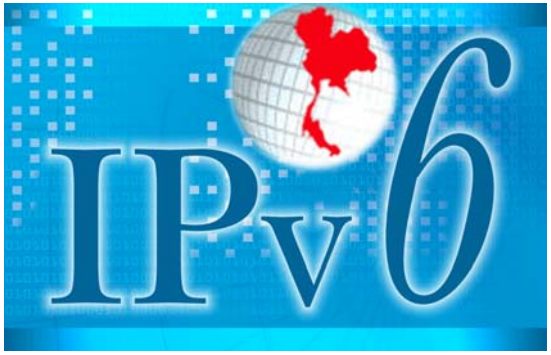
IPv4 vs. IPv6

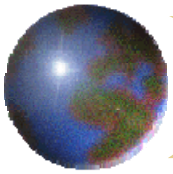


Advanced Computer Networks KU

Johannes Trummer, SS2007

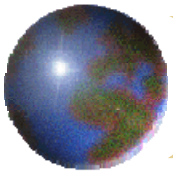
Outline:

- IPv4
- IPv6
- migration
- IPv6 mobile support
- future issues



IP Protocol Stack

Application	Telnet, FTP, ...
Transport	TCP / UDP
Network	IPv4 / IPv6
Link	Network Interface and Device Driver



IP Version 4

- 32-Bit Adressing

  (2^32 Adresses = 4.294.967.296)
- studies say that there will not be enough adresses anymore in 2010 (just think of china, india and the upcoming mobile IP generation)

IP v4 Problems

- IP adress starvation
- Distribution of adresses (USA >50%)
- Routing is complicated
- Realization of new technologies
  (Mobile computing, real time services,
  multicast, security, QOS, etc.)

IP version 6 (since 1996)

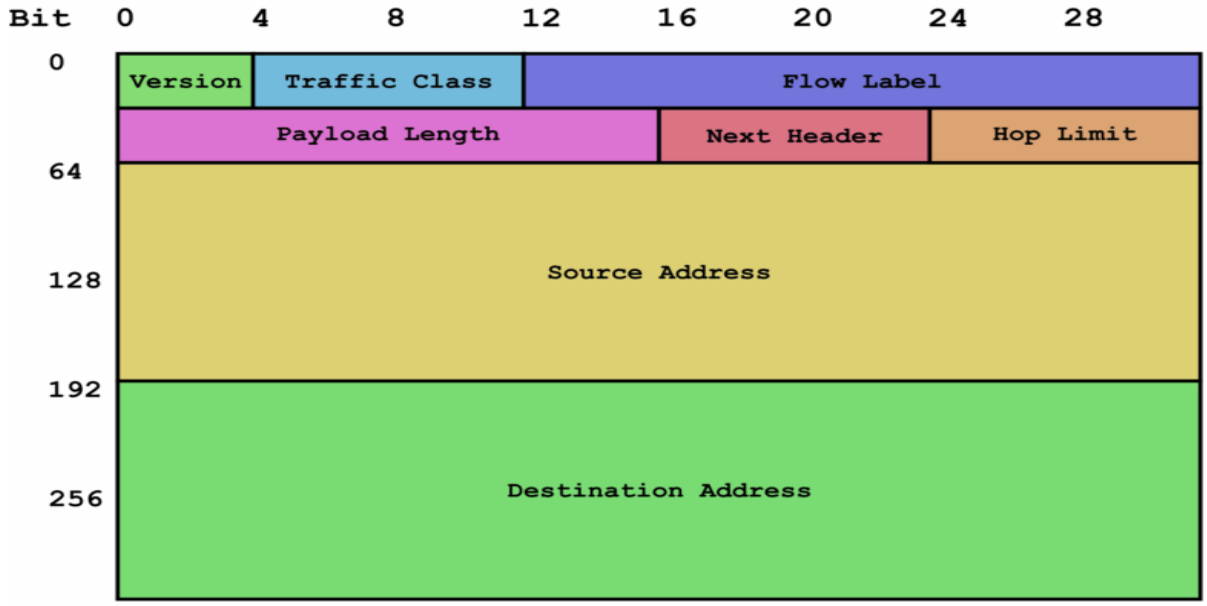
- 128-bit adresses
  (2^128 Adresses = 3.4*10^38)
- smaller header
- options placed in extension headers
- mobile IPv6 – roaming networks

comparison of headers

- IP v4:

0–3	4–7	8–11	12–15	16–18	19–23	24–27	28–31
Version	IHL	Type of Service		Länge			
Identifikation				Flags	Fragment-Offset		
TTL		Protokoll		Prüfsumme			
Quell-IP-Adresse							
Ziel-IP-Adresse							
evtl. Optionen ...							

