Dynamic Safety-Stocks for Asymptotic Optimality in Stochastic Networks

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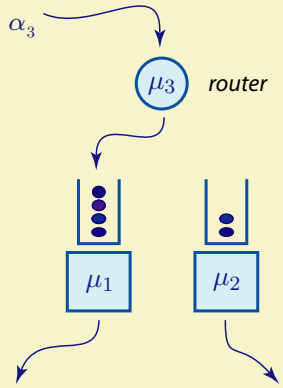
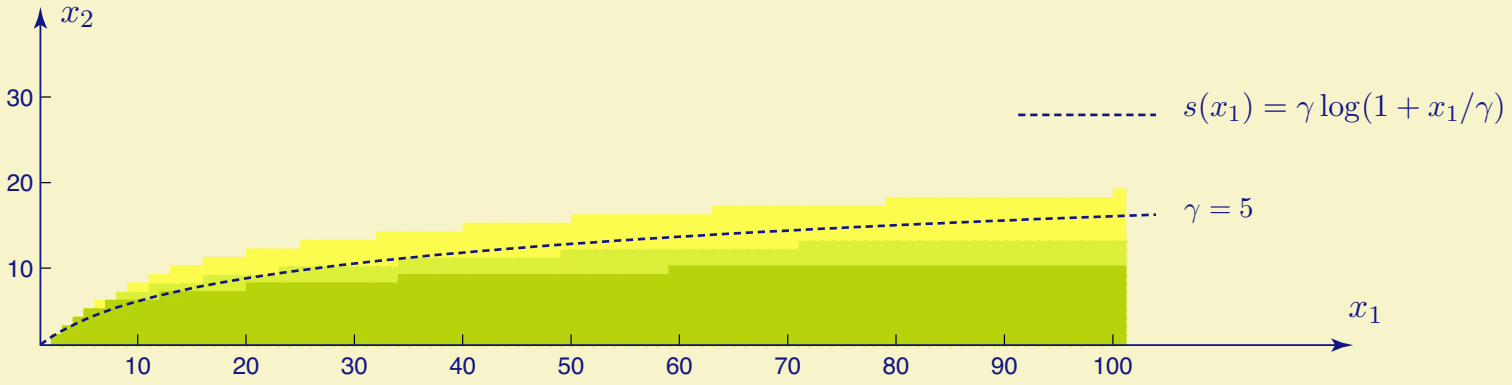
Issues

- Robust policy synthesis
- Asymptotic optimality
- Structure of optimal policies

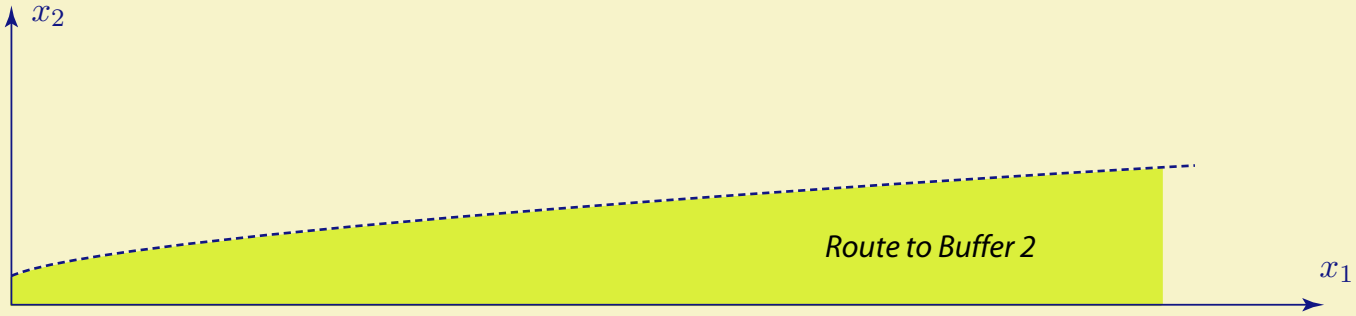


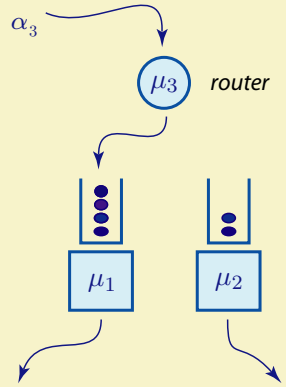


Safety stocks

- Yadin & Naor ‘63, Heyman ‘68, Miller ‘69
- Many subsequent papers!
- Hajek ‘84:

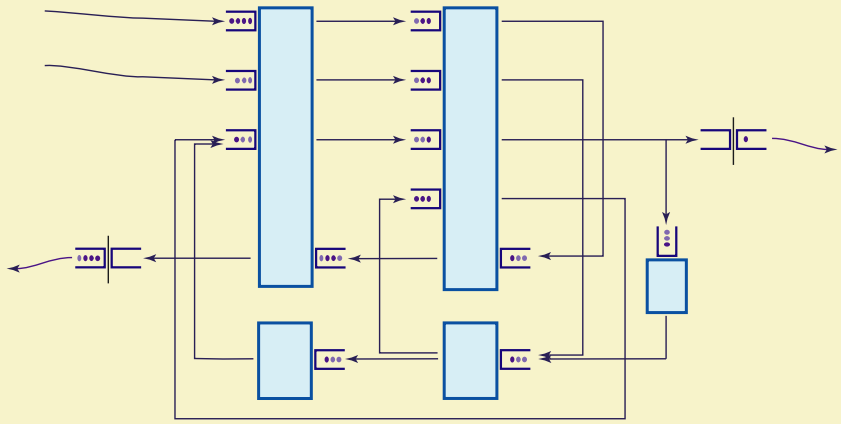
  Optimal policy exists, defined by a monotone switching curve





Structure of optimal policies

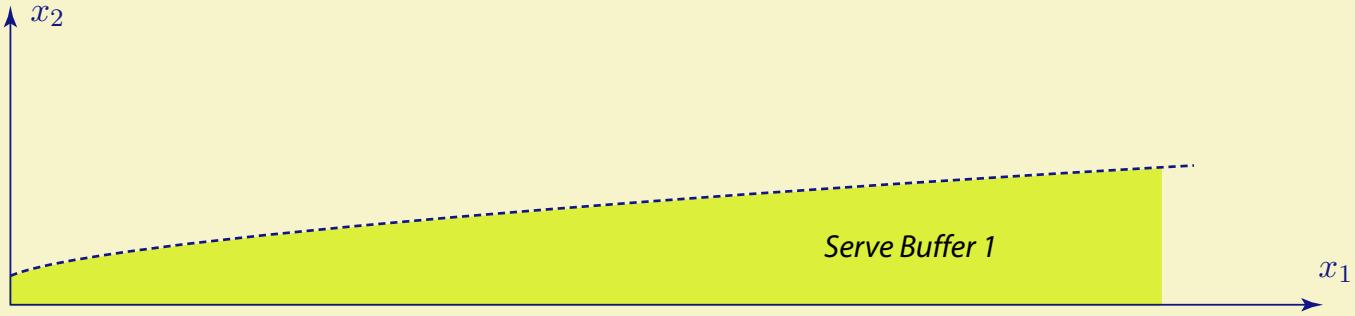
- Meyn '97 & '00



Fluid scaling: $q^n(t;x) = n^{-1}Q(nt;nx)$

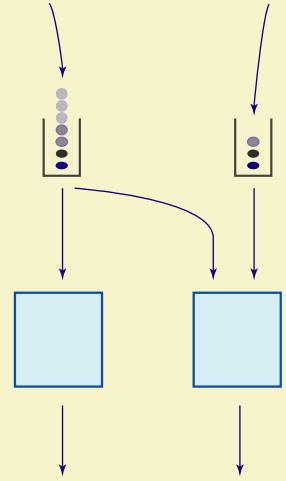
$q^{*n}(t;x) \to q^*(t;x), \qquad n \to \infty$

Optimal for *fluid model*



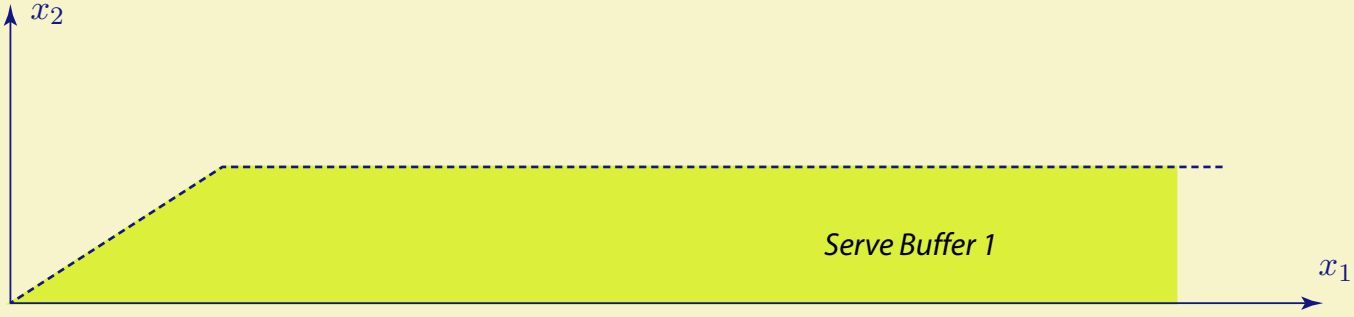
Conclusion: *Switching curves are unbounded*

Safety stocks in heavy traffic



- Bell & Williams '99, '01
- Meyn '03

Large deviation bounds:
Safety stocks designed so that
starvation is negligible in
heavy traffic



Conclusion: *Switching curves order* $O\left(\log \frac{1}{1-\rho}\right)$

Asymptotic optimality in tandem queues