

The Role of the Host in Supporting the Full Service QoS Enabled Network

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- ◆ **Why QoS?**
- ◆ **The quality/efficiency product**
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- ◆ **Summary**

**“Bandwidth - What me
Worry?”**



Alfred E. Neuman, ca. 1960

**“We’ll have infinite
bandwidth in a decade’s
time.”**

Bill Gates, 1994

**“640KB should be
enough for anybody”**

Bill Gates, 1981

Feeling Lucky Today?

- ◆ Metcalfe's Law: "The demand on a network grows by the square of the number of devices attached."
- ◆ Do you believe that supply will outpace demand?
- ◆ U.S. Dept. of Commerce reports in *The Emerging Digital Economy* growth rates of 1000% per year in Internet traffic (1998).



Can't I Just Add Bandwidth?



Over-provisioning is a valid QoS mechanism...

- ◆ Adding 1 Gbps on the LAN costs \$500 - once
- ◆ Adding 1 Gbps on the WAN costs \$100,000 - every month
- ◆ Feeling wealthy today?
- ◆ Maybe I need something else...

The Quality Efficiency Product

Some Definitions

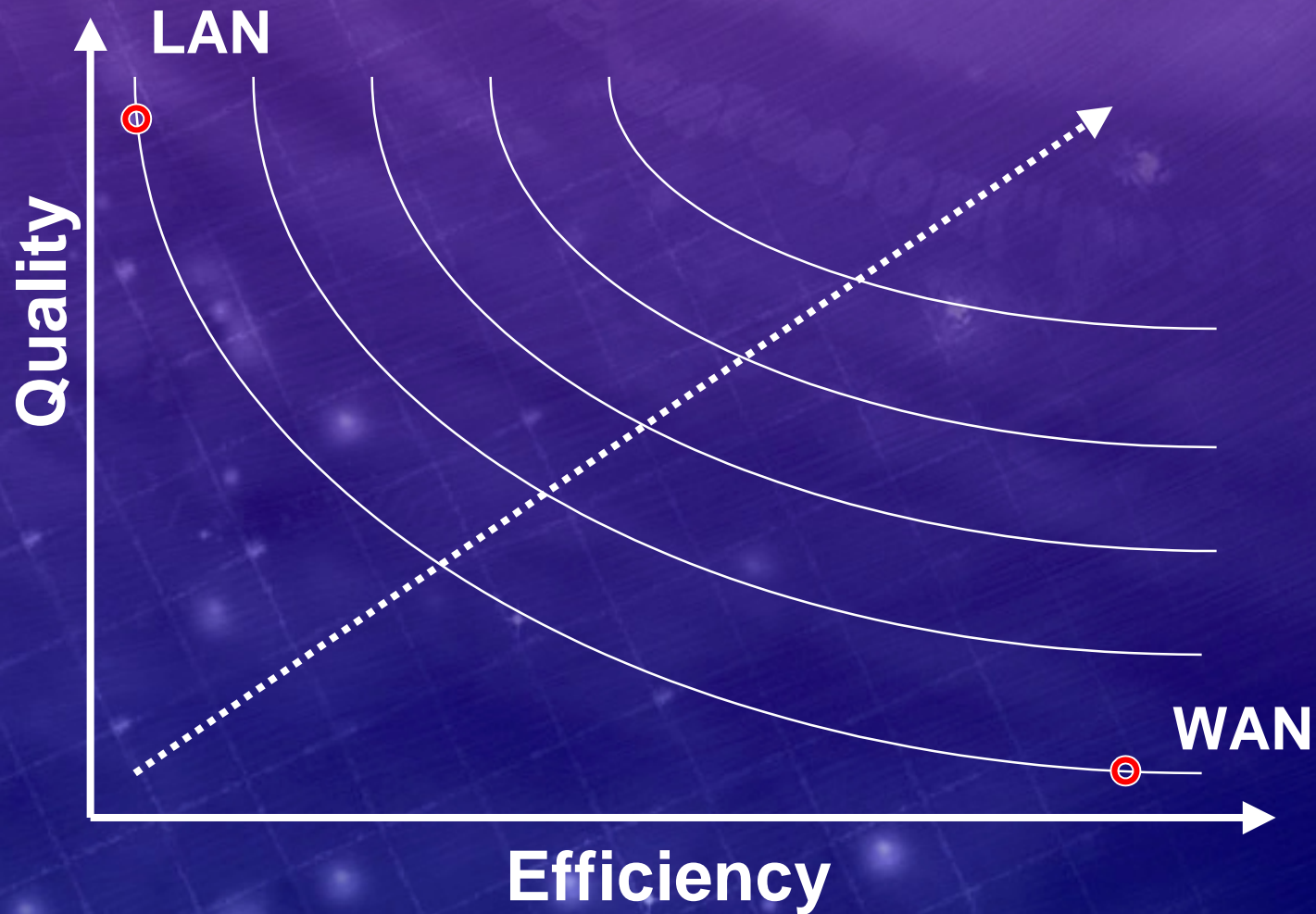
◆ Quality

- a high quality service commits strictly quantifiable resources with high integrity
 - telephony, video
- a medium quality service commits loosely quantifiable resources
 - 95% of client/server transactions complete in less than 5 seconds
- a low quality service commits more resources than would otherwise be committed

◆ Efficiency

- how much bandwidth is required to do the job?

