A packet scheduling bucket based on BRFQ and FQ algorithm in SpecC

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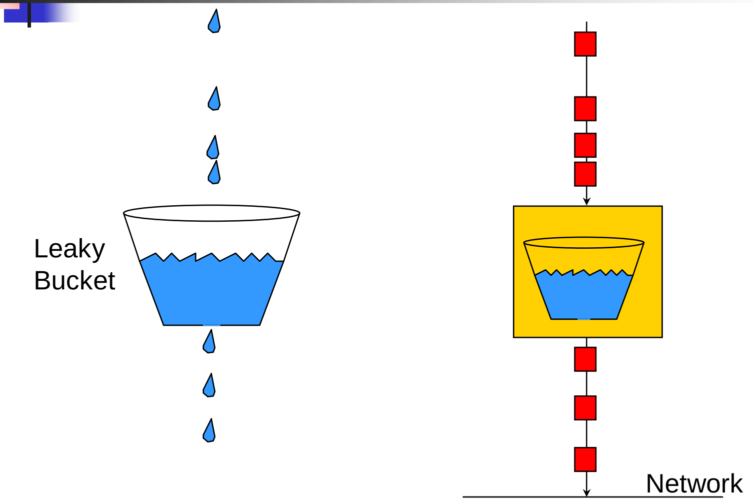
Overview:

- What’s packet scheduling bucket?
- BRFQ and FQ algorithms.
- Designed strategies in SpecC language.
- SpecC model of the bucket.
- Implementation in SpecC.
- Demo.
- Comparison between BRFQ and FQ algorithms.
- Lessons

What's packet scheduling bucket?



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What's packet scheduling bucket?

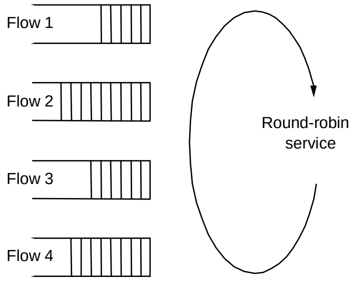
- It's usually a part of a router.
- In order to provide needed QoS, we use packet scheduling algorithms to decide the output sequence of incoming packets in a bucket.
- BRFQ and FQ algorithms are two of them.

Scheduling algorithms

- Round Robin
- Fair Queuing
- Bit Round Fair Queuing

Round Robin

- Round Robin
  - Segregate traffic into separate queues by flow (or class)
  - Serve queues in sequence and loop



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Fair Queuing (FQ)

- Fair Queuing (FQ)
  - Based on round robin
  - Explicitly segregate traffic based on flows
  - One packet at a time from each queue
    - Do not account for the size of individual packets

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BRFQ (Bit round fair queuing)

- BRFQ (Bit Round Fair Queuing)
  - Fair Queuing (FQ) with account for the size of individual packets

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BRFQ (Bit round fair queuing)

- Suppose clock ticks each time a bit is transmitted
- Let P_i denote the length of packet *i*
- Let S_i denote the time when start to transmit packet *i*
- Let F_i denote the time when finish transmitting packet *i*
- $F_i = S_i + P_i$
- When does a router start transmitting packet i ?
  - if packet *i-1* is being served, then immediately after its last bit was transmitted (F_{i-1})
  - if no current packets for this flow, then immediately when packet *i* arrives (call this arrival time A_i)
- Thus: $F_i = MAX(F_{i-1}, A_i) + P_i$

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BRFQ (Bit round fair queuing)

- For n active flows
  - Assume a bit from each flow can be transmitted simultaneously at 1/n-th the link rate
  - The clock ticks each time a bit from all n flows is transmitted
  - Calculate Fi,j for each packet i that arrives on each flow j
  - Fi,j = MAX (Fi – 1,j, Ai,j) + Pi,j
  - Treat all Fi,j's as timestamps
  - Next packet to transmit is one with lowest timestamp

