Comparison of Layer 2 CoS and ResE mechanisms in QoS delivery

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From the reflector traffic…(Hugh)

[why are we having PAR related issues?...]

1. The current standards for provisioning, admission control, policing and are...

2. These standards would be applied to our problem in this way...

3. Some or all of these do not meet our requirements because...

4. The originators of these standards have responded...

5. We think changes to 802.3 (or 802.1 - for their discussion) will be better because...

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Existing Layer 2 QoS/CoS standards

- **IEEE 802.1D-2004 (includes priority) defines up to 8 level of priority**
  - but not queue draining procedure.
  - Annex G (informative) describes queue mapping, but not scheduling
  - Expected to be vendor dependent, “value-add”.
  - Expected to map and meet upper layer services.
- **IEEE 802.1ad provider bridging work (rolled into Q-Rev) provides drop precedence.**

Table G-2—Traffic type acronyms

user_priority	Acronym	Traffic type
1	BK	Background
2	—	Spare
0 (Default)	BE	Best Effort
3	EE	Excellent Effort
4	CL	Controlled Load
5	VI	“Video,” < 100 ms latency and jitter
6	VO	“Voice,” < 10 ms latency and jitter
7	NC	Network Control

Table G-3—Defining traffic types

Number of queues	Defining traffic type							
1	BE							
2	BE				VO			
3	BE				CL		VO	
4	BK		BE		CL		VO	
5	BK		BE		CL	VI	VO	
6	BK		BE	EE	CL	VI	VO	
7	BK		BE	EE	CL	VI	VO	NC
8	BK	—	BE	EE	CL	VI	VO	NC

Existing IP based Standard

- **IETF Work – General QoS Services (DiffServ, IntServ, and RSVP, etc), but the following three are RFC specific to IEEE 802:**
- **RFC 2814 provides admission control, and RFC2815 provides Integrated Services to IEEE Devices, but not widely implemented.**
  - RFC2814 SBM (Subnet Bandwidth Manager): A Protocol for RSVP-based Admission Control over IEEE 802-style networks. R. Yavatkar, D. Hoffman, Y. Bernet, F. Baker, M. Speer. May 2000. (Status: PROPOSED STANDARD)
  - RFC2815 Integrated Service Mappings on IEEE 802 Networks. M. Seaman, A. Smith, E. Crawley, J. Wroclawski. May 2000. (Status: PROPOSED STANDARD)
  - RFC2816 A Framework for Integrated Services Over Shared and Switched IEEE 802 LAN Technologies. A. Ghanwani, J. Pace, V. Srinivasan, A. Smith, M. Seaman. May 2000. (Status: INFORMATIONAL)
- **DLNA –**
- **uPNP QoS –**

