IPv6 Networking Over Satellite

For Mobile User Groups

TriaGnoSys GmbH

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About TriaGnoSys GmbH

TriaGnoSys develops communication services for mobile networks, our advanced products are based on innovative research

Satellite Communications

Aeronautical Communications

Maritime Communications

Navigation

ISO 9001 certified

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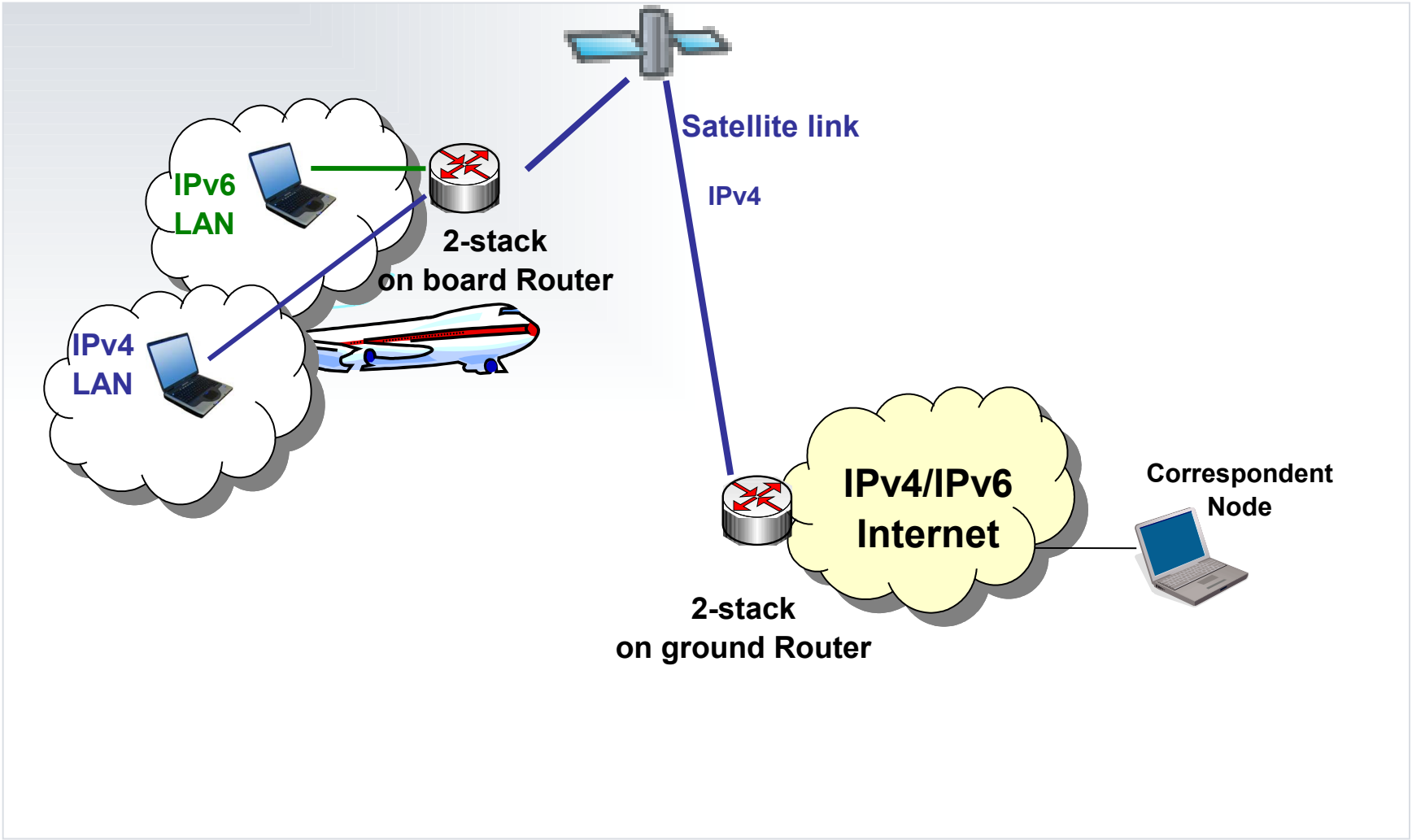
Scenario



Problem Statement

Satellite link only supports IPv4

Multiple IPv6 users inside the A/C

- **Packets must be sent through this link**

Aircraft moves

- **Mobility Problem**
  - **Every time the A/C changes AP, connection breakdown**
  - **Not addressed in this paper**