Quality/Efficiency Space



Raising the QE Product of a Network

- ◆ QoS mechanisms increase the QE product of a network
- ◆ They also increase the complexity of the network
- ◆ Selection of QoS mechanism is a local matter with global consequences
 - do I want to support high quality services?
 - how much can I afford to over-provision?
- ◆ Network manager should be free to choose where to operate in QE space

QoS Mechanisms

- ◆ **Traffic Handling**
 - Aggregate – diffserv, 802 user priority
 - Per-flow – intserv, dedicated ATM VCs
- ◆ **Provisioning and Configuration**
 - Top down – COPS/PR, SNMP, CLI
 - End-to-end signaling - RSVP

QoS Mechanisms

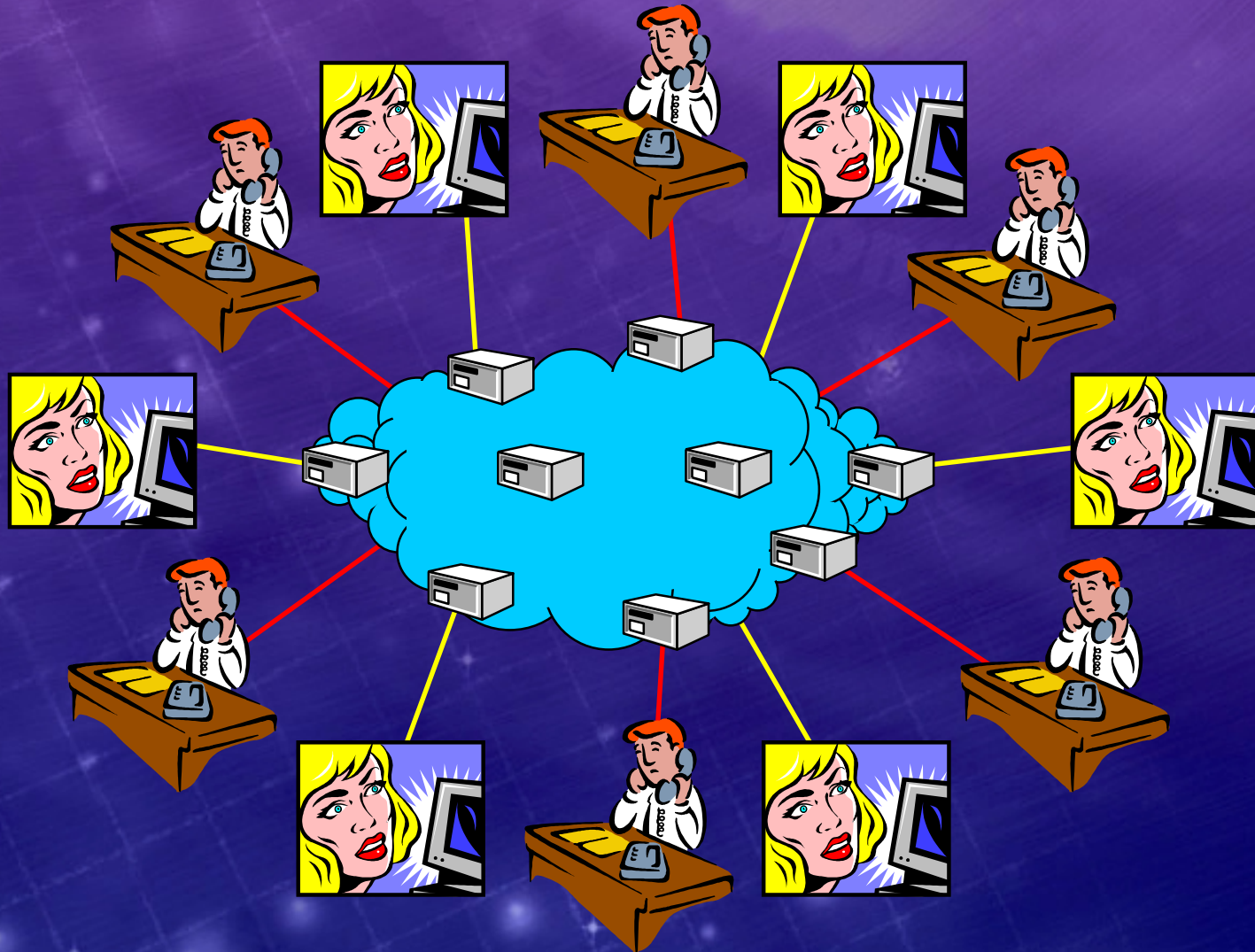
	Top-down Provision	Aggregate Signaling	Per-flow Signaling
No Traffic Handling	Over Provision/ FIFO queuing		
Aggregate Traffic Handling	Diffserv/ 802.1p	Aggregate RSVP/ Diffserv/ 802.1p	RSVP/ Diffserv/ 802.1p
Per-flow Traffic Handling			RSVP/Intserv

