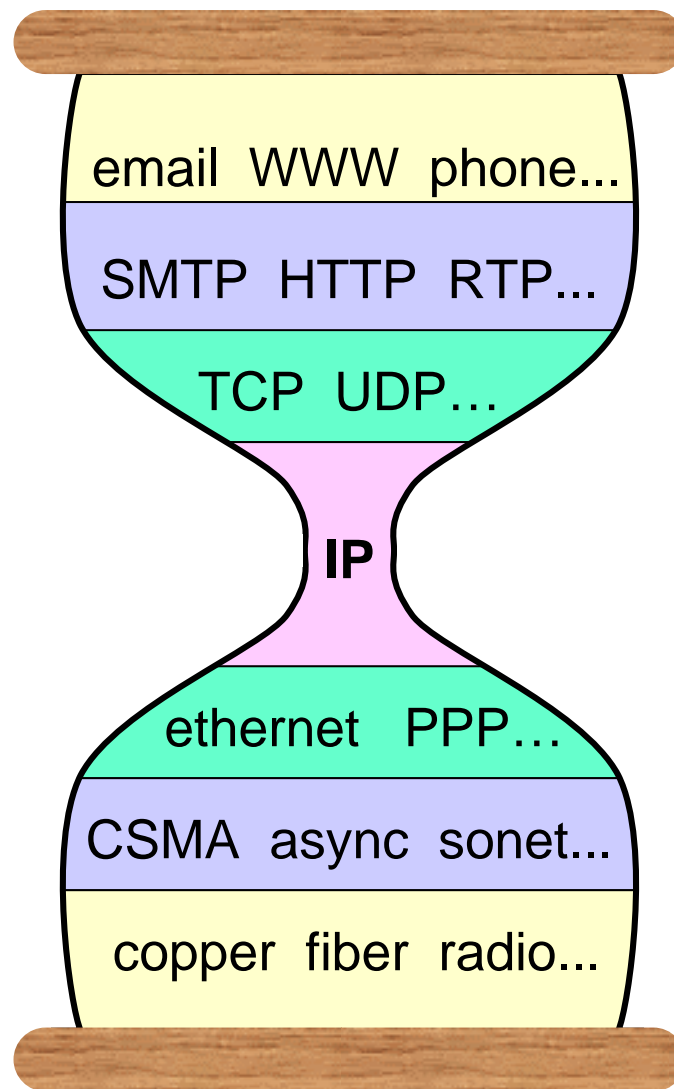


# IPv6: Addressing the Future

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Global IPv6 Summit  
Madrid, Spain  
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# The IP Hourglass



# Why the Hourglass Architecture?

## ⌚ Why an internet layer?

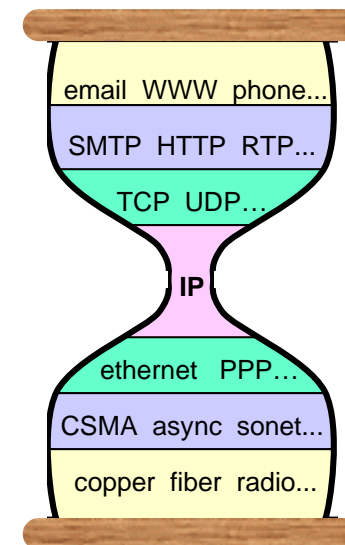
- make a bigger network
- global addressing
- virtualize network to isolate end-to-end protocols from network details/changes

