

CPU schedule

# Algorithms & metrics

- What are important metrics in CPU scheduling?
- What scheduling algorithms do you know?

# Fair Share Schedule

# Another metric: fair share

- How to make sure P1 gets exactly K-times the execution time of P2
- How to enforce the fair share in a dynamic and modular way
  - Adjustable at run time
  - Alice's decision shouldn't affect Bob's processes' behavior

# Naïve solutions

- Adjust the time slice length
  - Problem: can lead to unreasonable slice length
- Adjust the number of process instances in the ready queue
  - Problem: ...

# Lottery schedule

- Every process gets  $x$  lottery tickets
  - $X$  is determined by the “fair share”
- Scheduler runs lottery; the process holding the winning number runs
- Example

# Lottery schedule – ticket exchange rate

- Base tickets
- Regional tickets
- ➔ ensure dynamic and modular management
- Example

# Is lottery schedule perfect?

- No!
  - ...
  - ...



Before we move on ...

# Stride schedule

- Motivation
  - How to make lottery schedule deterministic?
- Algorithm
  - Every process has a stride and a start time
  - Every time a process is scheduled, it progresses its stride
  - The scheduler picks the least-progressed process to run
- Example

# Linux Complete Fair Scheduler

- Which process to run?
  - Similar with stride scheduling
  - “Nice” level decides the stride length
- What is the time slice?
  - Vary based on the number of ready processes, etc.
- An efficient scheduler is VERY important these days

# Resource Containers

# Background

- .com bubble
- Web!
- Dynamic web content

# Goal

- How to do accurate resource accounting

# The evolution of web server systems

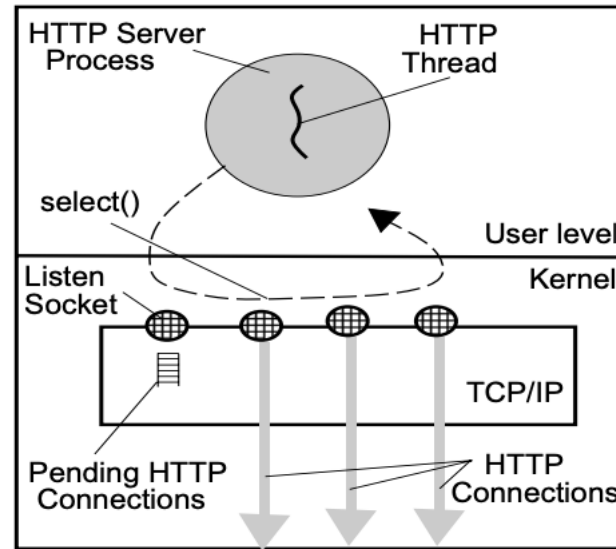
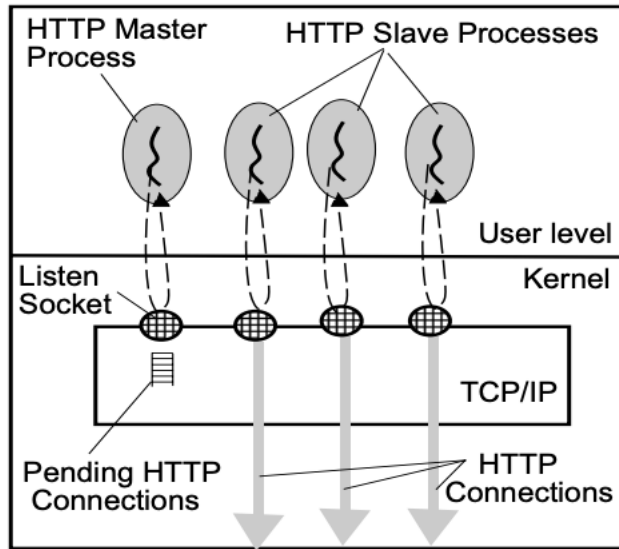


Fig. 2: A single-process event-driven server.

