



Quality of Service (QoS)

■ Параметри за наблюдение

- ☐ Loss (загуби)
- ☐ Delay (времезадръжка)
- ☐ Jitter (разлика във времезадръжката)
- ☐ Bandwidth (достъпна скорост)
- ☐ Out-of-order (разбъркване)
- ☐ Errors (грешки)



Изисквания за VoIP

- Загуби – под 1 %
- Еднопосочна времезадръжка – до 150 ms
- Jitter – до 30 ms
- 21 – 106 kbit/s гарантиран канал (в зависимост от използвания кодек)



Модели на QoS

- Best Effort – данните се доставят при възможност (дисциплина FIFO)
- Integrated Services (IntServ) – приложенията заявяват резервиране на ресурси
- Differentiated Services (DiffServ) – класификация и приоритизация на трафика, обслужване по приоритет

Класификация

Encapsulated Packet

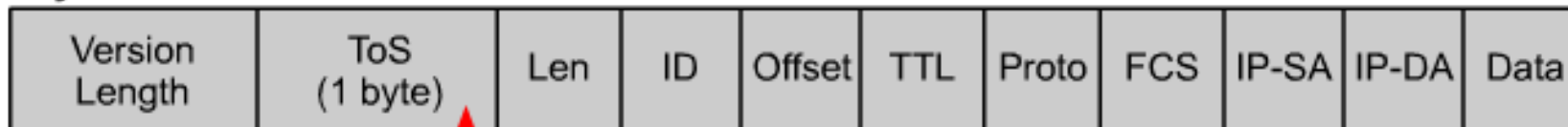


Layer 2 802.1Q/p Frame



↑
3 bits used for CoS (user priority)