Possible Networking Solutions

Manual Tunnelling

- Overhead due to additional header
- Simpler

NAPT-PT modified

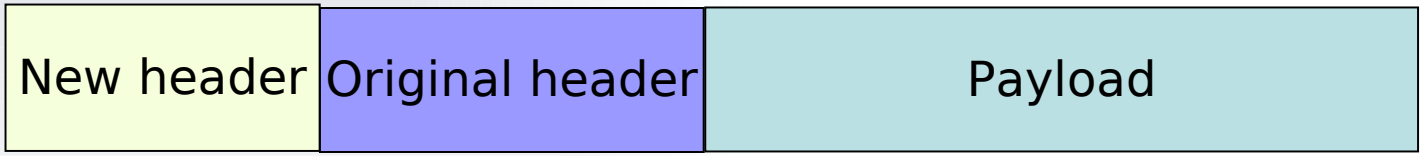
- Less bytes sent
- More complex at both ends of the Satellite Link

Automatic Tunnels

- Not addressed here

Tunnelling

Adding a new header



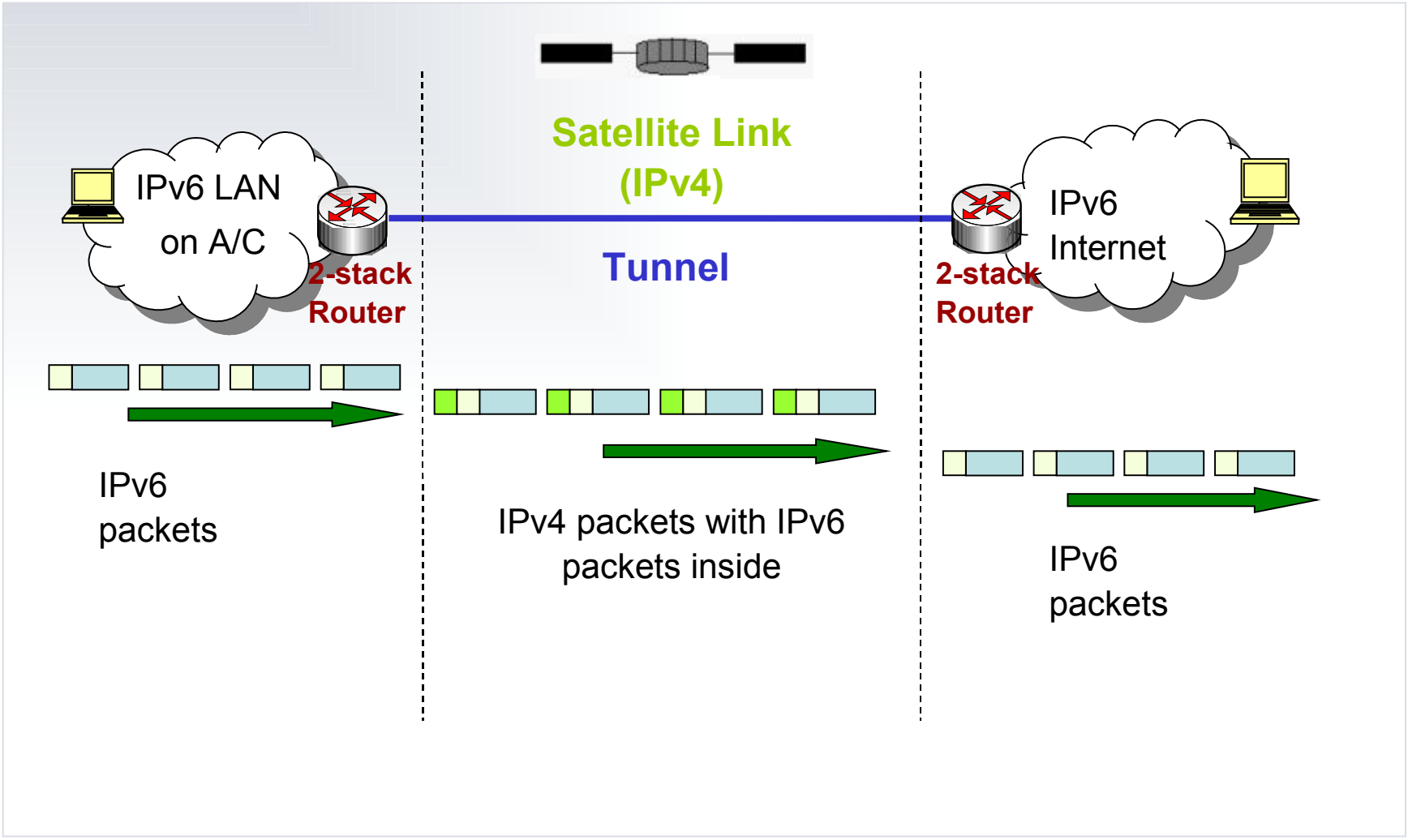
Advantages:

- **Simplicity**
- **Already implemented**

Disadvantages:

- **Overhead**

Manual Tunneling



Manual Tunneling

Both ends of tunnel are preconfigured

Encapsulation:

- **Adding IPv4 header with protocol type 41**
- **Fragmentation if MTU is smaller than 1280 Bytes**

Decapsulation:

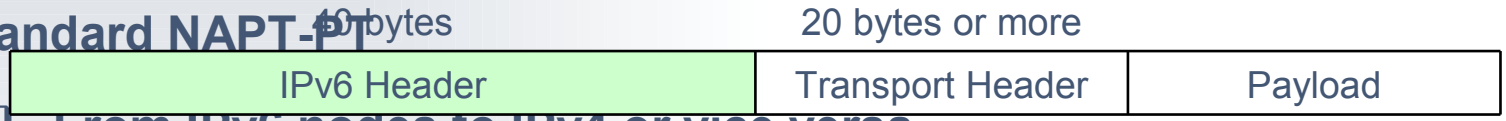
- **Security: accept packets only from configured tunnels**
- **Reassembling all fragments**

Translation of IPv4 error messages to IPv6

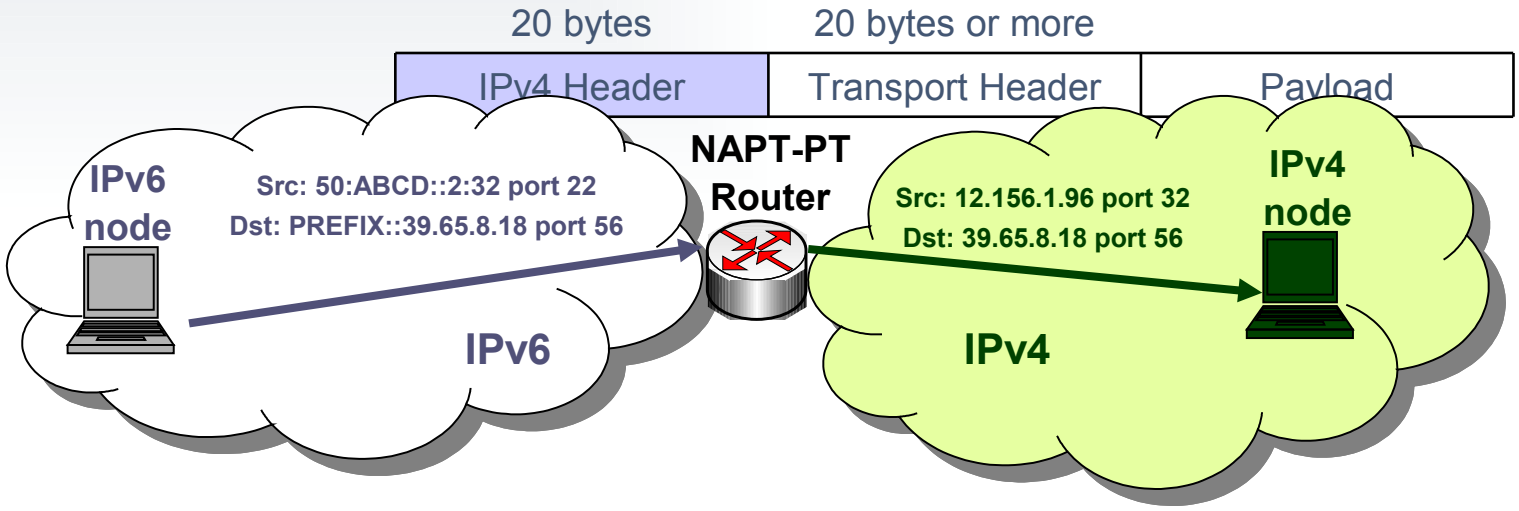
NAPT-PT

Protocol Translation (Header Translation)

