Resource Containers

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Presented by Michael Roitzsch

Observations

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  - no control over resource consumption by the kernel on behalf of the application
  - difficulty to express priority policies, QoS
  - denial of service

Web Server Example

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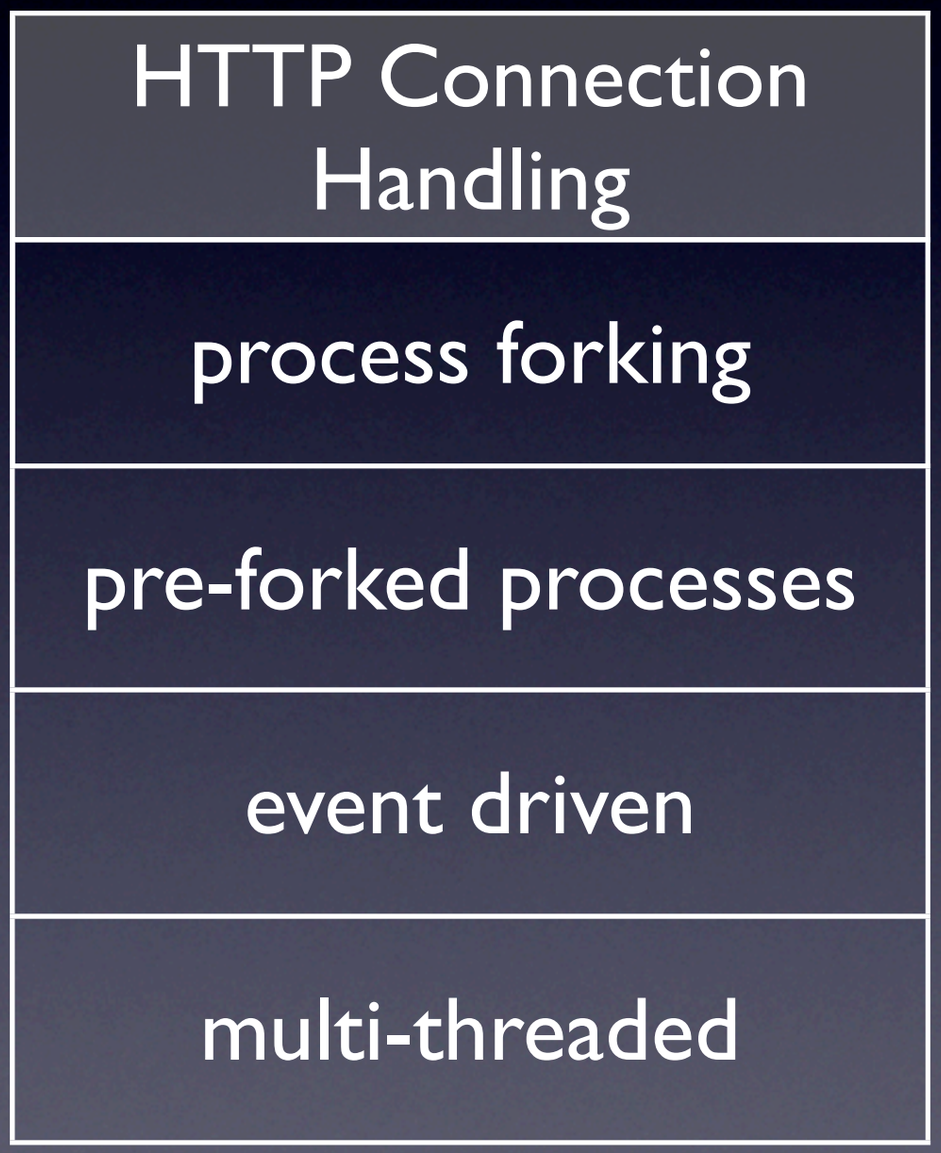
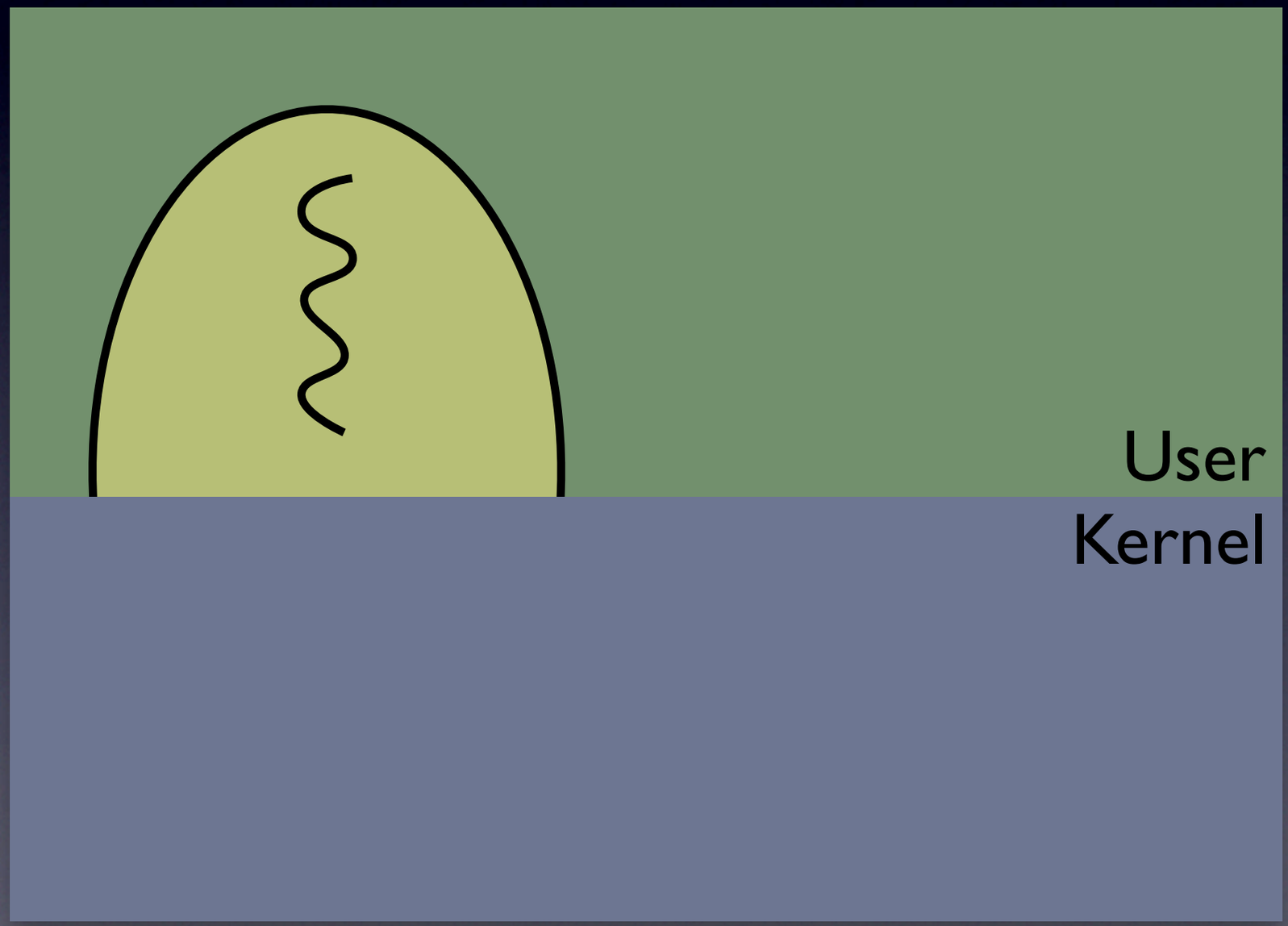


