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Buffering

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Categories

- Single Buffer
- Single Buffer with Process Cache
- Multi Buffer
- Multi Buffer with Linked List
- Circular Buffer

Single Buffer

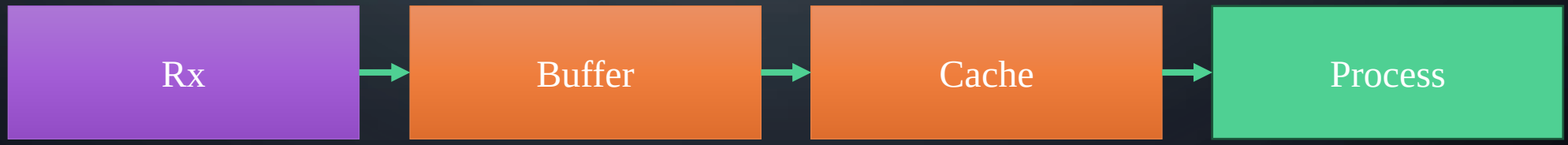
- Process task and Receiver/Sender task use same buffer
- It’s easy to implement
- Less RAM usage
- Data-Race possible

Single Buffer: Parameters

- $Tolerance = 1.2 = 20\%$
  - Tolerance depends on project 10% to 50%
- $BuffSize = MaxFrameSize + (MaxFrameSize \times Tolerance)$
- $MaxFrameDetect = 1$
- $FillRate = BitsPerFrame \div BaudRate$
  - Ex: $FillRate = 10 \div 9600 = 1.041ms$
- $MinProcessTime = MaxFrameDetect \times FillRate$
  - Ex: $MinProcessTime = 1 \times 1.041ms = 1.041ms$
- $RAMUsage = BuffSize$

Single Buffer with Process Cache

- Receiver/Sender task just contact with Buffer
- Process task just contact with Cache Buffer
- Avoid Data-Race

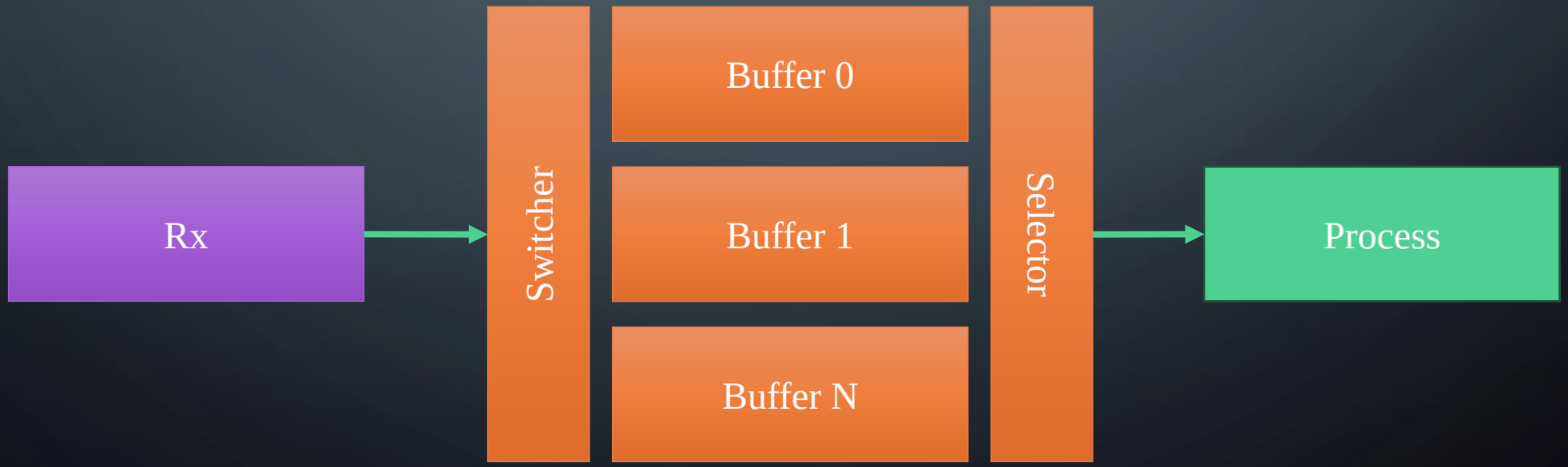


Single Buffer (Cache): Parameters

- $Tolerance = 1.2 = 20\%$
  - Tolerance depends on project 10% to 50%
- $BuffSize = MaxFrameSize + (MaxFrameSize \times Tolerance)$
- $MaxFrameDetect = 1$
- $FillRate = BitsPerFrame \div BaudRate$
  - Ex: $FillRate = 10 \div 9600 = 1.041ms$
- $MinProcessTime = (MaxFrameDetect + 1) \times FillRate$
  - Ex: $MinProcessTime = (1 + 1) \times 1.041ms = 2.082ms$
- $RAMUsage = BuffSize \times 2$

