

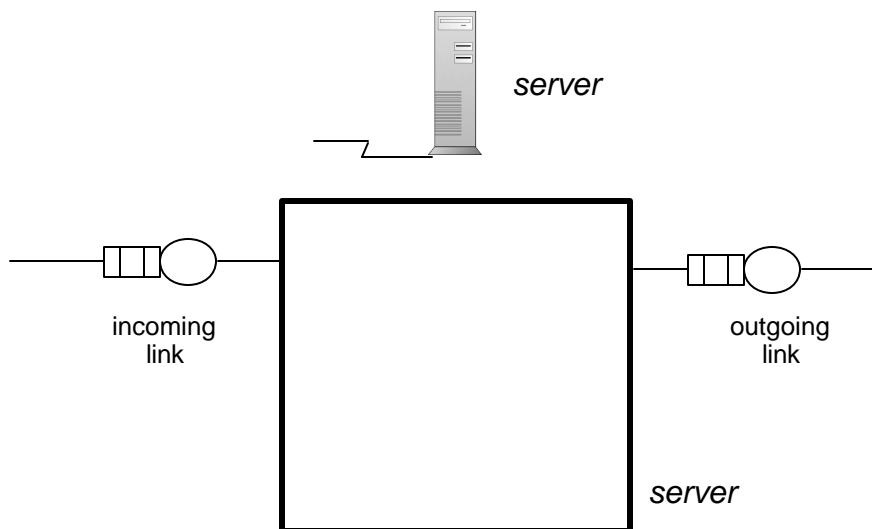
# Performance Models of E-Commerce Sites

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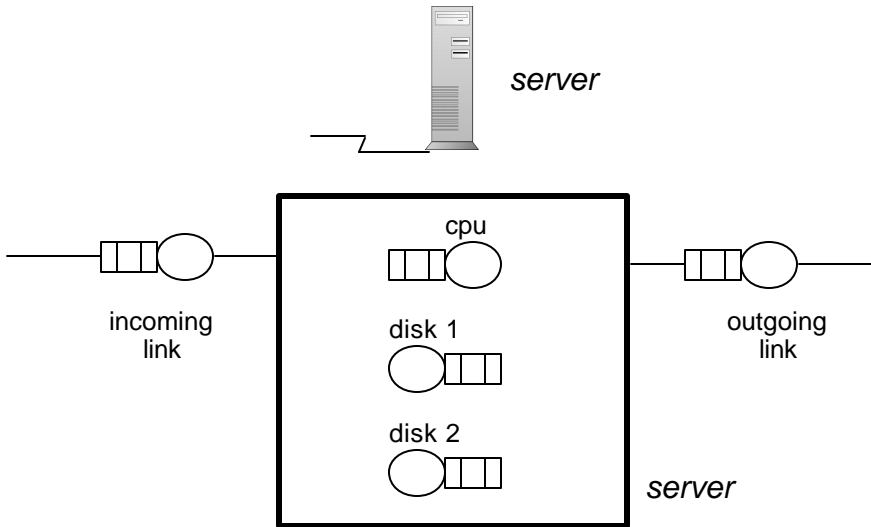
## Component-level models



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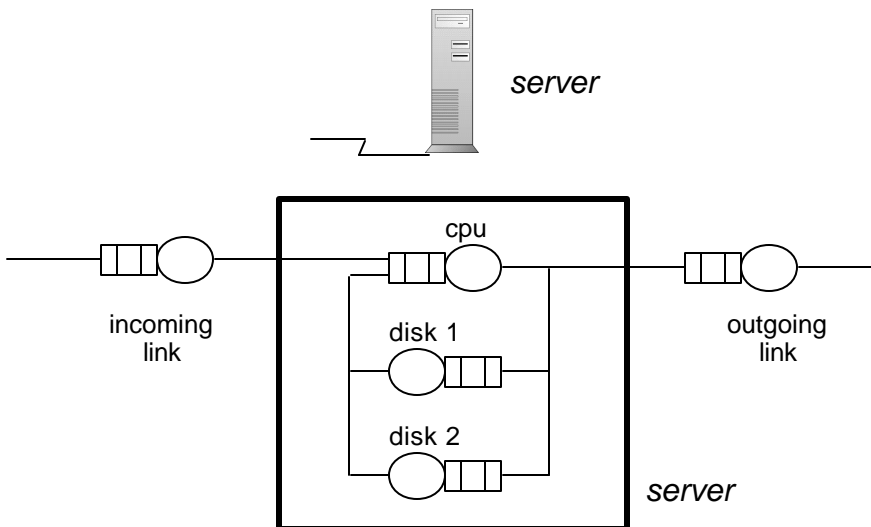
# Component-level models