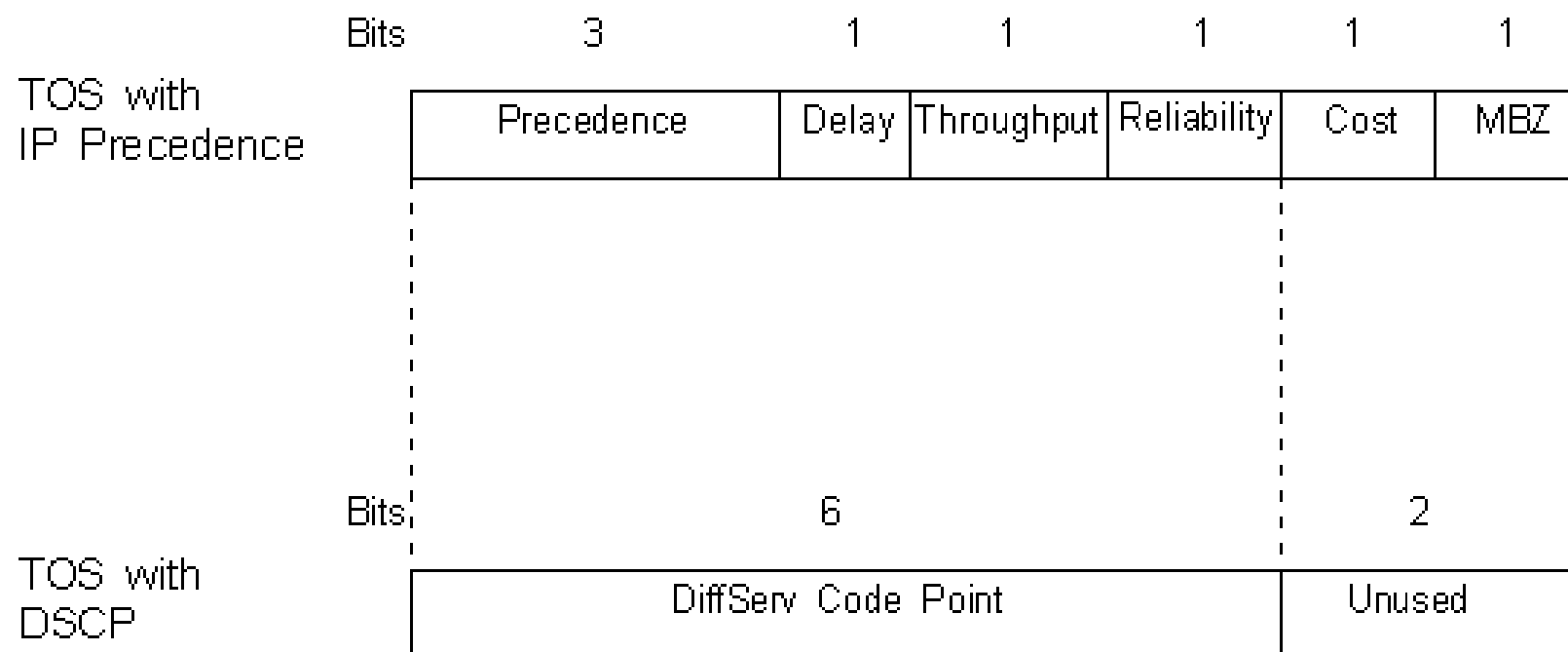
Layer 3 IPv4 Packet



↑
IP precedence or DSCP

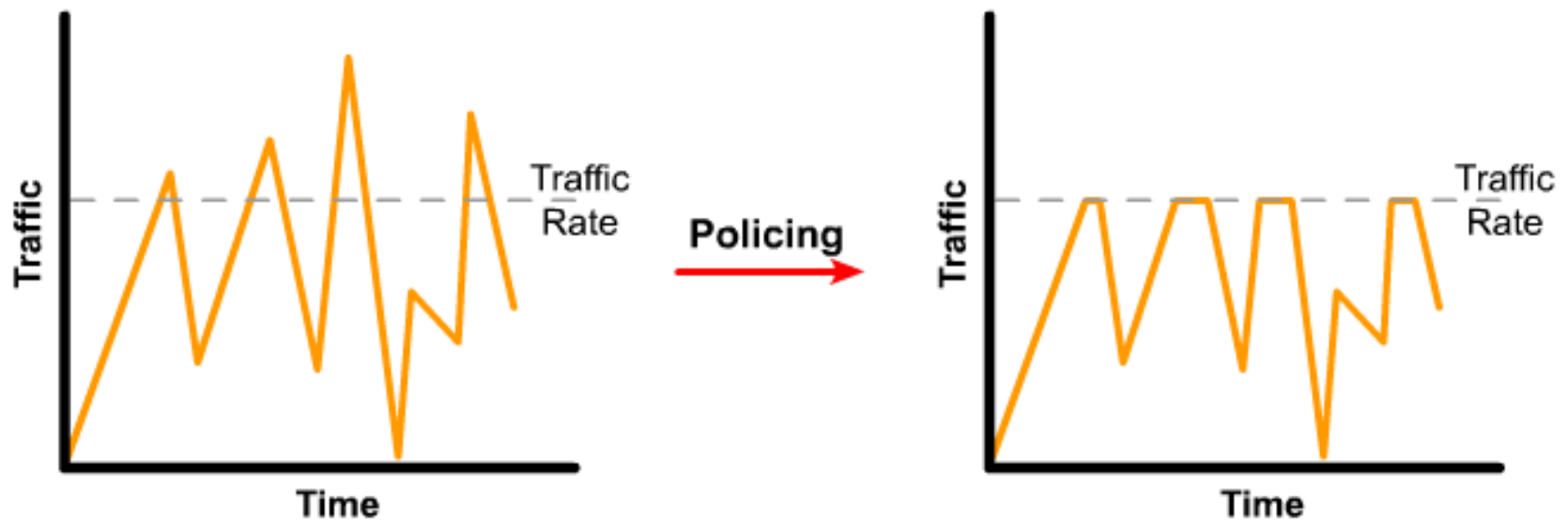
Класификация на ниво 3

■ Type of Service (3 bit Precedence)