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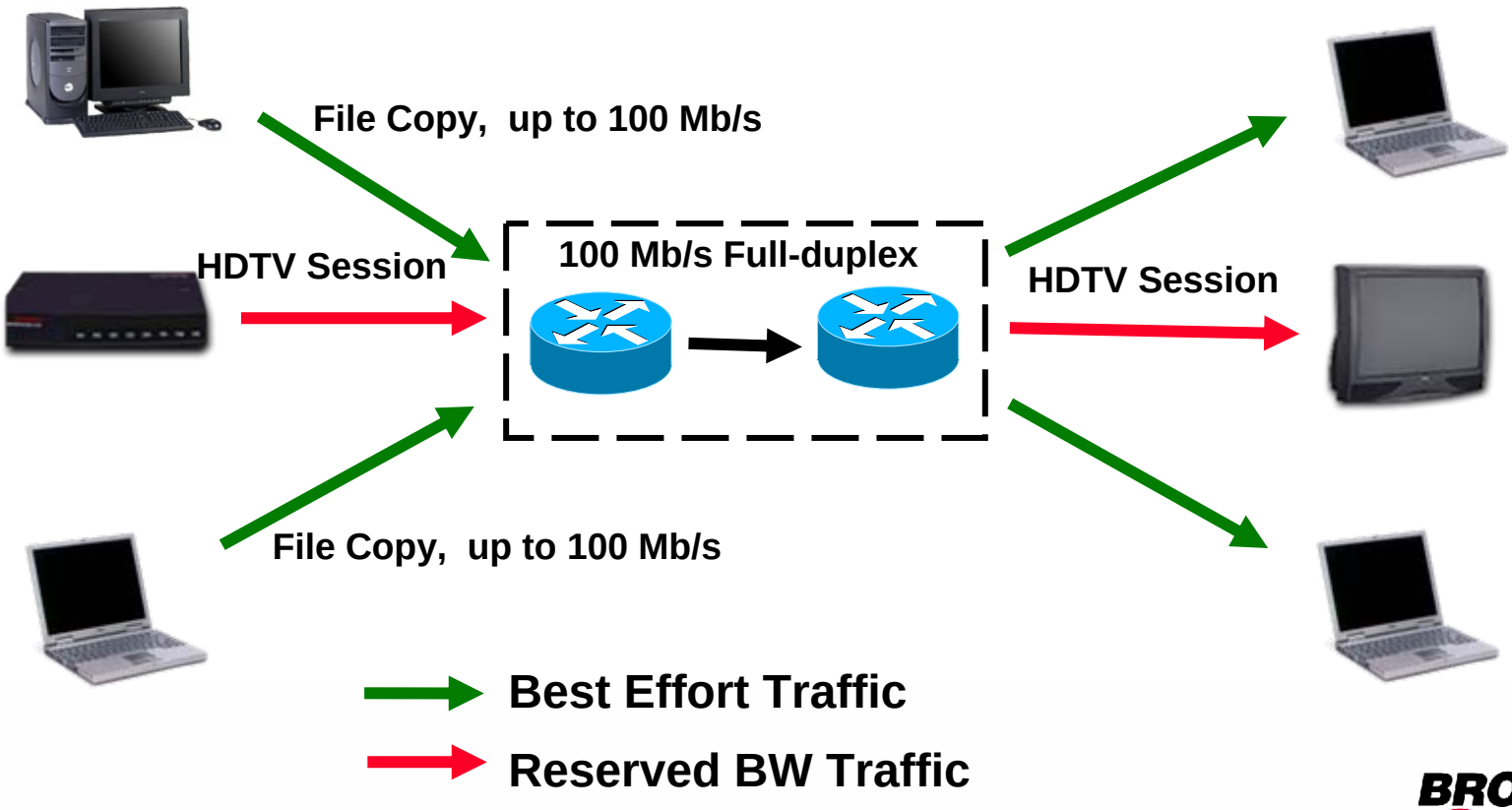
