Flexible Time-Windows for Advance Reservation in LambdaGrids

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Advance reservation

- A LambdaGrid provides the computational, storage, visualization, and the optical-network resources to the user as schedulable resources.
- Resources can be reserved in advance and requests may be rejected when the resources are not available

Flexibility

- GOAL →Use flexibility to increase acceptance rate and decrease blocking probability.

Should I be flexible or wait in the queue?

Hypothesis

The value of the average window time for all user requests, which will theoretically lower the blocking probability in the advance-reservation scheduling domain to 0, is the same as the mean waiting time of an equivalent queue-based on-demand scheduler, when the traffic intensity is less than 1.

Results

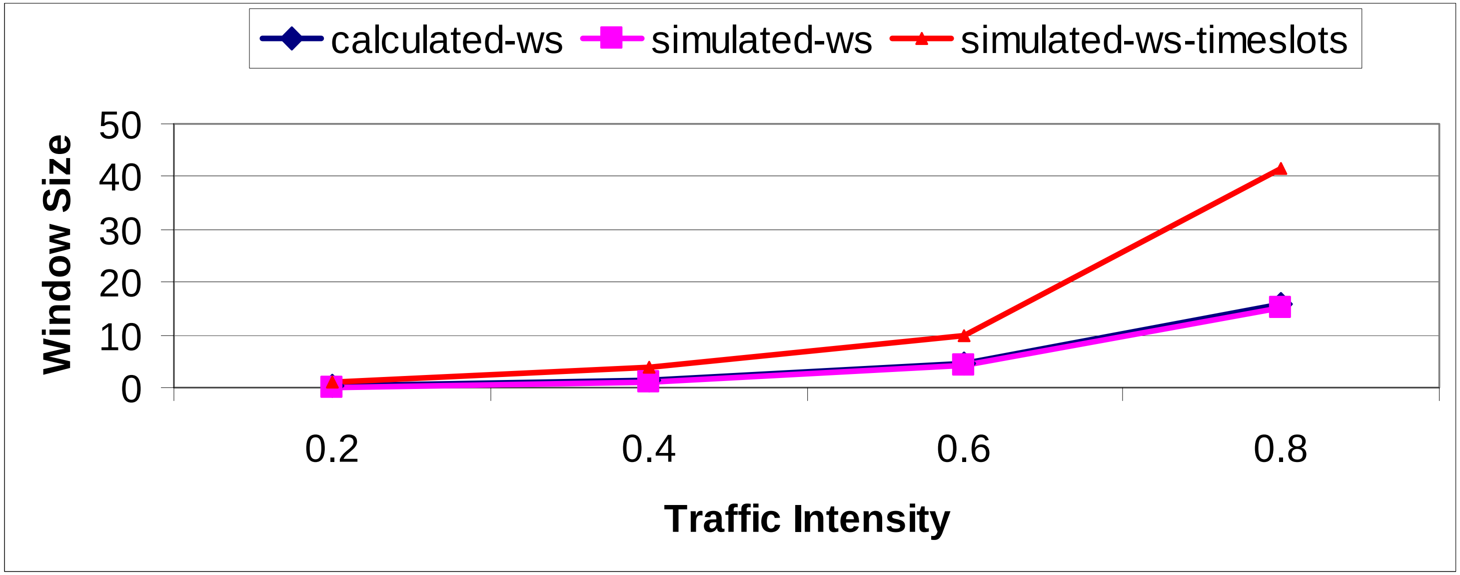
- Window size that brings the blocking probability to zero
  - M/M/1
- Represented in the results are window sizes for :
  - Queuing model
  - Simulation with no time-slots
  - Simulation with time-slots

Simulation parameters

- Traffic intensity ρ = 0.2 to 0.8
- 50 different traces
  - For each trace, calculate the average window size.
  - Take the average window size over the 50 values obtained.
  - Maximum possible window size = 1,000

Window size that brings the blocking probability to zero

ρ	WS(in hours)	Other Parameters
0.2	0.25	λ = 0.2, μ = 1
0.4	1.33	λ = 0.2, μ = 0.5
0.6	4.5	λ = 0.2, μ = 0.333
0.8	16	λ = 0.2, μ = 0.25