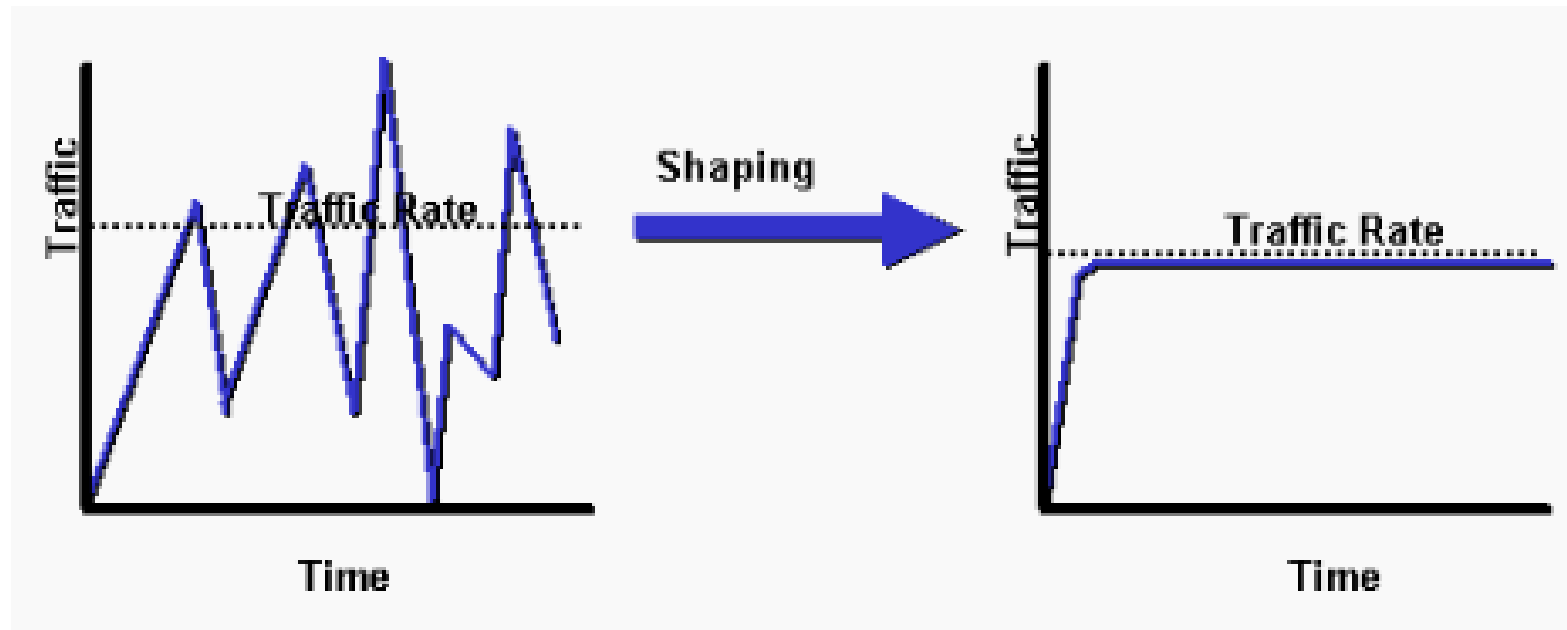


■ Differentiated Service Code Point (DSCP)