Multi Buffer

- It’s like single buffer except we use multiple buffer for receive/transmit
- More RAM usage

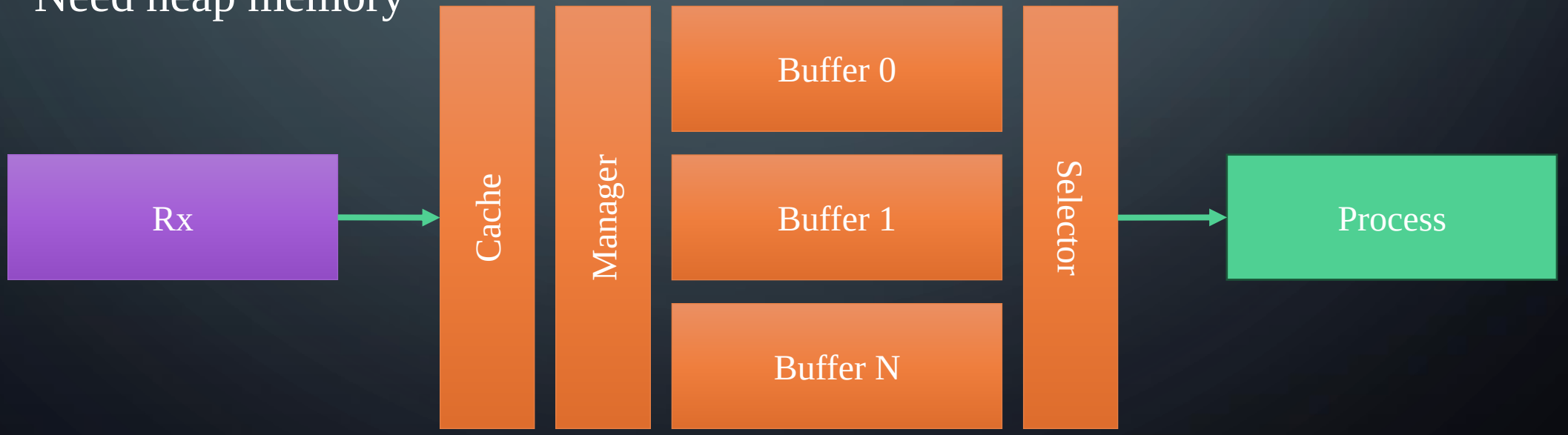


Multi Buffer: Parameters

- $Tolerance = 1.2 = 20\%$
  - Tolerance depends on project 10% to 50%
- $N = Number\ of\ buffers$
- $BuffSize = MaxFrameSize + (MaxFrameSize \times Tolerance)$
- $MaxFrameDetect = N$
- $FillRate = BitsPerFrame\ \div BaudRate$
  - Ex: $FillRate = 10\ \div 9600 = 1.041ms$
- $MinProcessTime = MaxFrameDetect \times FillRate$
  - Ex: $MinProcessTime = 10\ \times 1.041ms = 10.41ms$
- $RAMUsage = BuffSize\ \times N$

Multi Buffer with Linked List

- It’s like single buffer except we use multiple buffer for receive/transmit
- Maximum buffer number depends on heap memory size and frame size
- Need heap memory



Multi Buffer (Linked List): Parameters

- $Tolerance = 1.2 = 20\%$
  - Tolerance depends on project 10% to 50%
- $N = Number\ of\ buffers$ (Depends on Heap size)
- $CacheSize = MaxFrameSize + (MaxFrameSize \times Tolerance)$
- $MaxFrameDetect = N$
- $FillRate = BitsPerFrame\ \div BaudRate$
  - Ex: $FillRate = 10\ \div 9600 = 1.041ms$
- $MinProcessTime = MaxFrameDetect \times FillRate$
  - Ex: $MinProcessTime = 10\ \times 1.041ms = 10.41ms$
- $RAMUsage = CacheSize + \sum_0^N FrameSize$