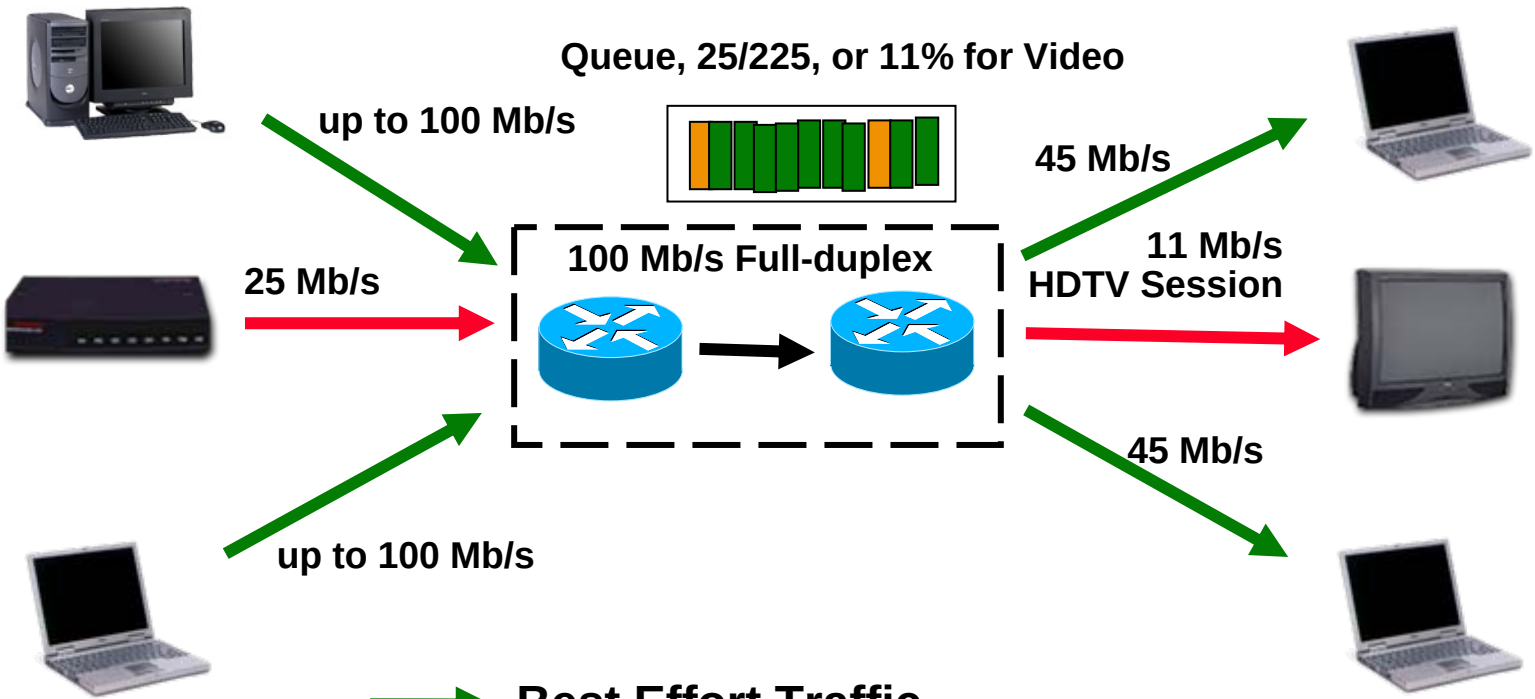
Why Ethernet as is (i.e. QoS/CoS solutions) does not address this problem