- IP v6:



comparison of headers (cont´d)

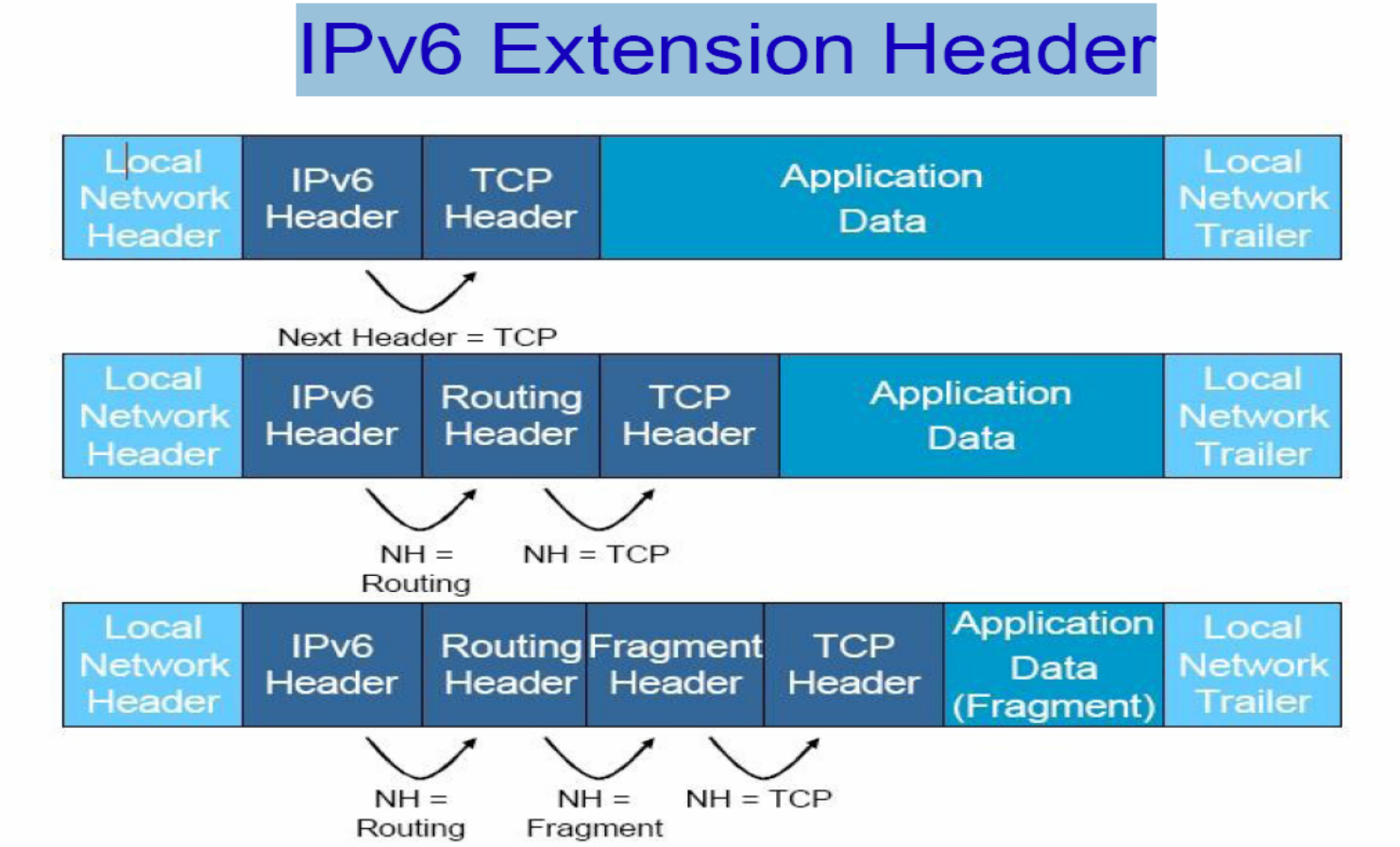
- IP v4: - every header has ALL options
  - inspected by each router
  -> TIME ISSUE !

- IP v6: - options in extension headers
  - next header pointers
  - routers don´t have to check options (except hop-by-hop)

IP version 6: extension header

- Hop-by-hop options header
- Destinations options header
- Routing header
- Fragment header
- Authentication header
- Encapsulation security payload header

IP version 6: extension header (cont'd)



IP version 6: adress format

- Hexadecimal:

  3ffe : 0400 : 0060 : 004d : 0250 : 04ff : fe44 : b099

- Without leading zeros:

  3ffe : 400 : 60 : 4d : 250 : 4ff : fe44 : b099

- Shortened adress format:

  3ffe : 0 : 0 : 4d : 250 : 4ff : fe44 : b099

  3ffe : : 4d : 250 : 4ff : fe44 : b099

- Prefix:

  3ffe : 400 : 60 : 4d : 250 : 4ff : fe44 : b099 /64

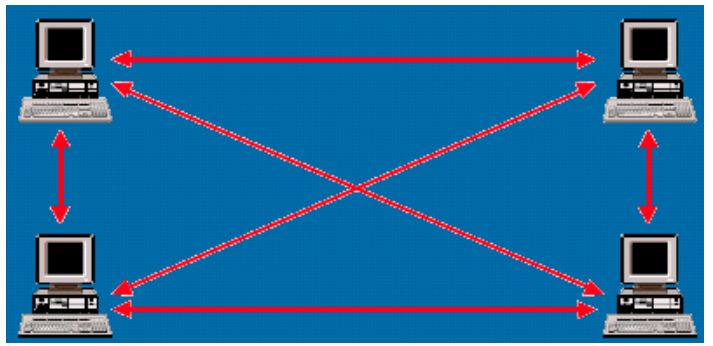
IP version 6: adress types

- UNICAST

  1 to 1, direct adressing of an IP node

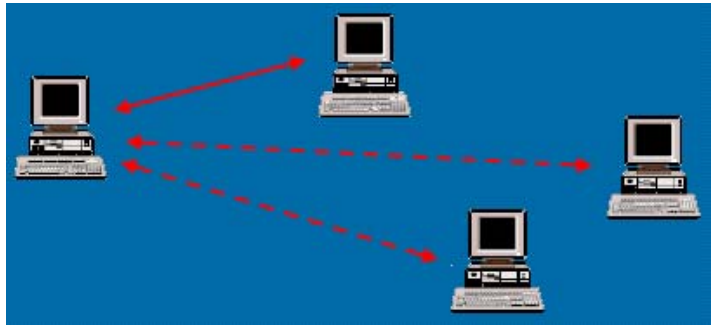
- MULTICAST

  n to m, adressing of groups

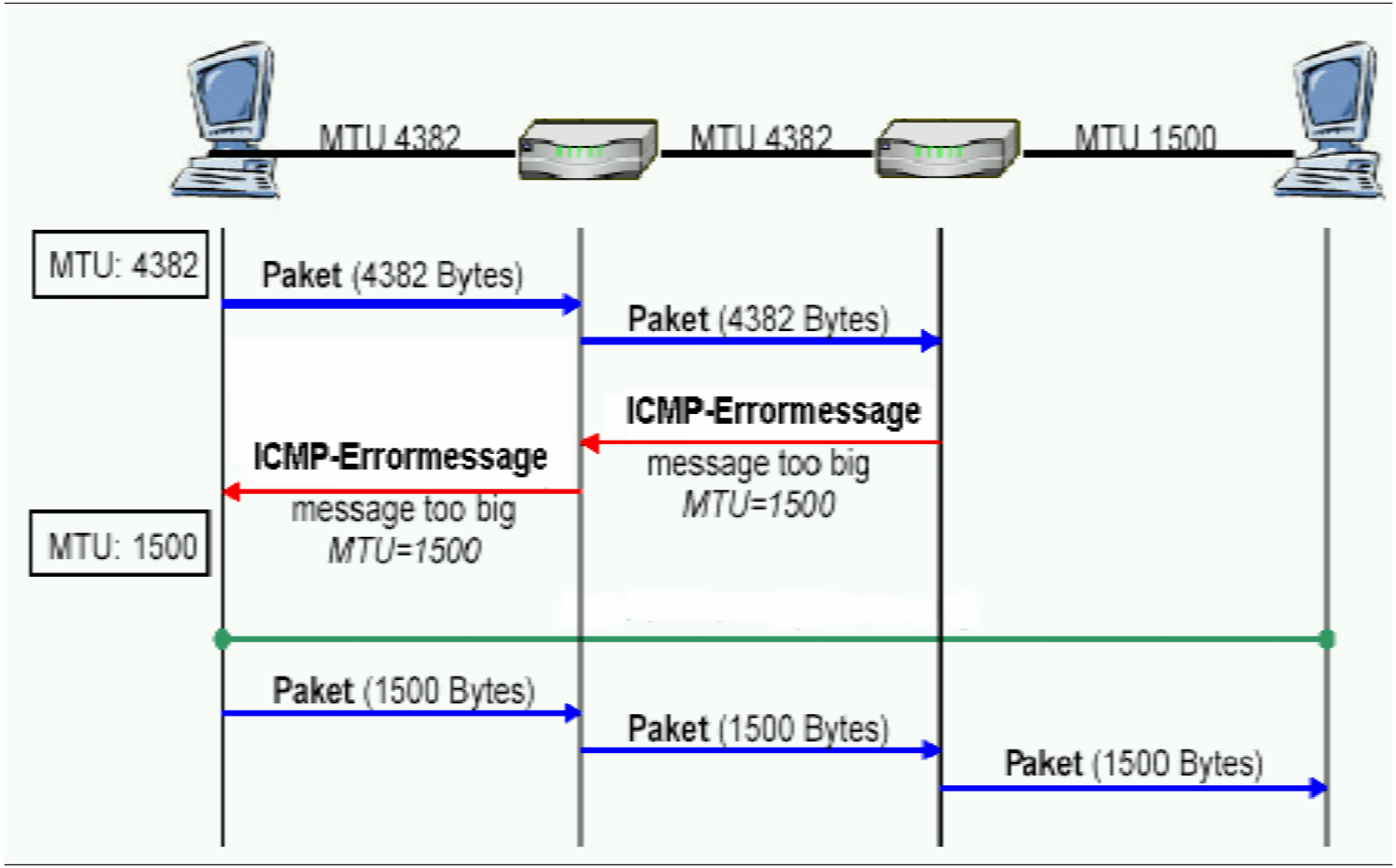


- ANYCAST

  1 to 1-n, several nodes have same adress, received by the nearest host



IP version 6: routing / fragmenting



IP version 6: advantages

- much more adresses available (2^128)
- no fragmentation in routers
- efficient routing
- no checksum in header
- security functions (e.g. IPSEC)
- auto-configuration