Standard NAPT-PT



- From IPv6 nodes to IPv4 or vice versa

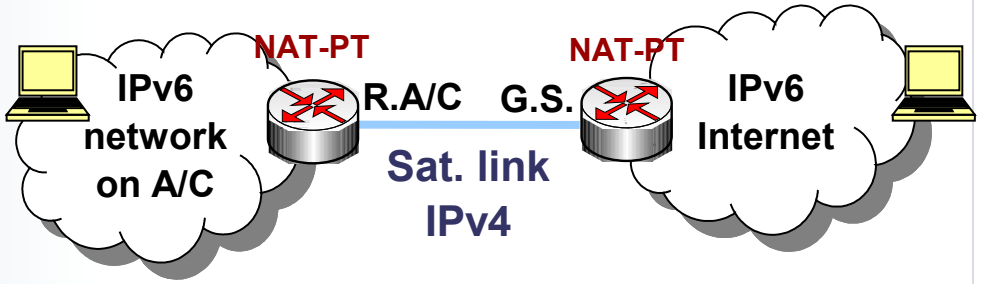


Some modifications needed

NAPT-PT modified

2 Translations:

- Router in A/C
- Router in Ground Station

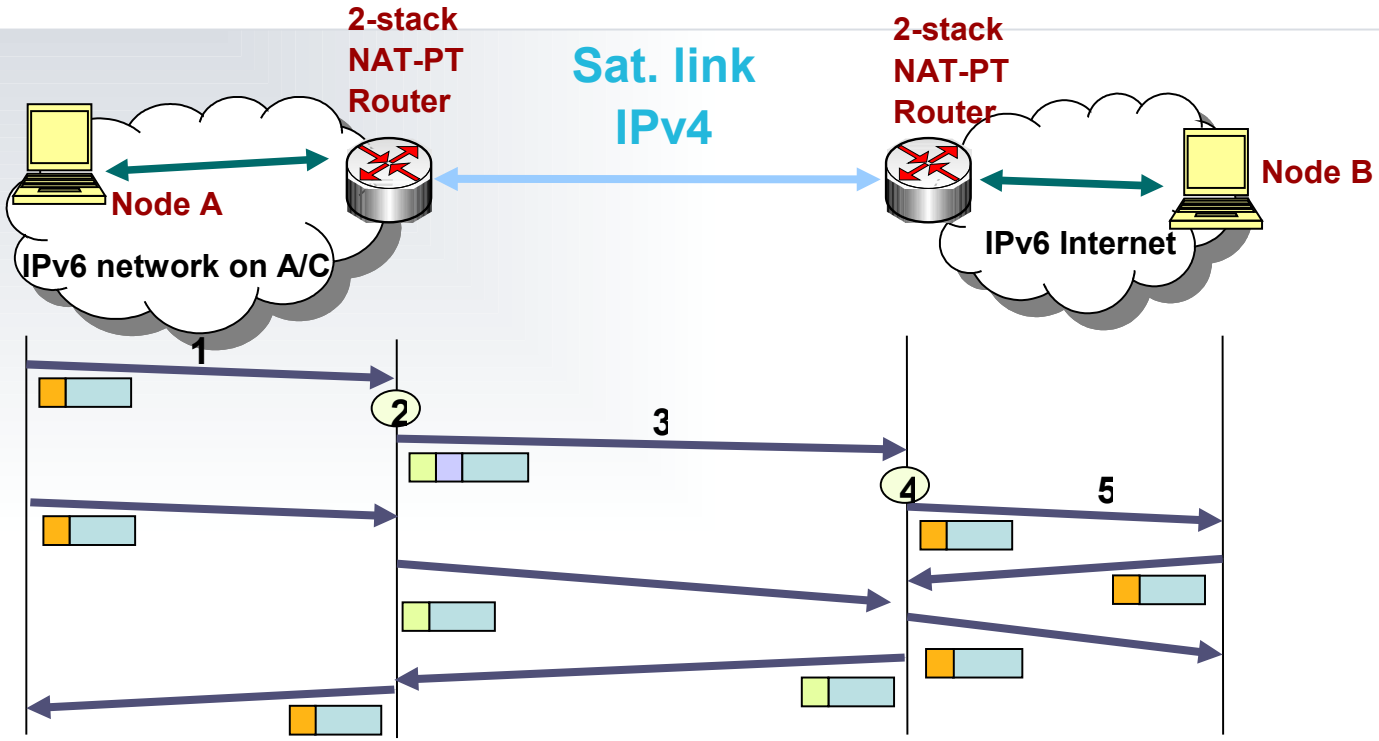


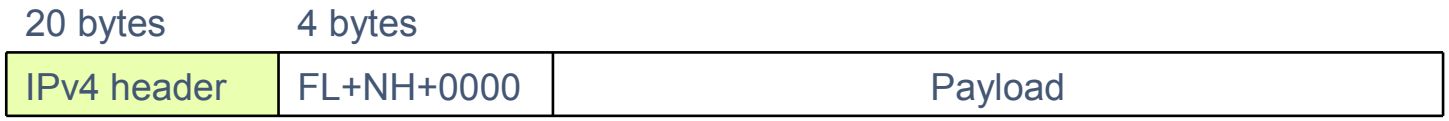