- Consider Best Effort Traffic mixing with AV traffic
- Grossly simplified layer 3 (IP-TCP) behavior



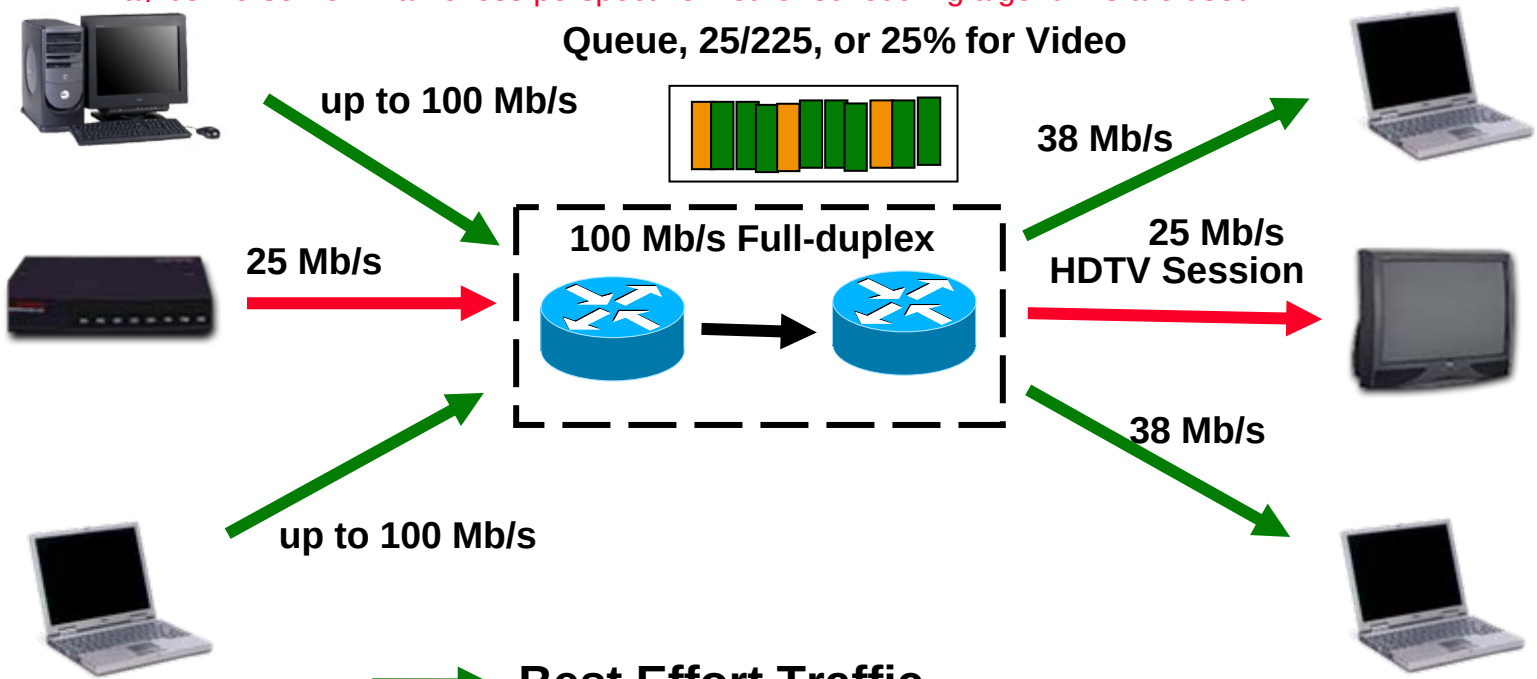
Why Ethernet as is does not address this problem – No CoS case

