Welcome to CPS 210

- Graduate Level Operating Systems
  - *readings, discussions, and programming projects*
- Systems Quals course
  - *midterm and final exams*
- Gateway to systems research
  - *E-track term project*

Logistics

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- Programming projects in Linux -- practical hands-on experience with a “real” OS. Book describing kernel design.
- Readings from the literature -- research topics.
- Background: any undergraduate Introduction to OS textbook – Tanenbaum recommended
- Discussion, in class / collaboration, outside of class.

E- and G- Tracks

E-track project:

- Project of your choice
- Mini-conference during reading period.
- Milestones:
  - March 7 - 1 page proposal.

What is an OS?
Traditional Definitions

- ***Resource Manager*** of physical (HW) devices
  ...
- ***Abstract machine*** environment. The OS defines a set of logical resources (objects) and operations on those objects (an interface on the use of those objects).
- Allows ***sharing*** of resources. Controls interactions among different users.

What is an OS?
Traditional Definitions

- Birthplace of ***system design principles***: e.g., Separation of Policy and Mechanism.
- Supporting role - to provide services for the target workload, not an end product itself.
- Privileged, protected software - the ***kernel***. Different kind relationship between OS and user code (entry via system calls, interrupts).

What is an OS?
Traditional Definitions

- ***Resource Manager*** of physical (HW) devices

  …
  - CPU (computation cycles)
  - Primary memory
  - Secondary memory devices (disk, tapes)
  - Networks
  - Input devices (keyboard, mouse, camera)
  - Output devices (printers, display, speakers)

What is an OS?
Traditional Definitions

- ***Resource Manager*** of physical (HW) devices …
  - Working simultaneously (source of ||ism).
  - Shared among tasks.
  - Relative performance, capacity, & cost constantly changing.

What is an OS?
Traditional Definitions

- ***Resource Manager*** of physical (HW) devices ...
- ***Abstract machine*** environment…
  - Threads or Processes (Fork)
  - Address spaces (Allocate)
  - Files (Open, Close, Read, Write)
  - Messages (Send, Receive)

What is an OS?
Traditional Definitions

- ***Resource Manager*** of physical (HW) devices ...
- ***Abstract machine*** environment...
- Allows ***sharing*** of resources. Controls interactions among different users.

What is an OS?
Traditional Definitions

- Birthplace of ***system design principles***:
  - Separation of Policy and Mechanism.
  - End-to-end argument.
  - Need-to-know principle.
  - Cache it!

What is an OS? Traditional Definitions

- Birthplace of ***system design principles***…
- Supporting role - to provide services for the target workload, not an end product itself.
  - Implications on design (build for the common case of the workload as you know it)
  - Implications on performance evaluation
    - *Everything* the OS does is overhead.
    - Must have a good workload model.

What is an OS?
Traditional Definitions

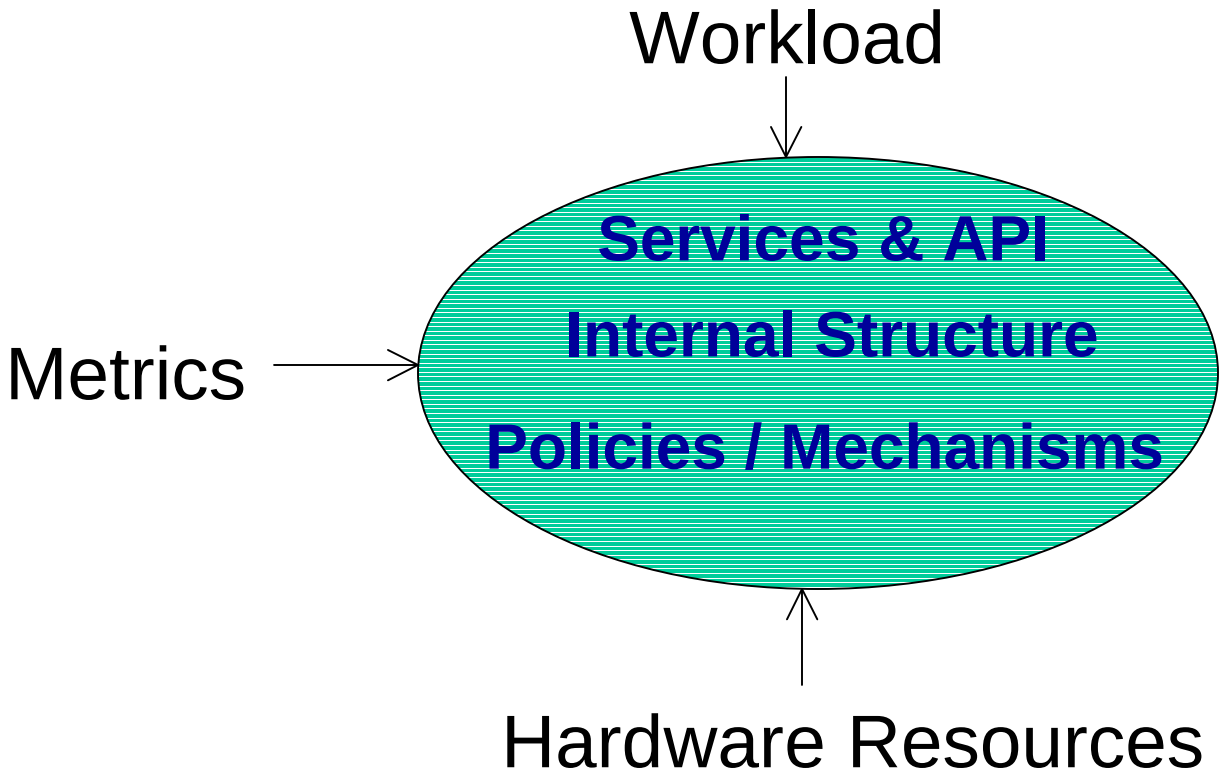
- Birthplace of ***system design principles…***
- Supporting role - to provide services for the target workload, not an end product itself.
- Privileged, protected software - the ***kernel***. Different kind relationship between OS and user code (entry via system calls, interrupts).
  - OS *structure* is always an issue