Web Server Example

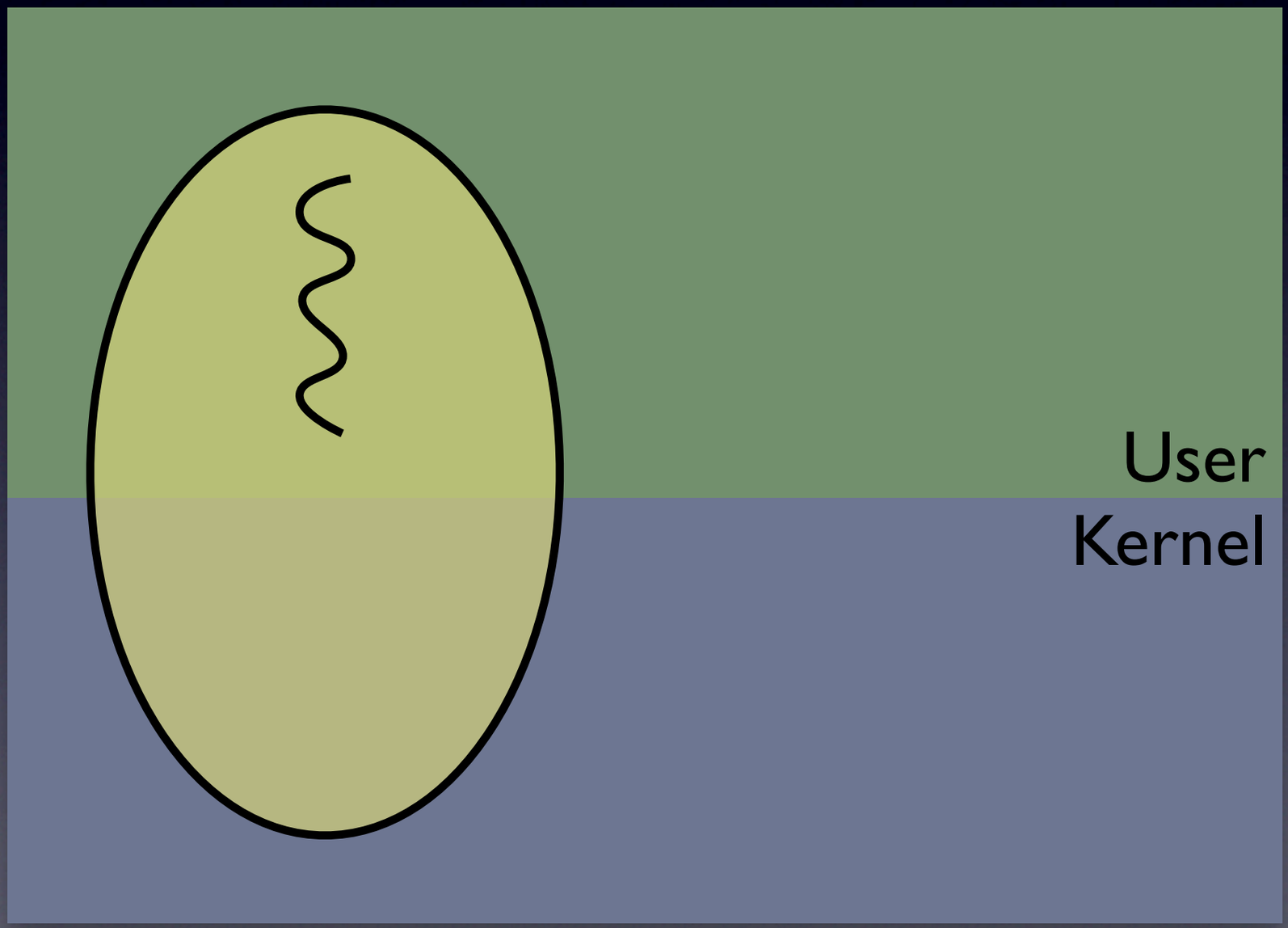
HTTP Connection Handling	CGI Handling
process forking	CGI process forking
pre-forked processes	persistent CGI processes
event driven	library based
multi-threaded	

Current Resource Management

Current Resource Management



Current Resource Management



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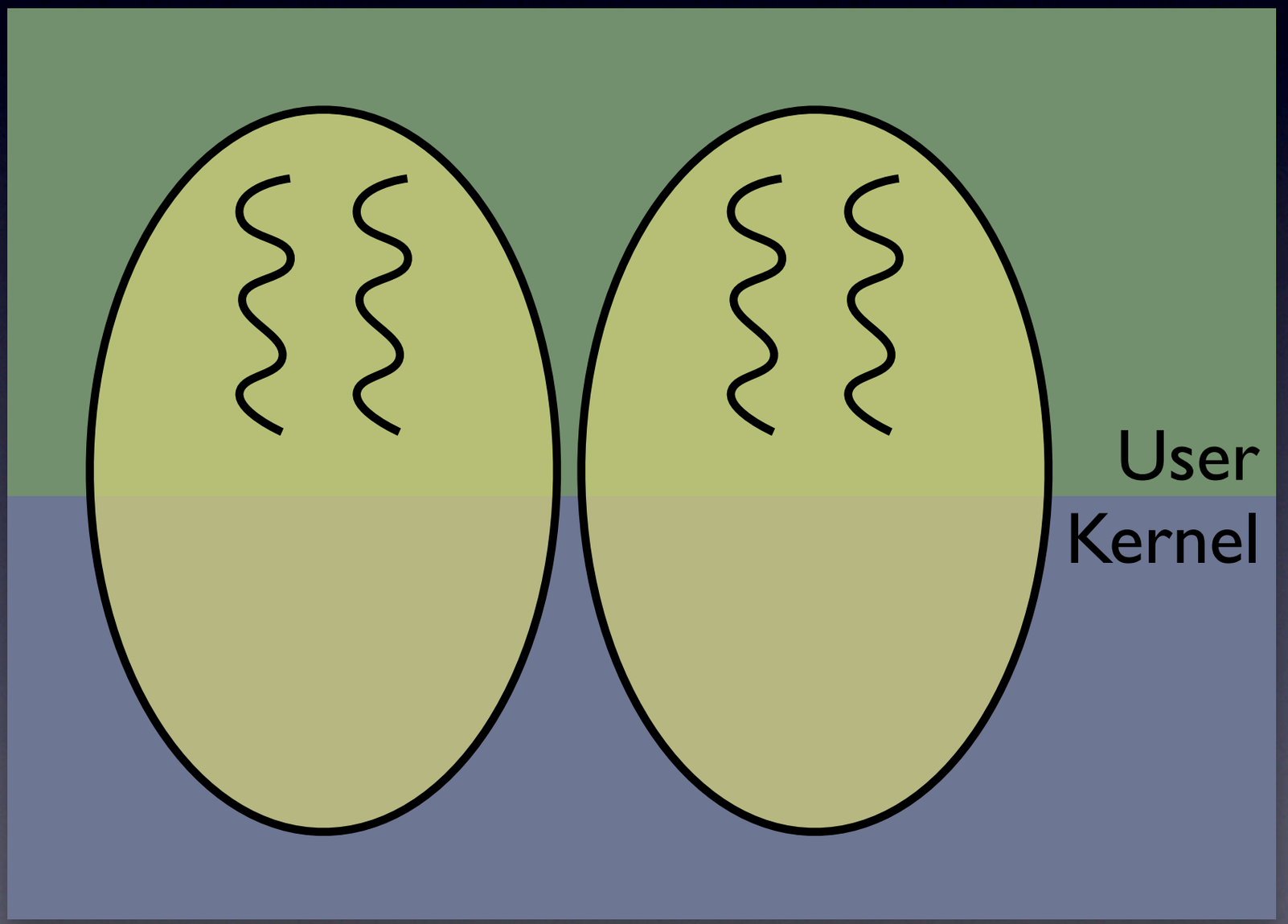