## ⌚ Why a *single* internet protocol?

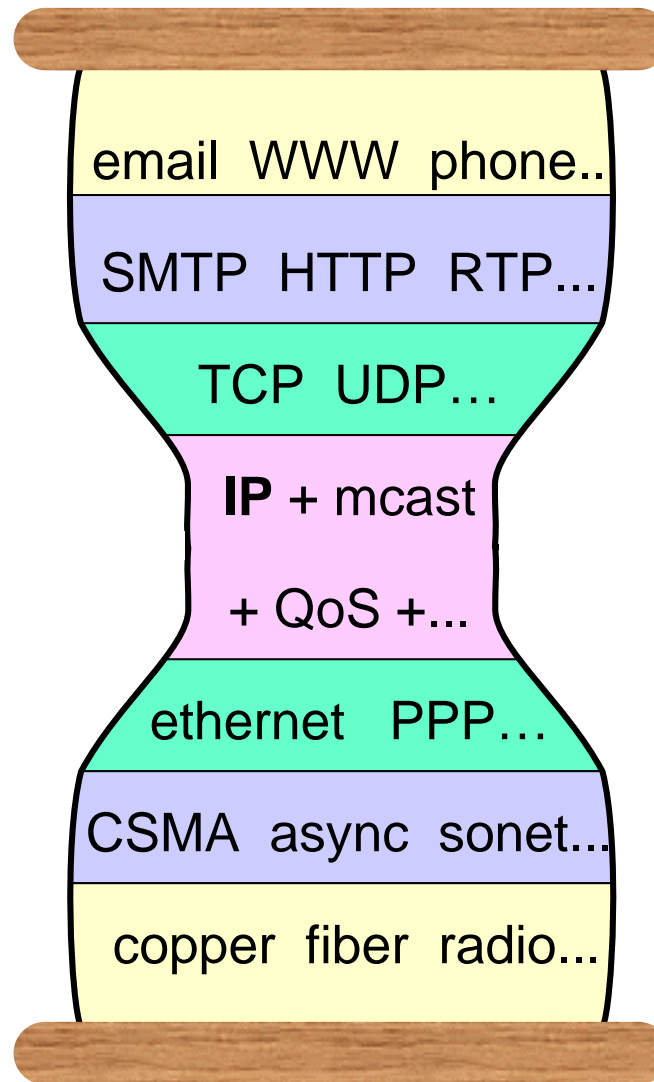
- maximize interoperability
- minimize number of service interfaces

## ⌚ Why a *narrow* internet protocol?

- assumes least common network functionality to maximize number of usable networks

