

IT Key Metrics Data 2023: Infrastructure Measures — Data Center Framework Definitions

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Initiatives: [Technology Finance, Risk and Value Management](#); [I&O Operations Management](#); [I&O Organizational Strategy](#)

This research outlines the Gartner Infrastructure — Data Center consensus model and framework definitions for IT cost management.

Overview

Key Findings

This document elaborates on the framework used by Gartner to compile the “IT Key Metrics Data Infrastructure Measures — Data Center” and the data structure a user should align to in order to accurately benchmark using the published research or the self-service comparison tools.

Recommendations

- Ensure you understand the metrics before referring to the published research or using any of the available self-service comparison tools.
- Evaluate your organization by leveraging the available published content or receive a report tailored to your organization by completing the [IT Key Metrics Data Comparison Tool: Data Center & Network](#)
- Follow the [Practitioners Guide](#) to best prepare your data for comparison.
- Schedule an [inquiry](#) with a Gartner Expert to address alignment questions or to review your results and gain valuable insight based on your submission.

Analysis

Scope

Data Center consists of Compute, Storage, Database, Middleware and Facilities/Hosting. Data Center spending includes the annual capital and operational expense, maintenance, installation and taxes, as appropriate, for all of Personnel, Hardware, Software and External Services. The below outlines the Gartner Benchmark Analytics consensus cost model for the Data Center environment which has been leveraged for the respective component's analysis report.

General Information

Business Metrics

The enterprise Revenue and Operating Expenses associated with the business units supported by the IT organization. This section should be answered based on the latest 12-month actuals available.

Company Employees

The count of employees (i.e., headcount excluding contractors or consultants) on a full-time equivalent basis, regardless of whether these employees are frequent users of the technology supported by the IT organization. This includes full-time and part-time employees, or as reported in the public record.

Definitions for Total IT Spending and Staffing, Revenue, Operating Expenses, and Company Employees can be found in [IT Key Metrics Data 2023: Industry Measures – Framework Definitions](#).

Data Center Staff

Staff should be reported as full-time equivalents (FTEs). FTEs should be measured in calendar time. For example, an individual who works full-time on an assignment for one full year would be reported as 1 FTE while an individual who was employed for six months of the study period would be reported as 0.5 FTE. Do not subtract such activities as vacation time, sick days and administration time. Do not count any one physical person as more than one FTE (for example, due to overtime). FTEs are assigned to services based on the functional definitions provided. If an individual or group performs more than one function, FTEs may be prorated between services and/or functions based on client estimates of time spent in each area.

Insourced IT FTEs are defined as FTEs who are employed by the IT organization (excluding contractors). Contractor IT FTEs are defined as FTEs who are supplemental to your staff and are “operationally” managed by the in-house staff.

Data Center Personnel Spending

Annual spending for each Data Center's sub-area internal staff and contractors includes salary, overtime pay, benefits and "other" employee costs such as job-related travel and IT training. The "benefit load" should include costs for bonuses, paid holidays, vacations, medical/dental coverage, life and accident insurance, retirement plans, stock plans, disability, Social Security, unemployment compensation, dependent care, tuition reimbursements and employee assistance programs (for example, physical exams, exercise programs and similar).

Only individuals whose responsibilities are primarily focused on operational tasks of running data center operations should be included in this section. This can include "project" work such as moves/adds/changes and rollouts or new technology. Individuals whose primary responsibility is Project/Program/Portfolio Management, Architecture, Product Management or Service Management as defined in [IT Key Metrics Data 2023: Industry Measures – Framework Definitions](#) are excluded from this category

For contractors and consultants, include all compensation that was paid directly to the individual or agency.

Do not include the spending related to human resource department staff allocations, early retirement incentive bonuses and internal "cross-charges" for corporate overhead such as for the chairperson's salary.

