



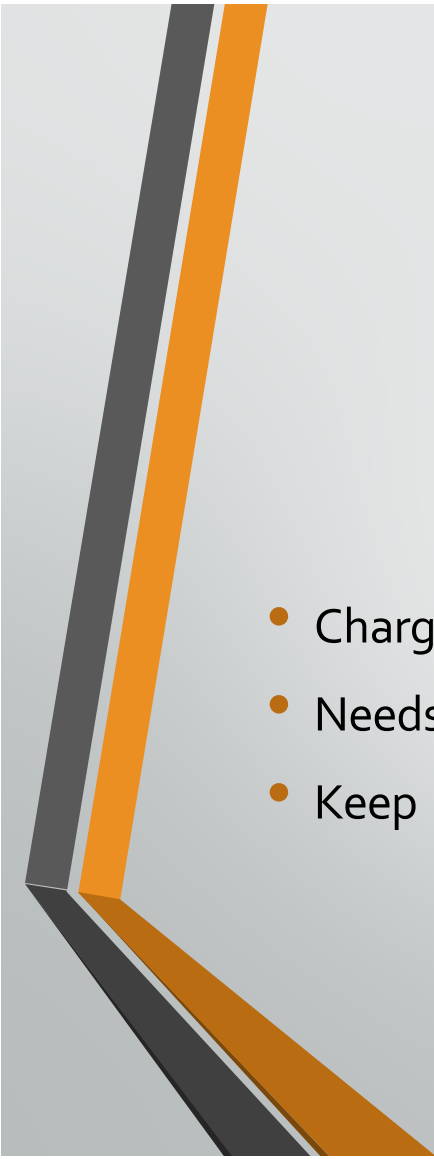
Systems Architecture

Cost Recovery

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Goals

- Charge rate/model for scientific computing clusters
- Needs to conform to the cluster expenses but meet accounting needs
- Keep it simple



WHY DO YOU CARE?



Constraints

- Cost recovery (sustainment) not profit
- Fully accountable to customers and tax-payers
- First year so no historical data
- Fiscal year boundaries
- No research funding augmentation
- Not driven by marketing but must be marketable



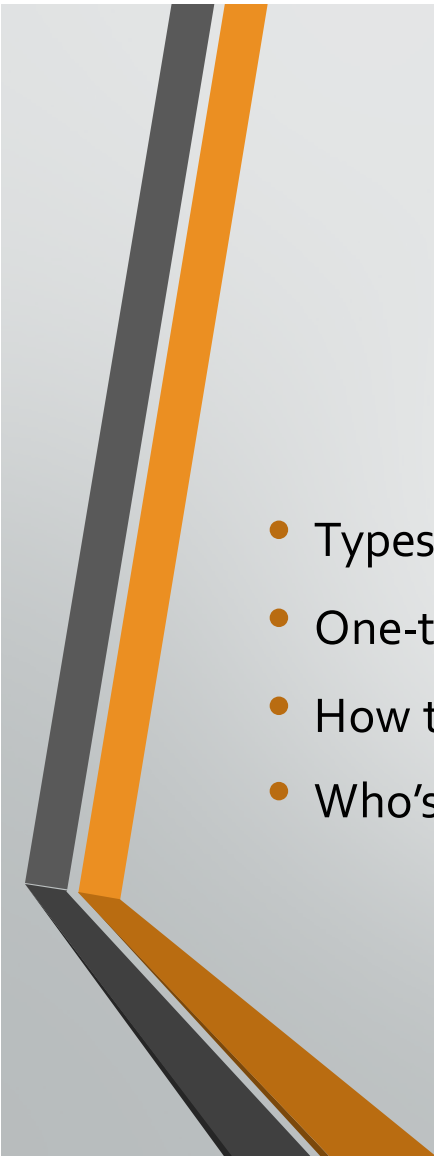
The Systems

- **Clusters from one blade to hundreds**
- Institutional/overhead investment:
 - Network
 - Core services (auth, OS mgmt, software licensing, config mgmt, etc)
 - Network
 - Storage (Infra and high-performance)



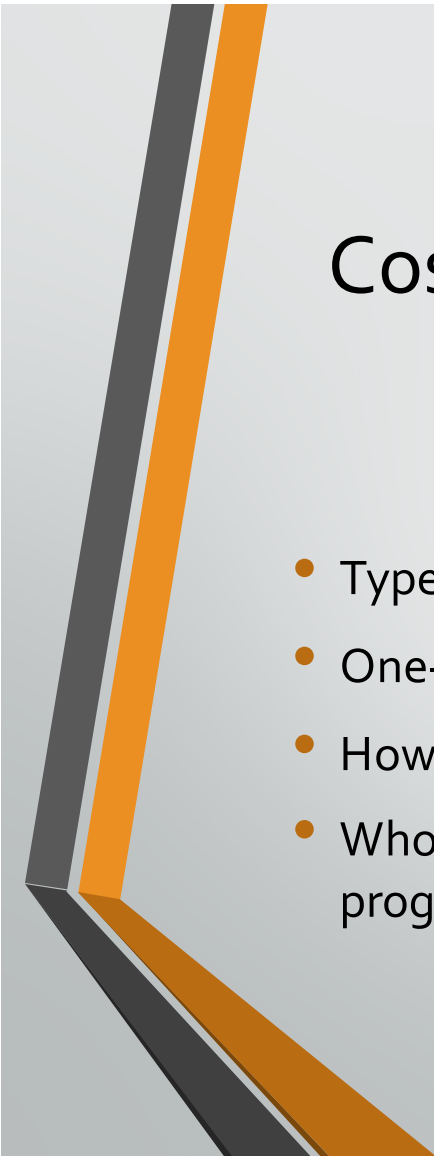
JUST COST RECOVERY?

