

Wireless WG Workshop
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Future of Transport Protocol



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Overview

- Transport Protocol
- Transport Issues
 - Diverse Infra
 - Diverse Applications
- Infra-based Ubiquitous Transport
- Summary

Transport Protocol

- A protocol in the transport layer that is responsible for
 - End-to-End connection
 - Error Recovery
 - Flow/Congestion Control
- Examples
 - TCP, UDP, DCCP, STCP, ...

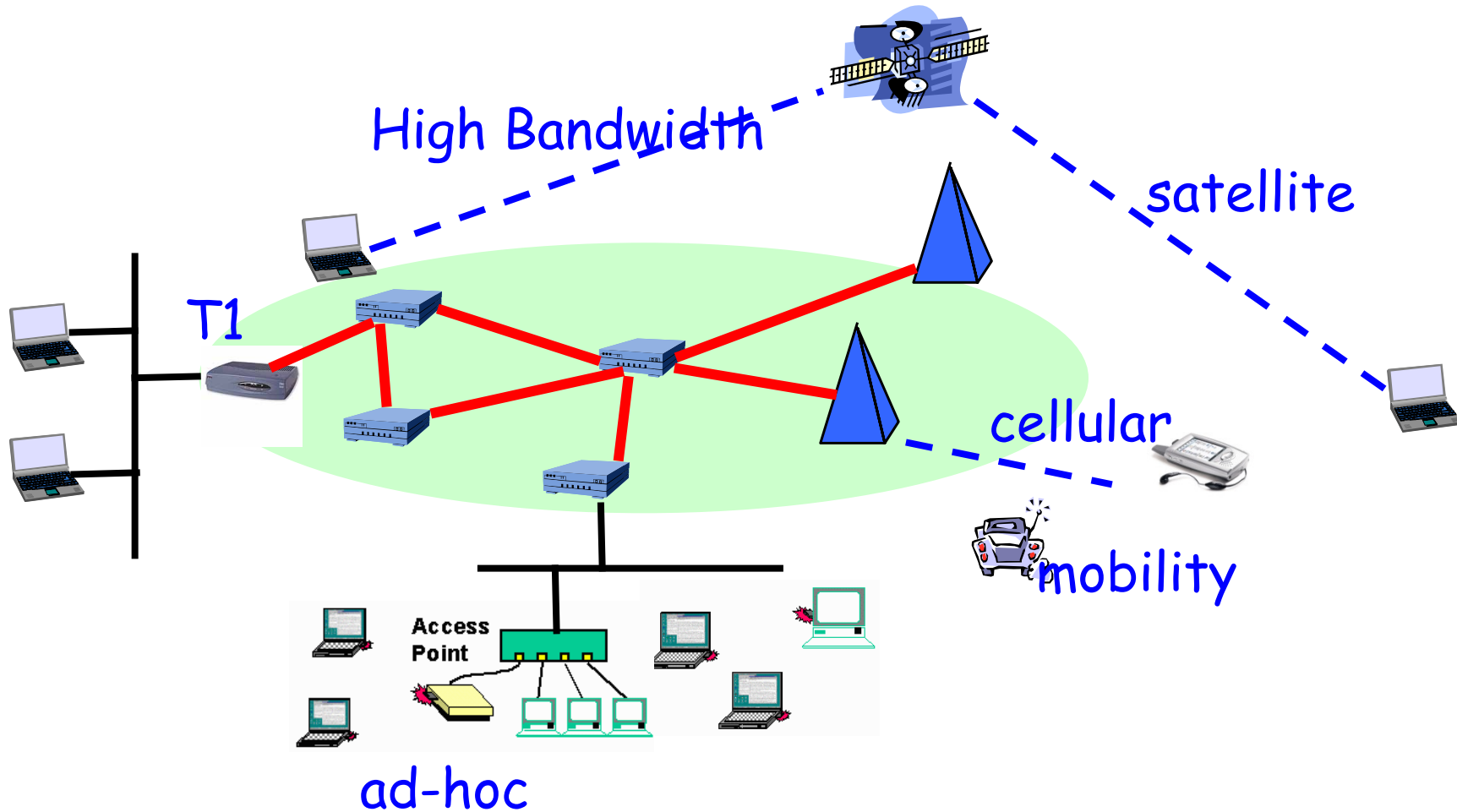
Trends in Transport Research

- Late 90's
 - Started to look at wireless TCP problems
 - Mostly single hop solutions
 - Split-TCP, Snoop, Freeze-TCP, ...
- 2000's
 - Multihop problems
 - Ad-hoc, Mesh Network