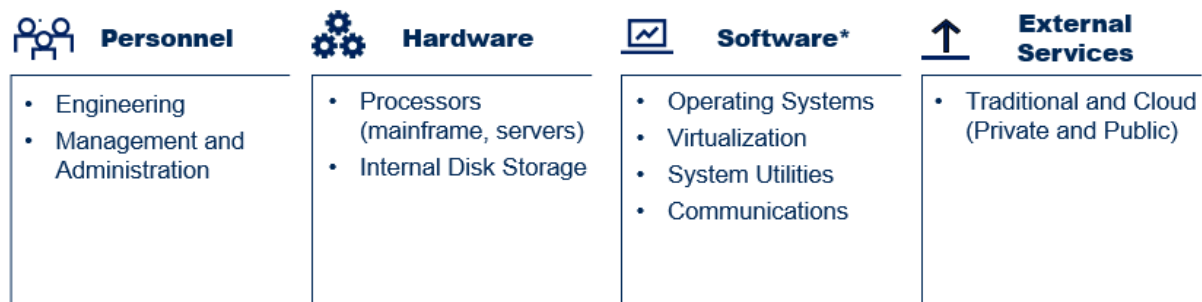
Service Definitions

Compute

This includes the provisioning of the full life cycle management of processing/hosting services on both mainframe and midrange (Windows Server, Linux Server, UNIX, etc.) platforms and racks including acquisition, deployment, maintenance, change management and disposal. Expenses, staff and workload related to data center facilities management are included in the Facilities/Hosting service.

Figure 1: Compute Framework

Compute Framework



*Includes SaaS
Source: Gartner (2022)
ID: 779723



Personnel

Annual spending, as described in [general information](#), for staff functions providing second tier support of the compute management systems. Functions include:

- **Engineering**
 - Change and Release Management
 - Problem and Incident Management
 - Performance Management
- **Management and Administration**

Hardware

Annual capital and operational expense, maintenance, installation and taxes, as appropriate, for all hardware in computing platform configurations, including internal disk storage (but not external disk arrays), processors, memory, cards, etc.

Software

Annual license and maintenance spending, as well as capital costs associated with new purchases and upgrades, for all operating systems, virtualization and partitioning, system utilities, and communications software.

External Services

- Traditional Outsourcing
- Infrastructure as a Service

Storage

This includes the provisioning of the full life cycle management of storage services utilizing online, near-line and offline technologies including acquisition, deployment, maintenance, change management and disposal.

Figure 2: Storage Framework



Personnel

Annual spending, as described in [general information](#), for internal staff functions providing second tier support of the storage systems. Functions include:

- **Engineering**
 - Change and Release Management
 - Problem and Incident Management
 - Performance Management
- **Management and Administration**

Hardware

Annual capital and operational expense, maintenance, installation and taxes, as appropriate, for all storage hardware assets including:

Solid-state appliances are based exclusively on semiconductor memory technology (typically NAND flash or DRAM), rather than hard-disk drives (HDDs) and include fully integrated, higher-level optimization software. The storage software management layer should enable one or more of the following benefits: high availability (HA), enhanced capacity efficiency, automated data management and guaranteed levels of performance (even when the solid-state drives [SSDs] are more than 80% full).

Serial attached SCSI (SAS) devices are a technology designed to move data to and from computer storage devices such as hard drives and tape drives.

Serial ATA (SATA) devices act as a computer bus interface that connects host bus adapters to mass storage devices such as hard-disk drives, optical drives, and solid-state drives.

Object storage is characterized by access through RESTful interfaces via a standard internet Protocol (IP), such as HTTP, that have granular, object-level security and rich metadata that can be tagged to it. Object storage products are available in a variety of deployment models – virtual appliances, managed hosting, purpose-built hardware appliances or software that can be installed on standard server hardware. These products are capable of huge scale in capacity and are better suited to workloads that require high bandwidth than transactional workloads that demand high input/output operations per second (IOPS) and low latency.

Components utilized in the provision of storage capabilities including, but not limited to controllers, connectivity, thin provisioning, data deduplication, data compression, storage virtualization etc.

Components utilized in the provision of backup/archival storage capabilities including, but not limited to products that are designed to provide backup of storage to tape, disk or optical devices and to recover that data when needed. This also includes products focused specifically on supporting the recovery process. Also included are media management, and backup reporting products, as well as archiving products that are included with the backup application. Media management activities include allocating, labeling, tracking, recycling and monitoring media, as well as storage pool management.

Software

Annual license and maintenance spending, as well as capital costs associated with new purchases and upgrades, for all software dedicated to managing the storage systems. This includes creation and setup, storage maintenance, reporting, backup/restore, archival, replication, media handling and data migration/tiering. Note that Storage monitoring software is not included here as it is covered under IT management in the Enterprise IT Spending framework.

