

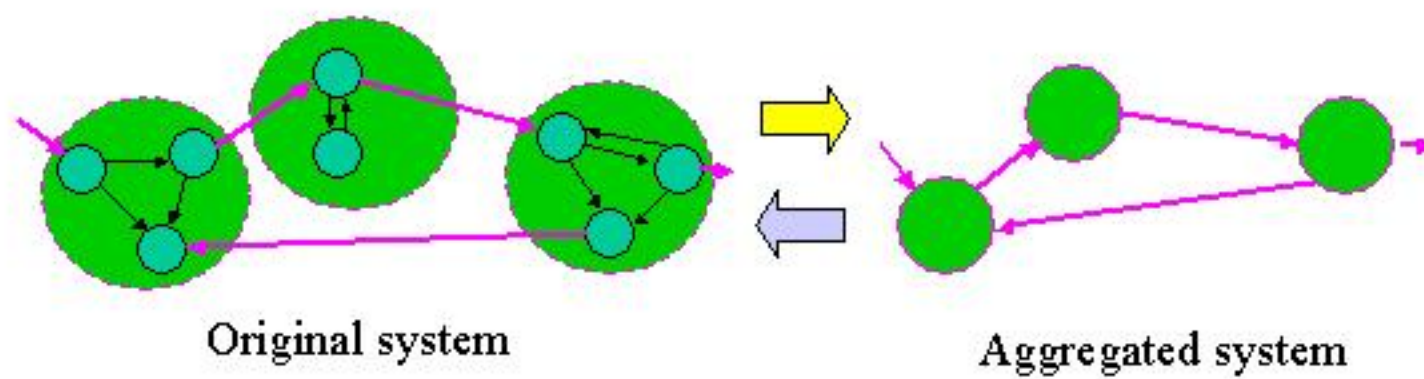
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## Objectives and Outline

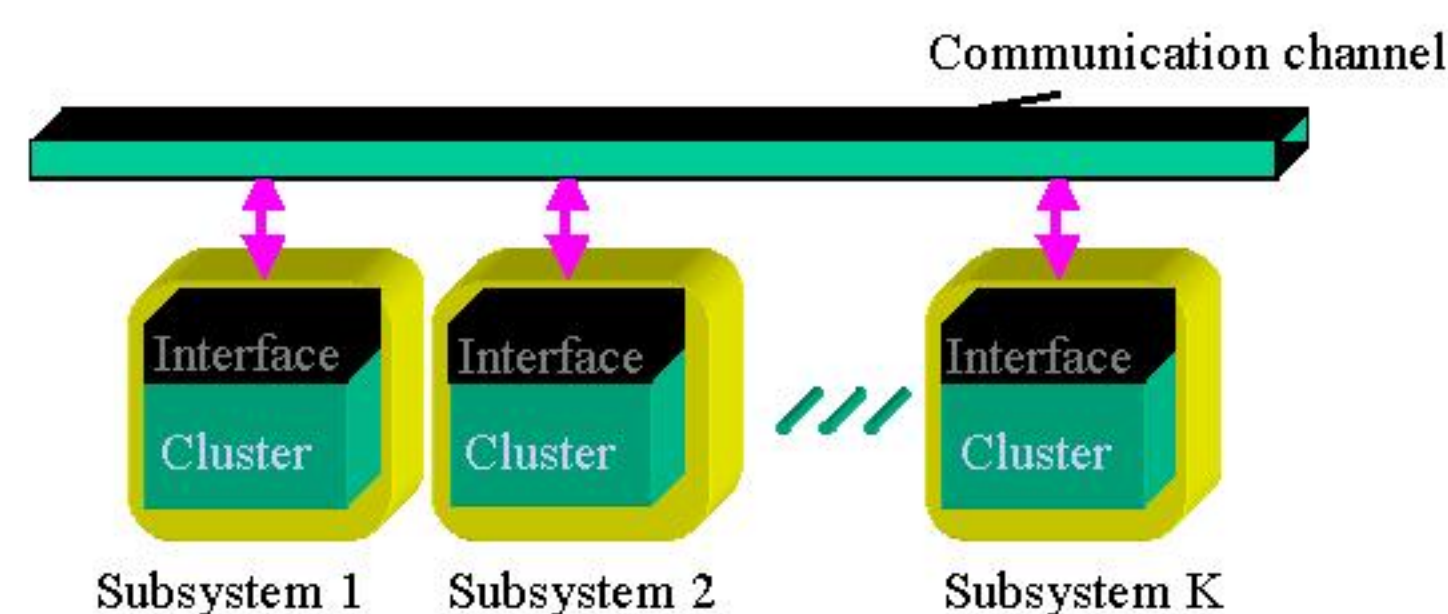
- Overcome the “curse of dimensionality”.
- Reduce the computational time and computational cost by using **approximate** Dynamic Programming (DP) methods.
- Two approximate DP methods are proposed:
  - The **Direct Computation** based on state **Aggregation** (DCA) method.
  - The **Distributed Hierarchical Dynamic Programming** (DHDP) method.

