Standard)

[12] S. Thomson, C. Huitema, V. Ksinant, M. Souissi, *"DNS Extensions to Support IP Version 6"*, IETF RFC-3596, October 2003. (Draft Standard)

[13] Srisuresh, P., Tsirtsis, G., Akkiraju, P. and A. Heffernan, *"DNS extensions to Network Address Translators (DNS_ALG)"*, IETF RFC-2694, September 1999. (Informational)

[14] J. Rosenberg, H. Schulzrinne, G. Camarillo, A. Johnston, J. Peterson, R. Sparks, M. Handley, E. Schooler, *"SIP: Session Initiation Protocol"*, IETF RFC-3261, June 2002. (Proposed Standard)

[15] Handley, M. and V. Jacobson, *"SDP: Session Description Protocol"*, IETF RFC-2327, April 1998. (Proposed Standard)

Reference (3)

[16] S. Olson, G. Camarillo, A. B. Roach, *"Support for IPv6 in Session Description Protocol (SDP)"*, IETF RFC-3266, June 2002. (Proposed Standard)

[17] LibPcap網站, http://www.tcpdump.org/

[18] 6WIND公司網站, http://www.6wind.com/

[19] CISCO- Implementing NAT-PT for IPv6-Cisco IOS Software Release 12.3 Mainline, http://www.cisco.com/en/US/products/sw/iosswrel/ps5187/products_configuration_guide_chapter09186a00801d6600.html

[20] SER網站, http://www.iptel.org/ser/