Challenges to Transport Protocol

- Diverse Infra
 - Wireless
 - High error and low bandwidth
 - Frequent route change (ad-hoc)
 - Cellular, WiMax/WiBro, Wi-Fi, Mesh
 - Satellite
 - Long delay and error-prone channel
- Diverse Applications Requirements
 - P2P
 - Multicast
 - Short Duration Sessions
 - Signaling Application
 - High Bandwidth Protocol
 - Real Time Applications
 - High Mobility

Diverse Infra and Applications



Satellite Path

- Issues
 - Long RTT
 - Geo-Stationary altitude: 36,000Km
 - RTT is between 480 and 560ms
 - Low SNR (BER of 10^{-7})
- Solutions
 - Window Scaling to cope with the large delay bandwidth product ($2\text{Mbps} * 700 \text{ msec} = 180\text{KB} \gg$ (Typical Limit of 64K Byte)
 - Forward Error Correction

Mechanism	Use	Location
Path-MTU Discovery	Recommended	Sender
FEC	Recommended	Link
TCP		
Slow Start	Required	Sender
Congestion Avoidance	Required	Sender
Fast Retransmit	Recommended	Sender
Fast Recovery	Recommended	Sender
Window Scaling	Recommended	Sender and Receiver
PAWS	Recommended	Sender and Receiver
RTTM	Recommended	Sender and Receiver
SACK	Recommended	Sender and Receiver

Wireless Environment

- Issues
 - High BER
 - Mobility
 - Variable RTT
 - MultiHop
- Solutions
 - TCP-Sack (selective Ack), TCP-Westwood
 - TCP-ECN (Explicit Congestion Notification) or ELN, ...
 - Cellular network: Snoop, Split-TCP, Freeze-TCP

Short Duration Session

- Issues
 - Short duration transactions can take too long if loss happens in the beginning.
- Solutions
 - T/TCP (RFC 1644)

Signaling

- Issues
 - Some applications do not need strict ordering of packets
 - e.g. HTTP
 - MultiHoming is possible.
- Solutions: SCTP (RFC2960)
 - Streaming Control Transport Protocol (SCTP)
 - Originally designed to support PSTN signaling messages over IP Networks
 - Adopt similar congestion and flow control as TCP

High Bandwidth Transport

- Issues
 - Would like to transmit in the order of 10-100Gbps
- Solutions
 - HighSpeed TCP/FAST/BIC TCP