- **Consider no CoS no Residential Ethernet (simple model)**



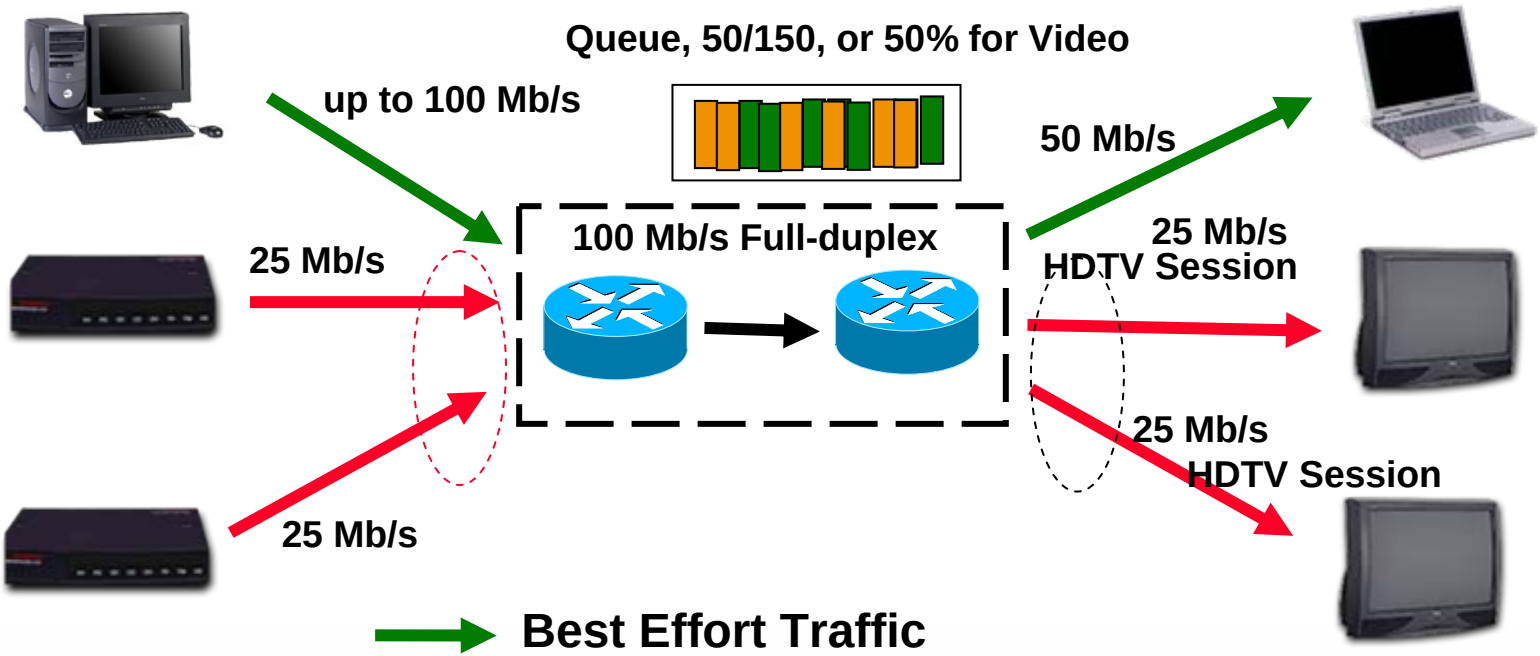
Why Ethernet as is does not address this problem – 2 CoS, Strict priority Case