SWEET, THIS WILL BE EASY



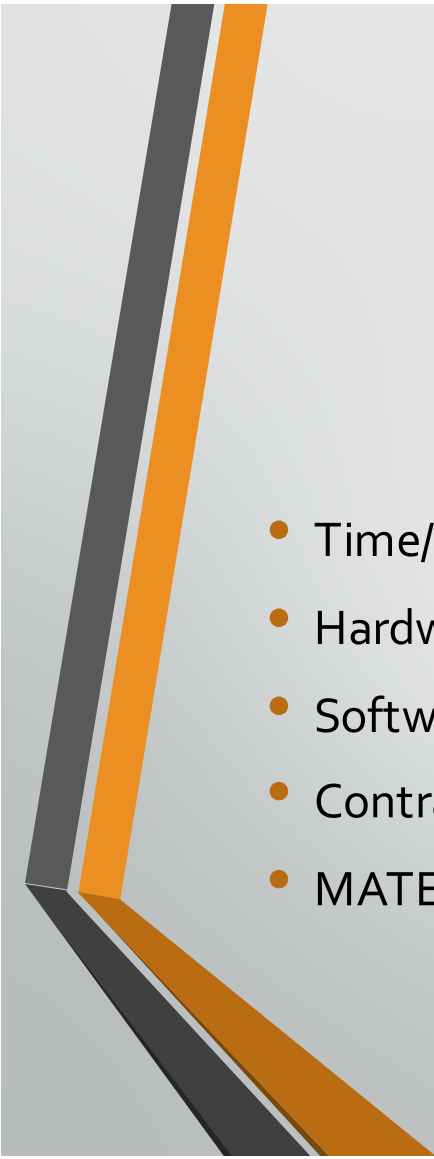
Factors

- Types of expenses
- One-time vs recurring expenses
- How the expense scales
- Who's paying (overhead, internal program, or external customer)



Cost Architecture and Systems Architecture

- Types of expenses
 - One-time vs recurring expenses
 - How the expense scales
 - Who's paying (overhead, internal program, or external customer)
- Types of compute workload/data
 - Single, recurring, or daemon
 - How the workload/data scales
 - Context/memory/namespace: kernel, user space, or remote



Types of Expense

- Time/labor
- Hardware (Materials)
- Software (Materials)
- Contract labor (Materials)
- MATERIALS



Expense Periodicity

- Upfront
- Annual
- Daily/weekly/monthly



Expense Periodicity

- Upfront: Hardware/software purchases (CAP EX)
- Annual: Annual support/maintenance or leases (OP EX)
- Daily/weekly/monthly: Ongoing support (OP EX)



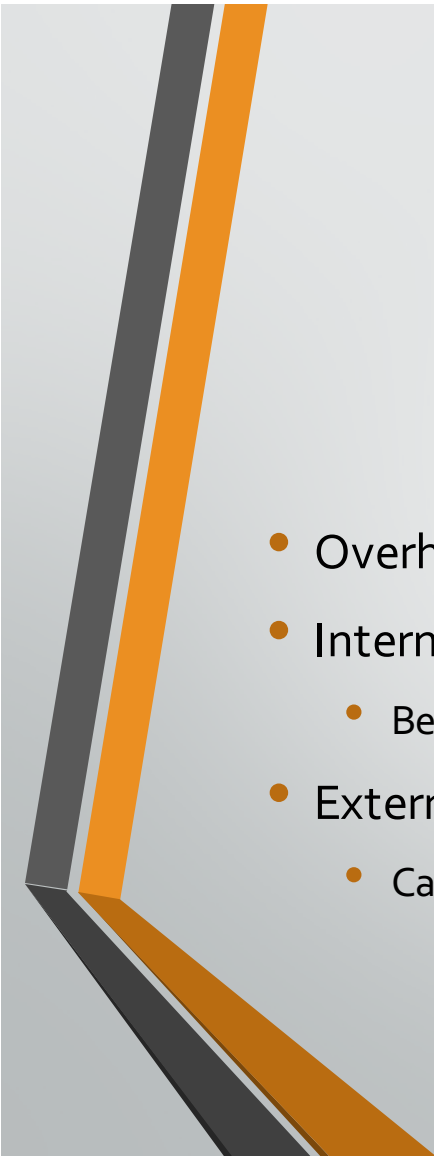
Expense scaling

- Flat
- Linear
- Power law
- Step
- Geometric
- Exponential
- Logarithmic
- Horseshoe