IP v4 vs. V6: migration

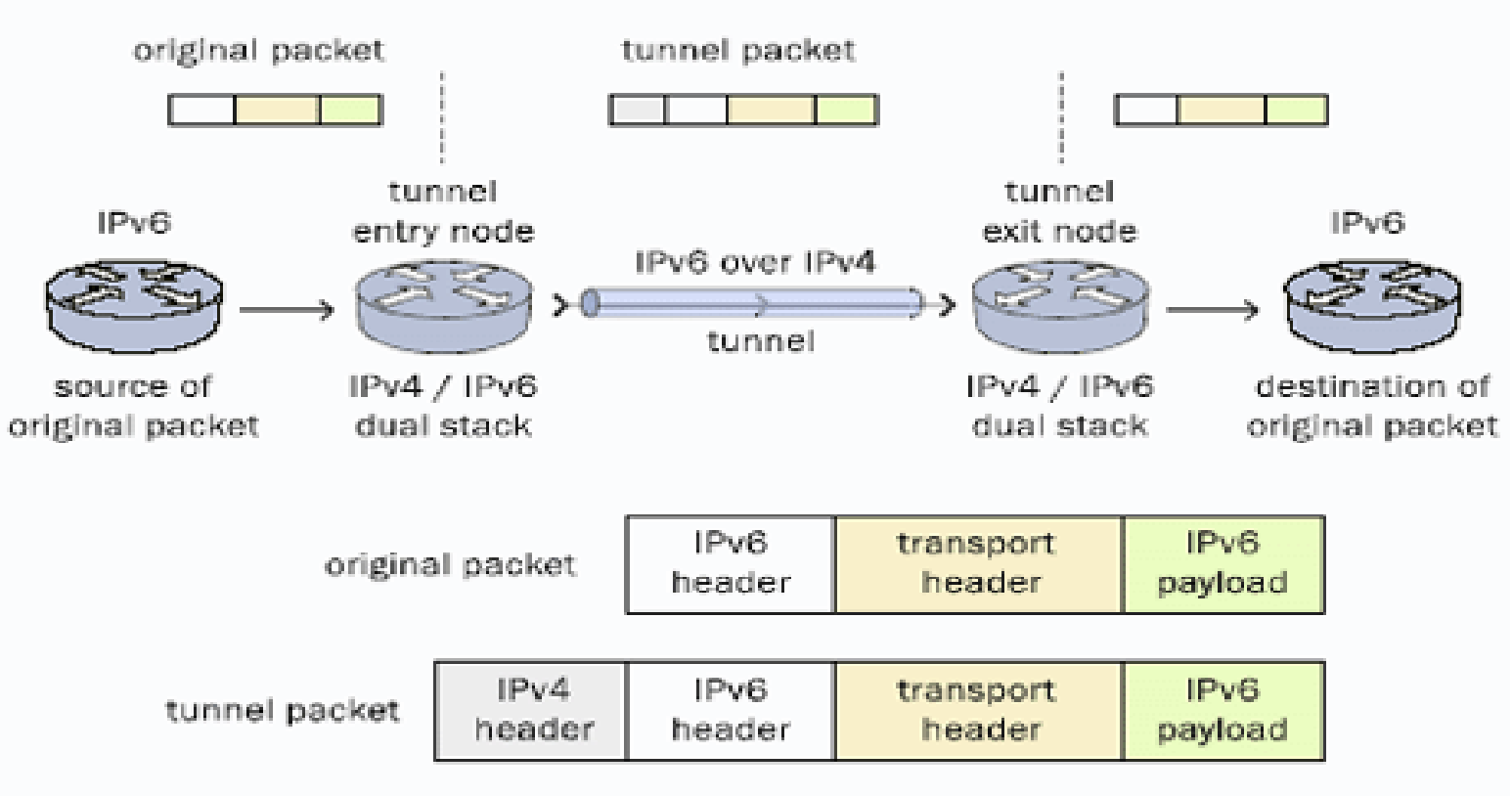
- Problems:
  - IPv4 and IPv6 are not compatible
  - Data exchange
  - Avoid internet-breakdown when changing over
  - „one day migration“ is impossible
- Solution:
  - soft migration over time
  - Coexistence of IPv4 and IPv6

