# WHAT ARE THE LIMITATIONS OF IPv4, WHAT IS IPv6

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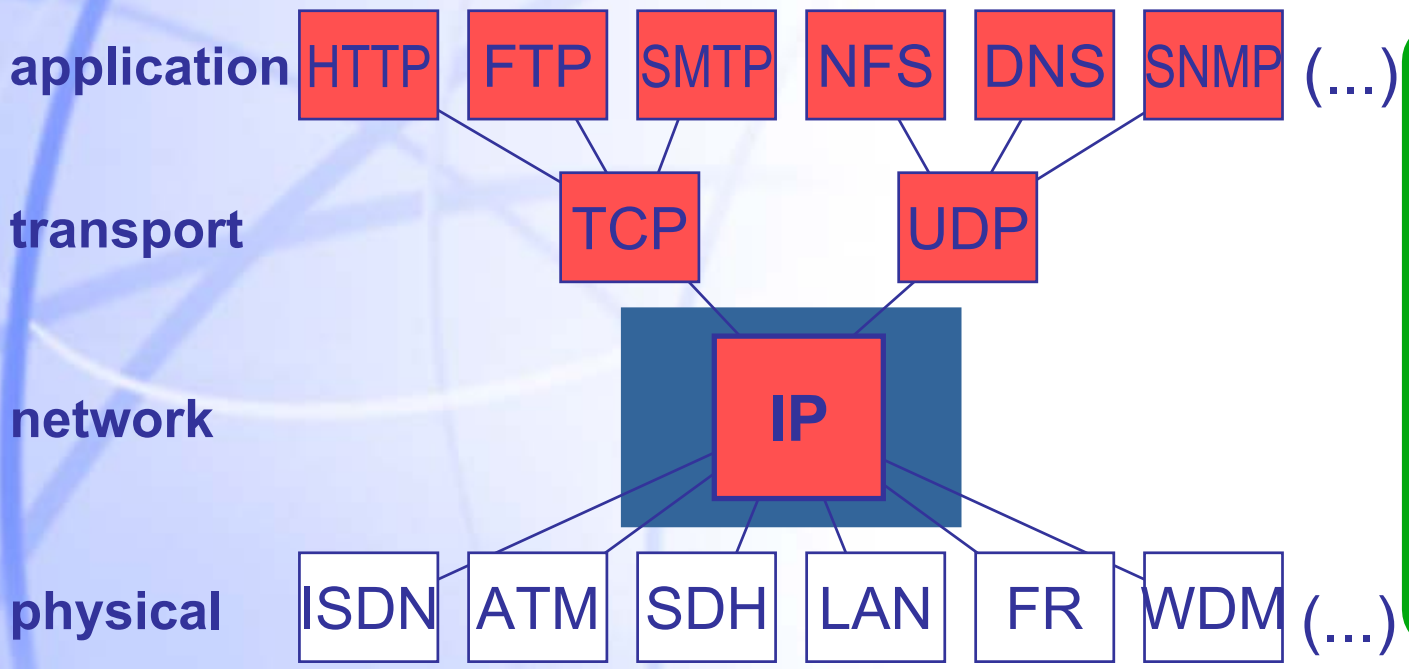
# INTERNET PROTOCOL (IP)

- Dominat general purpose networking protocol in use today.
- It runs over an astounding number of physical Media.
- Fundamental packet format that many computers Use.
- Routers are the fundamental building blocks of any IP-based network including the Internet.
- IP is a layered protocol, deisgned to facilitate the exchange of data between two applications on two different computers.