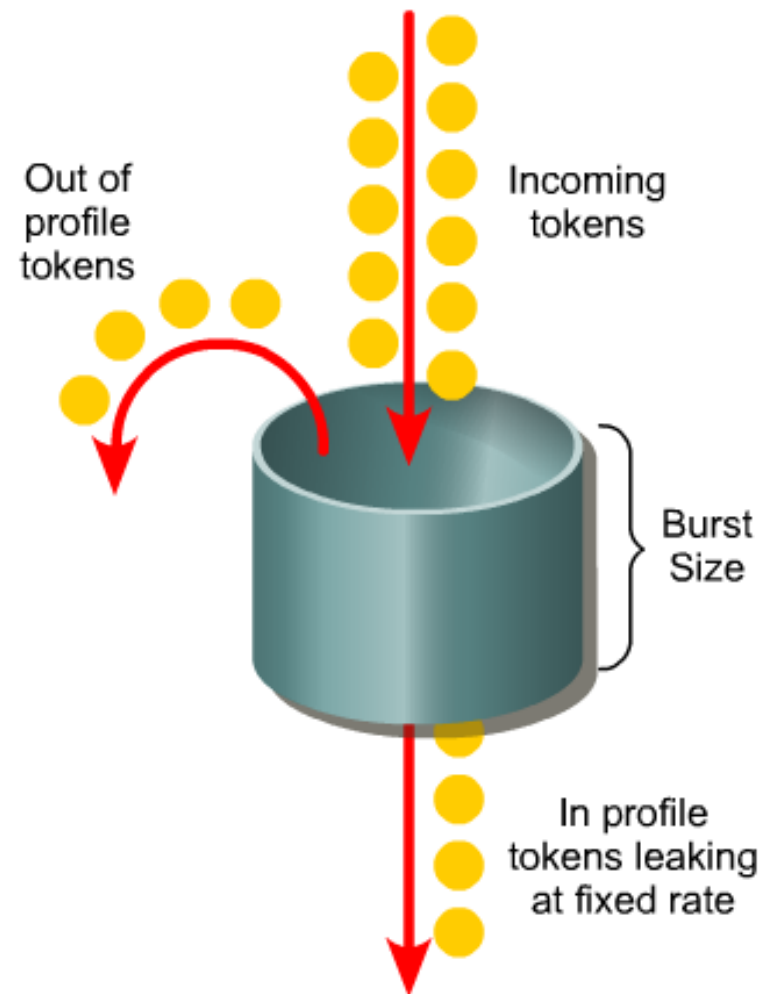
Ограничение (Policing)



Моделиране (Shaping)