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# Component-level models

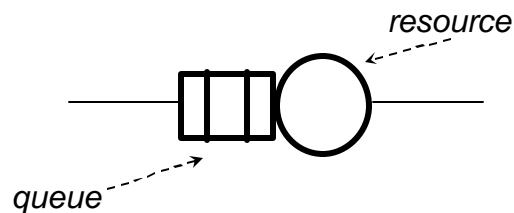


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## Component-level Models

- Each component is represented by a resource (e.g. CPU, disk, communication link) and a queue of requests waiting for the resource.



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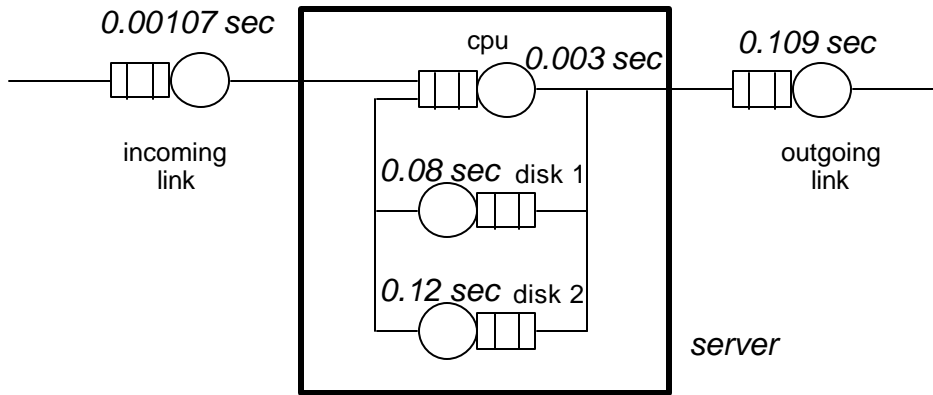
## Performance Model Parameters

- Workload Intensity
  - HTTP Requests/sec
  - Transactions/sec
  - E-business functions/sec
- Service demands for each resource and each type of request.

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# Service Demands

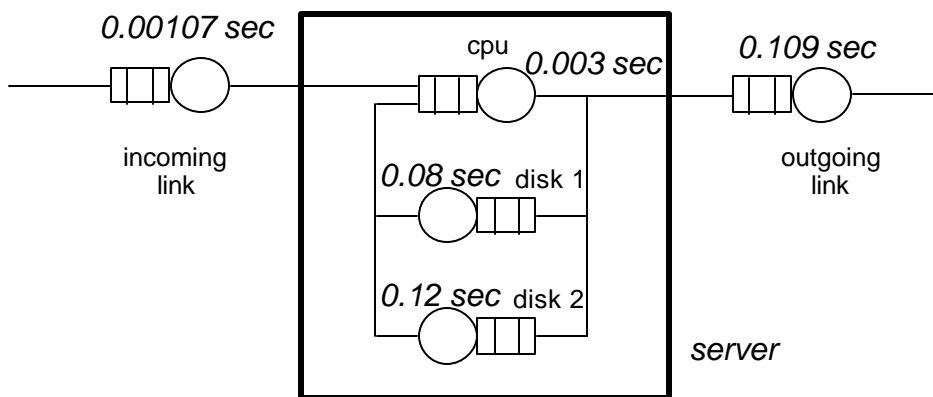


*Service demands do not include any queuing time! It is just service time.*

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# Computing Waiting Times

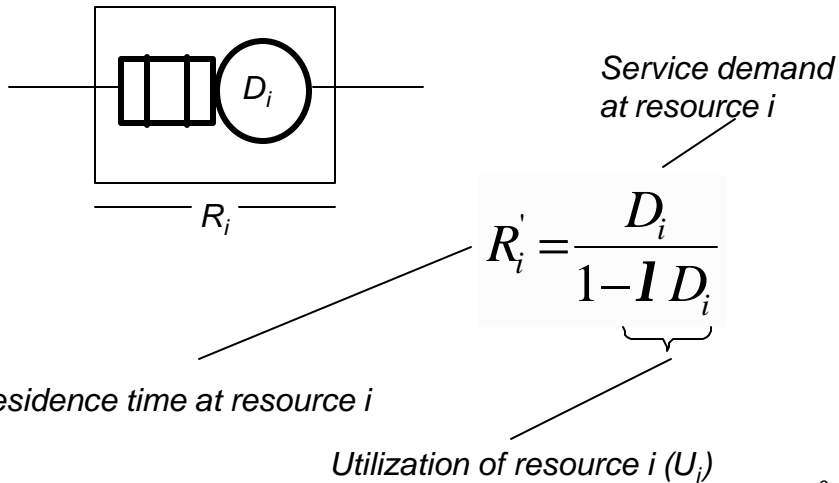


*Waiting times depend on the load (arrival rate of requests) and on the service demands.*