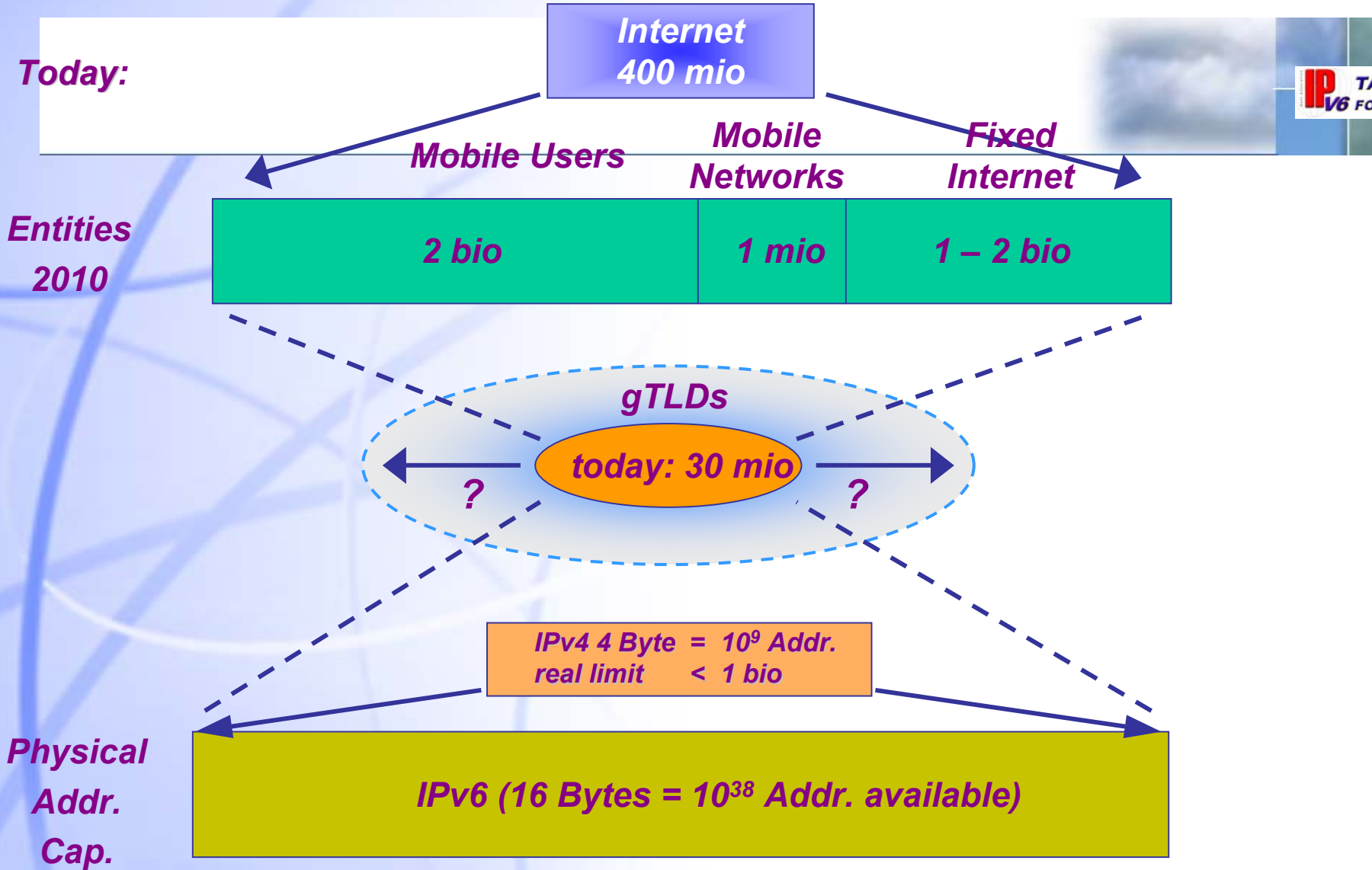
# WHAT DOES IP OFFER?

- THE CONVERGENCE LAYER FOR DATA, VOICE AND MULTIMEDIA NETWORKING, AS WELL AS FIXED AND MOBILE APPLICATIONS
- ALLOWS FOR THIRD PARTY DEVELOPERS TO ADD VALUE TO NETWORKS
- SINGLE SYSTEM FOR RESIDENTIAL, OFFICE, CELLULAR ENVIRONMENTS