Increased complexity
Increased quality/efficiency product

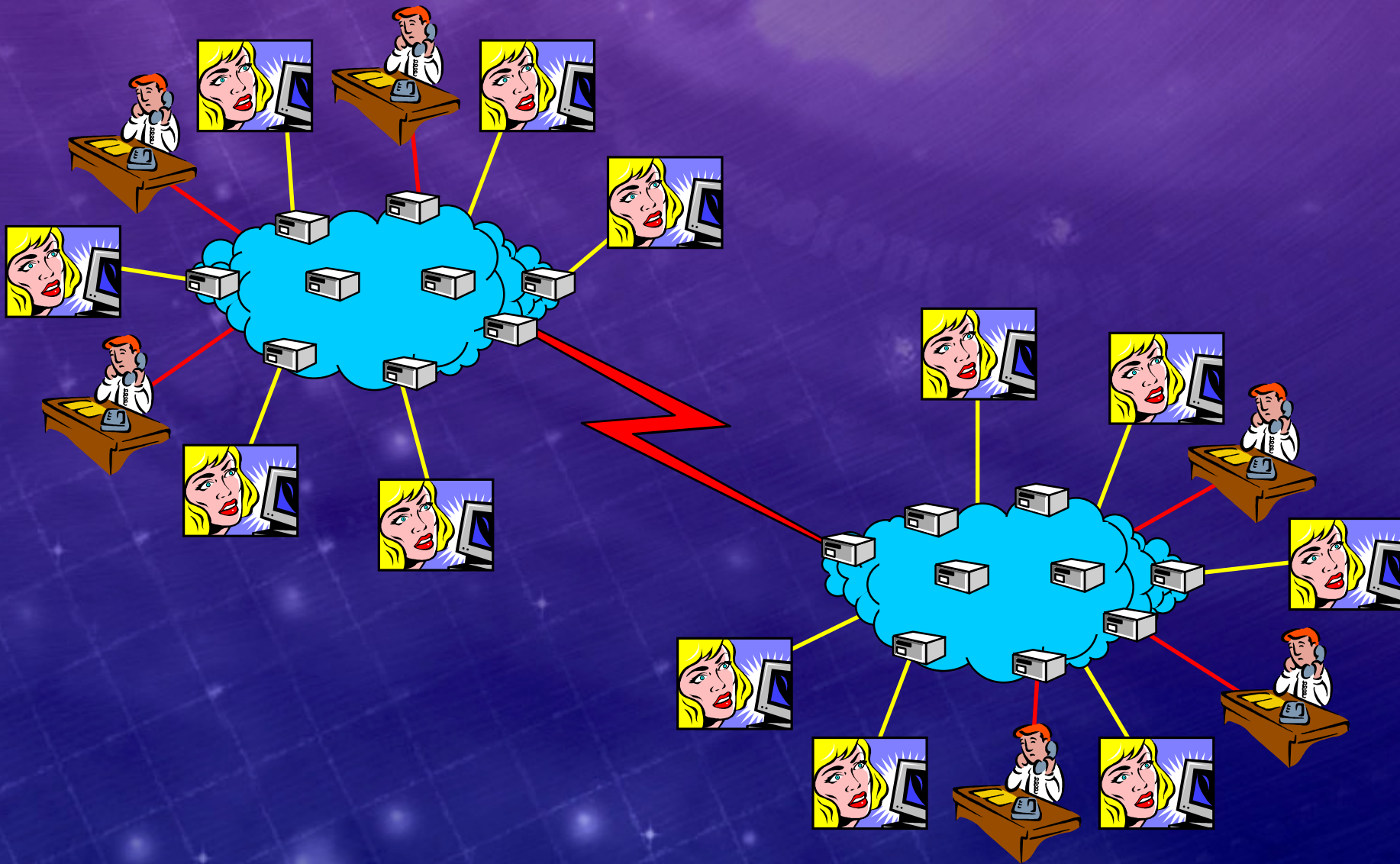
Increased complexity
Increased quality/efficiency product