Trends

- Non-performance goals: *-abilities: adaptability, availability, reliability.
- Use of remote resources (harvesting cycles, memory, storage, etc).
- Growth areas: wide area (Internet), clusters, grid, multimedia, mobility, ubiquitous computing, embedded systems.
- Security!
- Challenges / opportunities of HW advances.

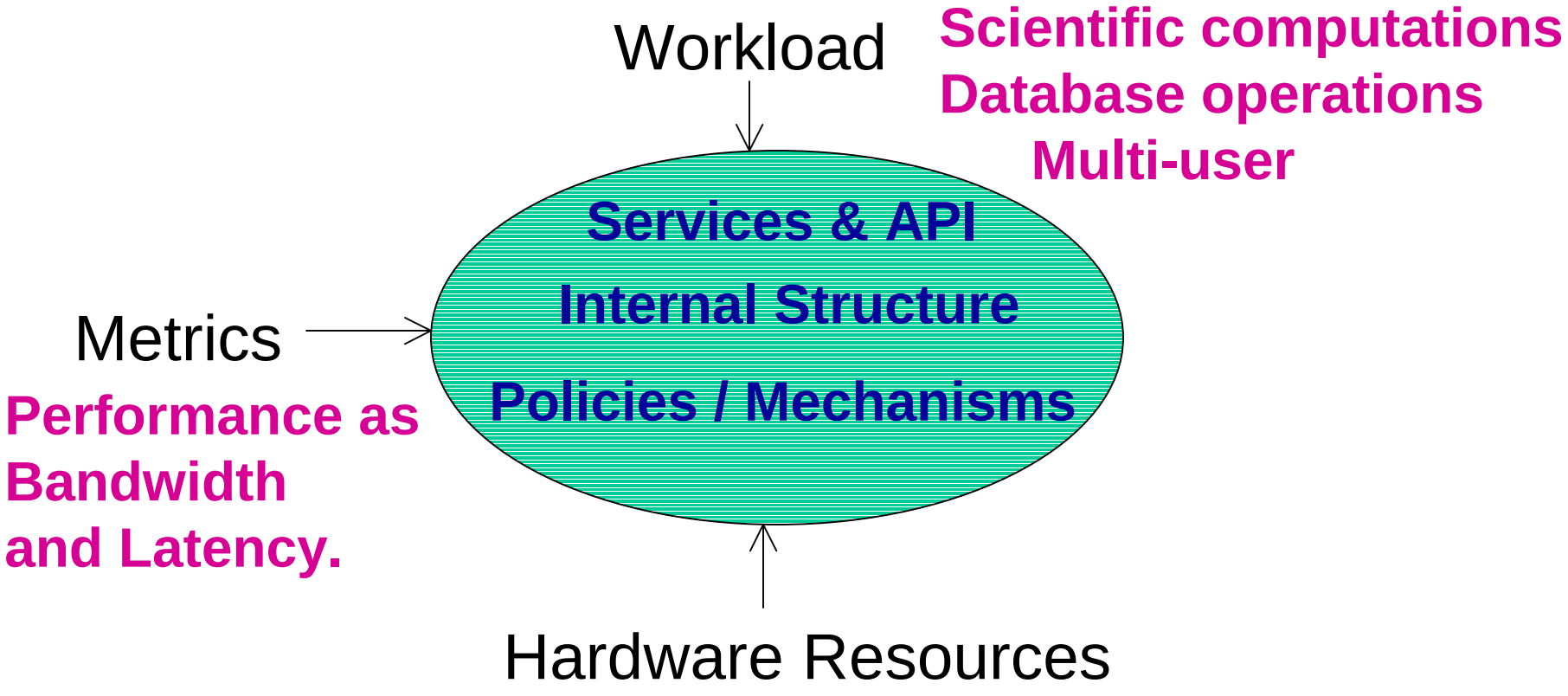
