Power Usage Calculations

Formula

power = voltage * (average of power per phase) * sqrt(3) * power factor

Where

- *power* is in watts
- *voltage* = 208 volts
- *average of power per phase* taken from readings on PDU
- *sqrt(3)* is approximately 1.732
- *power factor* (PF) varies in servers depending on load and model. A Dell R620 at 10% load has a power factor of 0.71, while the same machine at 100% load has a power factor of 0.99. Thus, this machine with 750 Watt power supply, when running at 75 watts actually uses less power than you would expect.

Example

Two circuits running 208 volts. Take readings from the first PDU; it will generally show three numbers, one after the other (one for each phase). Readings on one circuit shows 5, 6, 4, the other shows 7, 5, 6. Therefor, average on one PDU is 5 (5+6+4) and on the other is 6 (7+5+6). Plug these numbers into the above formula, using a power factor of 1 (0.99, worst case scenario).

Circuit A = 208*5*1.732*1 = 1801.28 watts Circuit B = 208*6*1.732*1 = 2161.536 watts

Total Power = 2161.536+1801.28 = 3962.816 watts

Simplified Example (results in amps)

If you want the current and are reading the current directly, the voltage does not matter. The formula simplifies to

current = (average current) * 1.732 * power factor

In the above example, we end up with

Total Current = 3962.816/208 = 19.052 amps

Or, just change the formula by leaving out the voltage:

Circuit A = 5*1.732 = 8.66 amps Circuit B = 6*1.732 = 10.392 amps

Total = 19.052 amp

Resources

- http://www.datacenterjournal.com/server-power-factor-thoughts-on-bridging-it-facilities-conversations/
- http://myelectrical.com/notes/entryid/8/three-phase-power-simple-calculations

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