SUPERMICRO®

# Data Center Power Savings with Supermicro


## Summary

This white paper presents a straightforward approach, to calculate TCO or Total Cost of Ownership, that will enable C-level executives to assess the true total costs of building, owning, and operating their data center physical facilities. Measurements show that the Supermicro FatTwin™ can save up to 38 watts per node over purpose-built competitive systems. The Data Center TCO model developed here demonstrates that the FatTwin™ can save up to $5.7 million in data center TCO over 4 years for a large deployment of 10K servers in this study.


## Introduction

By reducing server electric power, then the power and cooling infrastructure within the Data Center can also be reduced, leading to a multiplier effect of lower total electric power and capital costs. The simple model presented here quantifies the savings from a reduction of one watt in server power over a 4-year period, which can then be scaled quickly and easily to any size server installation. Figure 1 below outlines the key power consuming equipment used in data centers.

**Data Center Support Infrastructure (Power Usage = X watts)**

- Power Distribution
  - Switchgear
  - UPS
  - PDUs
  - Remote Power Plugs
- Mechanical Systems
  - Computer Room Air Handlers
  - Computer Room Air Conditioners
  - Cooling Water Pumps
  - Air Moving Equipment
  - Chillers

**Data Center IT Equipment (Power Usage = Y watts)**

- Servers
- Storage
- Networking
- Racks

**Ancillary Spaces** (Power Consumption not counted in PUE or TCO)

- Offices
- Lobby
- Restrooms

***Figure 1: Data Center Power Consumers***

## TCO Model

### - Operating Expense (OPEX) per Watt

For Data Centers, OPEX includes expenditures incurred as a result of normal business operations such as electricity, maintenance, staff, and security. The PUE term in the OPEX model below follows the industry convention that for every watt of server power that is saved, a corresponding amount of infrastructure power is also conserved. Assumptions: server lifetime is 4 years, the cost of commercial electric power is $0.10 per kilowatt-hour*, and PUE† is 1.5.

**OPEX Expense per Watt** = **# Hours/Year * $/kWh * #kW/W * PUE * 4 Years**

**(Over 4 years)** = **8766 * $0.10 * .001 * 1.5 * 4**
= **$5.3 / Watt**

### - Capital Expenditure (CAPEX) per Watt

Capital expenditures are funds used by a company to upgrade physical assets. For Data Centers, less server power means less support infrastructure, thus leading to lower capital expenditures. Infrastructure is sized at $25/W (Koomey et al. 2009) based on the wattage of the servers supported, thus leading directly to savings that must be amortized over 4 years of the life of the infrastructure equipment, here assumed to be 15 years.

**CAPEX Costs per Watt= Infrastructure Costs/W * Amortization Factor**

**(Over 4 years)** = **$25/W * 0.37**
= **$9.3 / Watt**

### - Total Cost of Ownership (TCO) per Watt

Total cost of ownership, or TCO, is the cost of owning a data center for a given period, which is the sum of CAPEX and OPEX. Since TCO covers the total costs of acquisition and operation, buyers should look not just at short-term purchase price of server equipment, but also at its long-term cost savings. Servers providing lowest TCO will be the best value in the long run. For this model savings in administrative personnel, maintenance, security, and floor space are not included. Note that results may vary depending on specific situation.

**TCO Costs per Watt** = **OPEX Expense per Watt + CAPEX Costs per Watt**

**(Over 4 years)** = **$5.3/Watt + $9.3/Watt**
= **$15 / Watt**

**† Power Usage Effectiveness (PUE)** = $\frac{\text{Total Data Center Electricity Use}}{\text{IT Electricity Use}} = \frac{X + Y}{Y}$

** US Energy Information Agency (EIA), Average Retail Prices of Electricity. http://www.eia.gov/totalenergy/data/monthly/pdf/sec9_11.pdf*

*Contact your Supermicro sales representative for more information*
**www.supermicro.com**

  

## Case Study

A case study involving 10,000 server nodes was developed to demonstrate the large TCO savings from Supermicro FatTwin™ server solutions as a replacement for competitive servers. A 4U 8-Node FatTwin™ with Front I/O (SYS-F617R3-FT) and redundant 1280 watt Platinum Level (95%+) digital power supplies was compared on a per-node basis with two competitive systems: a H2312WPJR 2U 4-node server with redundant 1200 watt Platinum Level power supplies, and a R1208GZ4GC 1U mainstream server with redundant 750 watt power supplies. Each of these competitive servers was also compared with its closest Supermicro counterpart: SYS-6027TR-HTRF+ 2U Twin²™ server and a Supermicro SYS-6017R-TDLRF 1U mainstream server. A Supermicro SYS-6017R-TDF was also included for reference.

