Power Consumption in Enterprise-Scale Backup Storage Systems

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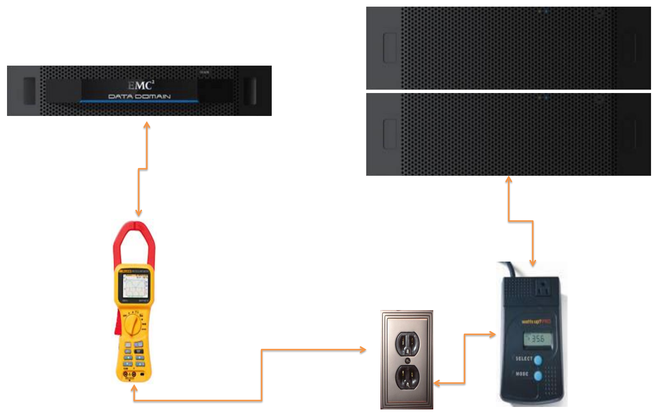
Motivation

- In need of storage-specific empirical power study
- Existing power management work relies on:
  - Anecdotal assumptions
  - Manufacturer data sheets
- Backup primed for power management

We did an empirical power study on backup systems

Methodology

Setup



Read idle/active controller and enclosure power draw

Controllers

	DD880	DD670	DD860	DDTBD
Ship	2009	2010	2011	Future
CPU	X7350	E5504	E5504	E7-4870
# CPUs	2	1	2	4
RAM	64GB	16GB	72GB	256GB
# Disks	4	7	4	4

Enclosures

	ES20	ES30
Ship Date	2006	2011
#Disks	16	15

Backup Workloads

	WL-A	WL-B	WL-C
Protocol	NFS	OST	BOOST
Chunking	Server	Server	Client

Disk Spin-Down is Not Good Enough

- Controllers constitute a large fraction of system power consumption
  - DDTDB consumes same as 100 2 TB hard drives
- Disk power-down may result in more savings than spin-down
- Enclosure may draw more power than the drives it houses

Need ways to save power in both the controller and enclosure

Newer is More Power Efficient

- Idle controller power varies by H/W spec and age
  - DD860 has a H/W profile as DD880 and consumes less power
- Idle enclosure power consumption varies
  - ES20 enclosure consumes more power than the newer ES30
  - ES20 is less sensitive to disk power down than ES30

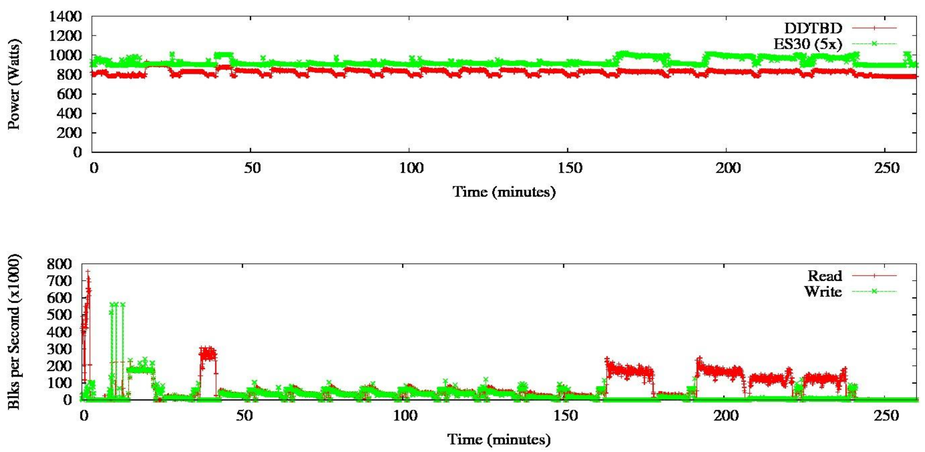
Retiring old hardware may result in lower power consumption

Not Power Proportional

- Active power consumption is not significantly higher than idle
  - 15-22% for enclosures under heavy load
  - 20-61% higher for controllers
- It takes a lot of powered-down drives to save a significant amount
  - DDTBD/ES30 75% of drives powered down to save 50%

Need additional power-saving techniques for idle systems

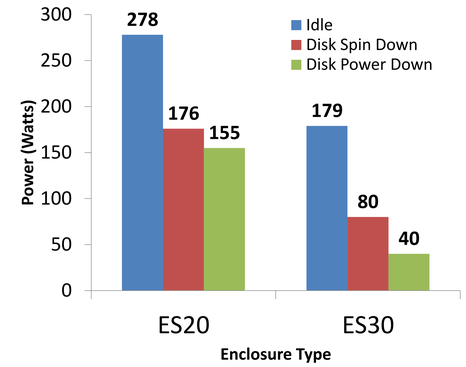
Power Consumption: NFS Backup Load



Controller Power Consumption

	DD880	DD670	DD860	DDTBD
Idle (W)	555	225	261	778
Cap (TB)	192	76	192	1152
Norm (W/TB)	2.89	2.96	1.35	0.675

Enclosure Power Consumption



	ES20	ES30
Max Power (W)	340	205

Power Increase During Workload

	DD880	DD670	DD860	DDTBD
WL-A	44%	24%	58%	20%
WL-B	58%	29%	61%	36%
WL-C	56%	28%	57%	23%

System-Wide Power-Down Savings