Tight Bounds for Clairvoyant Dynamic Bin Packing

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Online Bin-Packing

- Items arrive one at a time
- Each item with size $\in (0,1]$
- Items packed upon arrival into bins of capacity 1
- Goal: minimize number of bins used
- Algorithm is $c - competitive$ if $ON(\sigma) \leq c \cdot OPT(\sigma)$

Dynamic Bin-Packing

- Items arrive and depart
- Items have duration and load
- Upon arrival items are packed
- Upon departure space is freed up
- $ON(t)$ – # bins opened by *ON* at time t
- Goal Function: $\sup_t ON(t) / \sup_t OPT(t)$

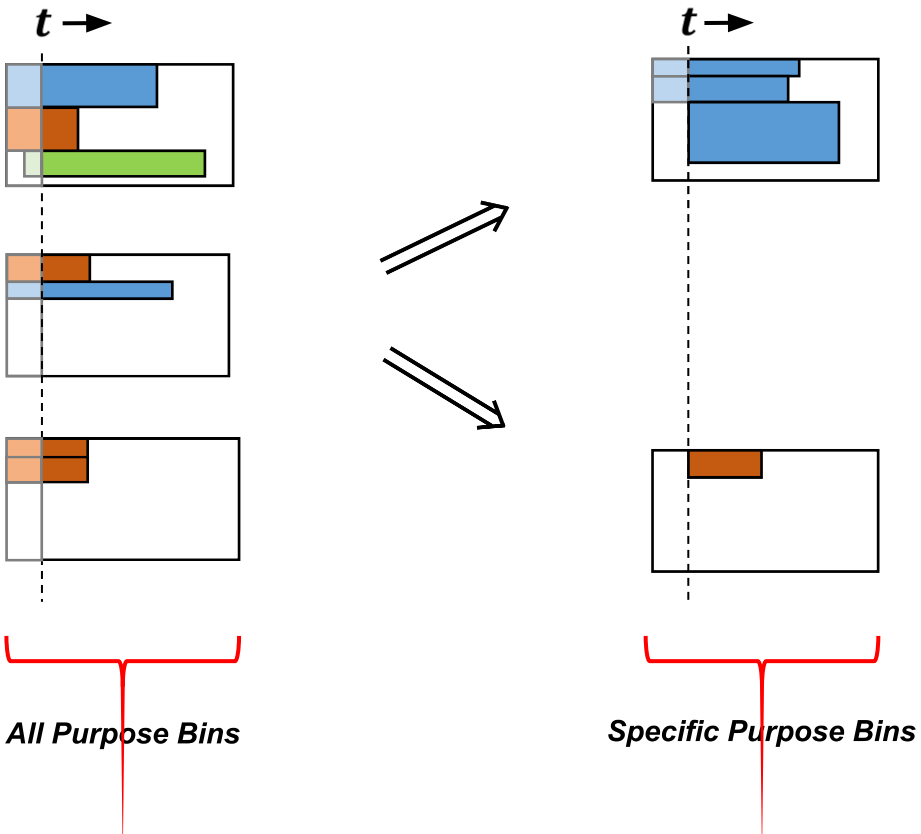
MinUsageTime Dynamic Bin-Packing

- New Goal: minimize total accumulated time of all open bins
  - $\int_t ON(t) / \int_t OPT(t)$
  - "MinUsageTime" – [Cai et al., '14]
  - Naturally arises in cloud computing – gaming for example

Clairvoyant MinUsageTime Dynamic Bin-Packing

- Departure time known upon arrival
- μ – $^{\textbf{longest duration}}/_{\textbf{shortest duration}}$
- Upper bound of $O(\log\mu/\log\log\mu)$ [Ren and Tang, '16]
- Lower bound of $\Omega(\sqrt{\log\mu/\log\log\mu})$ [Implicitly in Shalom et. al., '14]
- Our results
  - $\theta(\sqrt{\log\mu})$-competitive algorithm
  - $\theta(\sqrt{\log\mu})$ lower bound
- Further present a $O(\log\log\mu)$ algorithm for an interesting subset of inputs
- **Recap** – Clairvoyant MinUsageTime Dynamic Bin-Packing

The Algorithm – Pictorial Definition



Thank You!