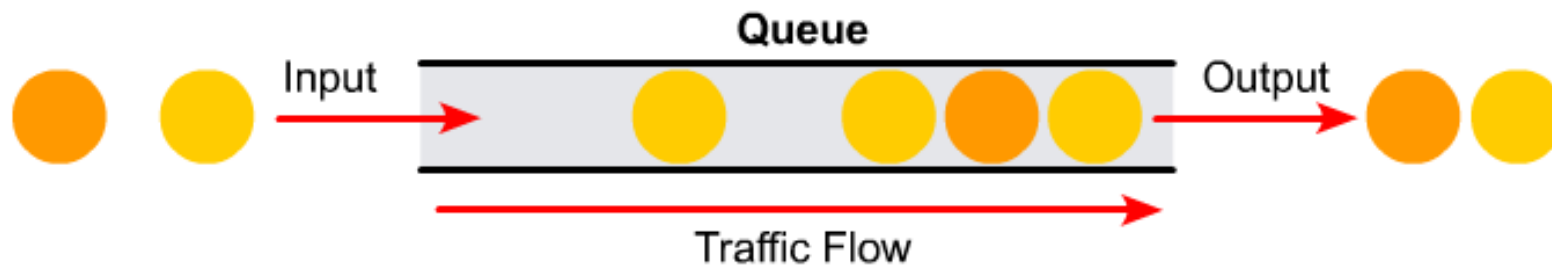


Алгоритъм Token bucket

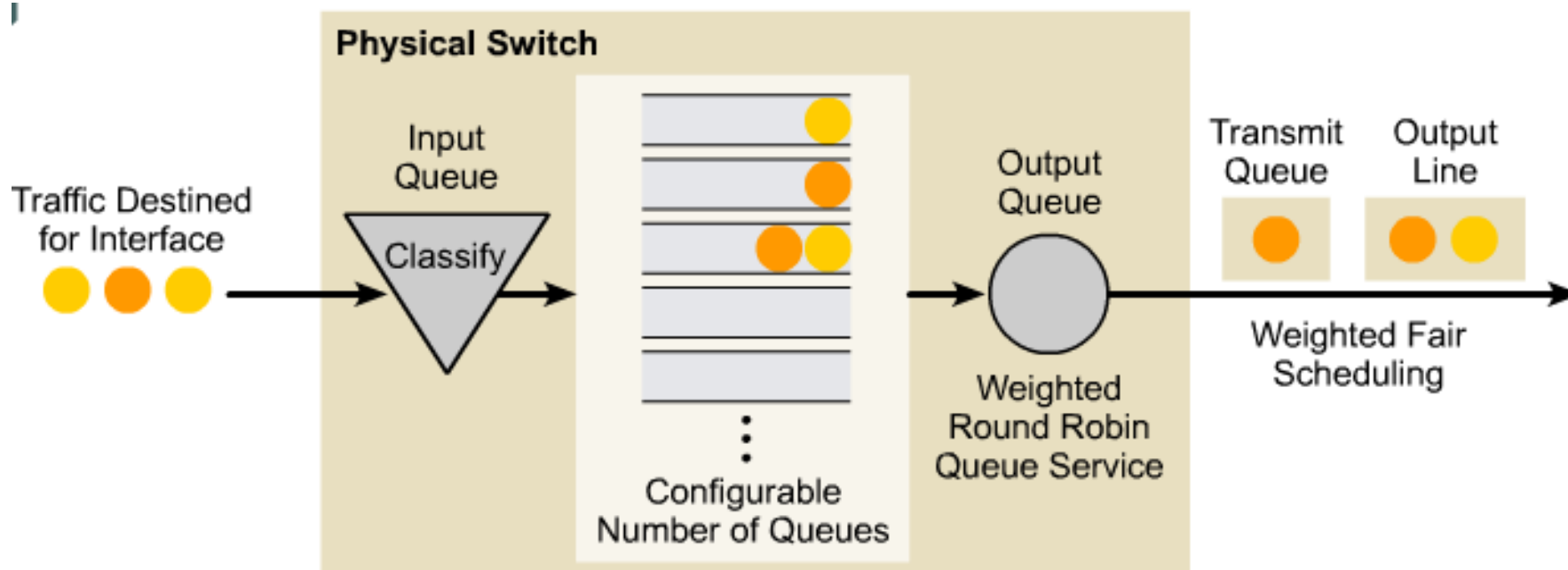


Пренареждане (Scheduling)