## The DCA Method



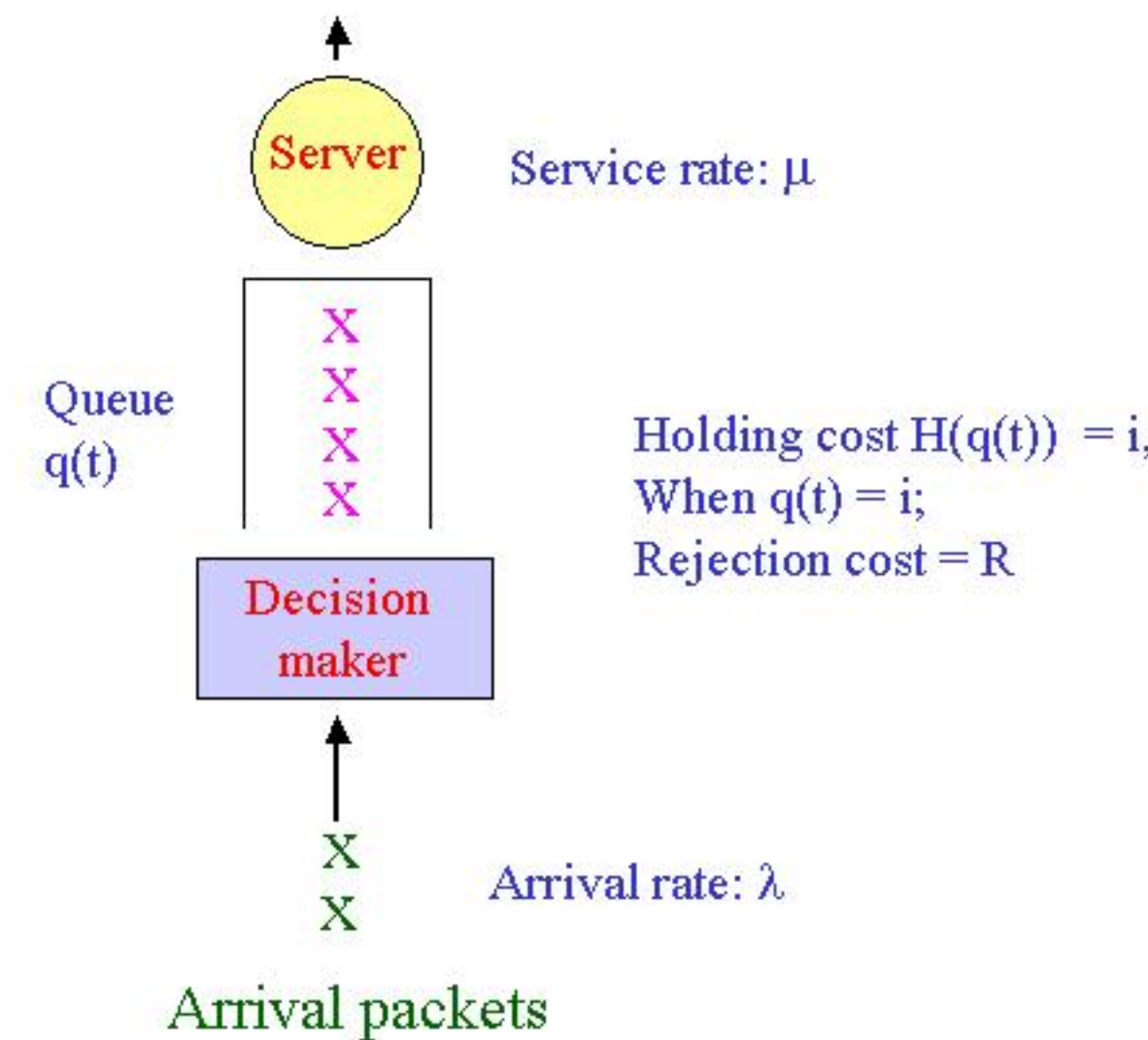
- Computation is carried on the aggregated system.
- Solutions of the aggregated system are mapped back to the original system.