Ways to Pay

- Time and materials
- Fixed rate
- Mix



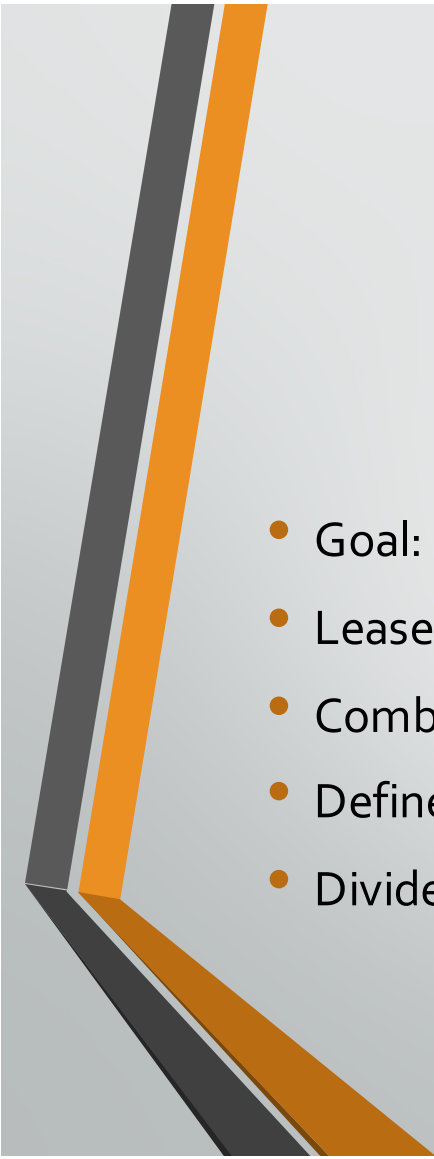
Funding Source

- Overhead: Services for everyone internal
- Internal research programs:
 - Benefits from overhead services
- External funding:
 - Cannot benefit from overhead services



The Systems

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Alpaca One

- Goal: Keep costs low and consistent across several years
- Lease hardware
- Combine labor and hardware into a single rate
- Define monthly rate for labor based on one FTE spread across all clusters
- Divide labor cost across all cluster owners by percentage



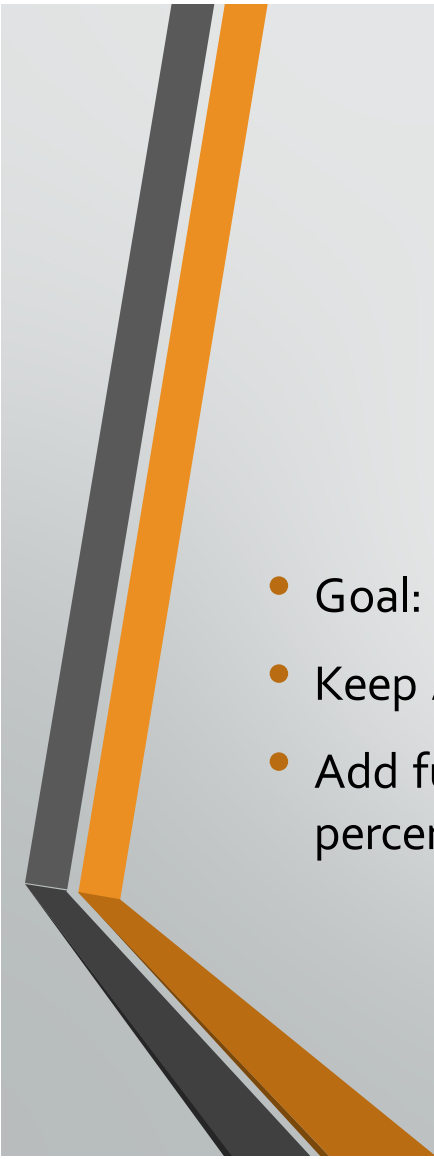
Alpaca Two

- Goal: Respect fiscal year boundaries and have all labor costs captured in rates
- Buy hardware with year-end funds
- Separate labor rate containing both initial deployment and ongoing mgmt



Alpaca Three

- Goal: Respect fiscal year boundaries, acknowledge upfront labor costs, and have ongoing labor costs captured in rates
- Buy hardware with year-end funds
- T&M for installation labor
- Fixed rate for ongoing labor costs
- Base per-node mgmt rate: recovery for one FTE spread proportionally across all customers
- Additional customers pay proportional base-rate (icing to be reinvested)



Alpaca Four

- Goal: Accommodate for both internal and external customers
- Keep Alpaca Three
- Add full cost recovery for institutional investment divided by estimated percentage usage



Discussion

Thanks!

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