**What does it take to
support high quality
services *end-to-end*?**

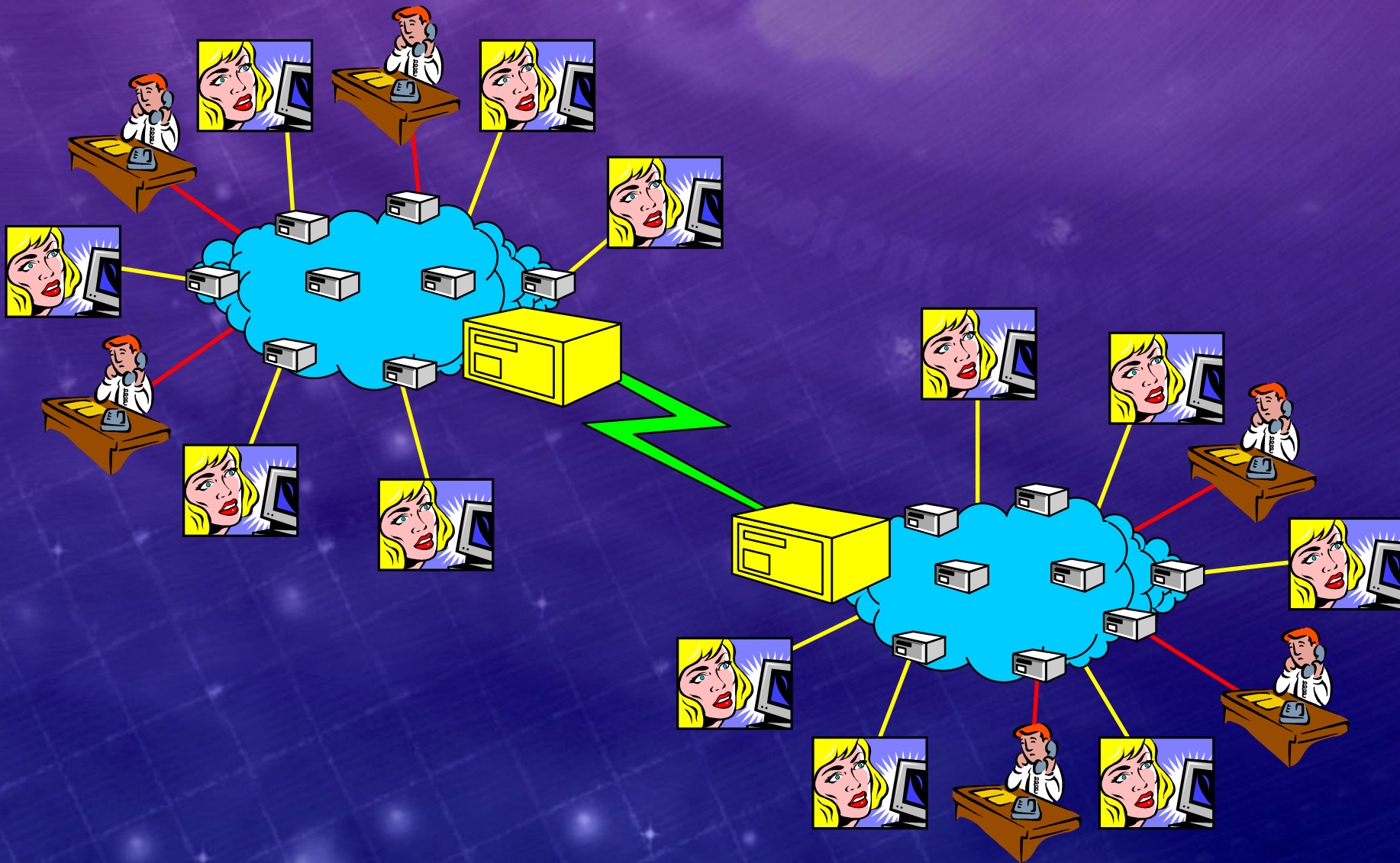
Simple Prioritization on LAN



Simple Prioritization on WAN



Explicit Admission Control



It Takes Signaling

- ◆ **There will be congested network links**
 - can't afford to over-provision everywhere
- ◆ **These will need admission control agents**
 - or will compromise service quality
- ◆ **Implicit admission control**
 - identify individual conversations in traffic flow
 - coordination problem – resources must be available end-to-end
- ◆ **Explicit admission control is simpler**
 - requires signaling