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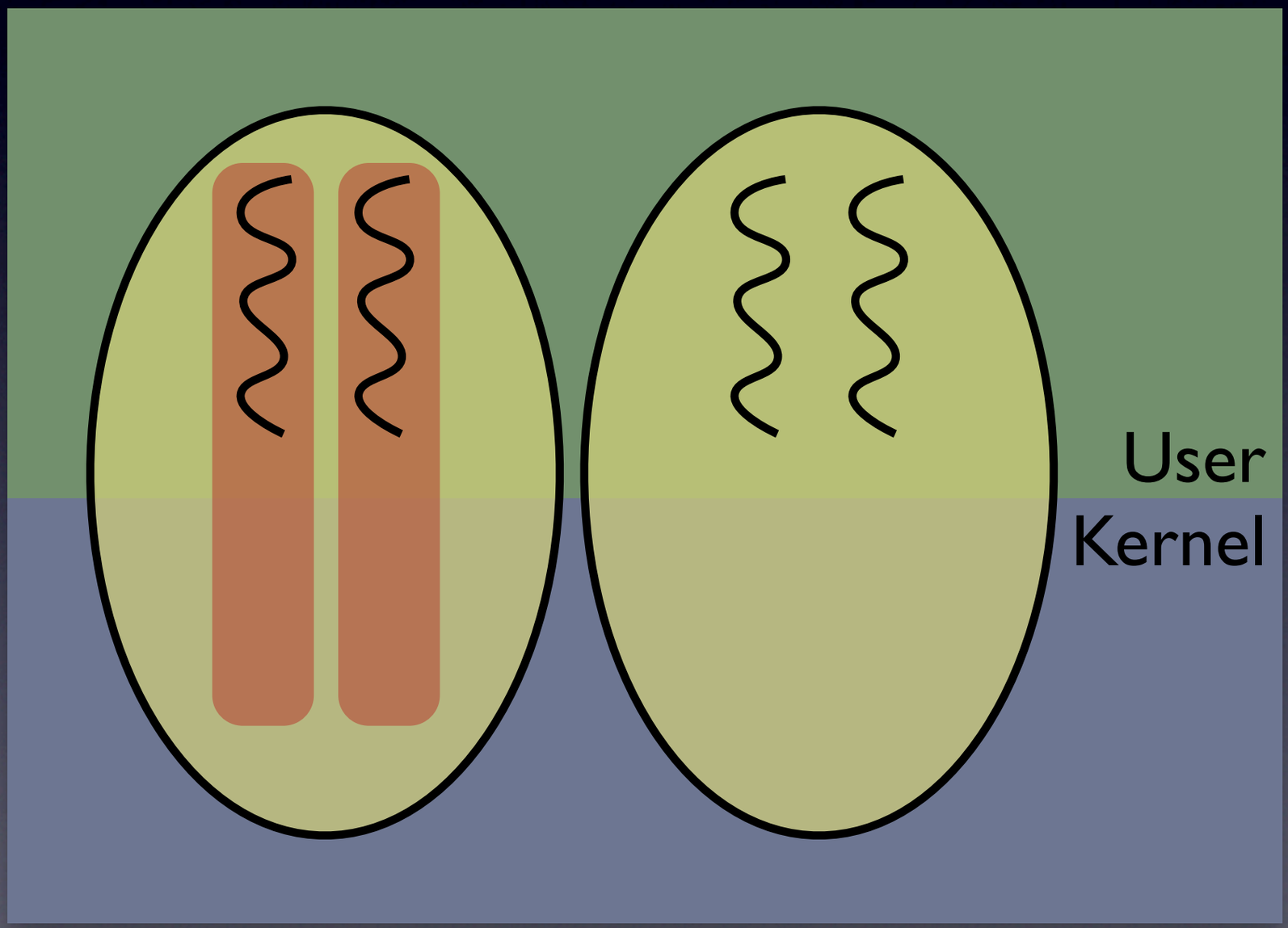

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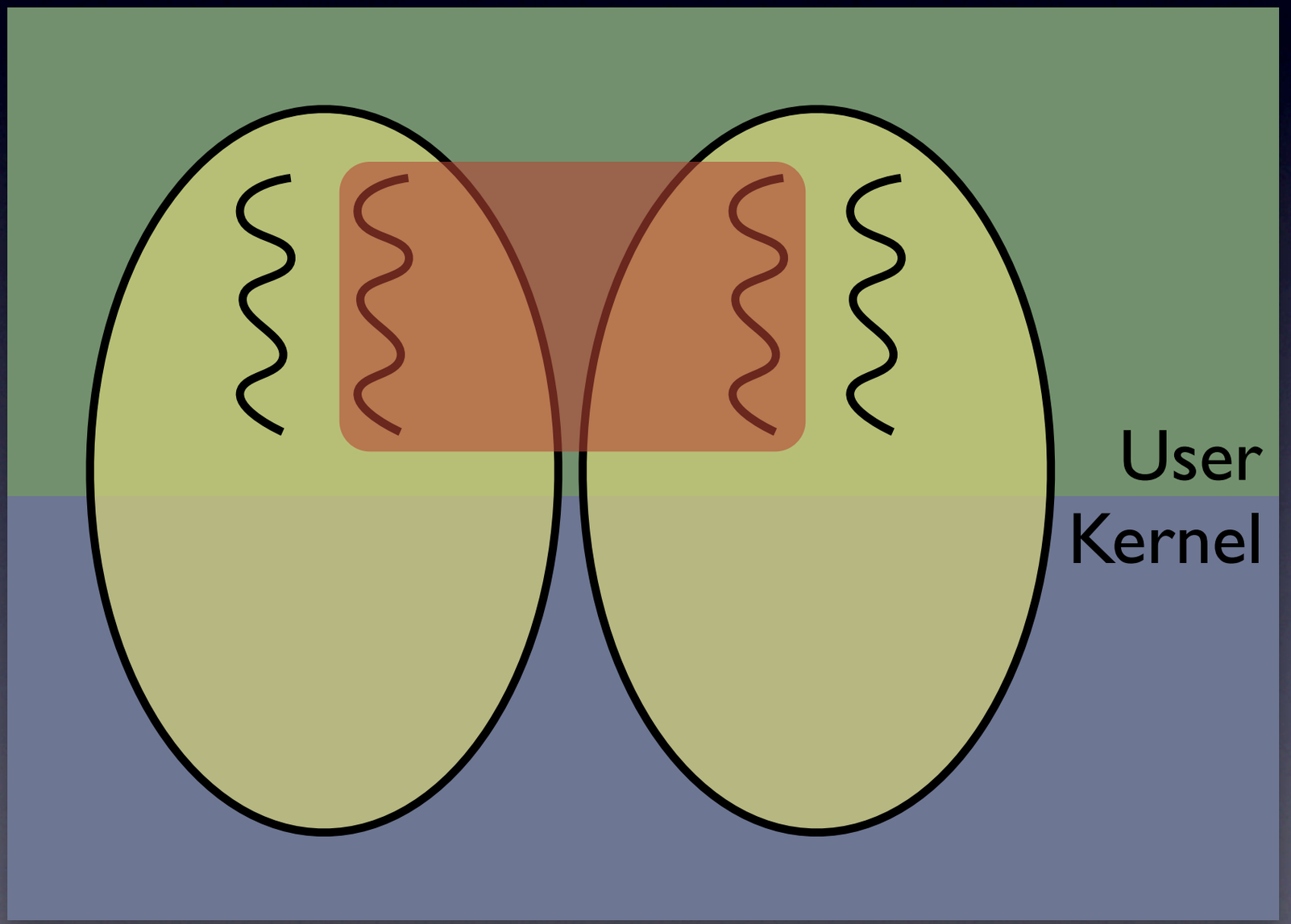