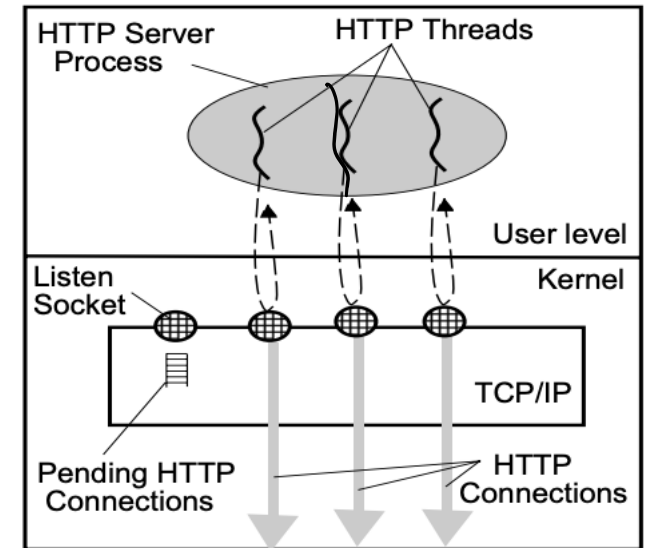
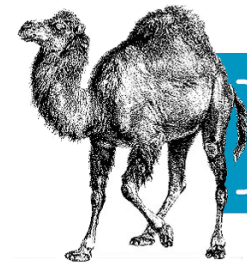


Fig. 3: A single-process multi-threaded server.



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# What should be the accounting unit?

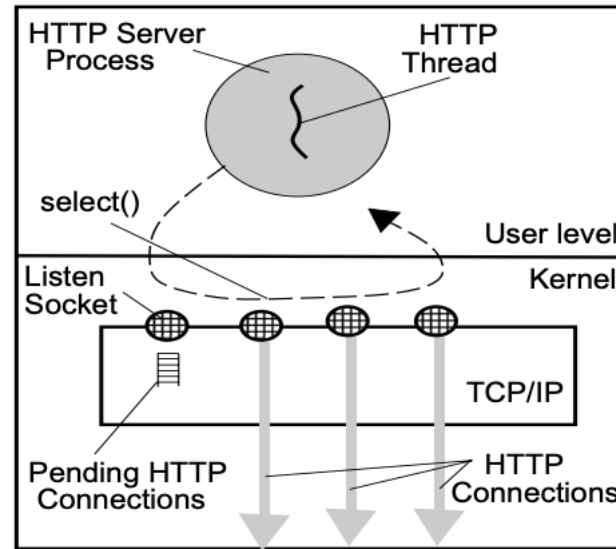
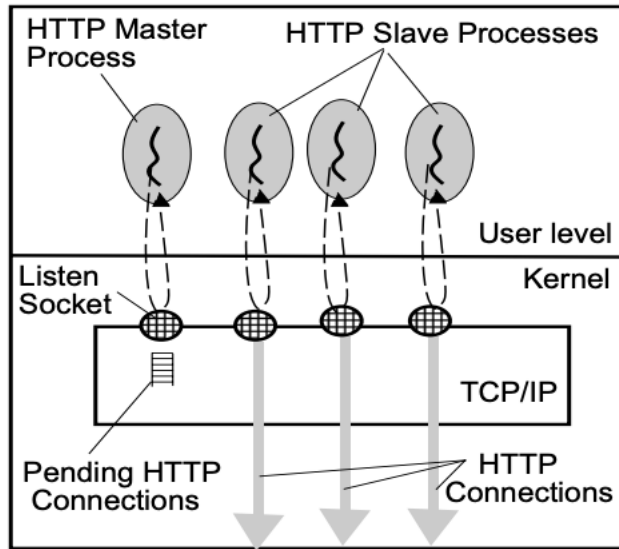


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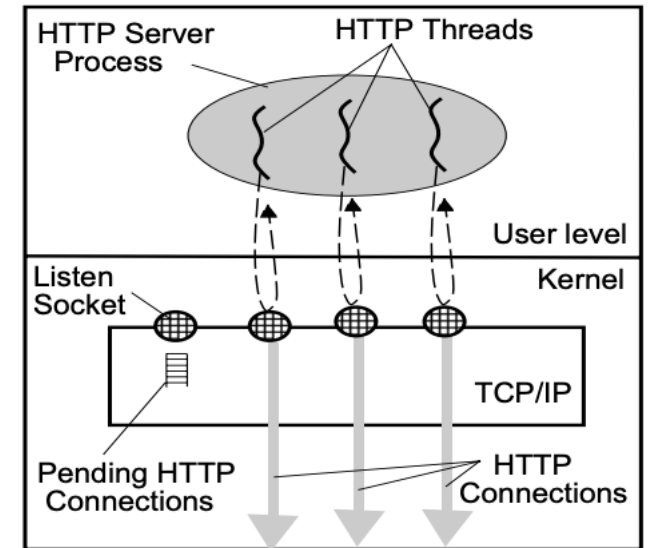
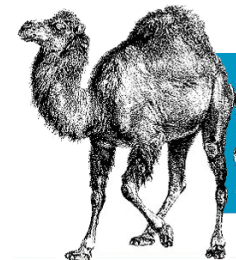


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