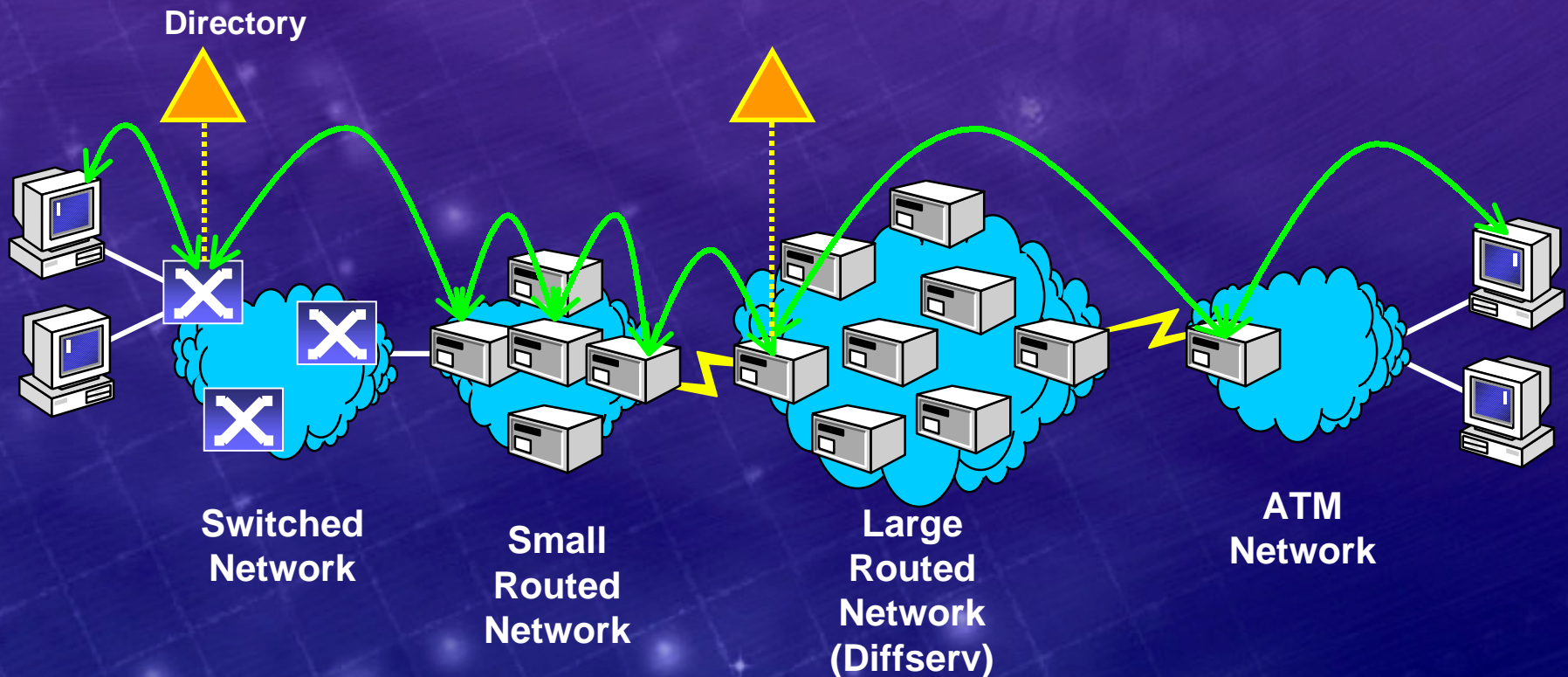
So – hosts *will* signal

who will listen?

Admission Control Agents

- ◆ **Appoint at key locations**
 - congestion points only
- ◆ **Agent is responsible for high priority resources in limited topological scope**
 - single interface – classic RSVP model
 - diffserv domain – diffserv ingress router
 - 802 collision domain – SBM
 - ATM subnetwork – ATM edge device
 - provider domain – bandwidth broker
- ◆ **RSVP as common protocol**
 - agents can map request to resources