Dual Use of Processes

Process

Dual Use of Processes

Process

Protection Domain

Dual Use of Processes

Process

Protection Domain

Isolation

Dual Use of Processes

Process

Protection Domain

Resource Principal

Isolation

Dual Use of Processes

Process

Protection Domain

Isolation

Resource Principal

Accounting

Dual Use of Processes

Process	Resource Container
Protection Domain	Resource Principal
Isolation	Accounting

Resource Containers

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- abstract operating system entity

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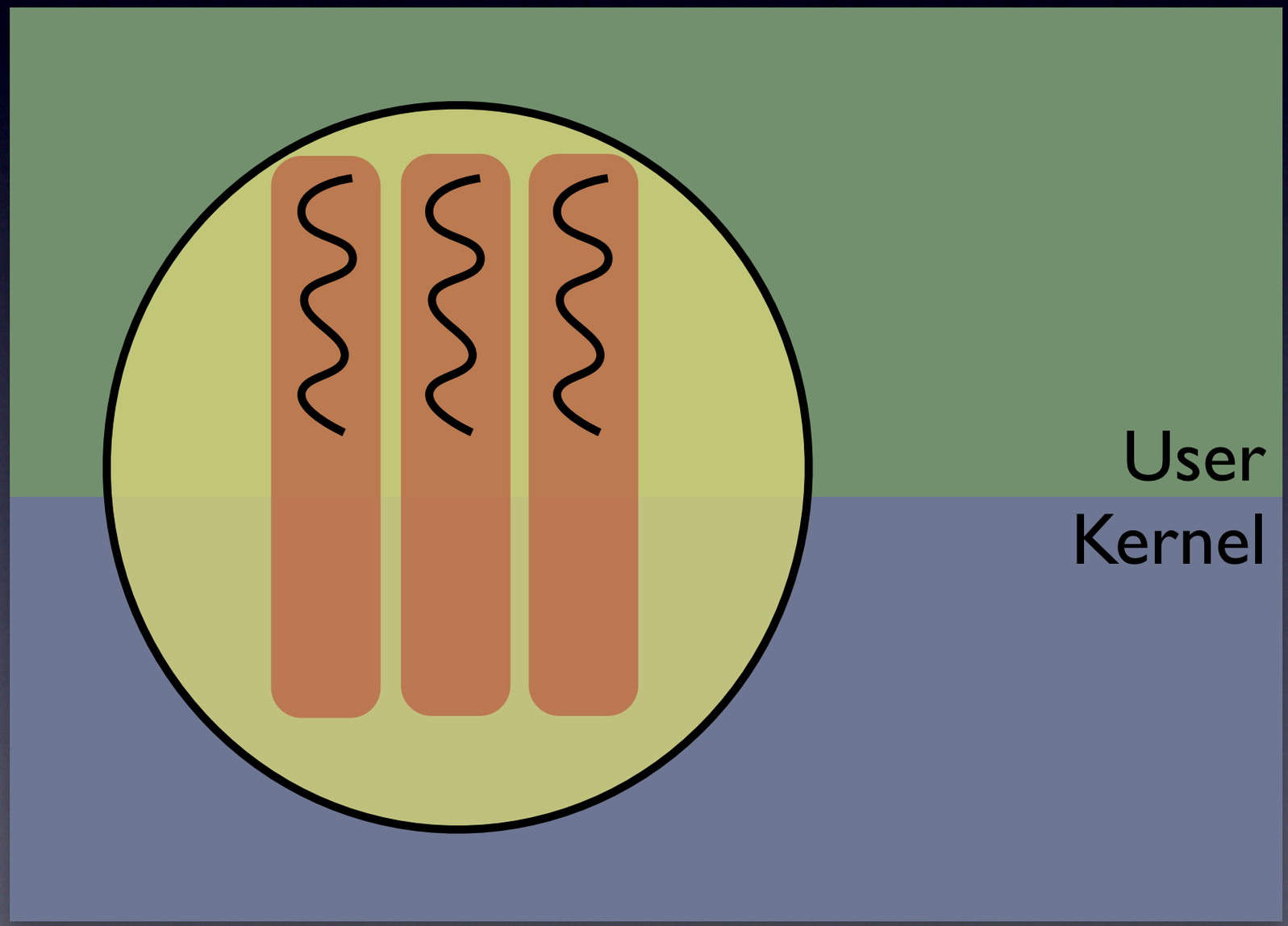
- arbitrary relationships between protection domains, threads, resource containers
- mechanism to be used with resource management policy
- form a hierarchy