## The DHDP Method



- Parallel computation in each subsystem.
- Reduced complexity in each subsystem.
- Information exchange is minimized in the channel.

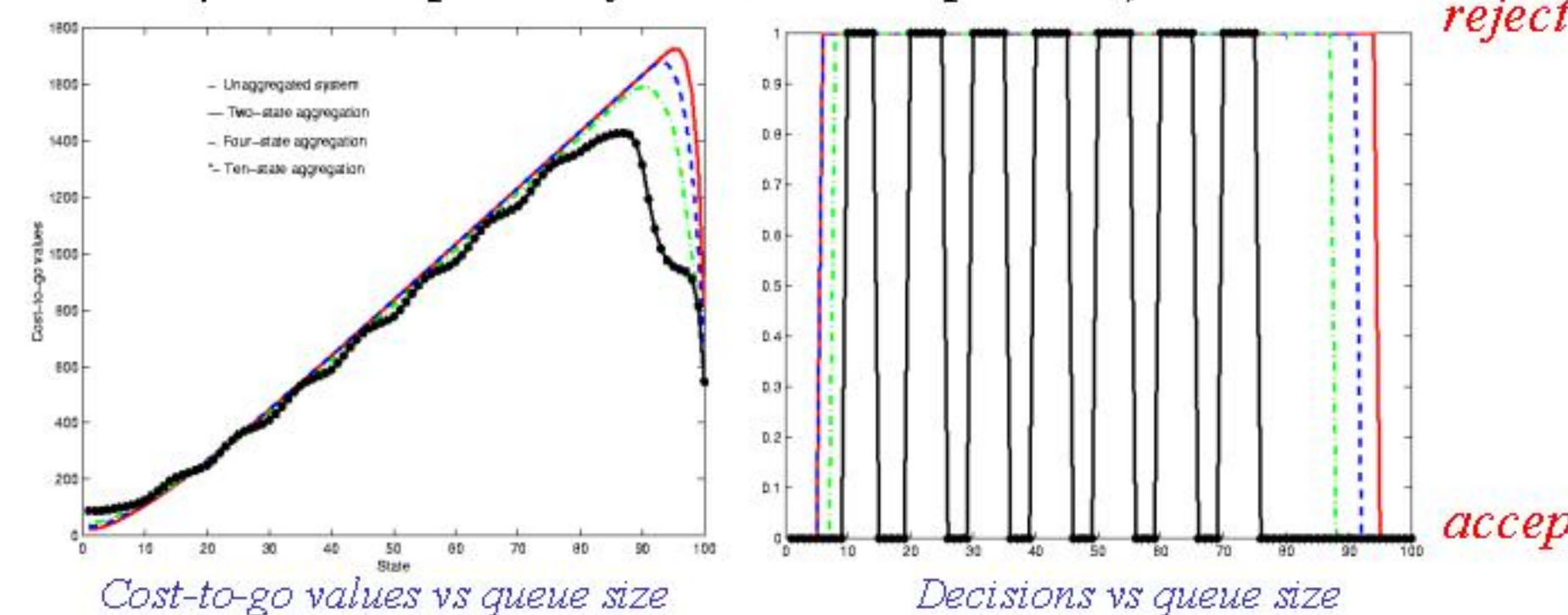
## Network Admission Control



- Objective: Minimize cost;  $\min\{E \sum_{t=0}^{\infty} \alpha^t (u(t)R + H(q(t)))\}$