Coordinated End-to-end Admission Control

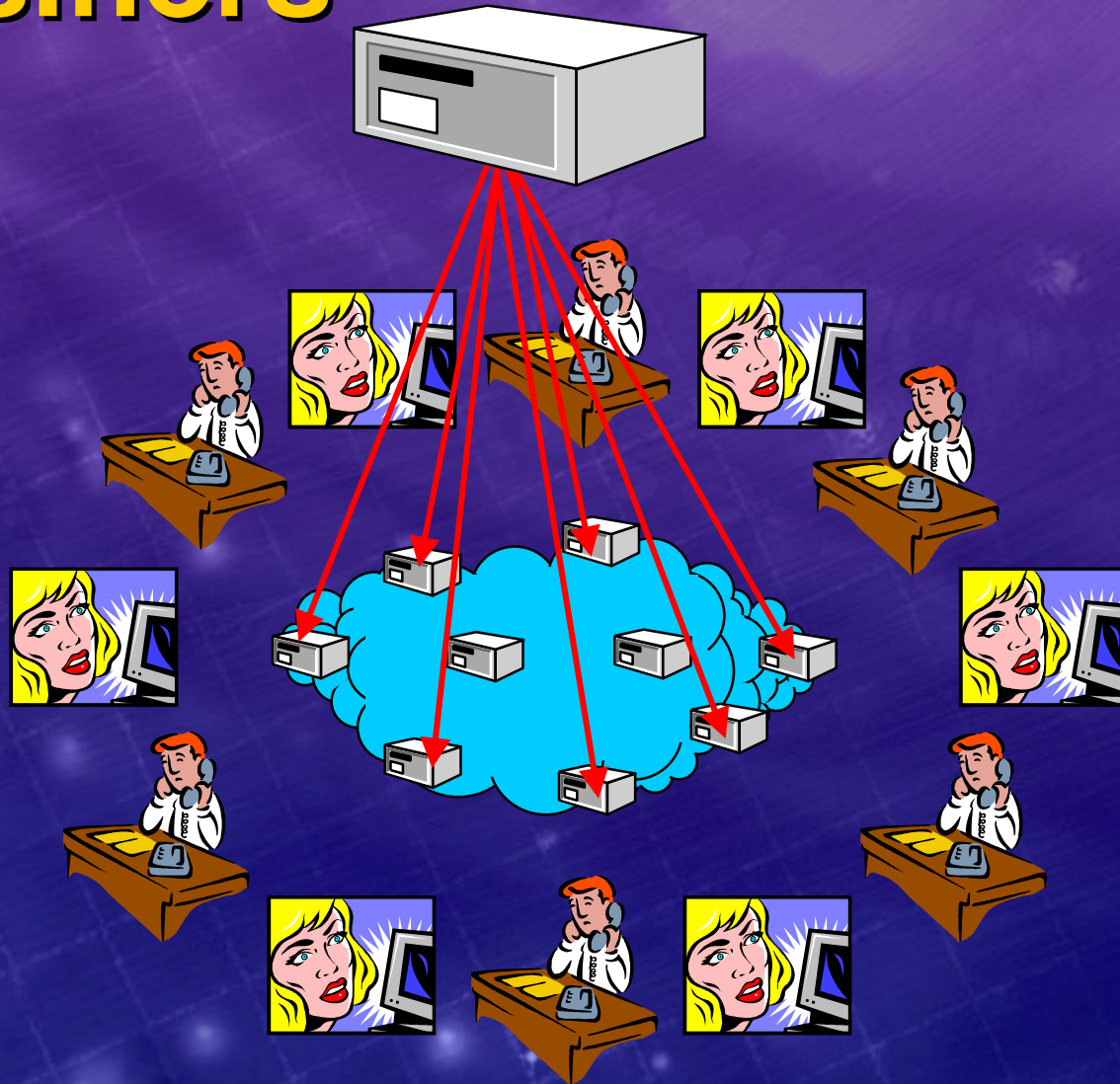


Challenges of classification

or

***Why we need more than
network based application
recognition***

Top-Down Configuration of Classifiers



Poor Network Manager

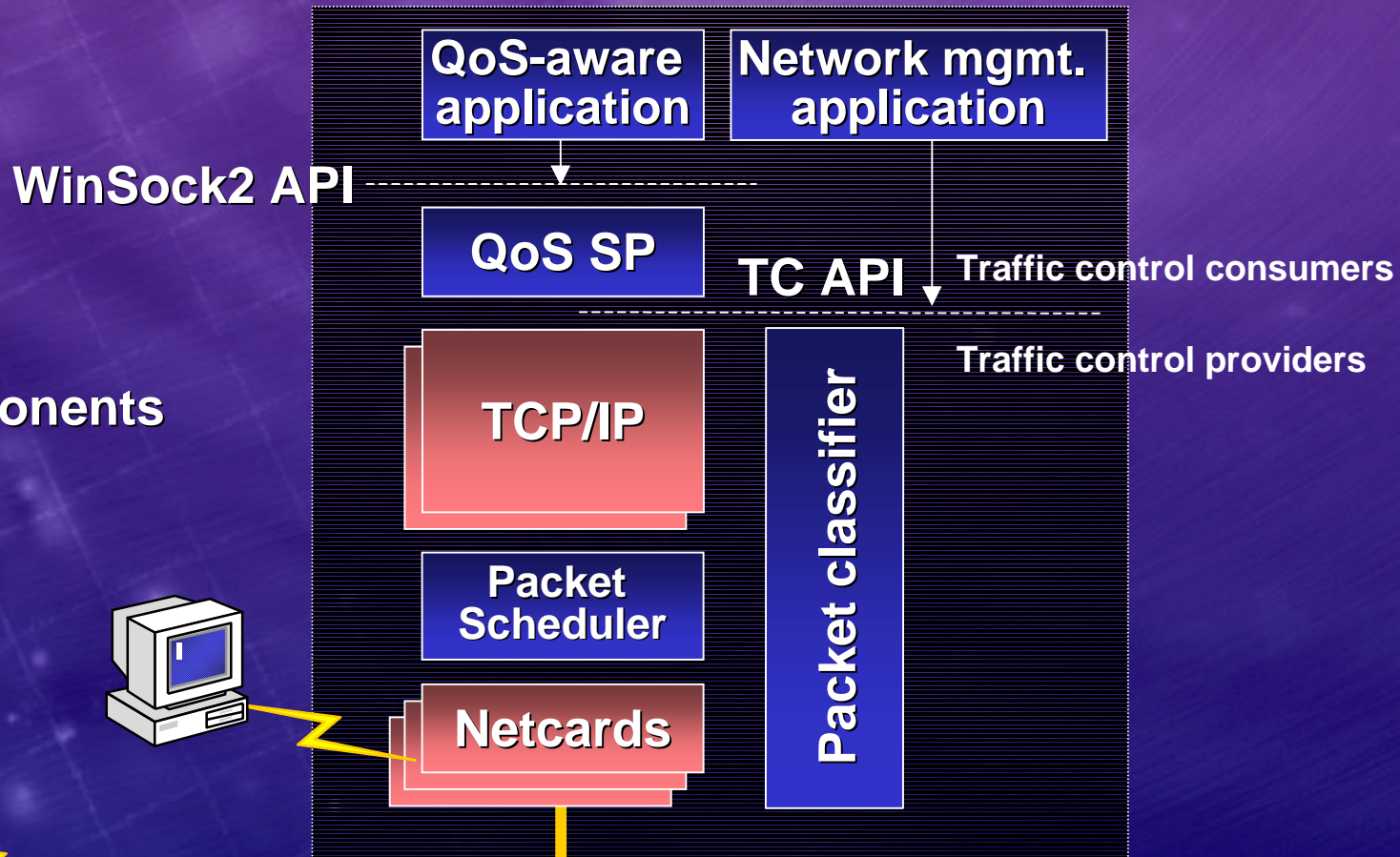
- ◆ Network manager wants to manage based on users and applications
- ◆ Devices recognize addresses and ports
- ◆ Policy systems try to help, but how to handle:
 - Volatile/transient/shared ports?
 - DHCP, multi-user machines?
 - IPSec?
 - Updating network classifiers?

