

Use a TCO Model to Estimate the Costs of Your Data Center

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The cost to own and run a data center is significantly higher than many IT managers realize. Develop a total cost of ownership model to capture or estimate these costs, analyze where costs are allocated, and determine where budgets need to be increased or reduced.

Key Challenges

- Data center total cost of ownership (TCO) is more about the cost of operations than ownership.
- Hardware refreshes, maintenance and upgrades represent 35% of the total annual costs.
- Personnel represent an average of 40% of data center TCO.

Recommendations

- Data centers should develop a broad-brush TCO model to define and establish the overall cost categories.
- Use industry metrics and averages as a baseline comparison tool.
- Focus on operational costs versus total costs, unless you're using the model for an ROI analysis.
- Use Gartner's TCO model as a general guideline to developing a company-specific TCO.

Analysis

As an increasing number of organizations consolidate data centers, the ongoing cost to own and operate a data center is being exposed to senior level executives, often for the first time. Couple this with the continuing demand for data center services to support the business and alternative IT delivery models, and the need for a comprehensive model to estimate these ongoing costs becomes paramount.

The model Gartner has developed is based on the integration of cost models and a significant amount of Gartner produced survey data. It is not intended to be the answer to what it costs to run a data center, but to highlight a methodology for determining your own TCO, by applying your own data to this methodology. The numbers presented here represent averages across many of our clients and a realistic sampling of costs.

Why a New Model, and What's So Great About This One

The Methodology

To develop this TCO model, we broke down data center costs into six broad categories: facilities, energy, servers, storage, communications and software. Obviously, one of the largest components in operational costs is personnel, and this will be broken down into subcomponents under each of the top-level categories.

Facilities

Facilities costs are a combination of the data center's overall construction costs (yearly depreciation), building maintenance, electrical/mechanical systems maintenance, physical security and upgrades. In this model, we have incorporated data center construction costs generated via a data center build cost-modeling tool, which we have developed internally (and validated externally through client interactions). Depreciation is assumed to be straight line over 20 years. Taxes are assumed to be 10% of the annual building costs. These factors will vary from site to site and from organization to organization.

Energy

Capturing energy costs is problematic in most data centers because the overall energy budget is often buried in the broader facilities budget. For the purposes of this model, we estimate energy consumption by comparing kilowatt (kW) per rack design estimates against estimated rack density and floor space utilization levels. Electrical loss is also factored in from uninterruptible power sources (UPSs), power distribution units (PDUs), static switches, etc., as well as the estimated cooling load required. For the purposes of this research, we're assuming an average charge of \$0.09 per kilowatt hour (kWh).

Servers

Physical server capacity is calculated as a percentage of rack space available (i.e., the total number of rack units [RUs] minus network and storage allocations multiplied by average rack utilization). The average cost to support a physical server per year was obtained from Gartner's IT Key Metrics data report for 2012 (see "IT Key Metrics Data 2012: Key Industry Measures: Cross Industry Analysis: Multiyear"). This report does not factor in the virtualization differential and its impact on staffing (this impact will be addressed in future research); however, it does include the estimated depreciation cost for server adds/replacements yearly.

Storage

Total storage capacity is assumed to be a combination of high-performance arrays for transactional applications and high-density storage for standard data types. The cost estimates were derived from Gartner's IT Key Metrics Data 2012 research. All storage figures below reference terabytes of capacity.

Communications

Communications encompasses the cost of intra-data-center networking. This includes LANs, switches, cabling and the tools to manage them. Communications costs below are based on the total number of ports required and the average cost per port, as derived from the Gartner IT Key Metrics Data of 2012.

Software

Software includes all system management software, OS licenses, security licenses, storage management and operational tools. It does not include application software specific to an individual enterprise.

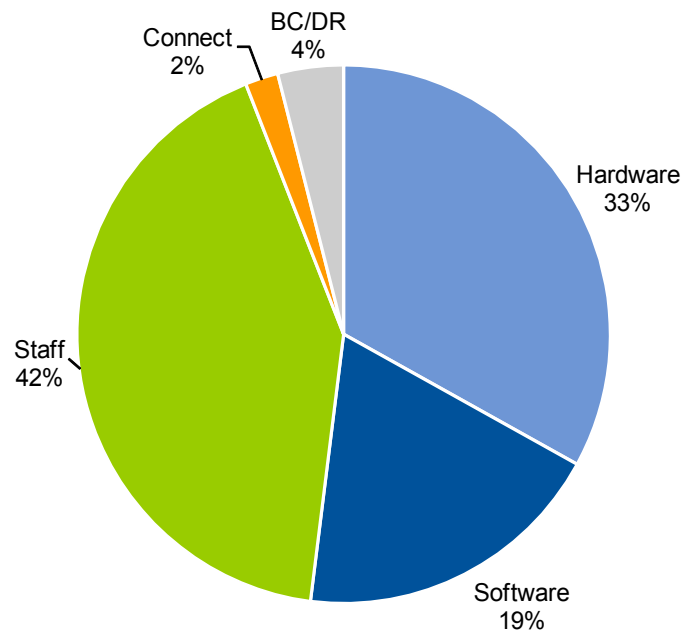
The Metrics

This model incorporates metrics from the data center construction model Gartner has developed, which is used to estimate average construction costs for any size data center, in most geographies. These costs are then straight-line depreciated over 20 years to determine annual costs. Factored into this are the estimated annual costs of building maintenance, upkeep and cleaning, as well as mechanical and electrical system maintenance and upgrades. Annual property taxes are not included.