# Addresses Bottleneck for growing Internet

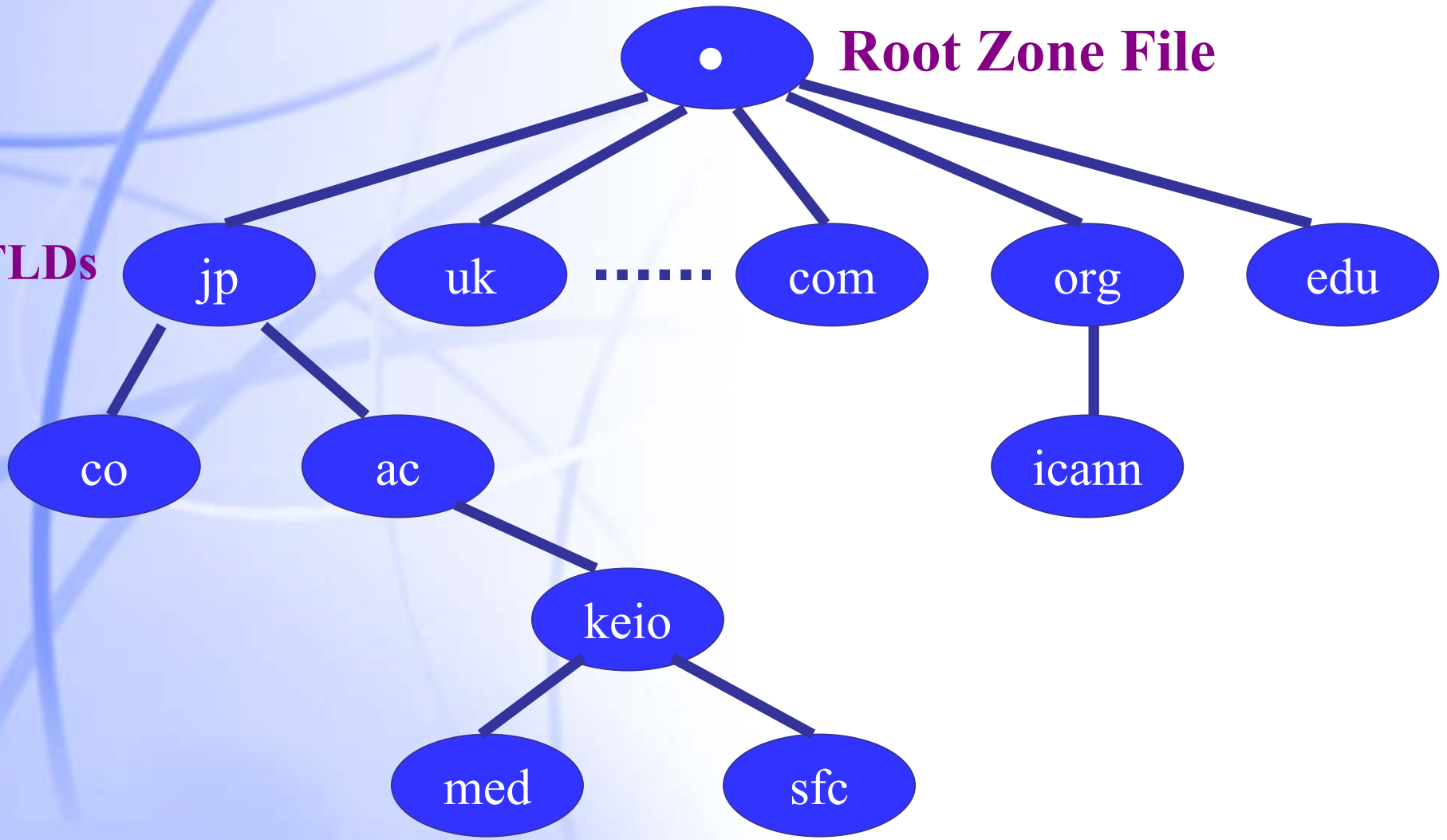



Does not scale to the growth of the fruits and roots




# DNS – bottleneck for Mobiles?

# The DNS Tree



# Map of the Root Servers

# TLD Naming Capacity will be exhausted by

## Sample Calculation

- **Today:** ~ 200 mio host addresses (IPv4) equivalent to 40 mio TLD names used
- **2010: (IPv6)** 2000 – 5000 mio host addresses

  equivalent to 400 – 500 mio TLD

***Conclusion: TLD overload goes up by factor 10***

# IPv4 - Limiting factors

- **Running out of Internet addresses**
  - —Limits Internet growth for existing users & Hinders use of the Internet for new users
  - —Internet Routing is inefficient
  - —Forces users to use translation (NATs)
- **System Management Costs**
  - —Labour intensive, complex, slow & error prone
  - —Inconsistent level of DHCP support in clients
  - —Networks are having to Renumber
    - –Caused by address space shortage/ When choosing a more competitive ISP