Dynamic tables for ports/addresses:

- Info sent from MR to GW or vice versa
- MR manages resources to be assigned

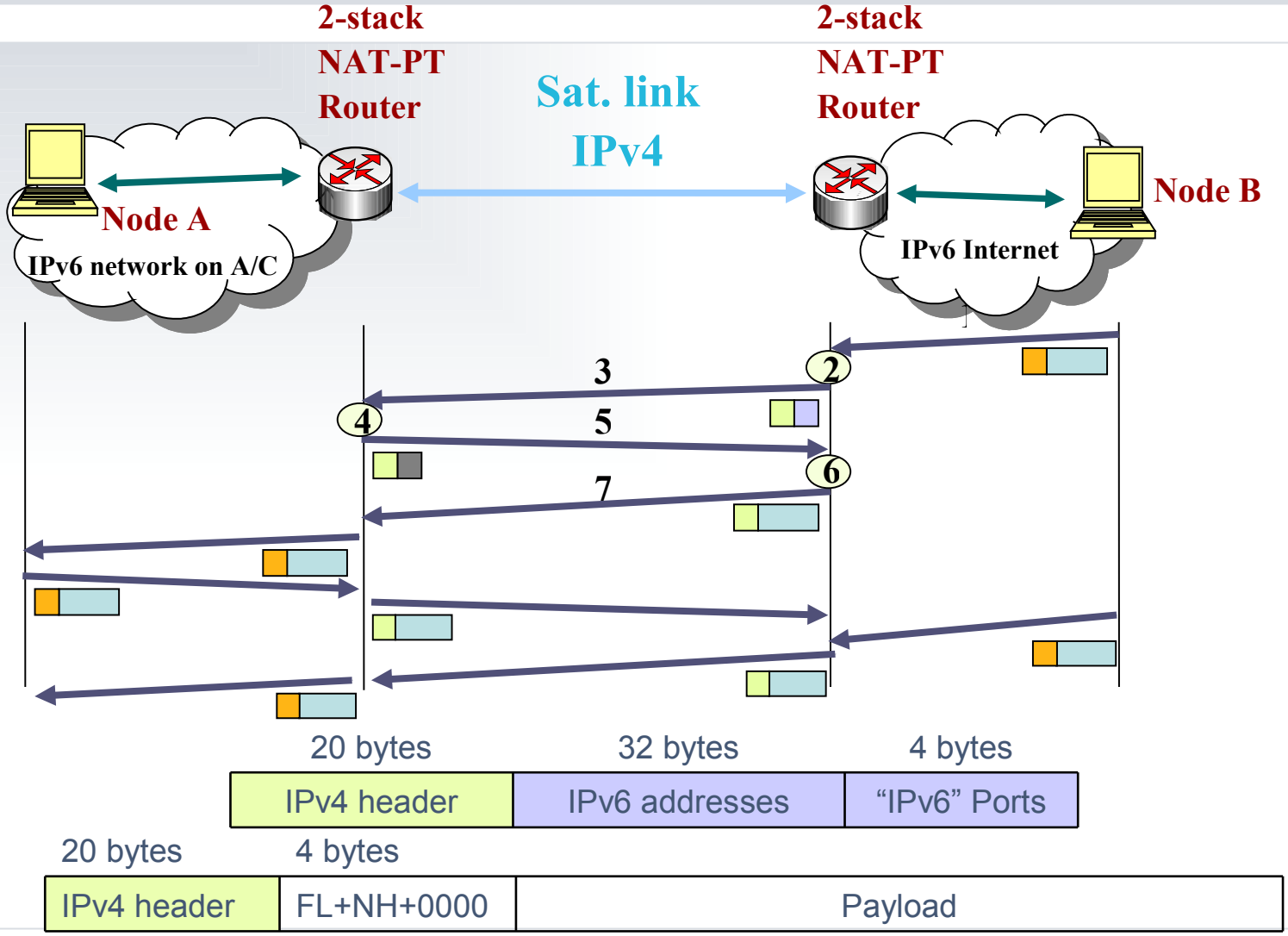
IPv6 Domain		IPv4 Domain	
Source	address port	Source	address port
Destination	address port	Destination	address port