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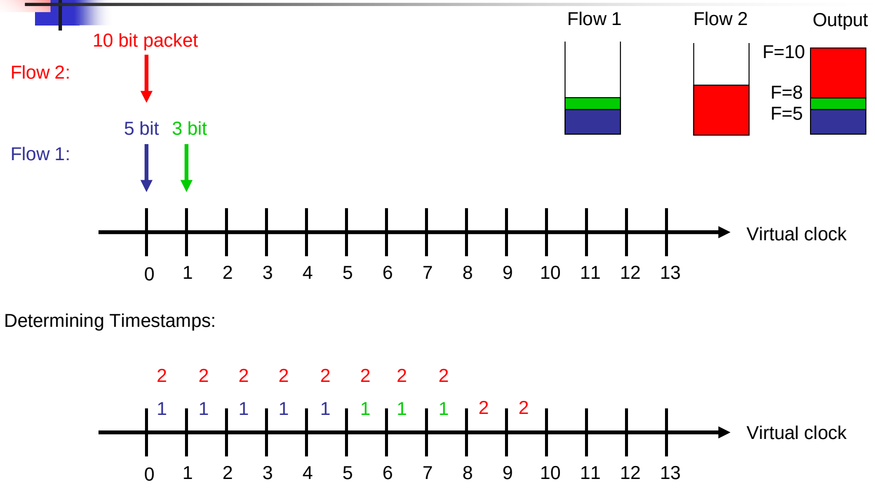
BRFQ (Bit round fair queuing) Example:



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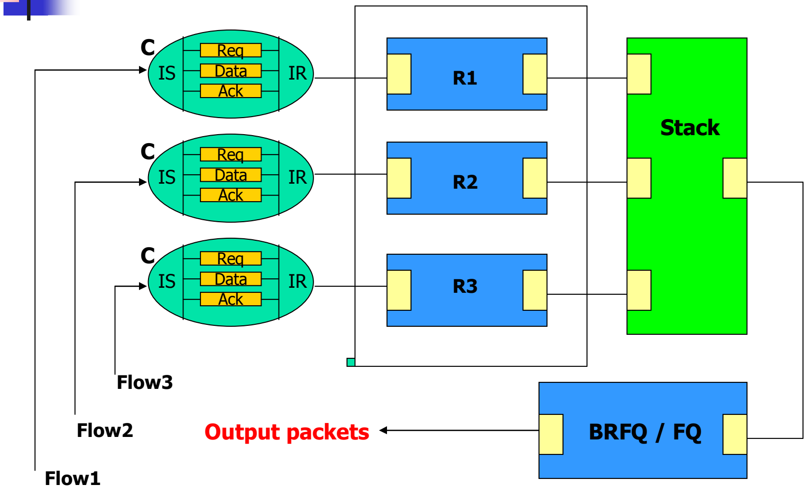
Designed strategies

- Figure out inputs and outputs.
- SpecC models
  - Behaviors and channels
  - Computations in behaviors

→ Coding and Testing

SpecC model of the bucket.



C
IS
Req
Data
Ack
IR
R1
R2
R3
Stack
Flow3
Flow2
Flow1
Output packets
BRFQ / FQ

Implementation in SpecC.

- Flow1, Flow2, Flow3 input testing set of packets to R1, R2, R3 through Channels.
- Stack is a memory to store input packet.
- BRFQ / FQ fetch packets from the Stack then schedule packet.
- BRFQ / FQ output packets.

Implementation in SpecC.

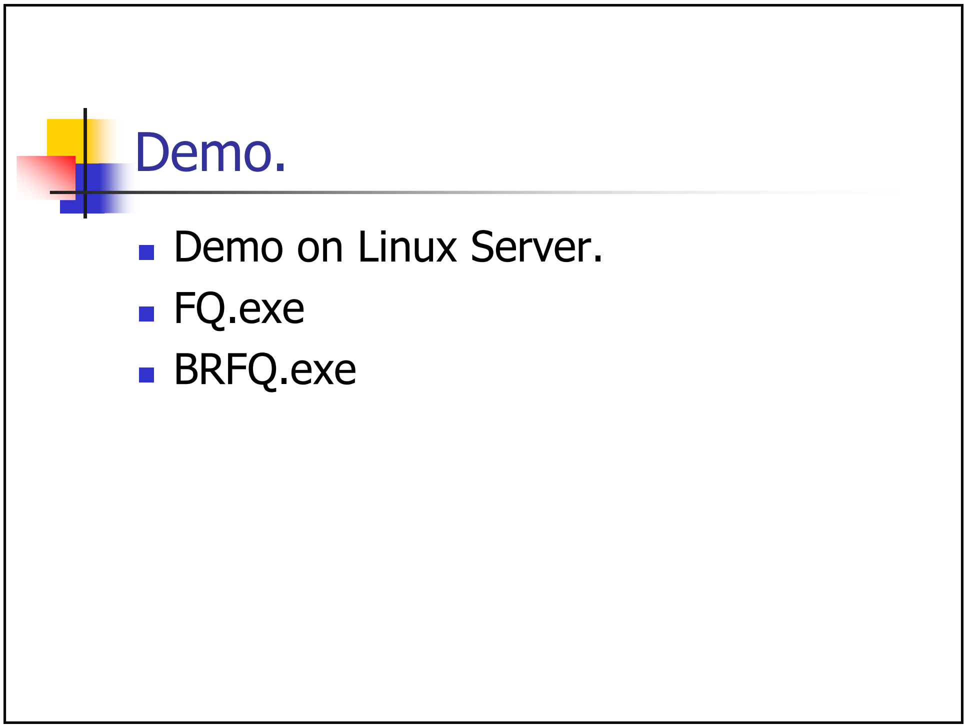
- Testing input packets:

Name	Arriving time	Flow	Size (bit)	Time Stamps (BRFQ)
A	0	1	6	6
B	3	2	10	13
C	8	1	2	10
D	9	3	6	15
E	12	1	10	22
F	17	2	4	21

Assume that bucket output 1 bit/s

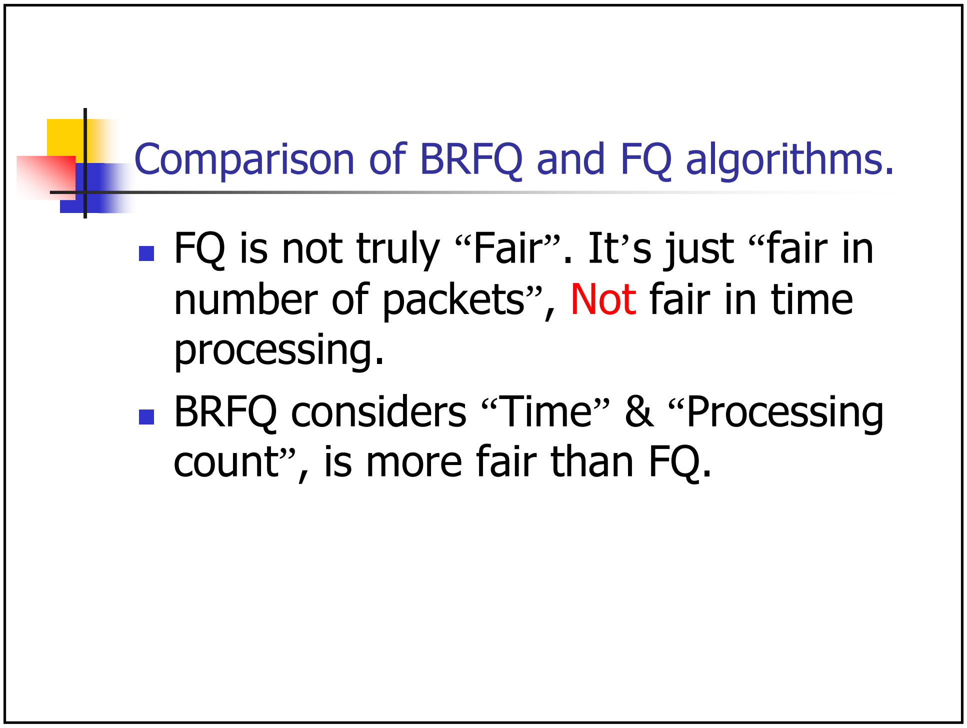
Demo.

- Output result:
- FQ: A , B, D, C, F, E
- BRFQ: A, C, B, D, F, E



Demo.

- Demo on Linux Server.
- FQ.exe
- BRFQ.exe



Comparison of BRFQ and FQ algorithms.

- FQ is not truly “Fair”. It’s just “fair in number of packets”, Not fair in time processing.
- BRFQ considers “Time” & “Processing count”, is more fair than FQ.

Lessons

- SpecC provides a powerful concurrent environment which meets users’ need to design many systems.
- Easily to familiarize with if you had experience in C language.

Thank you for your listening.

If you have any further questions, please feel free to contact :
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