# IPv4 issues

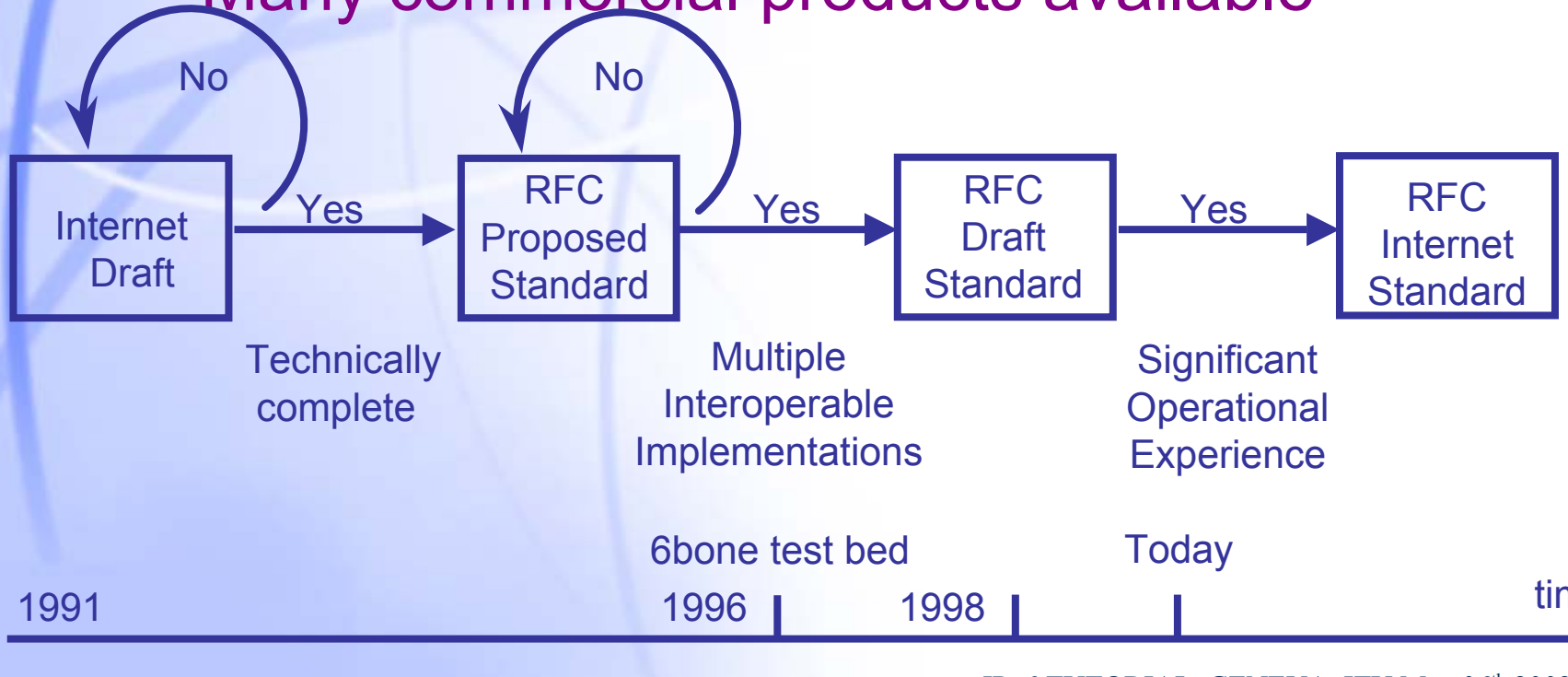
- **Optional Security**
  - —Retrofitted and many solutions defined
    - –SSL, SHTTP, IPSEC v4 etc.
    - –No ONE standard
  - —Security features are optional
    - –CANNOT count on their availability
- **Difficult to add support for future needs**
  - —Adding it on is very high overhead
  - —Hinders the ability to connect everything over IP