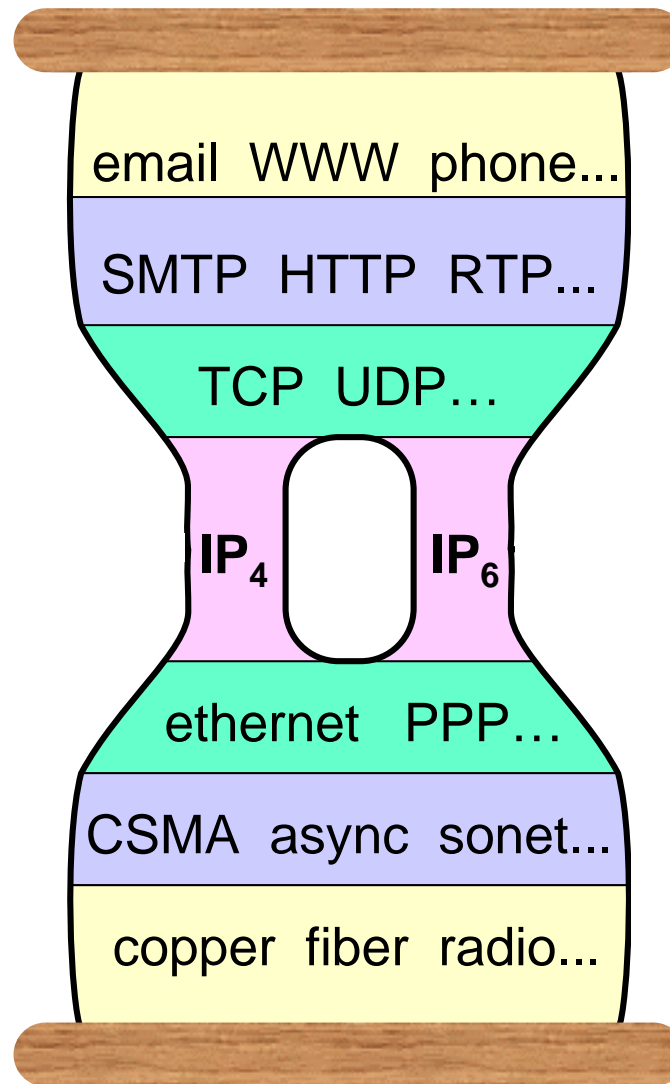


# Putting on Weight



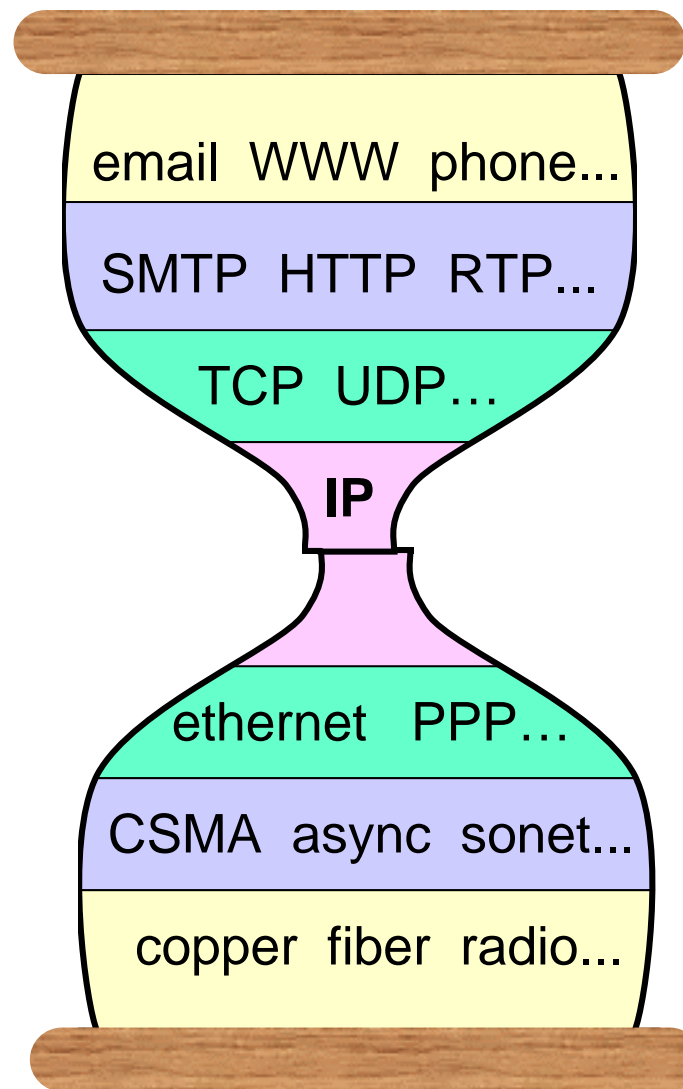
- requires more functionality from underlying networks

# Mid-Life Crisis



- doubles number of service interfaces
- requires changes above & below
- creates interoperability problems

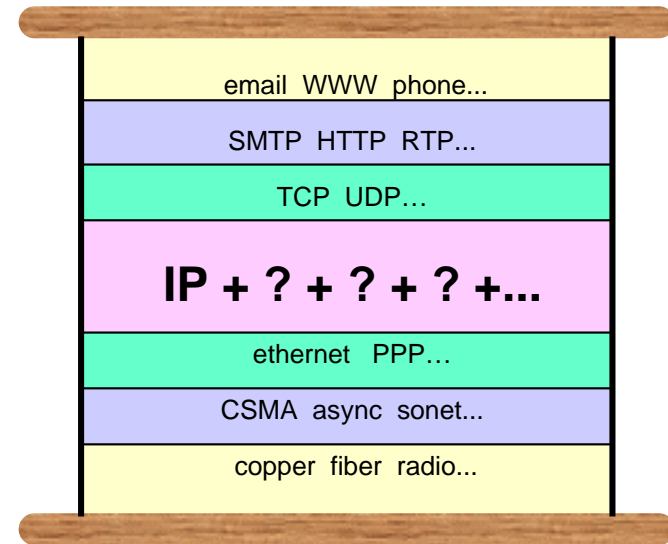
# Oops! An Accident



- NATs & ALGs used to glue the broken pieces
- lots of kinds of new glue being invented—ruins predictability
- some apps remain broken, since repairs are incomplete

