

Lecture 1

What is an OS?

- Special layer of software that provides app software
- Referee
 - Manage protection, isolation, sharing of resources
 - OS *isolates* processes from each other, and from itself, even though it's running on the same HW!
 - Resource allocation and communication
- Illusionist
 - Provide clean, easy-to-use abstractions of physical resources
 - Infinite memory, dedicated machine
 - Higher-level objects: files, users, messages
 - Masking limitations, virtualization
- Glue
 - Common services
 - Storage, window system, network manager
 - Sharing, authorization
 - Look and feel
 - Everything that the linux ricers are trying to compete about

Why 162?

- Maybe I design OS
- Lots of changing trends in basic technologies
 - Moore's law is dead?
 - Specialized processors for improved compute (GPUs, NPUs, etc)
 - More cores as well
 - SSD's have began to have larger capacity, with inflection point ~2016
 - Largest 3.5-in SSD: 100TB @ \$40k

- Largest 3.5-in HDD: 24TB @ \$480
 - Cheaper (esp. per terabyte) but more powerful, less reliable
 - Largest 2.5-in SSD: 4TB @ \$180
- Network Capacity
 - I/O Bandwidth doubles every three years
 - Operating system becomes a bottleneck, as opposed to bandwidth
- People-to-computer ratio over time -- there are now multiple CPUs per person!
- High range of timescales. L1 cache reference is 0.5ns, while sending a packet CA->NL->CA is 150,000,000 ns.
- Also a lot of challenges, such as complexity
 - More range of purpose and range of interconnection between vastly different purposes
 - Specialized hardware is no longer enough for the demand. GPU and TPU are not scaling as fast as training data...
 - Servers to Pods