# Will IPv4 last forever?

- **How long can we ignore these problems?**
  - —IPv4 address space will run out
  - —There is an engineering limit to the amount of add-on and retrofitting that can be applied to IPv4
    - –Ever more complex solutions
    - –Each solution causes new problems to solve
    - –Limits scalability
- **A natural evolution from IPv4 is required**
  - —Designed with extensibility and scalability in mind

# Where are we now?

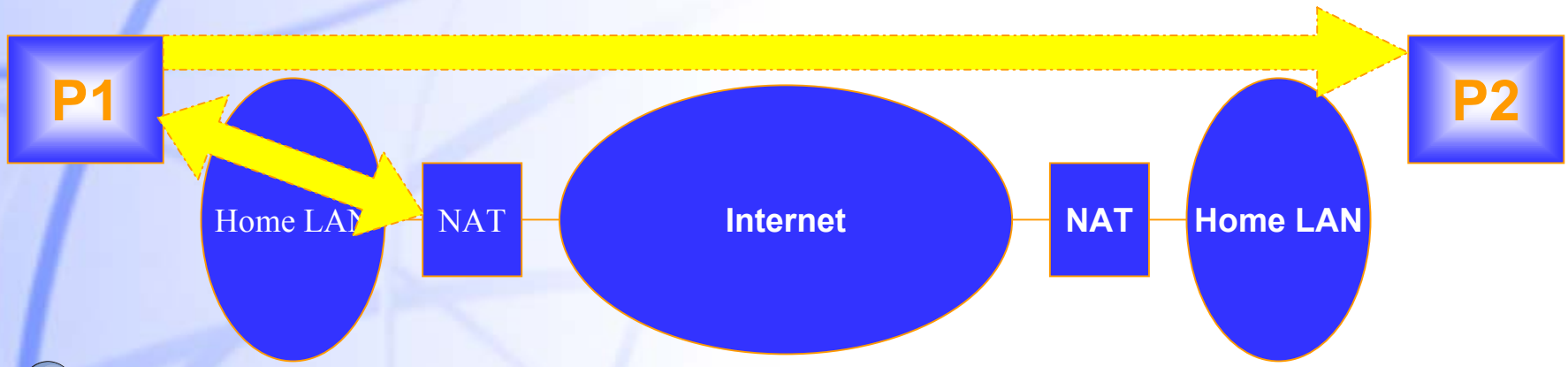
- **IPv6 is here now!**
  - Core specifications achieved Draft Standard status
  - Many commercial products available



# NETWORK ADDRESS TRANSLATOR (NAT)

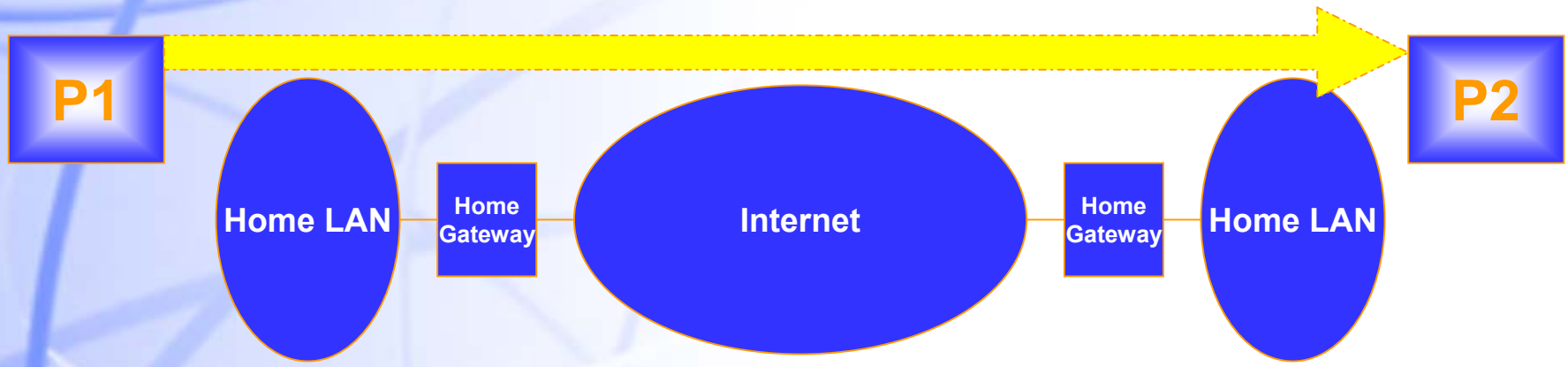
- Limits Multimedia and Interactive Internet
- Extensibility of VPNs, encryption and security
- VoIP simply does not work in many cases with NATs
- NAT inhibits many forms of innovative network use