- Packets arrive according to Poisson Distribution.
- Decisions: Accept or reject incoming packets.

## Application of the DCA Method

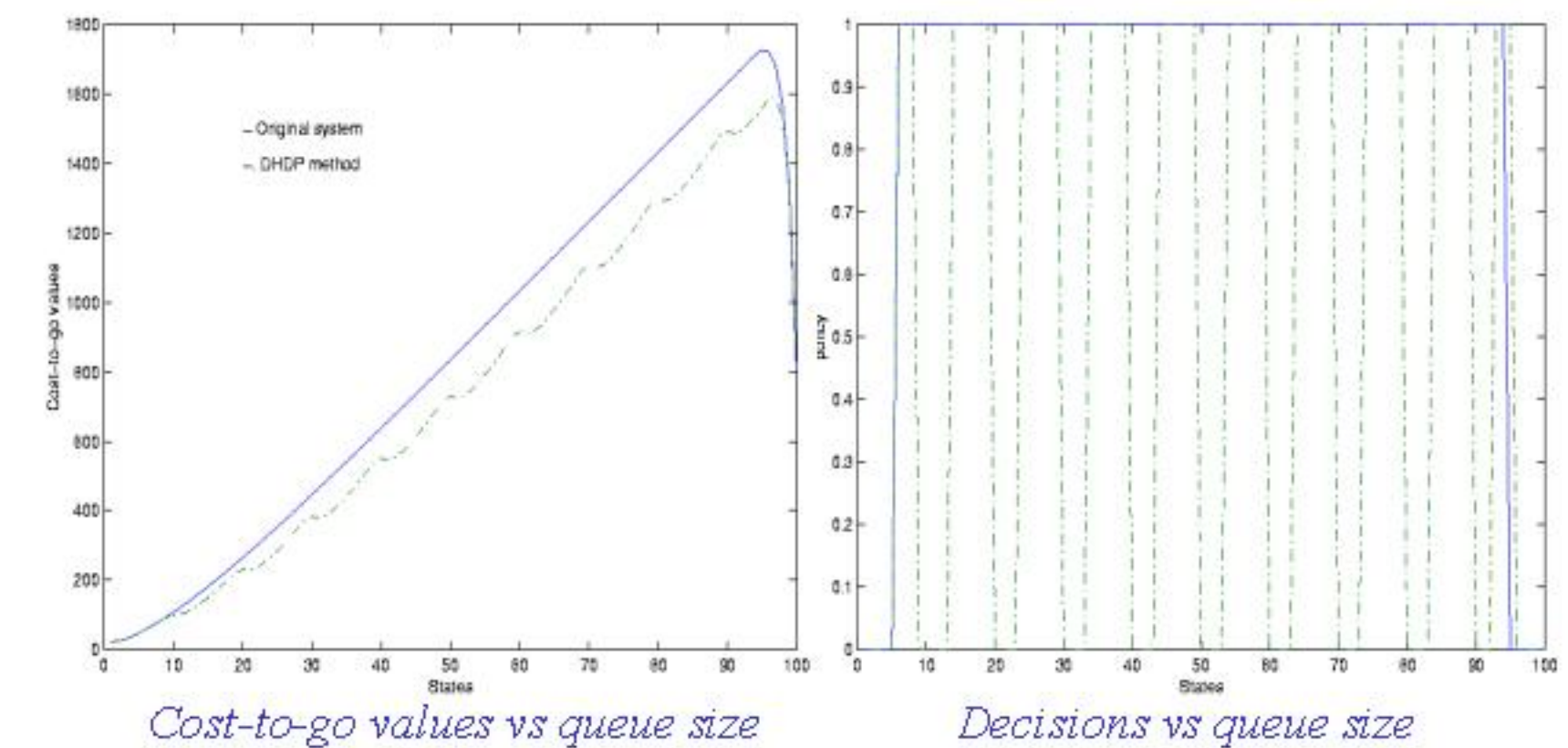
The arrival rate is  $\lambda = 0.4$  packets/sec, service rate  $\mu = 0.6$  (prob. of service completion).