NAPT-PT modified: cabin-originated packets

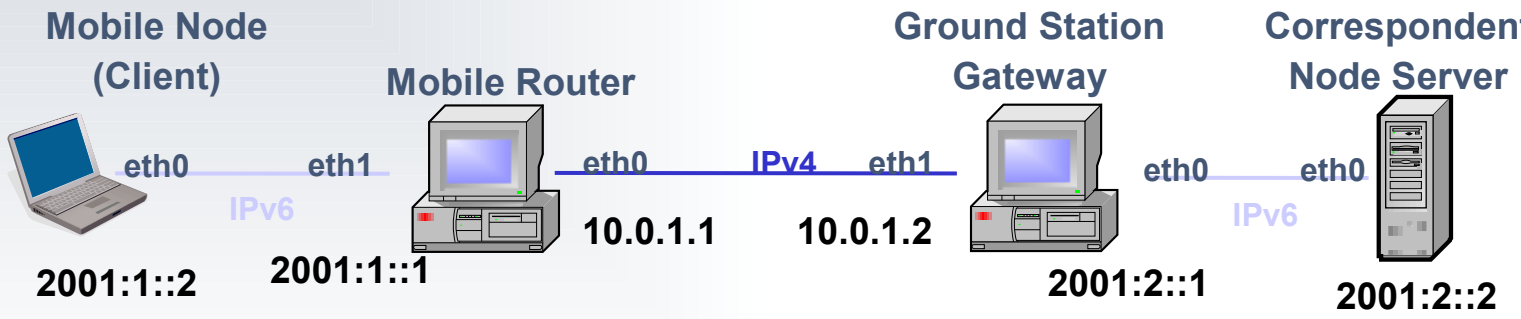




NAPT-PT modified: ground-originated packets



Simulation



All nodes implemented in XEN machine

Tunnel

- Existing module in Linux: ip tunnel

NAPT-PT modified

- Implemented in C/C++ in Linux user space

Measurements

Tunnel

		Sessions	Packet/Session	Bytes/packet	Payload
HTTP	**IPv4**	44	11	279	205
	IPv6			259	
FTP	**IPv4**	6	4645	1243	1169
	IPv6			1223	
VoIP	**IPv4**	1	18000	102	28
	IPv6			82	

NAPT-PT mod

		Sessions	Packet/Session	Bytes/packet			Payload (Bytes)
				First Packet	*Others*	*Mean*	
HTTP	**IPv4**	76	11	252	234	235	198
	IPv6			252			
FTP	**IPv4**	6	5118	1118	1102	1102	1064
	IPv6			1118			
VoIP	**IPv4**	1	18000	102	66	66,002	28
	IPv6			82			

Results

		HTTP	FTP	VoIP
NAPT-PT mod.	*Header Length (Bytes)*	25,44	24,03	24,002
	Overhead	2,50%	2,26%	86%
	Delay (ms)	0,79	0,75	0,75
Tunnel	*Header Length (Bytes)*	60	60	60
	Overhead	5,90%	5,60%	215%
	Delay (ms)	1,9	1,9	1,9
IPv6	*Header Length (Bytes)*	40	40	40
	Overhead	3,90%	3,70%	142%
	Delay (ms)	1,25	1,25	1,25

NAPT-PT better than Tunneling in terms of overhead

Conclusions

Problem:

- IPv4 satellite link with multiple IPv6 users in A/C

Best solution in terms of efficiency

2 Options:

- Tunneling
  - 2 headers: overhead
  - Simpler
- NAPT-PT mod
  - Only one header (IPv4): more efficient
  - More complex: translation necessary

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