# Peer-to-peer RTP audio example



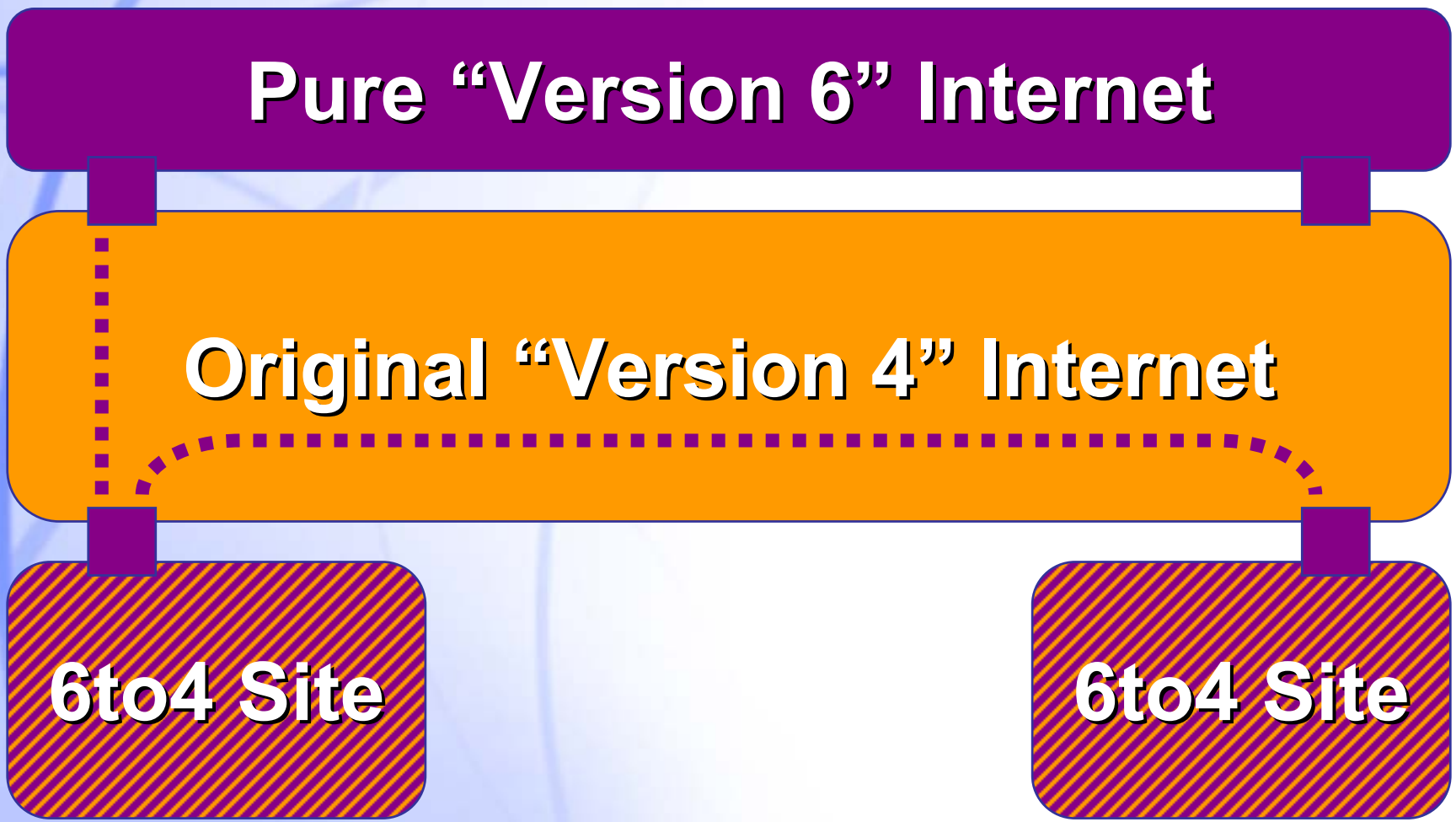

- With NAT:
  - —Need to know the address “outside the NAT”
  - —Provide that address to peer
  - —Need either NAT-aware application, or application-aware NAT
  - —May need a third party registration server to facilitate finding peers

# Peer-to-peer RTP audio example




- **With IPv6:**
  - —Just use IPv6 address

# Transition, with 6to4: No dependency on "core"



# IPv6 part of the future

- **IPv6 Solves many of the problems caused by the IPv4 success and more...**
- **Will the whole Internet get upgraded any time soon?**
  - —No way!
  - —Some “green field” sites considering use of IPv6
- **IPv6 offer useful features for Today's networks**

# IPv6 Key Features & Advantages

- Larger Address Space
- Efficient and Extensible IP datagram
- Efficient Route Computation and Aggregation
- Improved Host and Router Discovery
- New Stateless and Stateful Address Autoconfiguration
- Required Security for IP datagrams
- Easy renumbering

# IPv6 ADDRESSING

IT IS MORE THAN ABOUT ADDRESSING

# IPv6 OPPORTUNITIES

- Autoconfiguration of Link-local connections
  -Time limited local addresses given by nearest (inhouse) proxy
- Plug and Play connectivity
  - Link-local or main address accessable
- Mobile use