IP v4 vs. V6: migration / compatibility

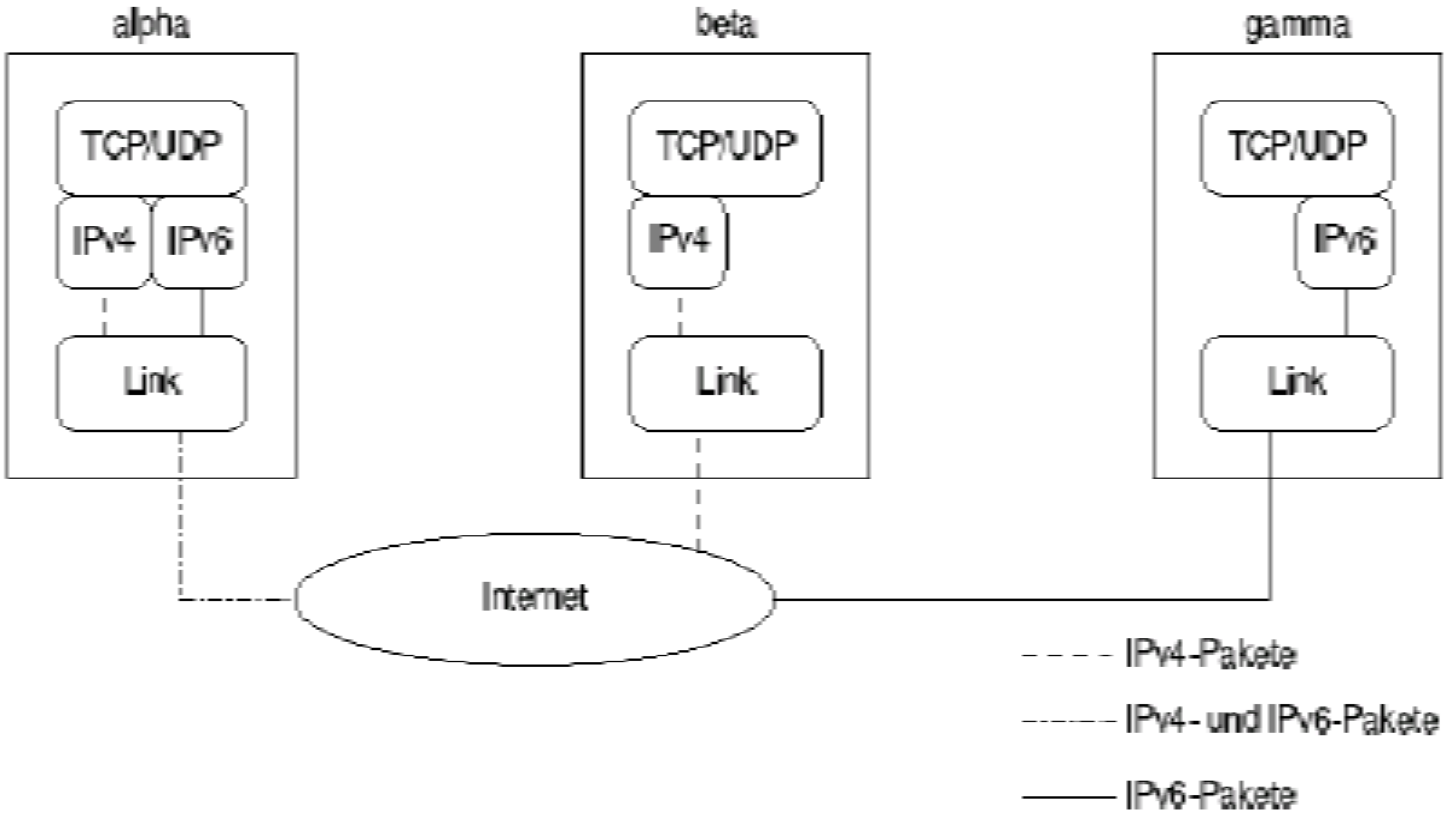
- Computers migrated to IPv6 can still be reached over IPv4 (Dual stack)
- IPv6 can be tunneled over IPv4 networks
- There will have to be a „long-time compatibility“