Flexibility

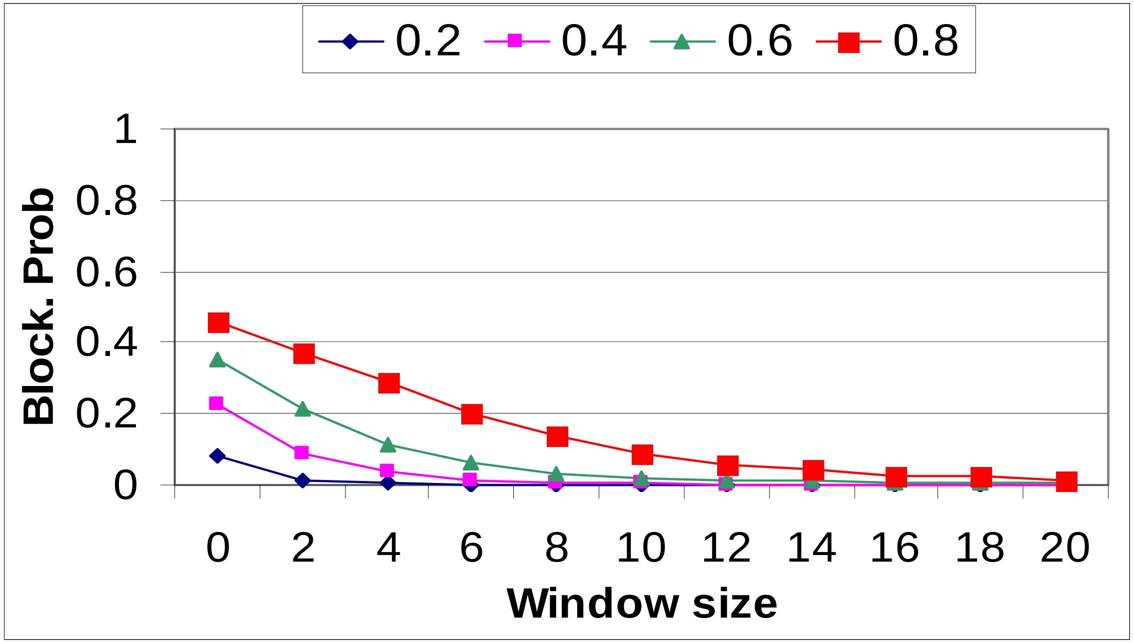
- How much flexibility will help to decrease the blocking probability of advance reservations?

How flexible should I be?

Simulation parameters

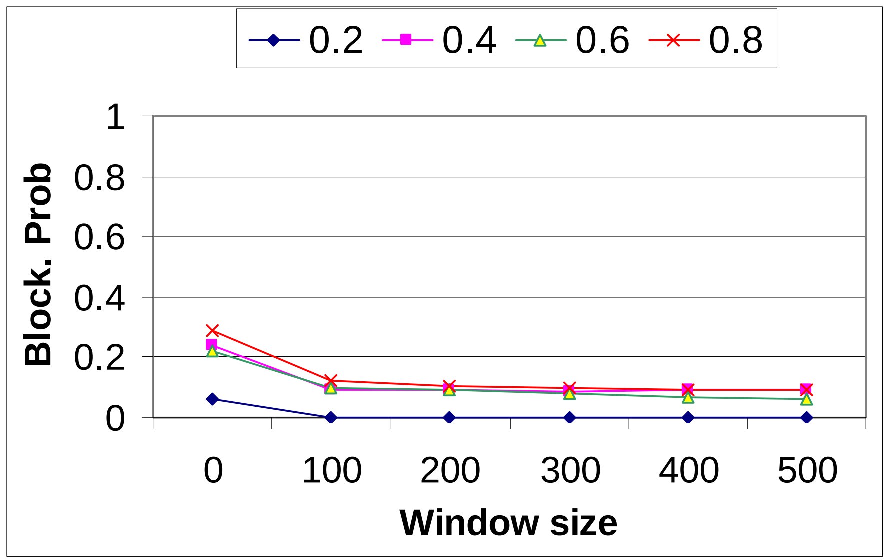
- A single trace was generated.
- Calculate the blocking probability and utilization for increasing window sizes.
- The window size is increased until the blocking probability drops to zero or close to zero.

Decreasing blocking probability with increasing window size (1 of 3)



M/M/1

Decreasing blocking probability with increasing window size (2 of 3)

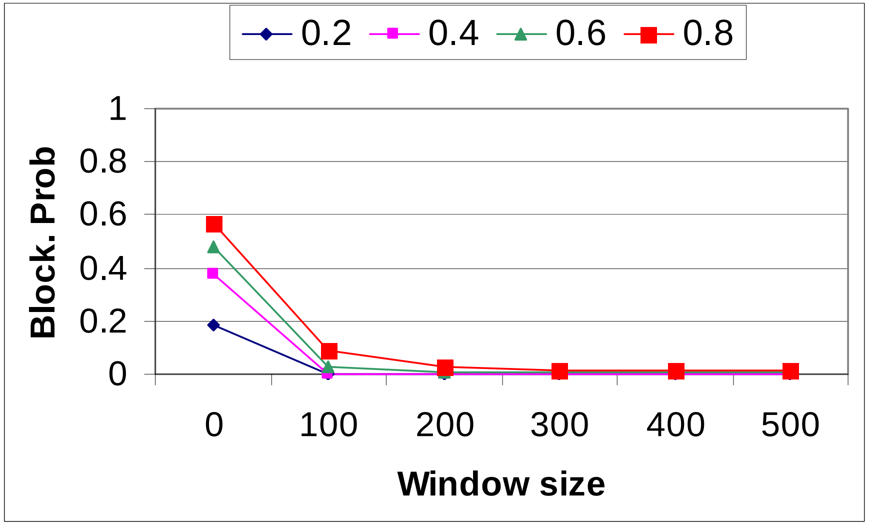


M/B/1

$f(x) = (\alpha k^{\alpha}/(1-(k/p)^{\alpha}))x^{(-\alpha-1)}$, $k \le x \le p$

M/B/1 : $\alpha = 1.7$, $k = 1$, $p = 1000$

Decreasing blocking probability with increasing window size (3 of 3)



B/M/1

$f(x) = (\alpha k^{\alpha}/(1-(k/p)^{\alpha}))x^{(-\alpha-1)}$, $k \leq x \leq p$

B/M/1 : $\alpha = 0.9$, $k = 1$, $p = 1000$

Conclusion

- Flexible time-windows can improve resource utilization in advance reservation scheduling.
- Flexible window size is equal to mean waiting time in the queue.