- **Consider CoS, AV traffic runs at high priority.**
- **Average throughput would be 25 Mb/s, but runs into**
  - Frame loss (buffer-full), Buffer starvation of high-priority traffic (could be carefully designed and configured)
  - Also suffers from “Bunching, Bursting” problems that causes jitter (refer to Michael Johas Teener’s Presentation)
  - May be worse from frame loss perspective if other scheduling algorithms are used.



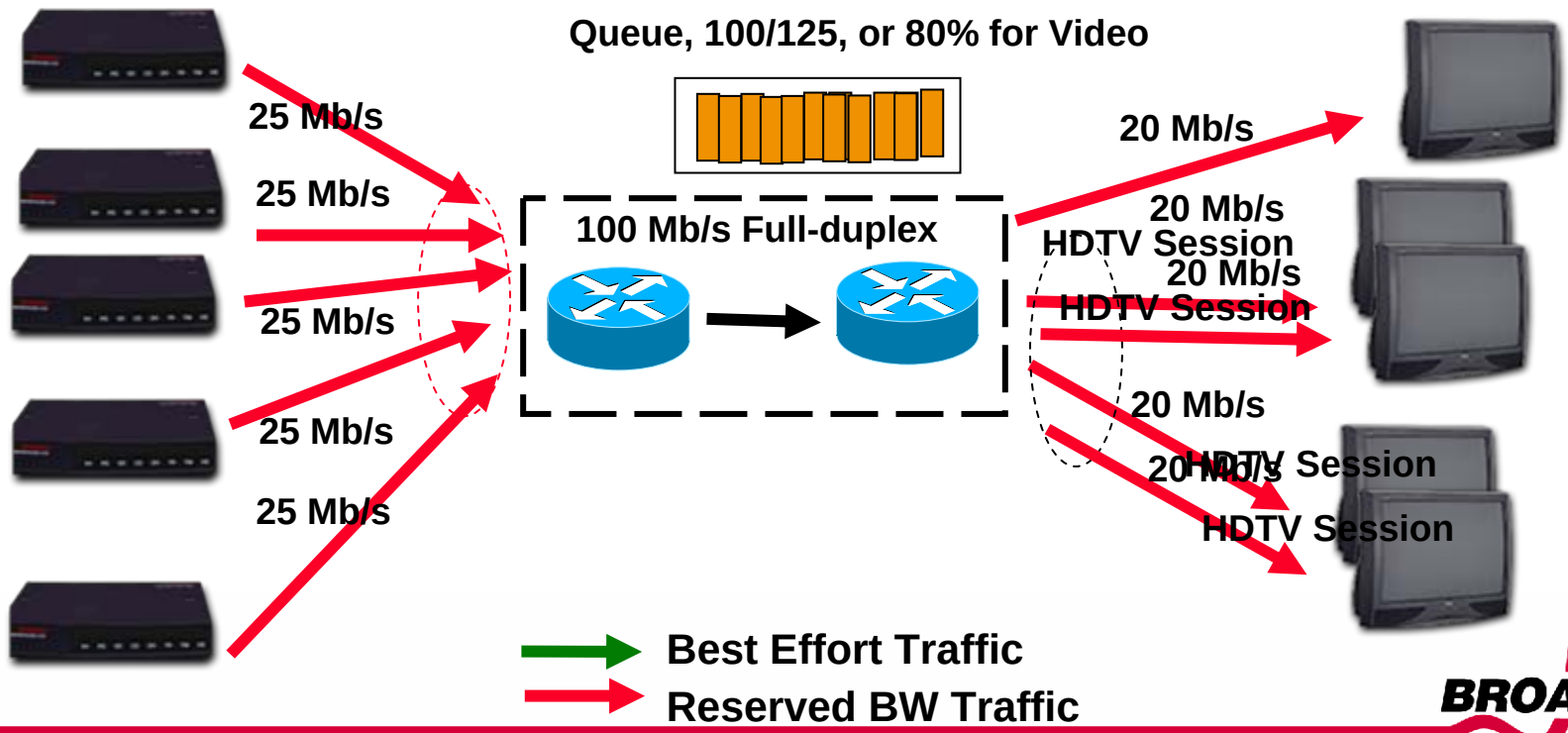
Why Ethernet as is does not address this problem – multiple ResE streams

- **Consider CoS, dual AV traffic runs at high priority.**
- **Average throughput would be 25 Mb/s each**
  - Relative Bursts of the AV traffic
  - Causes "Bunching, Bursting" problems at high priority queues (Increased buffer requirements)
- **Greater Issue: If more high priority traffic is added beyond 100 Mb/s, the network behaves like no QoS enabled network.**