  -Each station has a main address (Home address pre-fixing) and several time limited sub-addresses (Care-of-Addresses, local host pre-fixing)
  -In mobile use often two addresses active (cell related)
  at the time to determine the handoff. Movement direction may be determined.
  -Terminal Mobility in form of Mobile IPv6 considered

# Enables Next Generation Applications

- **IPv6 Flow Labels provide support for Data Flows**
  - Allows Packet Prioritizing
  - Ensures that high priority traffic is not interrupted by less critical data
- **IPv6 Multicast & Anycast**
  - Multicast delivers data simultaneously to all hosts that sign up to receive it
    - Makes conferencing more efficient
  - Anycast delivers data to one host in the group
    - Could be used to implement fault tolerant client/server applications more efficiently

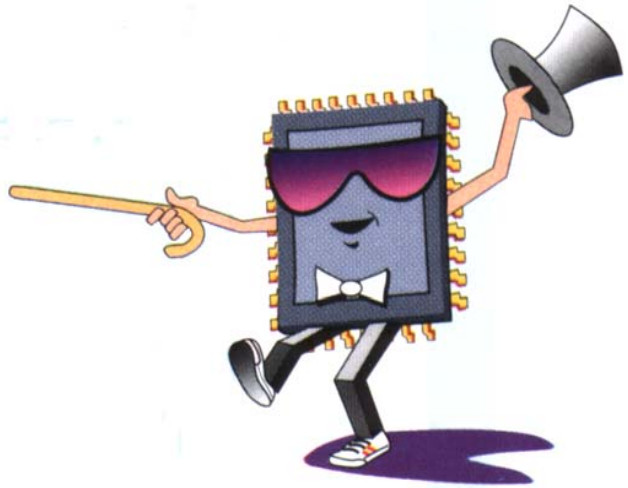
# Available TODAY in commercial products

- Microsoft will offer IPv6 in next Windows XP
- Sun offers it now in Solaris 8
- Cisco
- Telebit has it standardly now in router
- Hitachi
- Fujitsu
- 6WIND

  etc...

# Conclusions

- **IPv6 is ready for deployment;**
  - —all the components are now in place
- **Most mobile systems need IPv6**
  - —the participants are much more committed to it now than 6 months ago
  - —Agreed standards are coming
- **Large-scale trials and experiments**
  - —Needed and happening



# Thank you for your attention!!