IP v6 in v4: Encapsulation

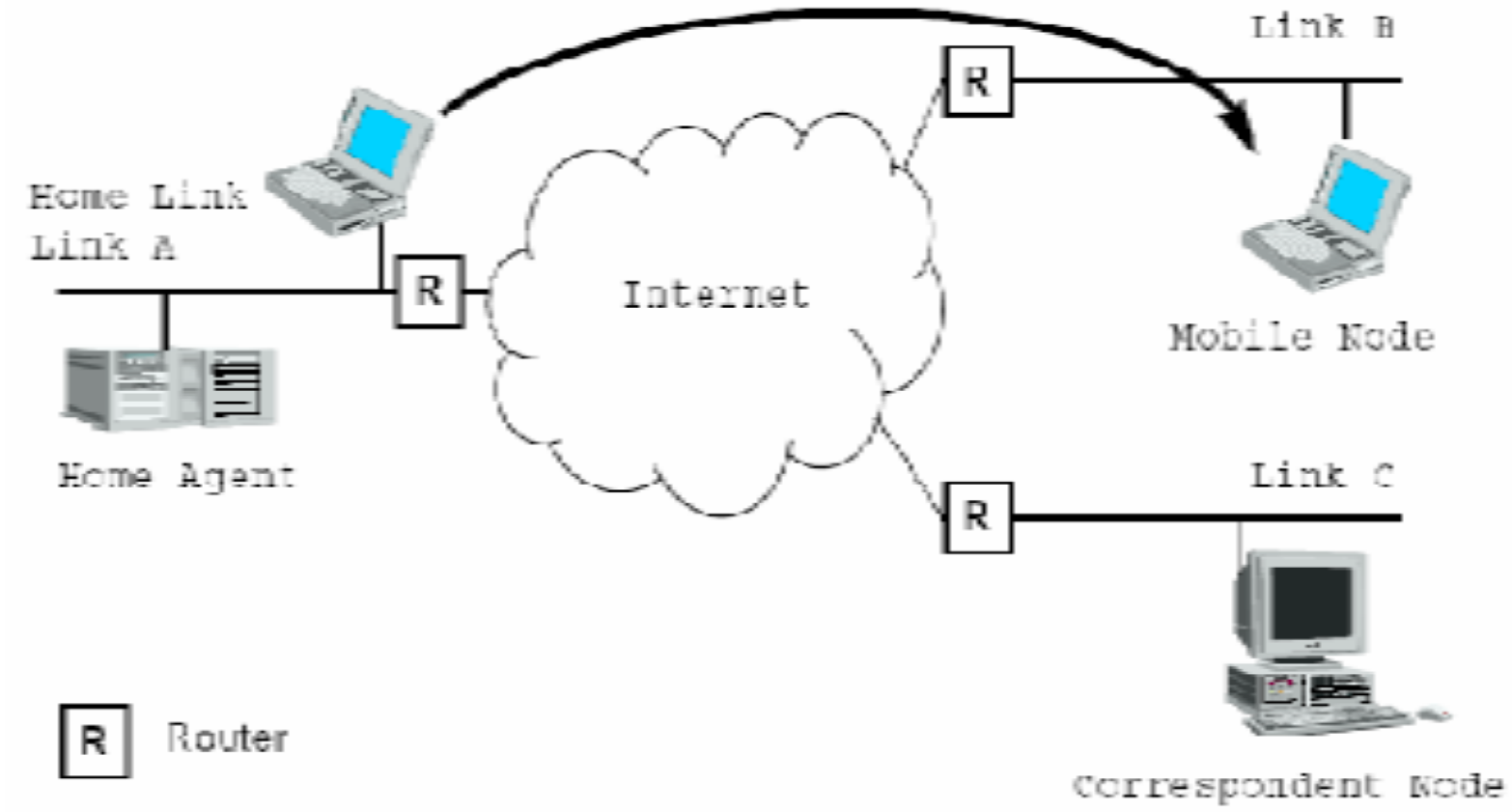
- IPv6 Datagrams packed in IPv4 Datagrams



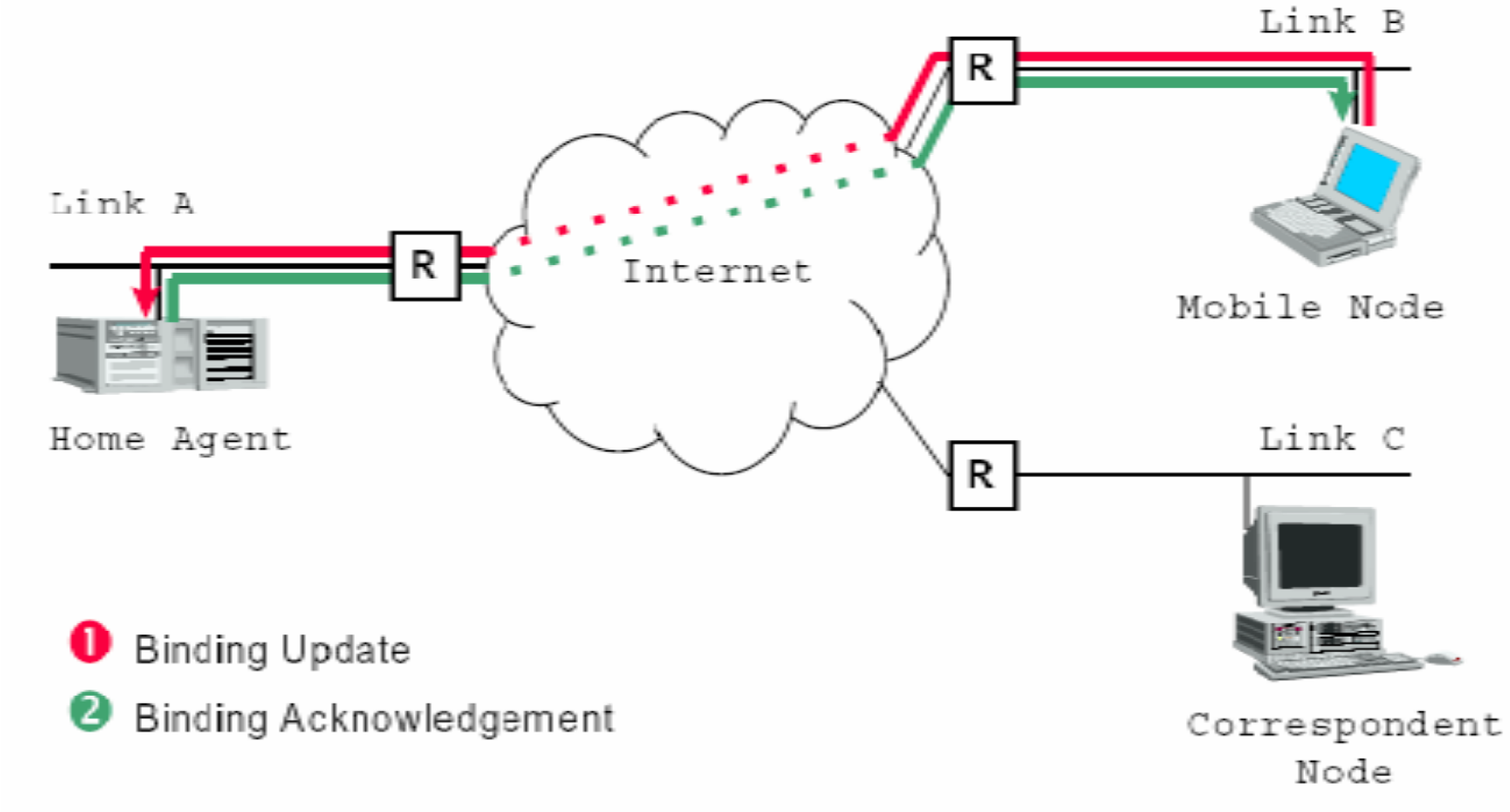
IP v6 in v4: Dual Stack (no tunneling)