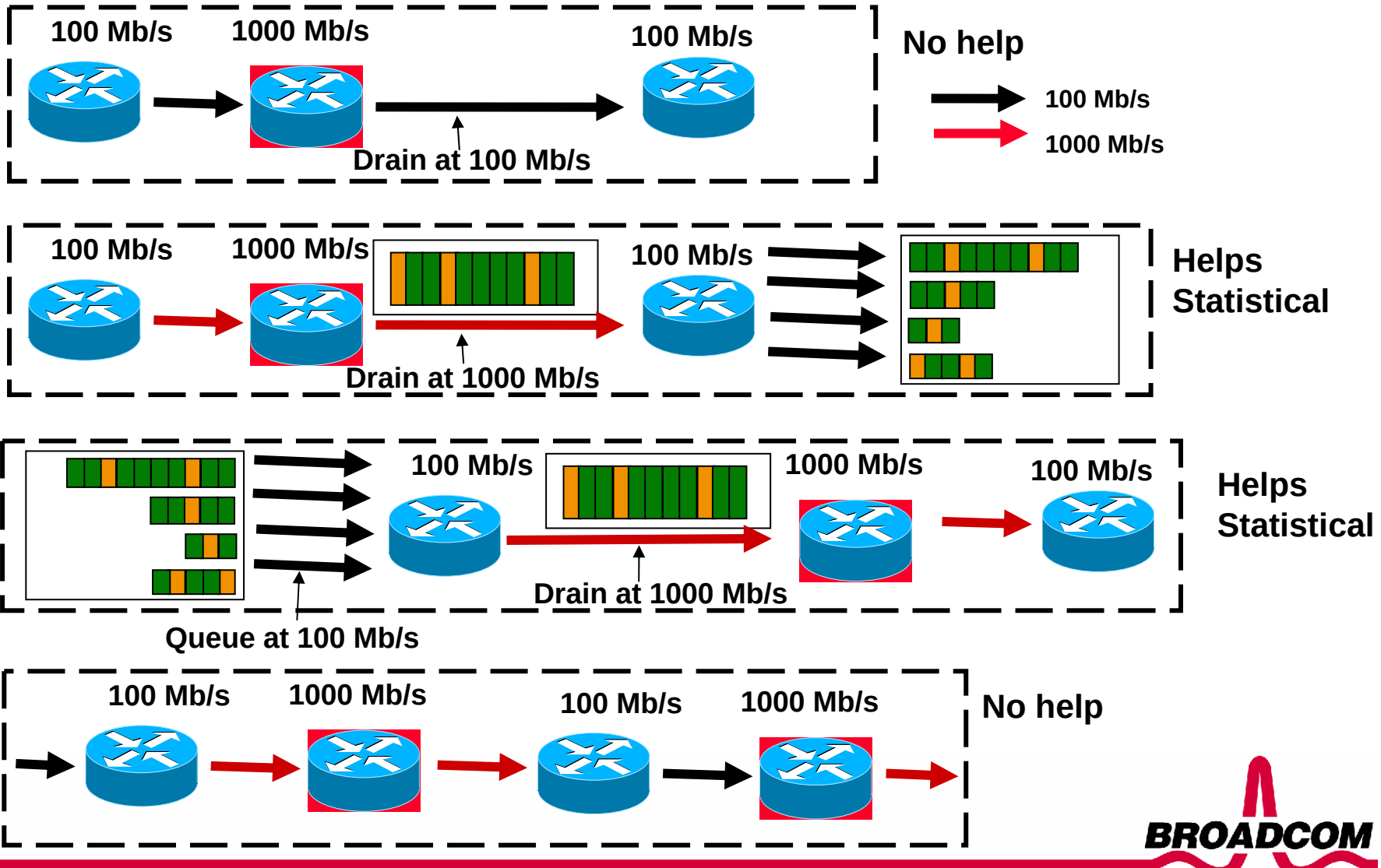


Why Ethernet as is does not address this problem – Exceeding link/device BW

- Consider CoS, dual AV traffic runs at high priority.
- If more high priority traffic is added beyond 100 Mb/s, the network behaves like no QoS enabled network.
- OK, how about gigabit (oversubscription)?