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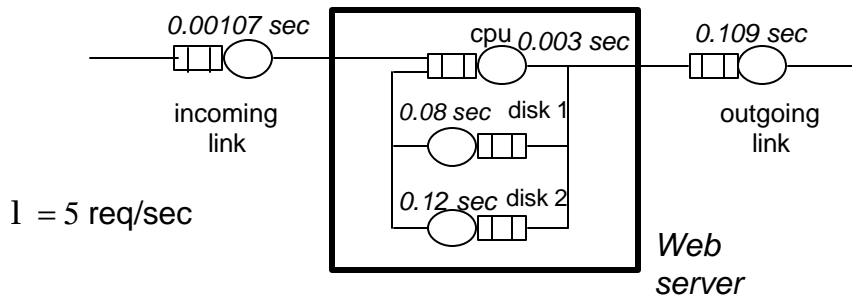
# Computing Residence Times



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# Residence Time at Incoming Link

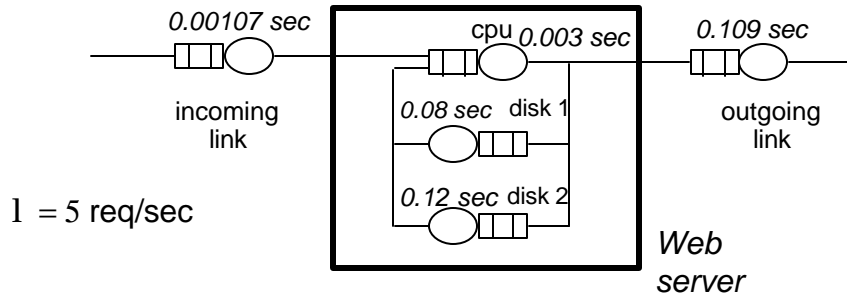


$$R'_{IncLink} = \frac{D_{IncLink}}{1 - I D_{IncLink}} = \frac{0.00107}{1 - 5 \times 0.00107} = 0.00108 \text{ sec}$$

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## Residence Time at Outgoing Link

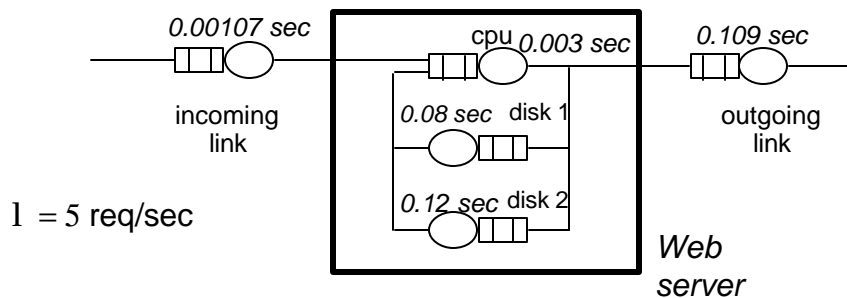


$$R'_{Outlink} = \frac{D_{OutLink}}{1 - \lambda D_{OutLink}} = \frac{0.109}{1 - 5 \times 0.109} = 0.239 \text{ sec}$$

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## Residence Time at the CPU

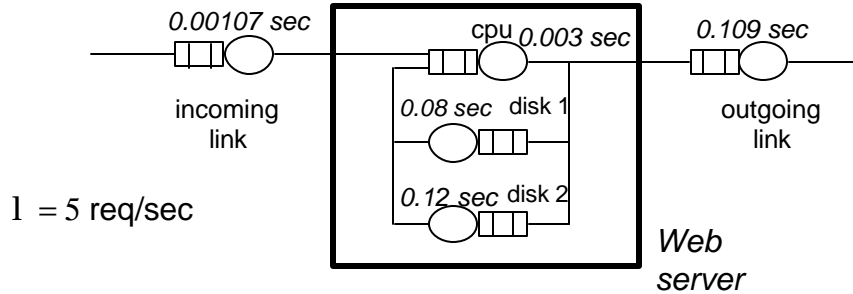


$$R'_{CPU} = \frac{D_{cpu}}{1 - \lambda D_{cpu}} = \frac{0.003}{1 - 5 \times 0.003} = 0.00305 \text{ sec}$$