Traditional

Influences in OS Design

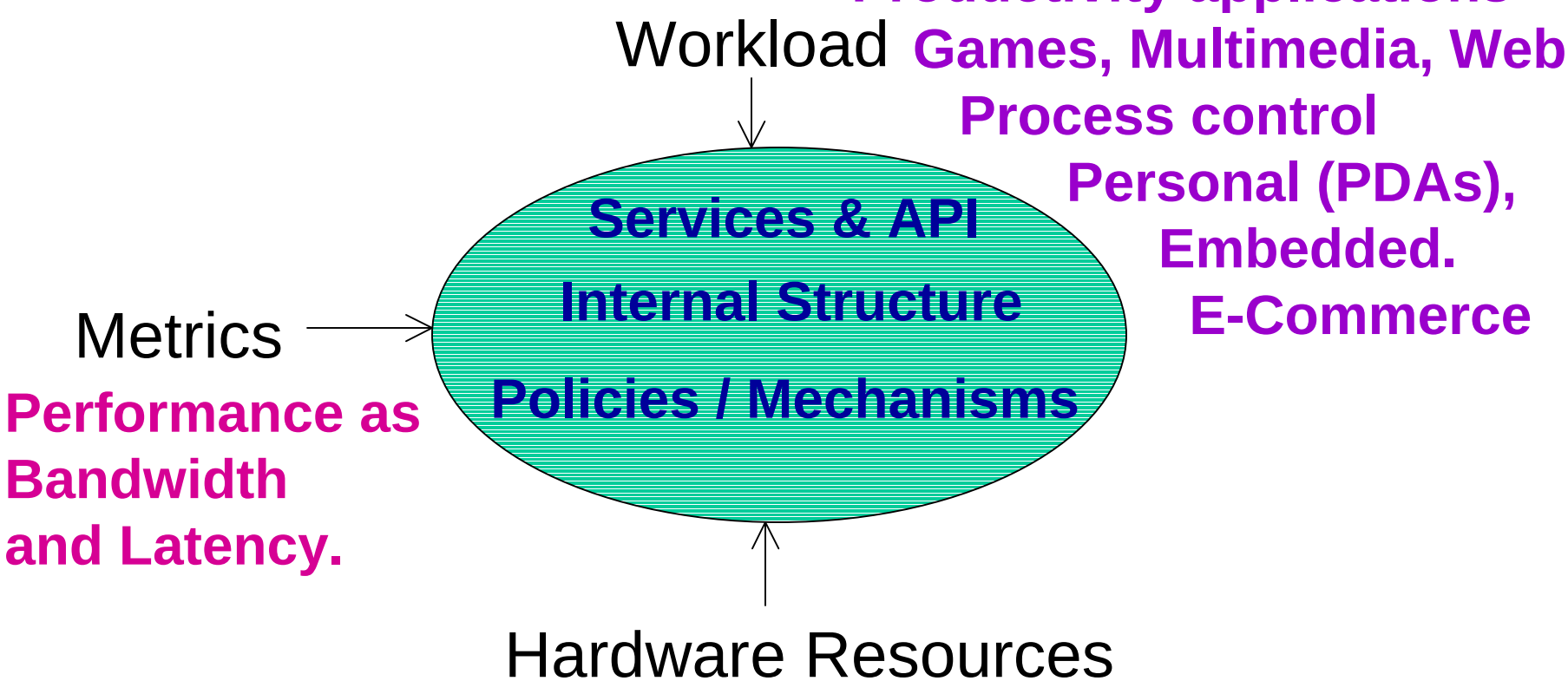


Traditional

Influences in OS Design



Changing Influences in OS Design



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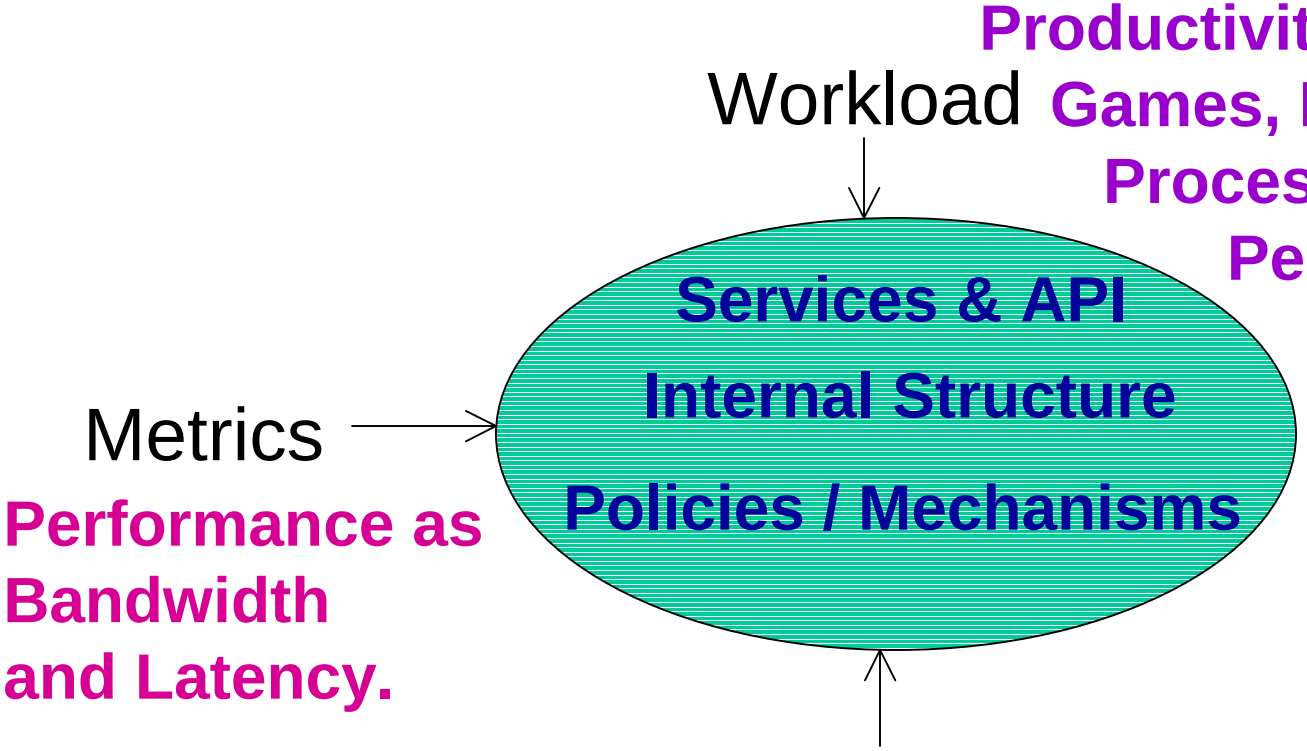

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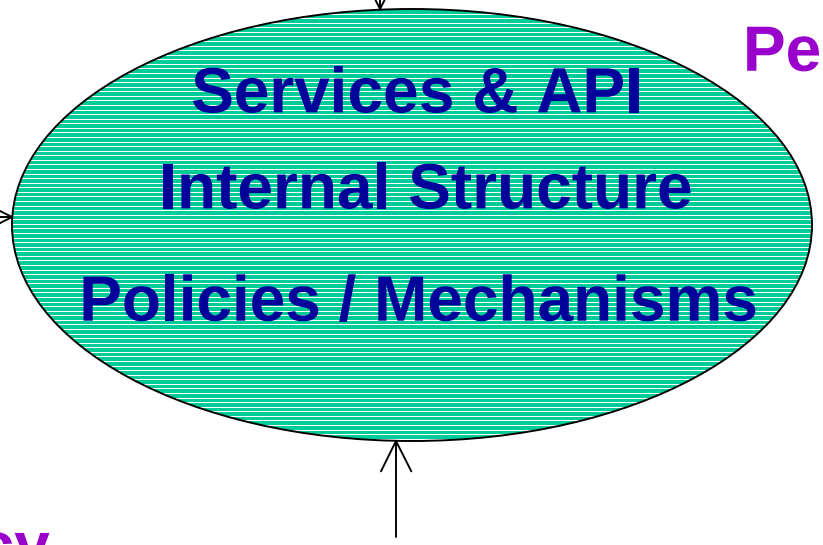

Workload

Productivity applications
Games, Multimedia, Web
Process control
Personal (PDAs),
Embedded
E-Commerce

Metrics

Accessibility,
Reliability,
No-futz-ness
Energy efficiency,
Security

Hardware Resources

Processor, Memory, Disks (?), Wireless & IR,
Keyboard(?), Display(?), Mic & Speaker,
Motors & Sensors, GPS, Camera, Batteries