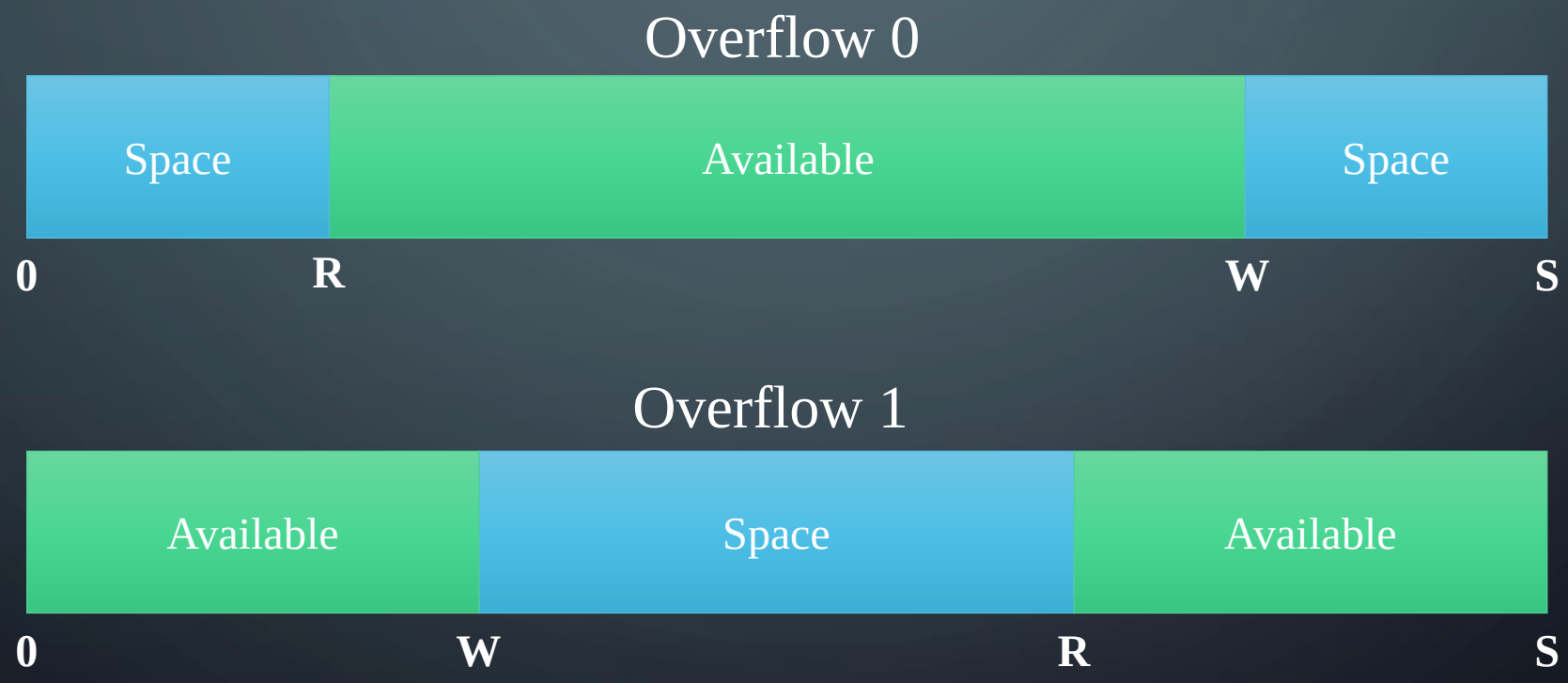
Circular Buffer

- Like single buffer, it just use one big buffer
- Process task and Receiver/Sender task use same buffer but not same area
- Avoid Data-Race
- Less RAM than Multi Buffer
- More Speed

Circular Buffer: Parameters

- $Tolerance = 1.2 = 20\%$
  - Tolerance depends on project 10% to 200% or more
- $BuffSize = MaxFrameSize + (MaxFrameSize \times Tolerance)$
- $MaxFrameDetect = BuffSize \div MaxFrameSize$
- $FillRate = BitsPerFrame \div BaudRate$
  - Ex: $FillRate = 10 \div 9600 = 1.041ms$
- $MinProcessTime = (MaxFrameSize \times Tolerance) \times FillRate$
  - Ex: $MinProcessTime = (100 \times 20) \times 1.041ms = 20.82ms$
- $RAMUsage = BuffSize$

Circular Buffer: Diagram



Circular Buffer: Formula (Available)

Overflow	Condition	Formula
0	$R < W$	$W - R$
1	$R > W$	$S + W - R$
0	$R = W$	0
1	$R = W$	S

$$Available = S \times OVF + W - R$$

Circular Buffer: Formula (Space)

Overflow	Condition	Formula
0	$R < W$	$R - W$
1	$R > W$	$S + R - W$
0	$R = W$	S
1	$R = W$	0

$$Space = (S \times !\,OVF) + R - W$$