Operations

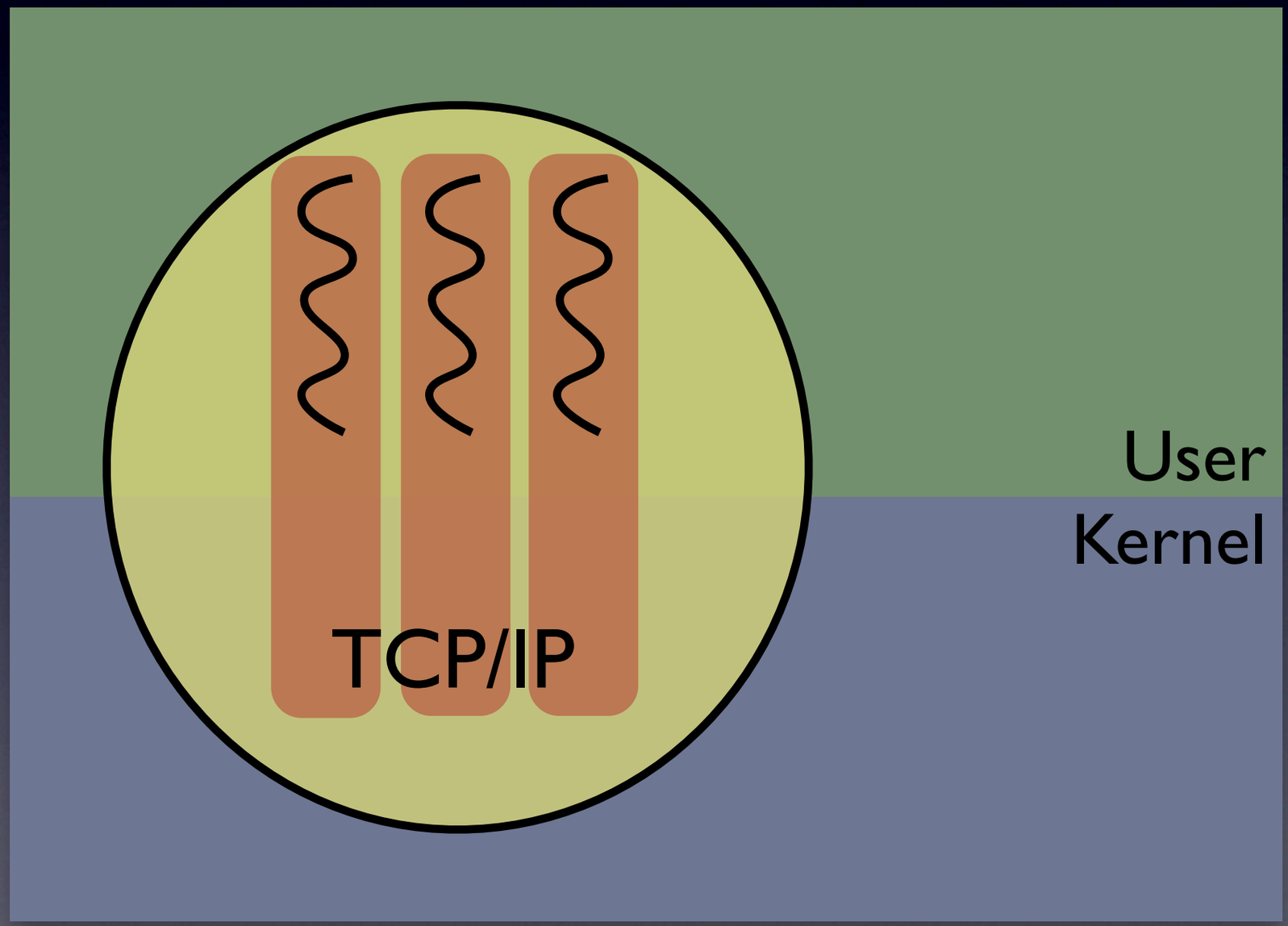
Operations

- creating a new container
- set a container‘s parent
- container release
- sharing containers between processes
- container attributes
- container usage information
- binding a thread to a container
- reset the scheduler binding
- binding a socket or a file to a container