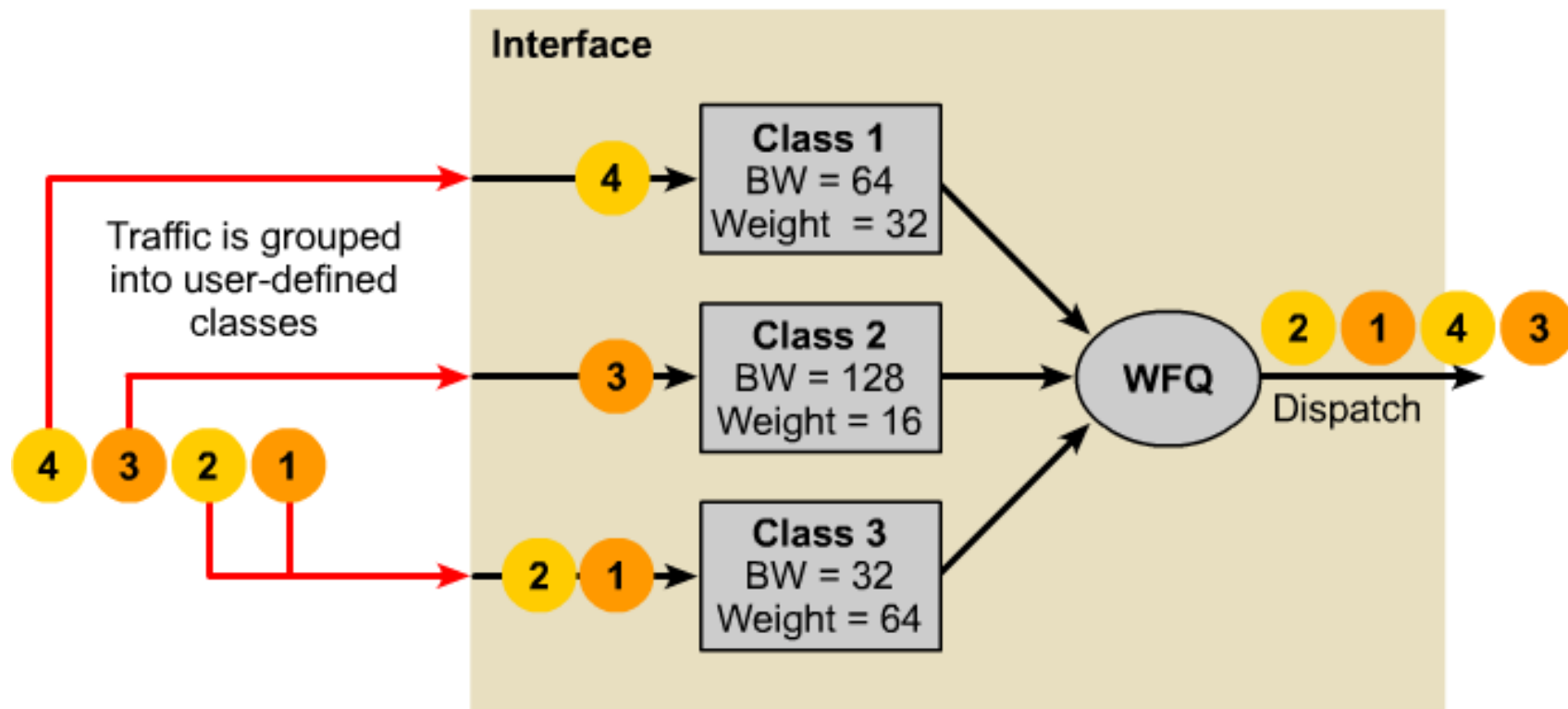
■ FIFO опашка



Опашка с тегла (Weighted Fair Queuing, WFQ)

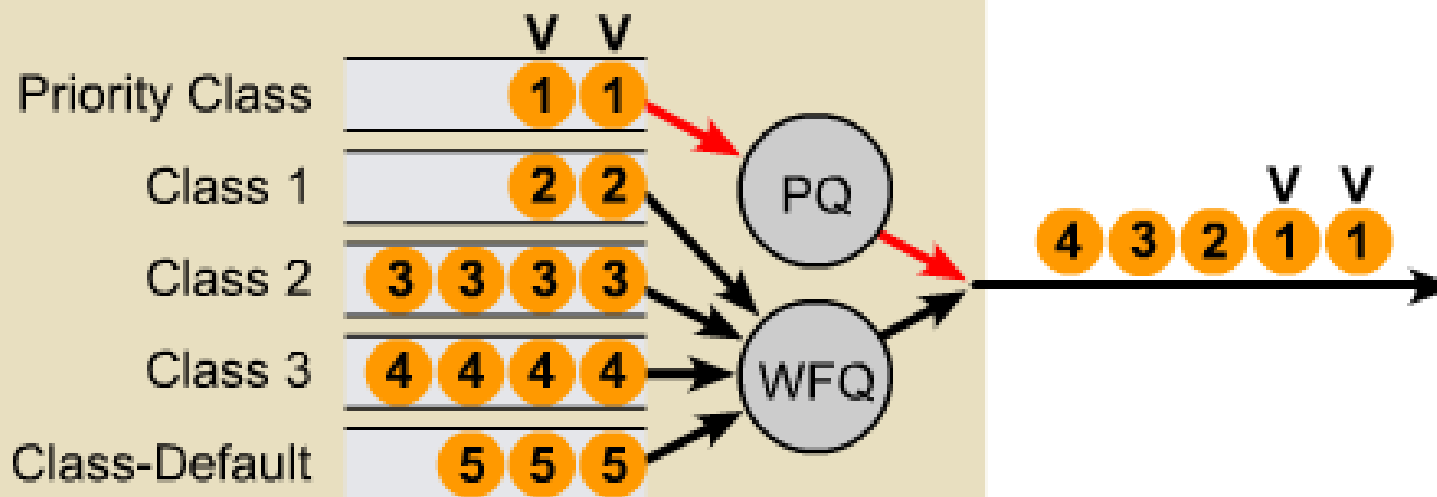


Class-Based Weighted Fair Queuing (CBWFQ)



Low Latency Queuing (LLQ) – 3a VoIP

Interface



<https://youtu.be/S03QnO8uhC0> - QoS Fundamentals

<https://youtu.be/CQ5dMXI7AoE> - QoS/Traffic Shaping/RSVP