Systems	Original	Two-states in a cluster	Four-states in a cluster	Ten-states in a cluster
Run time	26.03	21.15	15.10	11.14
Threshold for decision $u(t) = 0$ , if $q(t) < Th$	$Th = 5$	$Th = 5$	$Th = 7$	$Th = 9$
Residual error in [0, 60]	0	9.35	24.78	66.58

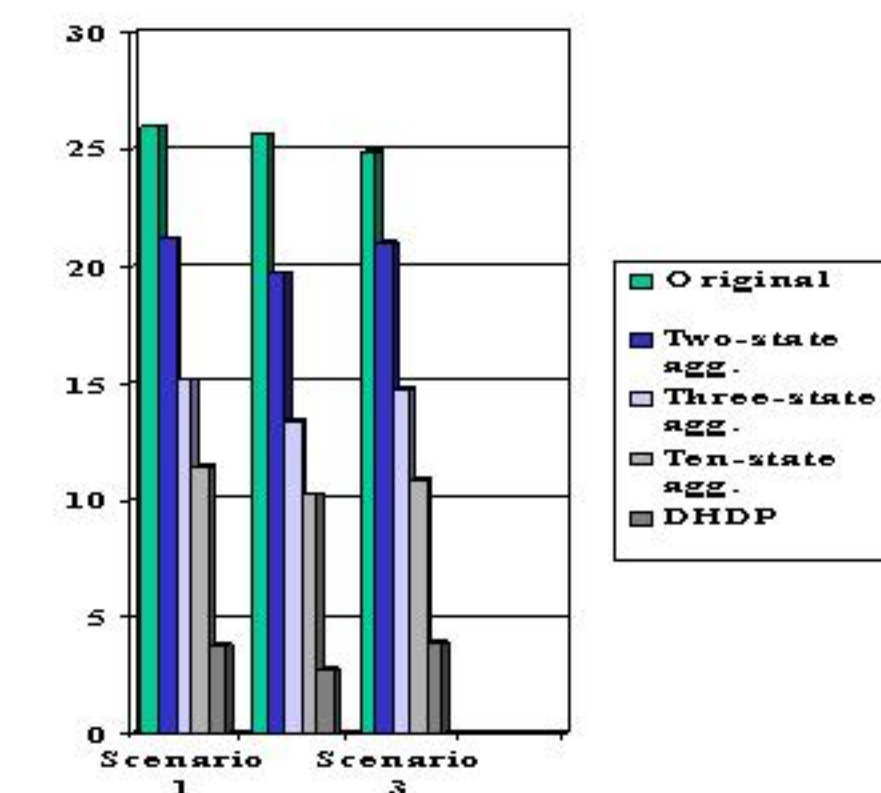
## Application of the DHDP Method

The arrival rate is  $\lambda = 0.4$ , service rate  $\mu = 0.6$



Scenario	$\lambda$	Threshold	Run time	Residual error in [0,60]
1	0.4	5	3.77	146.69
2	1.2	1	2.71	140.06
3	0.1	100	3.81	128.72

## Run Time Comparison



## Conclusions

- The DCA method and the DHDP method can reduce computational complexity and computational time.