The Host Can Help Too...

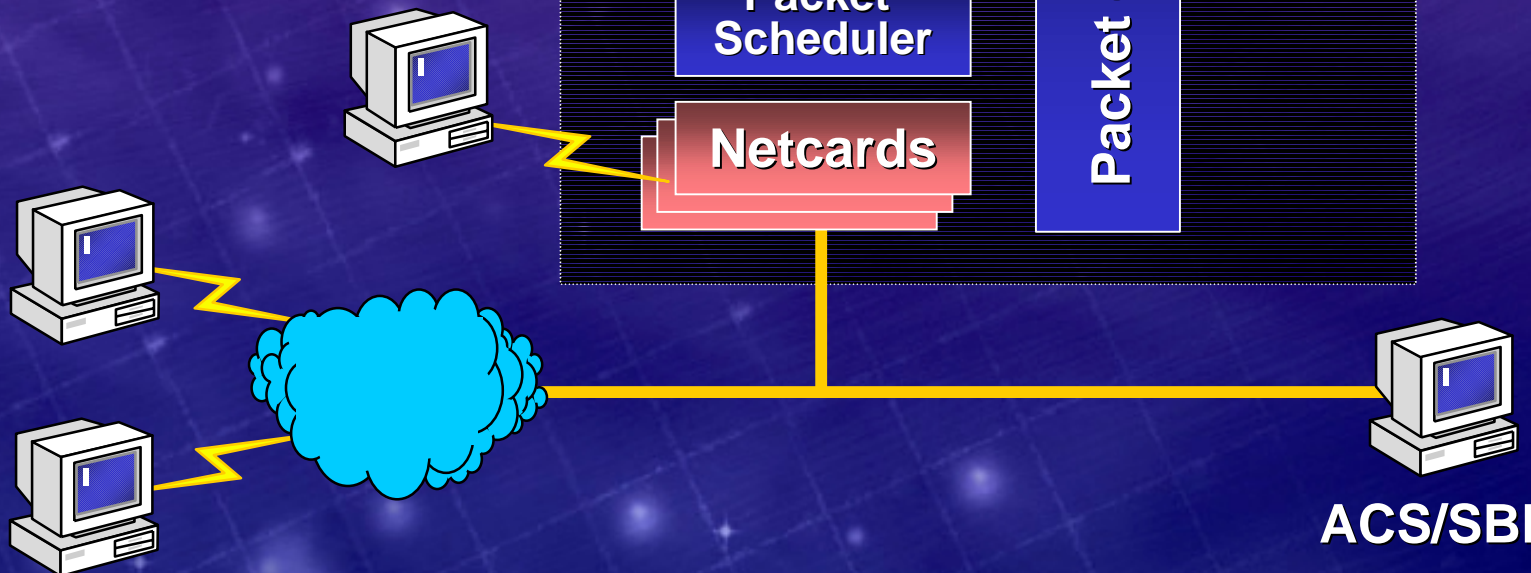
- ◆ **Signaling messages include**
 - Kerberos authenticated user ID
 - application and sub-application ID
 - classification criteria – current 5-tuple
- ◆ **Policy management systems can glean robust classification information**
 - just by snooping host generated RSVP messages
 - works for IPSec too