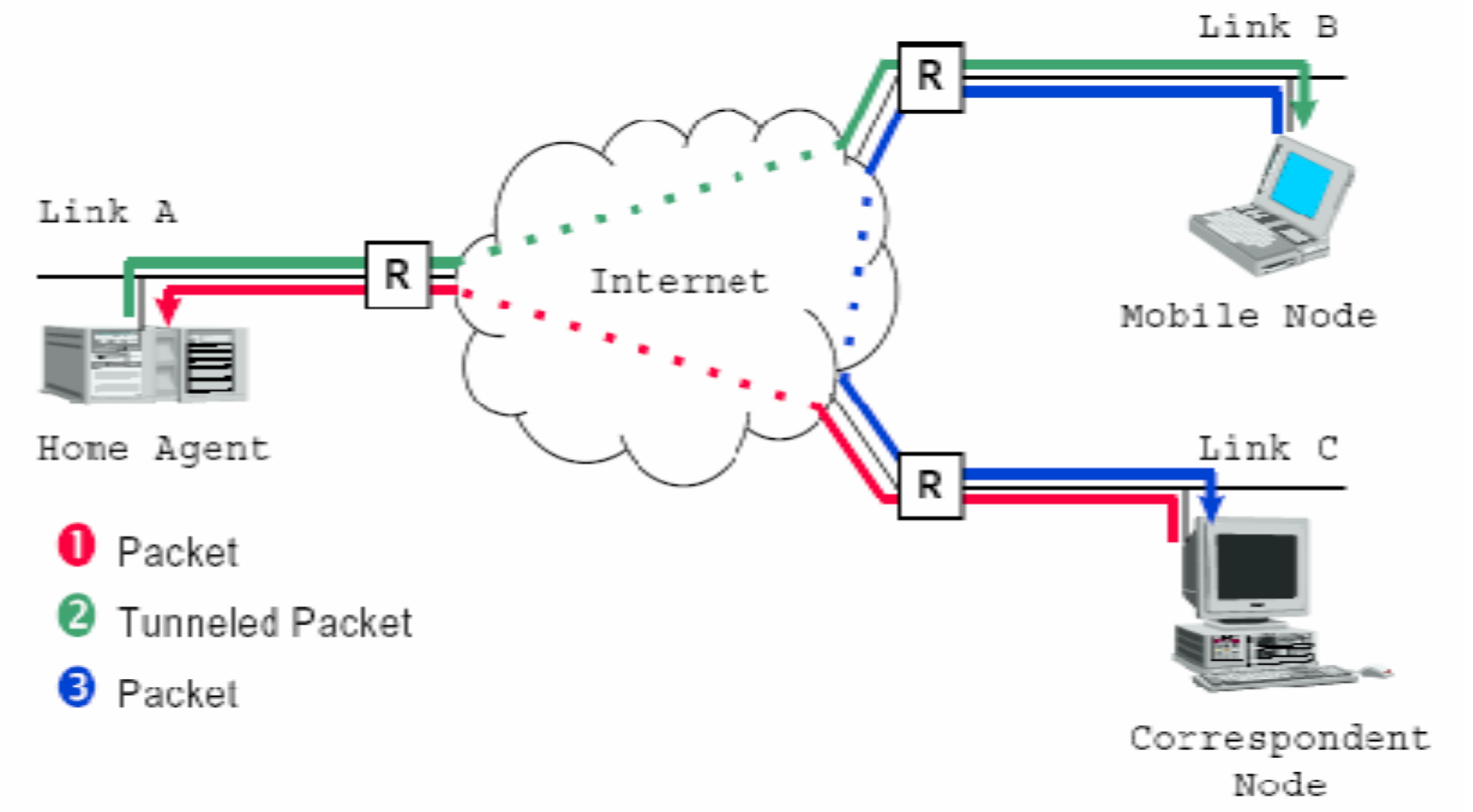
IP v6: mobile support



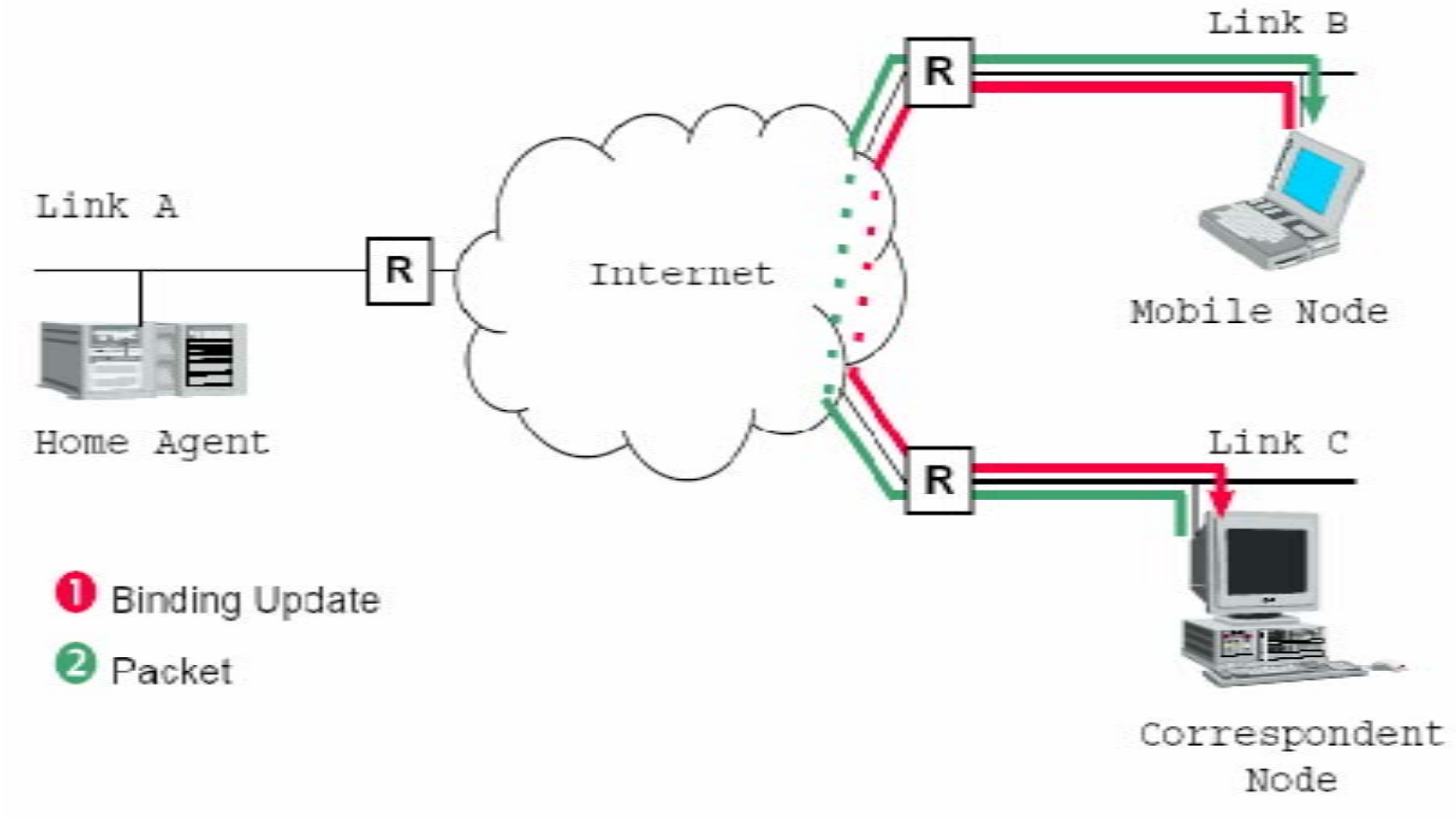
IP v6: mobile support



IP v6: mobile support



IP v6: mobile support



Future issues

- much more mobile IP-devices and rising number of internet users (china, india)
- IPv6 is necessary for the future
- change-over is starting slowly now

Prüfungsfragen:

- Migration from IPv4 to IPv6
- IPv6 Extension Headers