# More Fattening Temptations

- ⌚ TCP “helpers”
- ⌚ reliable multicast assists
- ⌚ packet-intercepting caches
- ⌚ “content-based routing”
- ⌚ active networking



# Lost Features of the Internet

- ⌚ transparency
- ⌚ robustness through “fate sharing”
- ⌚ dynamic routing
- ⌚ unique addresses
- ⌚ stable addresses
- ⌚ connectionless service
- ⌚ always-on service
- ⌚ peer-to-peer communication model
- ⌚ application independence



# Below-the-Waist Bulge

⌚ mostly reinventing, badly, what IP already does (or could do):

- VLANs
- layer 2 tunneling protocols
- MPLS, PPPoE,... (“layer 2.5”)

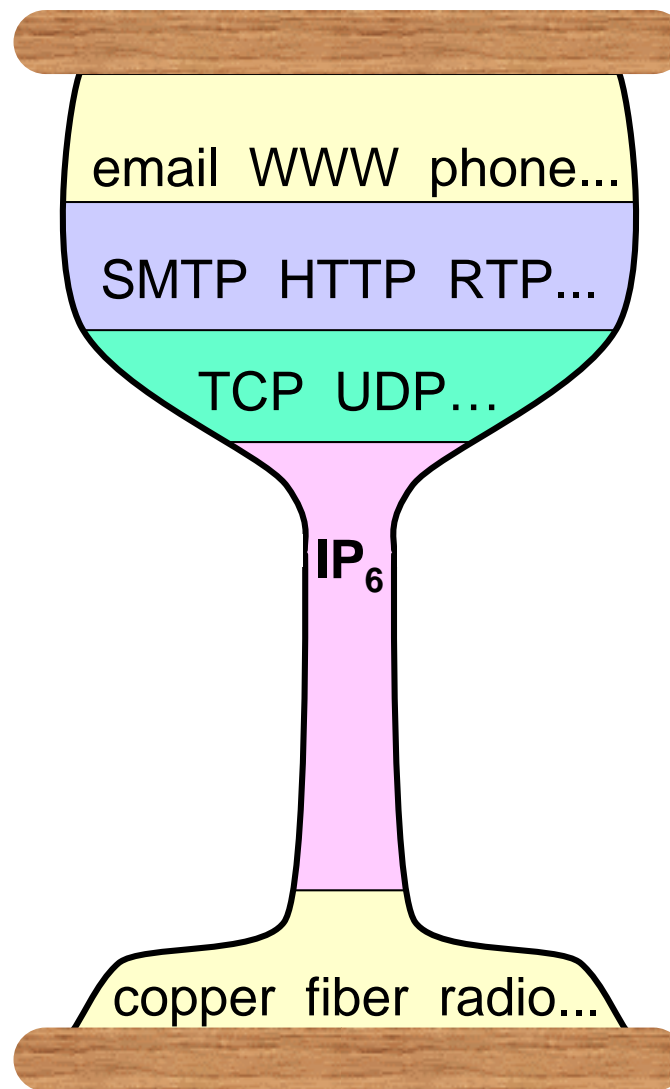
⌚ lower layers mostly seem to just make IP's job harder

- cells, circuits, QoS, multicast, large clouds, opaque clouds

# What to Do?

- ⌚ First, acknowledge that this is the normal entropy / decay that besets all large, engineered systems over time
- ⌚ So, shall we just let nature take its course?
- ⌚ Or, shall we make the effort to get back into shape?

# A Fitness Goal



- perhaps we can trim down from an hourglass to a *wineglass*
- promising signs: IP-over-SONET, IP-over-WDM
- IPv6 to restore simplicity *and* functionality

# Potential Impact of IPv6 on the Next-Generation Internet?

1. restore capabilities of the previous generation Internet!
2. add capabilities for new environments, new devices, and new applications
3. allow those capabilities to reach everyone, everywhere, all the time

**Only  
Time Will  
Tell...**