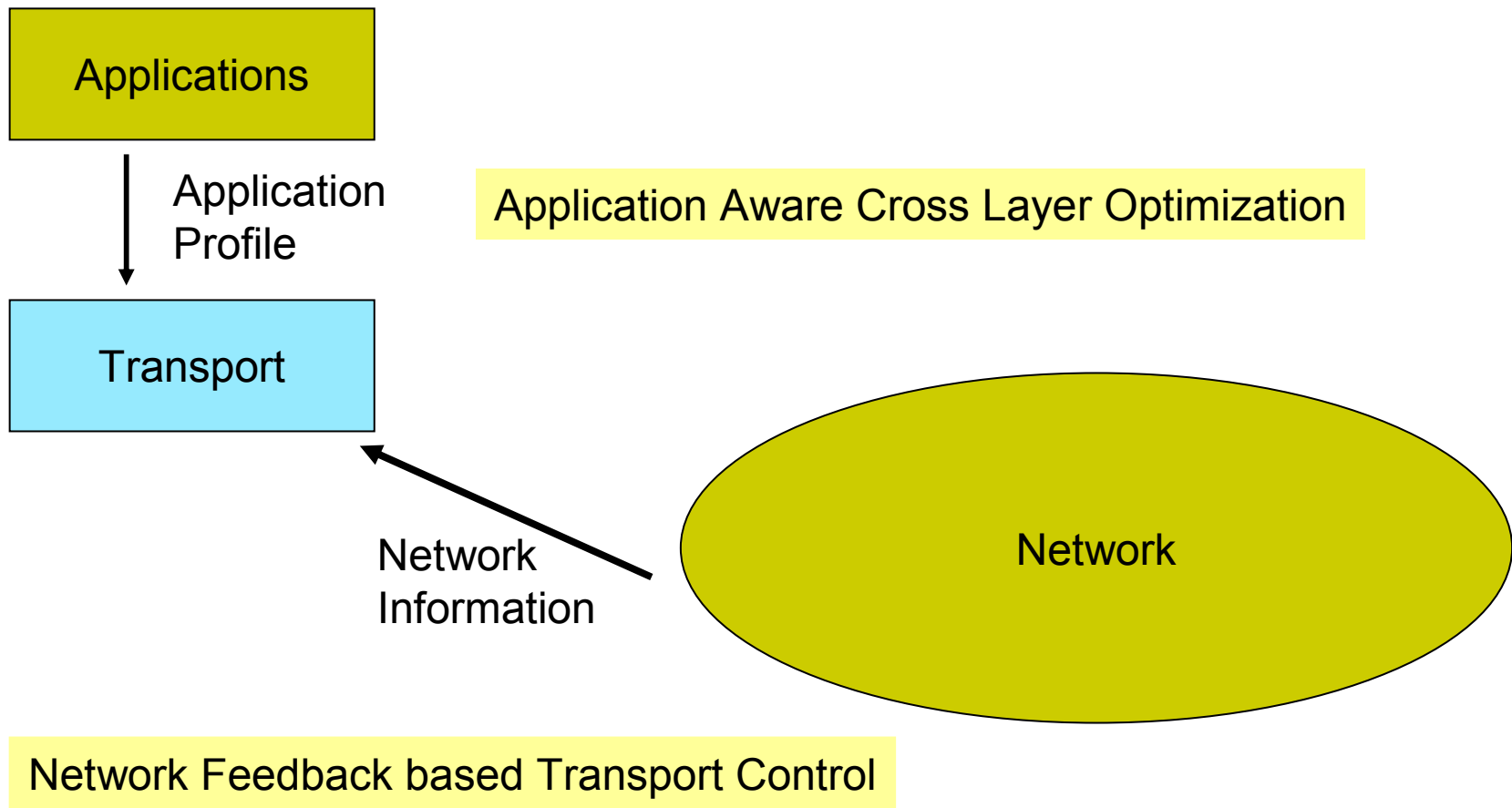
More Aggressive Increase of Windows

Real Time Transport

- Issues
 - How to support video/audio applications over wireless/wired networks
- Solutions
 - Relies on applications
 - RTP/UDP/IP or RTP/TCP/IP
 - Modified Transport
 - TCP-RTM
 - Cross Layer Optimizations