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## Residence Time at Disk 1

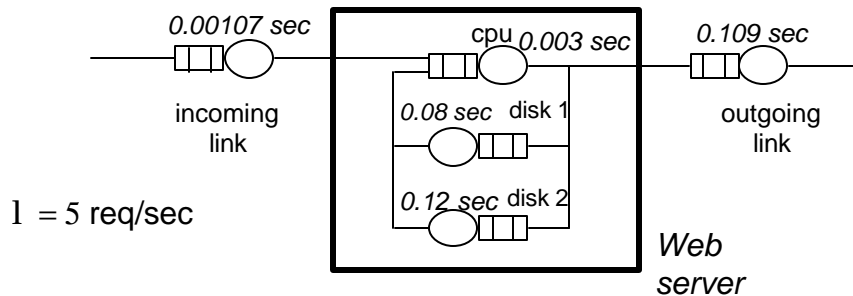


$$R'_{disk1} = \frac{D_{disk1}}{1 - \lambda D_{disk1}} = \frac{0.08}{1 - 5 \times 0.08} = 0.133 \text{ sec}$$

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## Residence Time at Disk 2



$$R'_{disk2} = \frac{D_{disk2}}{1 - \lambda D_{disk2}} = \frac{0.12}{1 - 5 \times 0.12} = 0.3 \text{ sec}$$

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# Summary of Results

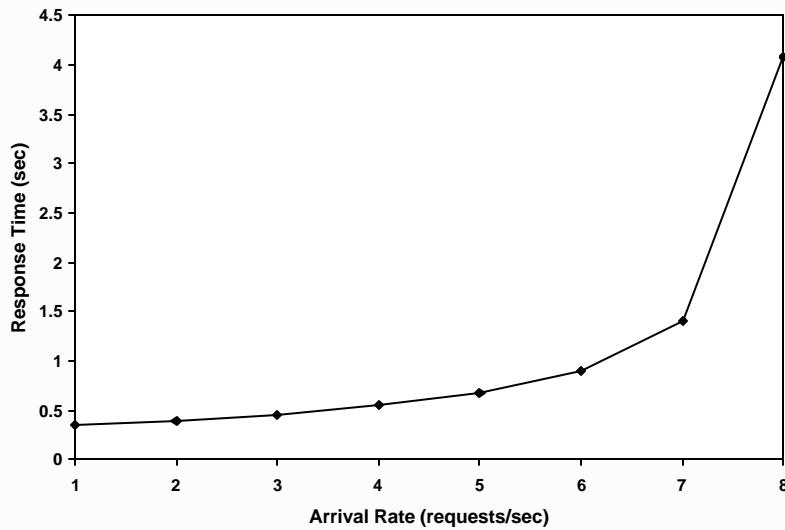
Resource	Service Demand (sec)	Utilization	Residence Time (sec)
Inc. Link	0.00107	0.54%	0.00108
CPU	0.00300	1.50%	0.00305
Disk 1	0.08000	40.00%	0.13333
Disk 2	0.12000	60.00%	0.30000
Out. Link	0.10900	54.50%	0.23956
	<b>0.31307</b>		<b>0.67702</b>

Sum of service demands

Average Response Time<sub>s</sub>

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# Response vs. Arrival Rate



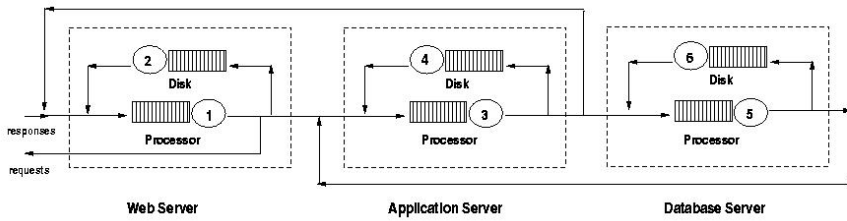
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# Example: online trading site

- Open QN for the online trading site:



$$R_{ShowPortfolio} = R'_1 + R'_2 + R'_3 + R'_4 + R'_5 + R'_6$$

$$R'_i = \frac{D_i}{1 - U_i}$$