The components (including 2 Intel® Xeon® E5-2630 2.3GHz 6-Cores Max TDP 95W, 8 Hynix 16GB DDR3-1600 2Rx4 ECC REG 1.50V, 1 Intel® SSD 320 Series 300GB SATA 2.5" 3Gb/s, and Red HatEnterprise Linux 4.0 update [64-bit]), the BIOS settings, and the test environments were identical for all the servers in this case study. All systems were run at room temperature (21°C) utilizing the high performance LINPACK (HPL) software program. The peak power levels of each system were determined under maximum LINPACK loading and the power usage for each system was continuously monitored during each test run using power meters. Due to the identical configurations all systems generated a performance of 205 GFLOPS per node utilizing HPL problem size of 125,000. The power per node is shown in ***Figure 2*** for each of the six systems tested.

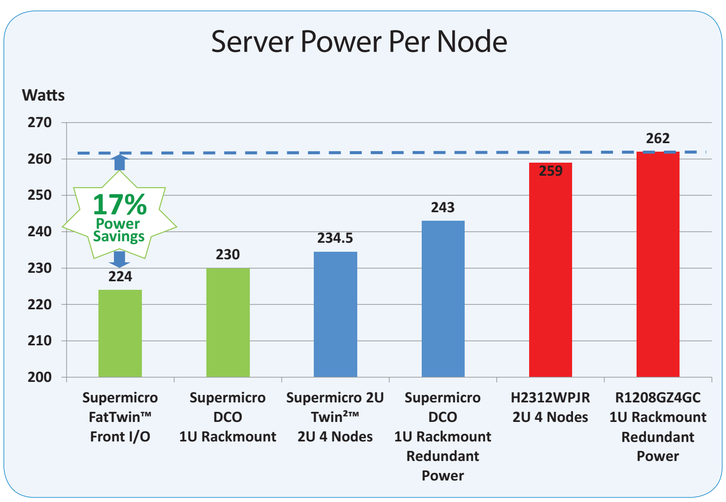


***Figure 2: Server Power per Node***

The Supermicro FatTwin™ Front I/O configuration with a 1280 watt power supply and Data Center Optimized Server (green color) used the least power, followed by the Supermicro 2U Twin² and the Supermicro 1U Data Center Optimized (DCO) server (blue color). The competitive server offerings (red color) were 16% and 17% less power efficient than the Supermicro FatTwin™ as indicated.

Using the competitive systems as a baseline, the TCO savings for the Supermicro FatTwin™ were then calculated for a four-year estimated lifetime under the assumption of PUE = 1.5 and $15 per watt saved (calculated earlier in this white paper) for a 10,000 node implementation. The results are shown in ***Figure 3***.

| | FatTwin™ Power Savings per Node | FatTwin™ TCO Savings per Node | FatTwin™ TCO Savings per 10K Nodes |
|---|---|---|---|
| H2312WPJR | **35W** | $525 | $5,250,000 |
| R1208GZ4GC | **38W** | $570 | $5,700,000 |

***Figure 3: FatTwin TCO Savings per Node (4 Years)***

## Conclusions

Due to its efficient component and system cooling technologies, advanced circuit designs, and optimized resource sharing architecture, the Supermicro FatTwin™ server improves power efficiency, cost-effectiveness, and reliability. The FatTwin™ modular architecture not only maximizes I/O capacity and performance, but also makes the system highly flexible to configure and exceptionally easy to maintain.

Supermicro optimizes FatTwin™ thermal airflow via an innovative chassis mechanical architecture. Advanced circuit designs for motherboard and power distribution with redundant Platinum Level high-efficiency (95%+) digital switching power supplies allow the system to deliver by far the highest energy efficiencies without sacrificing system performance. The FatTwin™ is designed to operate within an extended ambient temperature range (0 °C to 47 °C), ideal in higher ambient temperature Data Center and free-air cooled environments, to help further reduce energy consumption and reliance on costly traditional air conditioning.

Based on this case study, the Supermicro FatTwin™ outperforms a competitor's 2U 4-node server and 1U mainstream server systems in terms of power efficiency. The Total Cost of Ownership (TCO) savings of the Supermicro FatTwin™ during a 4-year server lifetime is substantial, saving $5,250,000 over the 2U 4-node server and $5,700,000 over the 1U mainstream server. These savings from the Supermicro FatTwin™ are clearly significant and highly attractive for data center customers.

**FatTwin™**

*Evolutionary 4U Twin Architecture*

***17% Lower Power Consumption***

***30% More Storage Capacity***