Host Mechanisms in Support of Network QoS

Microsoft QoS Components

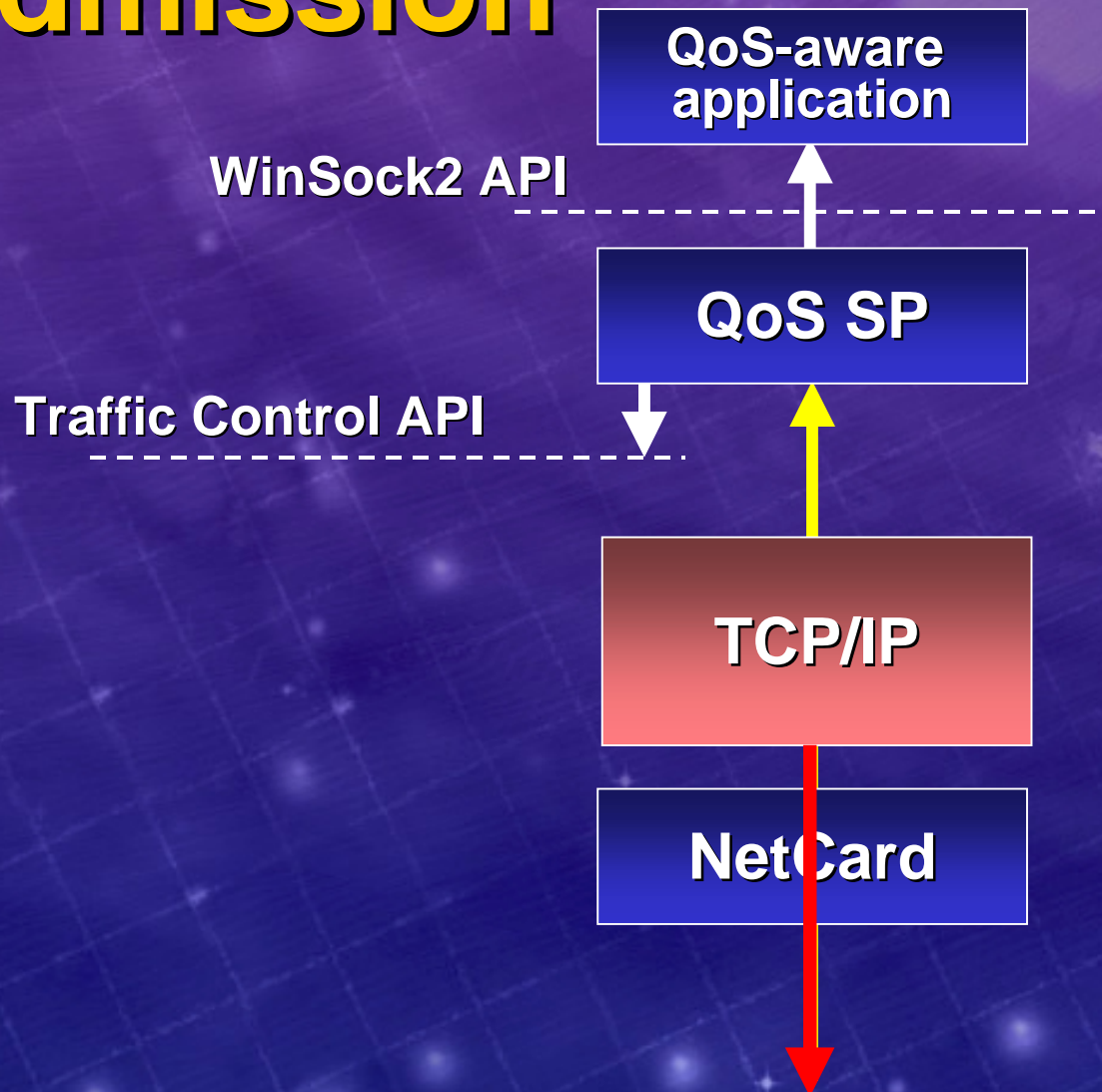


QoS components



ACS/SBM

Marking in Response to Admission



4. Transmitted data is marked high priority

3. QoS SP invokes greedy traffic control (marking)

2. QoS SP indicates successful admission control to application

1. RESV message arrives from network, indicating successful admission control

Summary

Enable the Network Manager

- ◆ To operate each region of the network wherever appropriate in the QE space
 - Select aggregate or per-conversation traffic handling mechanism
 - Enable admission control agents at congested locations
- ◆ To easily associate traffic with users and applications

The Host Helps by

◆ Signaling

- To enable high quality services where over-provisioning is impractical
- To help the network associate packets with users and applications
- Will signal for all *persistent* and important applications
 - Multimedia – e.g. Netmeeting, WMT
 - Qualitative – e.g. SAP/R3

◆ Shaping traffic

◆ Marking based on admission control

Thanks...