The second set of metrics used come from Gartner's IT Key Metrics database, which has been developed over many years from thousands of client benchmarks. These metrics reflect the estimated costs for specific IT functions within data centers and include everything from estimated software costs, communications, business continuity/disaster recovery (BC/DR), hardware and personnel. These costs are not the definitive answer, but represent the average cost across many Gartner clients in that specific category. Your costs will vary, based on the IT efficiency measures you've put in place, the building efficiency methods adopted, and your levels of standardization.

In the example below, we have estimated the cost to build a specific data center and then calculated its annual depreciation and maintenance costs, as well as the estimated ongoing yearly costs, based on an assumed 40% floor space utilization level.

Figure 1. TCO Example



Source: Gartner (June 2012)

Facility Specifics

- Building — 4,000 square feet of IT space; Tier 3
- Total power load — 720 kW
- Sixty percent rack density; 40% floor space utilized

Cost Specifics

The breakdown in Table 1 is based on estimated equipment counts (e.g., terabytes, physical servers, ports), given a 4,000 square foot data center at 40% floor space capacity and with racks at 60% capacity. For example, the total server count was calculated by determining the number of server racks multiplied by the percentage of rack utilization, and then multiplied by the floor space utilization. In this case, 2U server configurations were assumed. The storage component represents roughly 20% of the rack space, whereas telecom represents 15% of rack space.

Table 1. Cost Breakdown

	Units ¹	Hardware	Software	Staff	Connect	BC/DR	Full-Time Equivalents
Storage	518.4	\$1,263,859	\$278,049	\$581,375	\$101,109	\$126,386	5
Servers	928	\$1,543,967	\$1,476,838	\$3,020,806	\$67,129	\$201,387	27
Network	3,859	\$192,767	\$25,702	\$192,767	\$25,702	\$4,284	2
Totals		\$3,000,594	\$1,780,590	\$3,794,948	\$193,940	\$332,057	33

Gartner (June 2012)

The estimates for annual facilities/IT costs are shown in Table 2. These reflect cost estimates only, and are based on client feedback. Your IT costs will vary based on depreciation schedules, refresh cycles, equipment age and growth. Equipment placement and power/cooling requirements (resource utilization) can also have a significant impact on energy costs.

Table 2. Annual Facilities Costs

	Category	Results
Facility	Building size	10,000
	IT space	4,000
	Construction costs	\$7,892,230
	Depreciation per year	\$315,689
	Power/cooling	\$252,565
Maintenance	Building	\$701,546
IT Costs	Hardware	\$3,000,594
	Software	\$1,780,590
	Staff	\$3,794,948
	Connectivity	\$193,940
	BC/DR	\$332,057
Annual TCO		\$10,371,929
Monthly		\$864,327

Source: Gartner (June 2012)

Factors that we will include in future iterations of this model are the impact of Unix and mainframe environments, virtualization impacts (especially on administrative costs) and mixed storage environments to accommodate the increasing use of high-density SATA versus high-performance 15K drives and solid-state drives (SSDs).

Bottom Line

Developing a data center TCO model can be a difficult process, especially in large and complex environments; however, by incorporating average industry costs for building maintenance and known depreciation factors for your facility, then integrating Gartner's IT Key Metrics averages, it is possible to develop a usable baseline model. This will provide a clearer understanding of the true costs of running your data center.

Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"IT Key Metrics Data 2012: Key Industry Measures: Cross Industry Analysis: Multiyear"

Evidence

¹Cost Specifics

The units column indicates the approximate number/size of devices in each category, based on the data center size and the density of the racks being used. In this example, the racks are allocated as follows (this is the total RU allocation):

- Servers = 65%
- Storage = 20%
- Telecom = 15%

Rack space consumes approximately 30 square feet per rack, yielding 134 racks maximum in the 4,000 square foot data center. Server space represents 65% of rack space, yielding 87 dedicated server racks. At an average of 14 servers per rack, this would support approximately 928 physical 2U servers. Server count varies, depending on data center rack density policies.

Storage space represents 20% of rack space (27 racks); however, of the maximum capacity possible (assuming three tiers), only 40% is currently allocated (518 TB).

Telecom counts equate to physical ports within the data center; at 15% of floor space, telecom consumes 20 racks worth of space. At a data center capacity level of 60%, the combination of host ports and switch ports equates to 3,859.

Gartner's IT Key Metrics Data is a substantial database of information available to Gartner clients on the gartner.com website. It represents survey work that we complete yearly that outlines the estimated costs our customers are spending to support various functions with IT. The costs shown below include hardware, software, personnel, connectivity, facilities and BC/DR for each category and are yearly estimates:

- Storage — \$4,876 per terabyte
- Wintel servers — \$8,260 per physical server
- Host costs per port — \$1111.00
- Data center switch costs per port — \$500
- Unix servers — \$23,520
- Cost per OS instance — \$6,349

By taking a data center's maximum capacity, we calculate expected current capacity based on floor space utilization levels (in this example, 60%). Once current capacity is determined, it can be broken down into servers, storage and telecom ports required; then the IT Key Metrics Data can be applied to these factors to yield an operational TCO result. Combining the operational TCO with the physical building TCO (build costs, facilities maintenance, etc.) results in a combined TCO for the data center. Your results may vary, because server density, topology (RUs per server), storage type and network topology can all affect these costs.

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