Future Transport Requirements

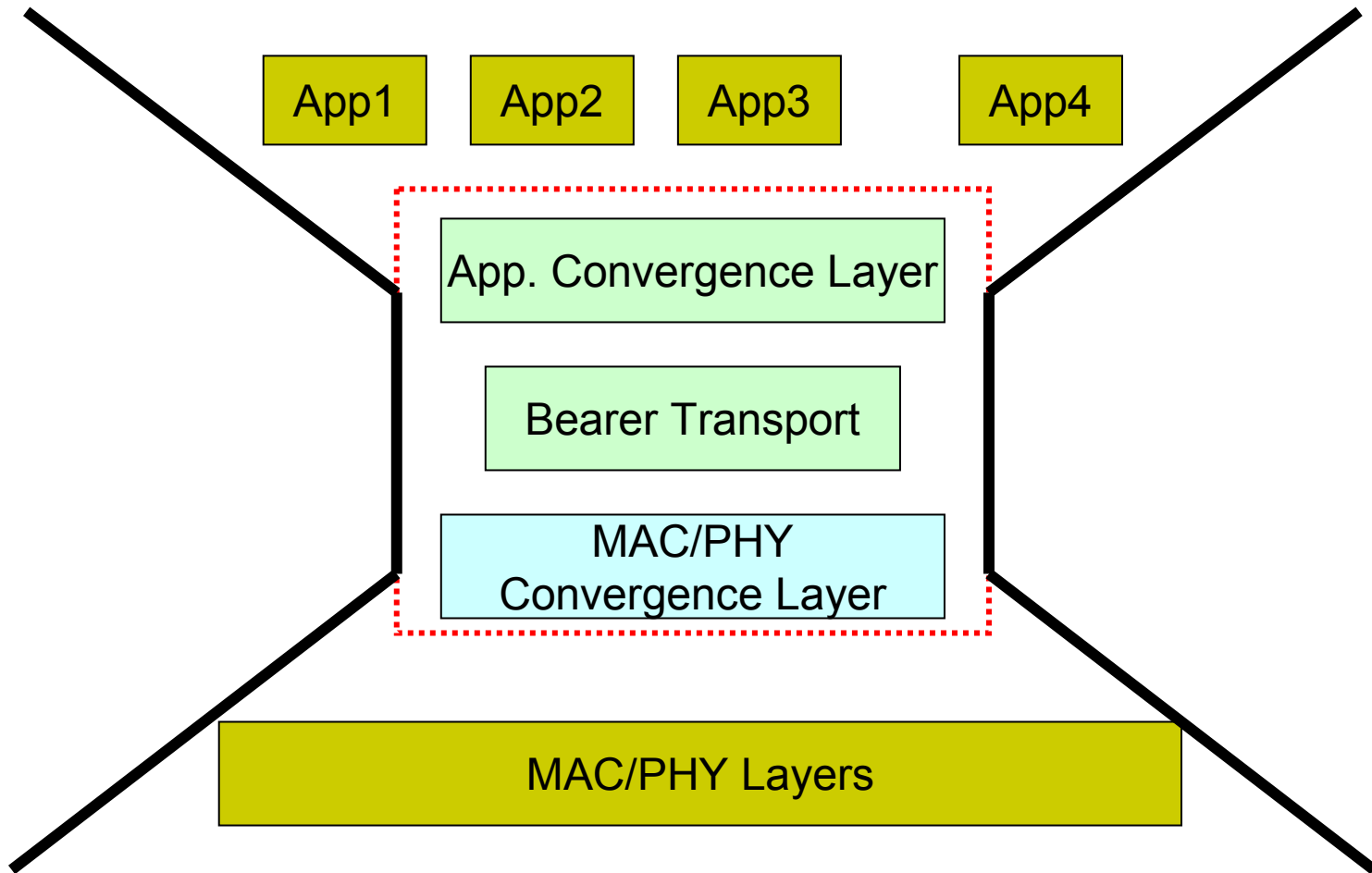
- Fast Response to
 - Different Infra
 - Different Applications
- Security & Reliability



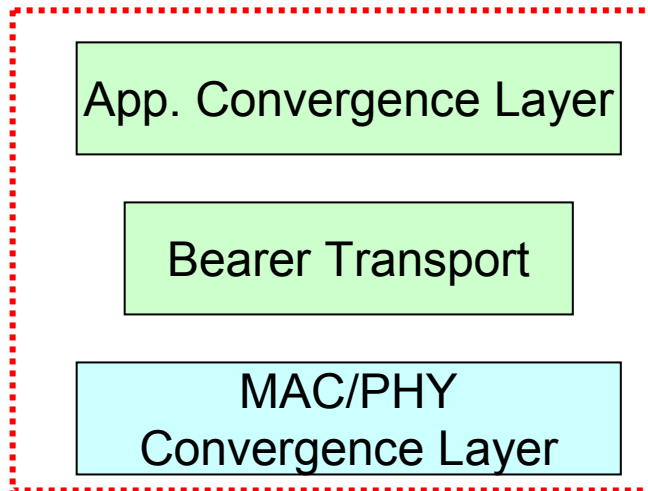
Research Questions

- Brand New Transport or Improved Transport?
- Current Approach
 - Many different versions of Transport
 - TCP_for_ad_hoc, TCP_for_web, ...

Brand New Transport?



Brand New Transport



- Bearer Transport
 - Performs the minimal transport functions
 - Reliable Transmission
 - SYN/ACK
 - Control Mechanism
- App. Convergence Layer
 - Application Specific Functions
- MAC/PHY Convergence Layer
 - Phy/MAC specific Functions

Summary

- Transport protocol needs to deal with diverse applications and different PHY/MAC layers.
 - Diverse PHY/MAC
 - Cellular, WiMax/WiBro, Wi-Fi, Mesh
 - Diverse Applications
 - P2P, Multicast, Short Duration Sessions, Signaling Application, High Bandwidth Protocol, Real Time Applications, High Mobility
- Future Transport should be able to handle these challenges

Thank you !!!