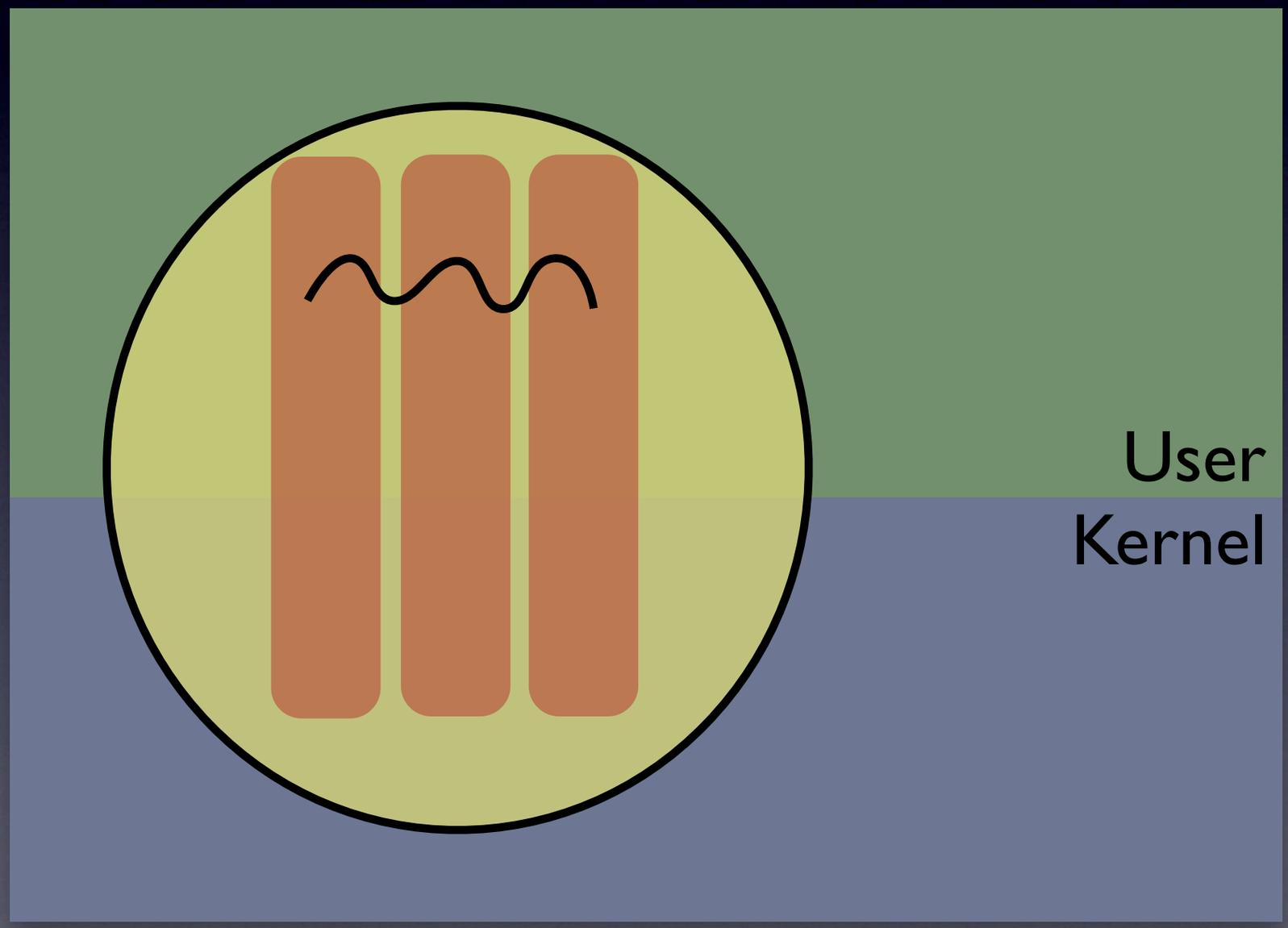
Multi-Threaded Server



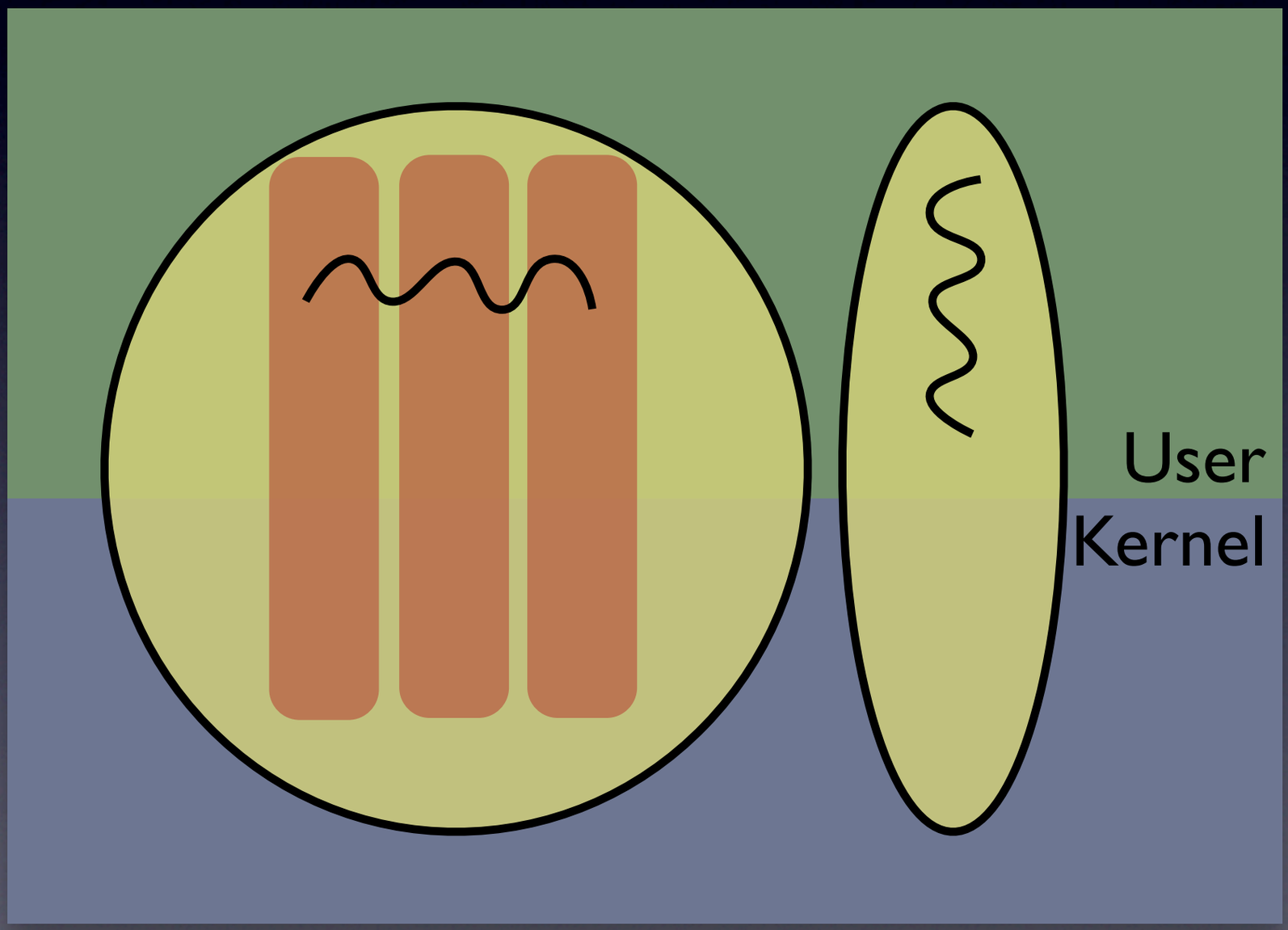
Multi-Threaded Server



Event-Driven Server



Event-Driven Server



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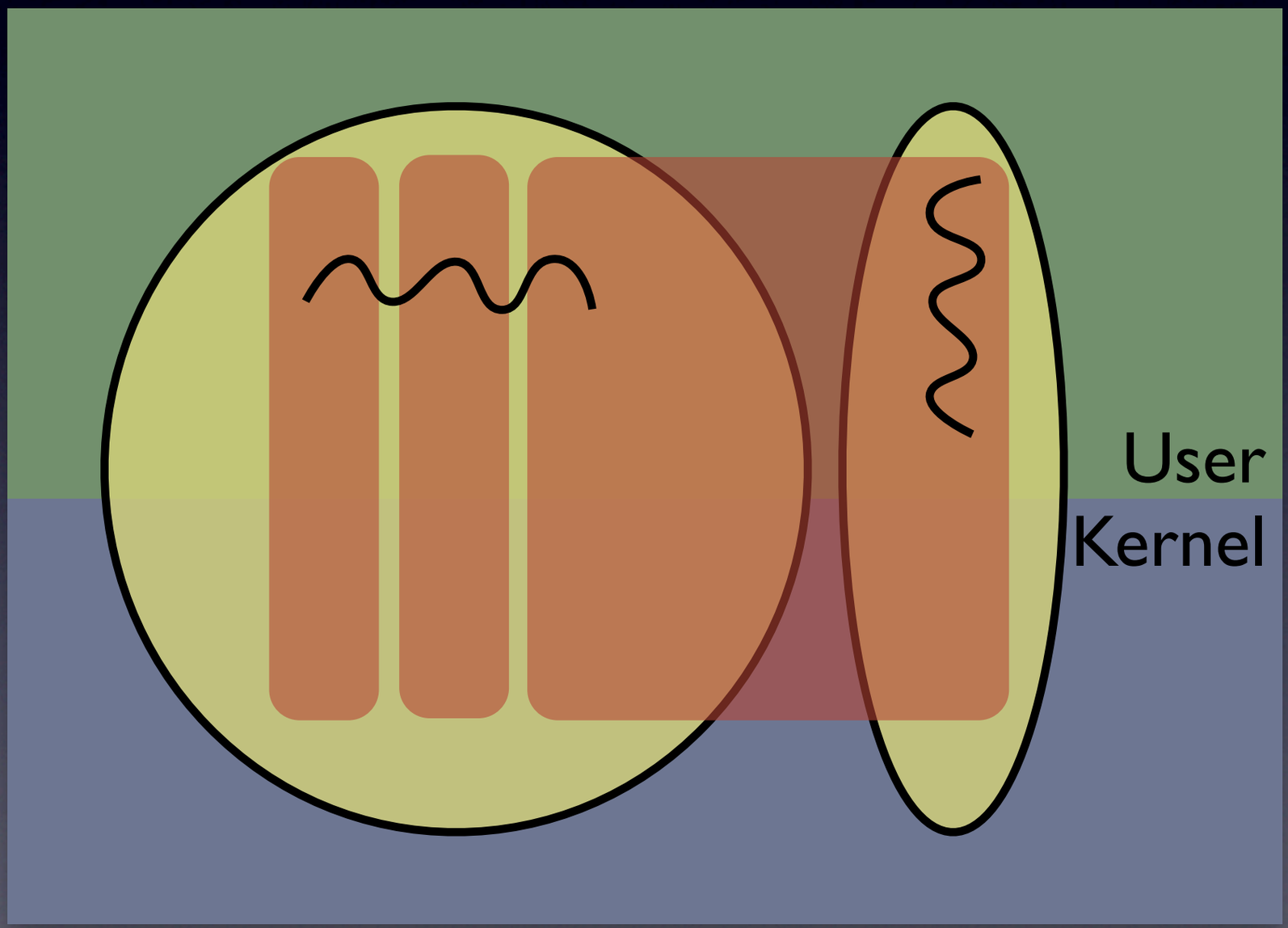
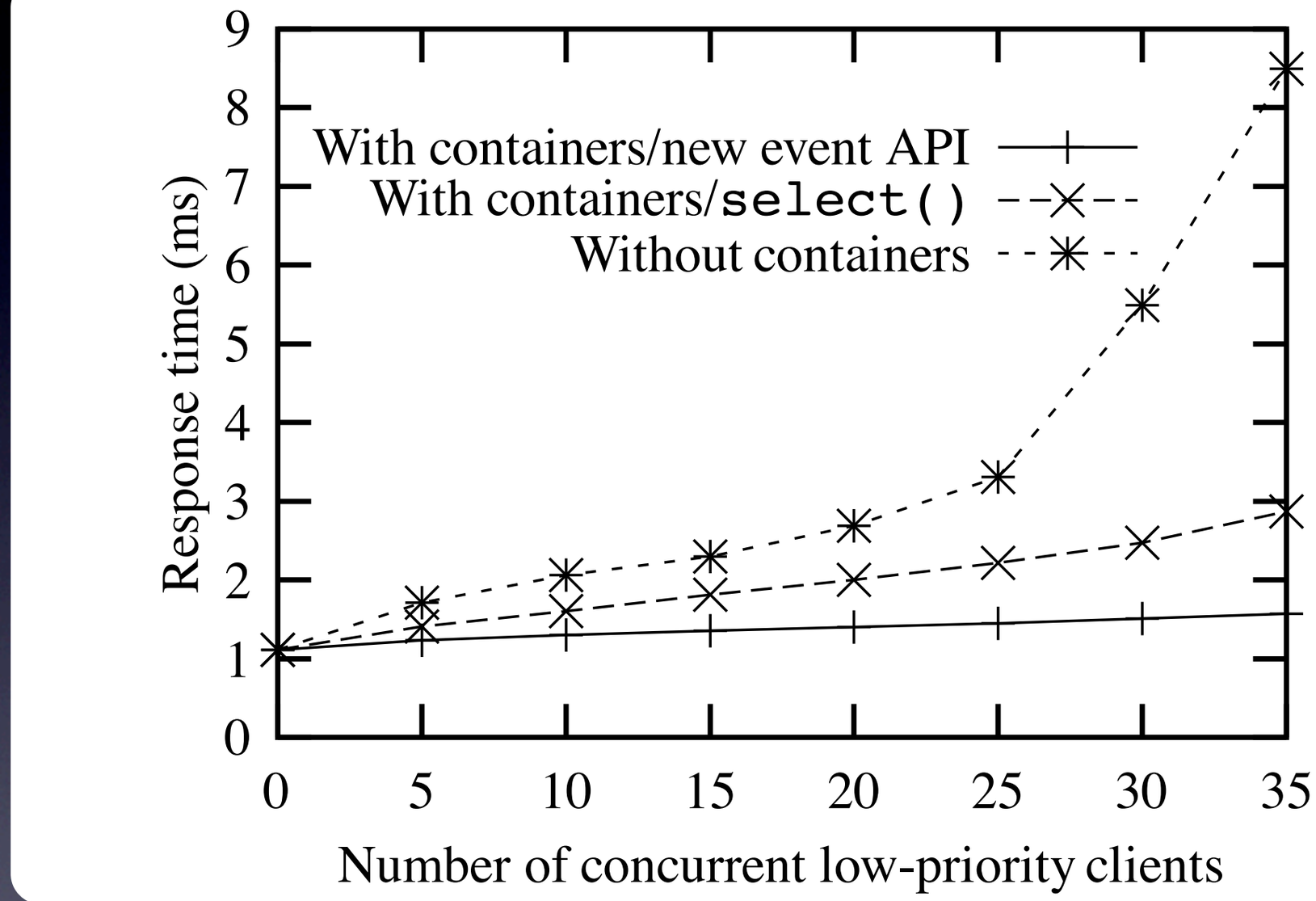
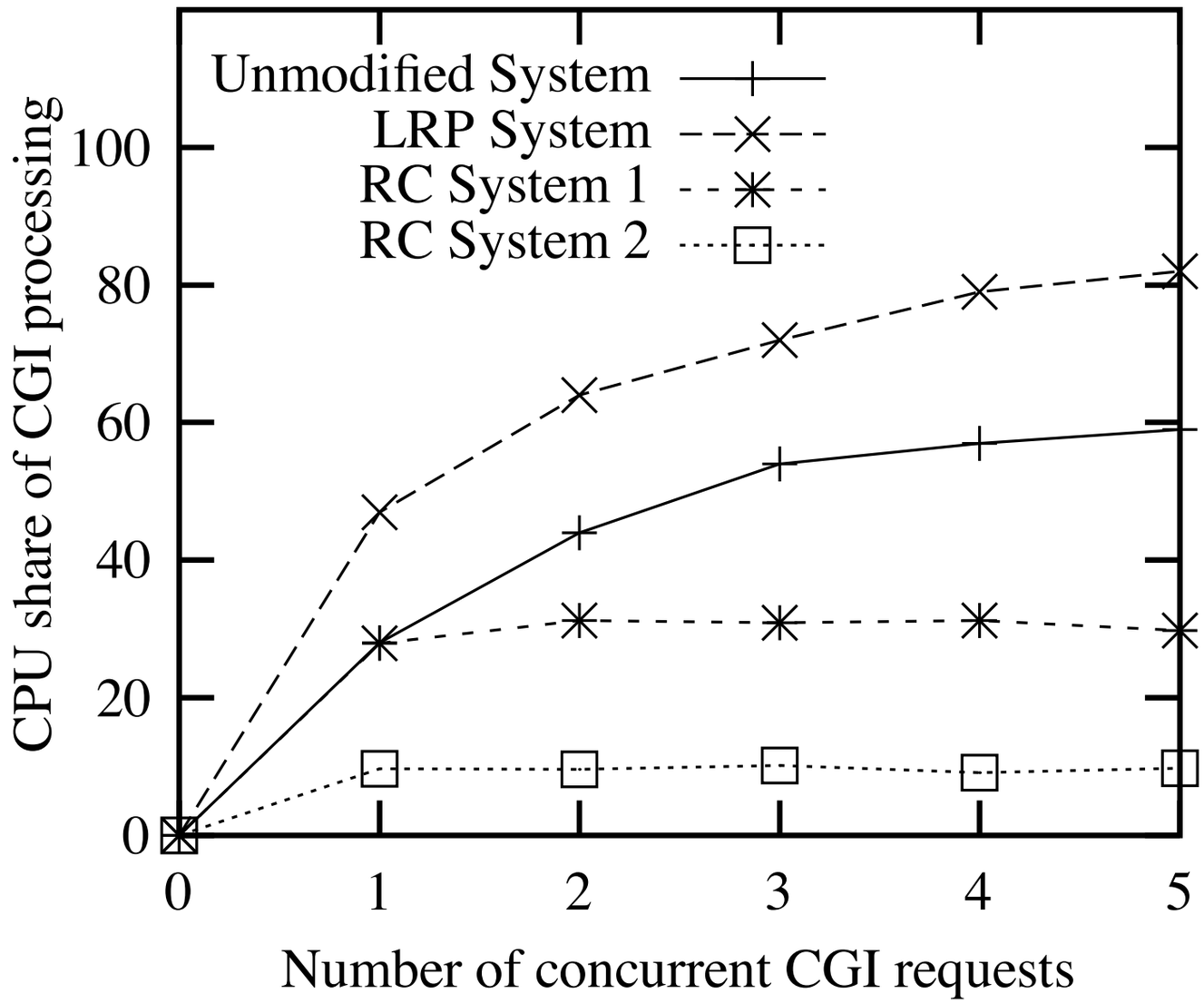
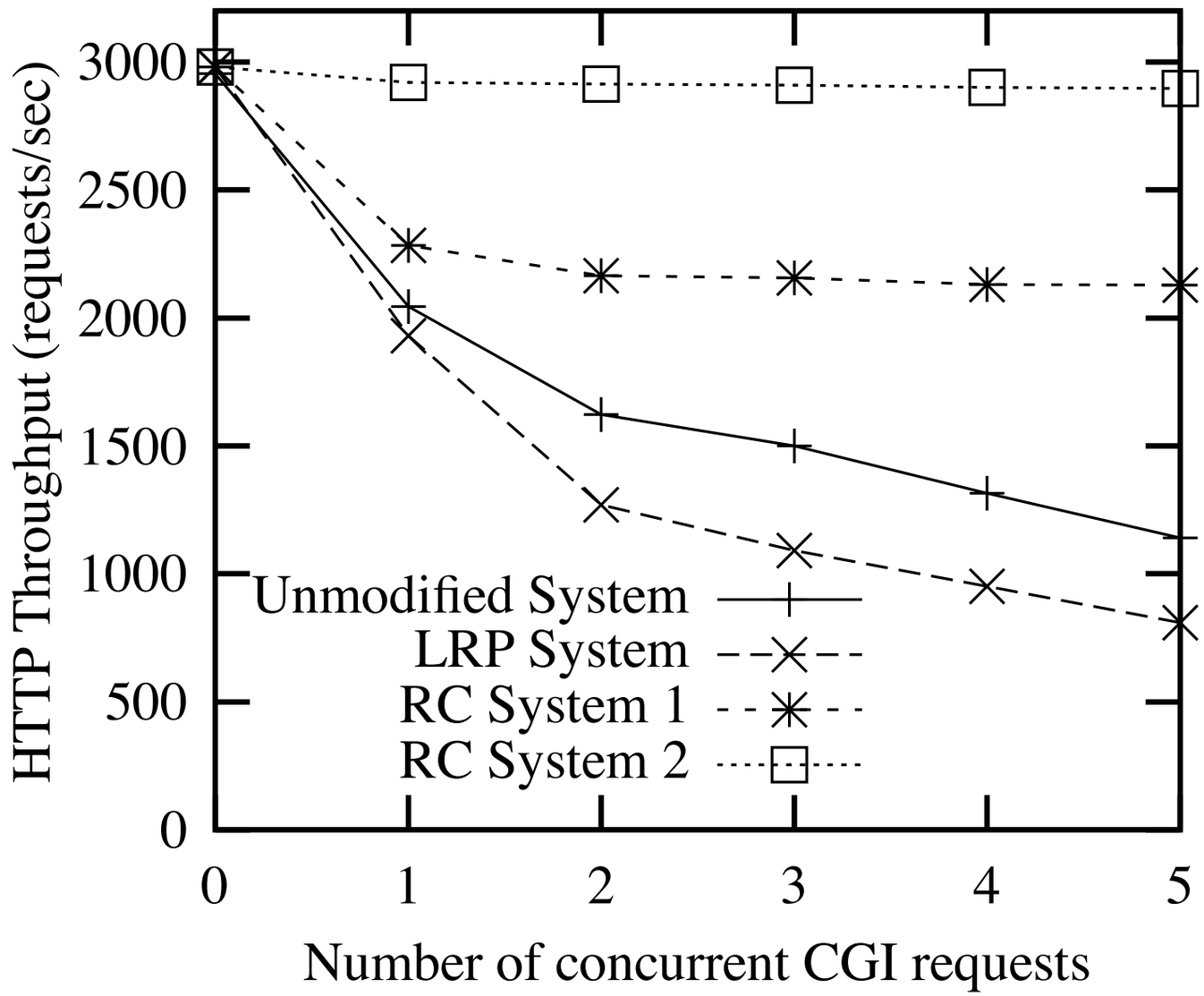
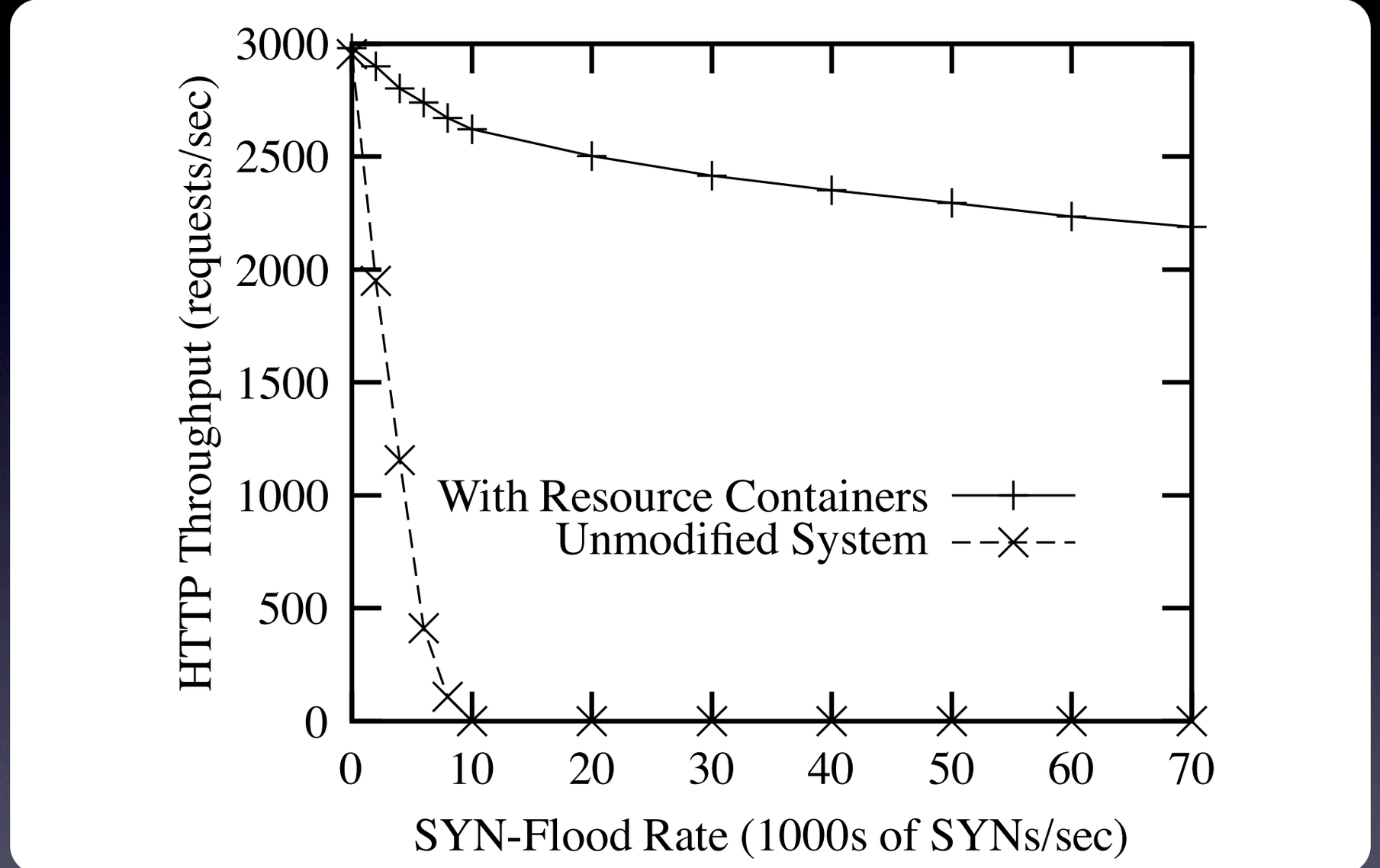



With containers/new event API
With containers/select()
Without containers
Response time (ms)
Number of concurrent low-priority clients
0
1
2
3
4
5
6
7
8
9
0
5
10
15
20
25
30
35


Unmodified System
LRP System
RC System 1
RC System 2
CPU share of CGI processing
0
20
40
60
80
100
0
1
2
3
4
5
Number of concurrent CGI requests


HTTP Throughput (requests/sec)
3000
2500
2000
1500
1000
500
0
0
1
2
3
4
5
Number of concurrent CGI requests
Unmodified System
LRP System
RC System 1
RC System 2


HTTP Throughput (requests/sec)
3000
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
SYN-Flood Rate (1000s of SYNs/sec)
With Resource Containers
Unmodified System

Discussion

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- Why can a container be reparented or even made parent-less?

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- How to account kernel resource consumption properly?

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- Why can a container be reparented or even made parent-less?
- How to account kernel resource consumption properly?
- Is the motivation for the problem still valid?