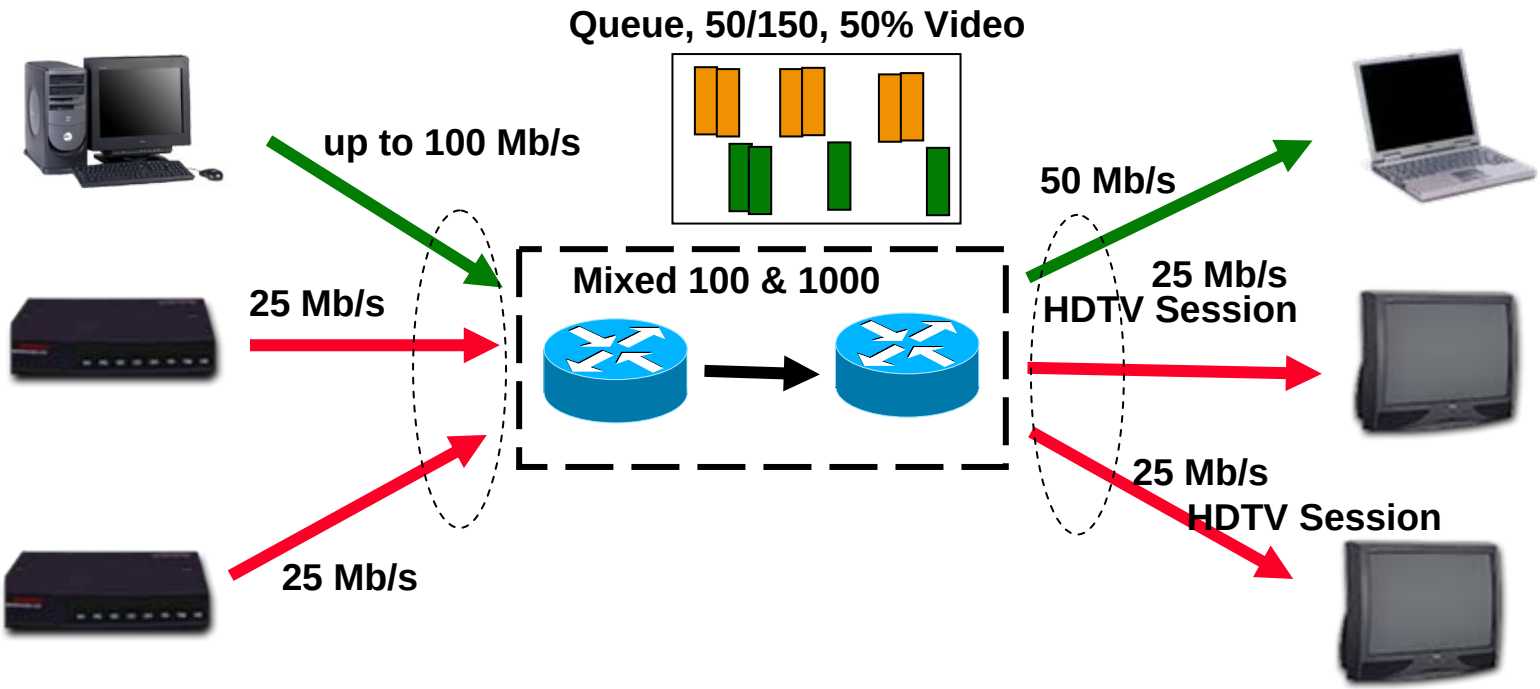


Why Ethernet as is does not address this problem – Gigabit Backbone



Why Ethernet as is does not address this problem – One of the proposed solution

- **Consider AV traffic runs in reserved bandwidth queues.**
  - AV traffic has guaranteed delivery slots
- **Bursting, Bunching limited to Best Effort Traffic**
  - Minimum guaranteed (defaults, provision able) best effort traffic service.



CoS Assignment Issue

- **What's available**
  - up to 8 layer 2 classes
  - RFC2814 SBM provides means of managing CoS assignment per admission control.

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- **What is the issue.**
  - CE end-point will want the highest priority encoding, whether or not network CoS enabled.
  - Best effort data will continue to not care.
  - Without enforcement/policing function, we expect two CoS service class encoding as the only stable network configuration.
  - Guaranteed path bandwidth would alleviate this behavior, e.g. "if the path bandwidth is guaranteed, I'll request only what I need."

Conclusions

1. **The current standards for provisioning, admission control, policing and are...**
   - IEEE 802.1: none, 802.3ar: MAC ingress/egress aggregate BW control.
   - Layer 3 & higher: IntServ, DiffServ, SBM, DLNA, uPnP/QoS
2. **These standards would be applied to our problem in this way...**
   - [not covered in here, but they are being applied today sub-optimally..]
3. **Some or all of these do not meet our requirements because...**
   - Not specified, or sub-optimal aggregation, or sub-optimal CoS class interaction.
4. **The originators of these standards have responded...**
   - [not covered here.]
5. **We think changes to 802.3 (or 802.1 - for their discussion) will be better because...**
   - IEEE 802.1D Bridging architecture needs to specify queue-draining (scheduling) specifications, recommendations, etc.
   - IEEE 802.3, at a minimum needs to deal with time-awareness and admission control in or near the MAC.

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