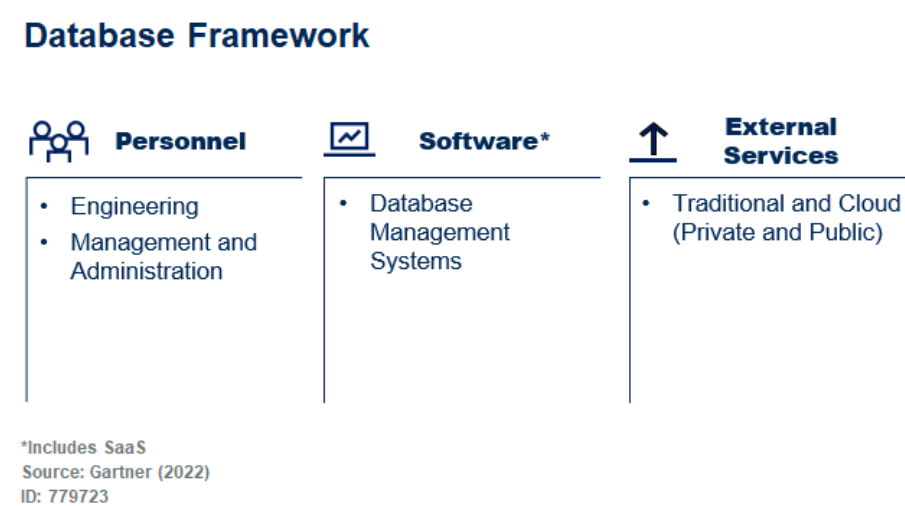
External Services

- Traditional Outsourcing
- Infrastructure as a Service

Database

This includes the full life cycle management of relational, non-relational and pre-relational databases including the tools for monitoring and diagnosing problems with databases, analyzing and improving the performance of databases, and routine administration of databases, including configuration changes.

Figure 3: Database Framework



Personnel

Annual spending, as described in [general information](#), for staff functions providing second tier support of database systems. Functions include:

- Engineering
 - Change and Release Management
 - Problem and Incident Management
 - Performance Management
 - Logical Database Administration

Accountable for analyzing and developing complex logical database designs, logical data models and relational data definitions in support of corporate and customer information systems requirements. Understands the methodologies and technologies that depict the flow of data within and between technology systems and business functions/operations. Responsible for the identification and resolution of information flow, content issues and the transformation of business requirements into logical data models. This position identifies opportunities to reduce data redundancy, trends in data uses and single sources of data. Additional functions that would fall under this category include Master Data Management Logical Database Administration Specialist, Data Modeler, Logical Database Administrator and Data Warehouse Analyst.

- Physical Database Administration

Loading, installing, patching, and maintaining the file structure and user privileges for the DBMS software (e.g., Oracle, SQL, DB2).

The scope of the database service is composed of both Applications and Infrastructure personnel functions including, but not limited to the following duties:

- Install and maintain the DBMS software
 - Maintain the links with other major system and subsystem components: network, security, performance monitoring, etc.
 - Obtain, allocate and initialize the storage spec from the storage management team
 - Implement the backup, redundancy and disaster recovery requirements of the database storage
 - Implement fallback, failover provisions for event and disaster recovery
 - Test security, fallback, failover and new implementations
 - Perform capacity planning and performance Management tasks
 - Respond to problem incidents related to DBMS software, DBMS performance including full system incidents or full system performance issues
 - Monitor DBMS performance, security, backup and failover status
 - Participate in disaster recovery tests
 - Tune physical layer of the database or subsystem interfaces
 - Data modeling: Creating physical data model
 - Interface directly with the developers/analysts on the development of the logical data model
 - Create process to initialize, load and scrub data
 - Creating scripts to initialize and load the data tables
 - Write and/or tune stored queries
 - Maintaining data standards
 - Writing database documentation, including data standards, procedures and definitions for the data dictionary ('metadata')
 - Controlling access permissions and privileges
 - Tune logical/applications layer of the database or application interfaces

- Management and Administration

Software

Annual license and maintenance spending, as well as costs associated with new purchases and upgrades, for database software products.

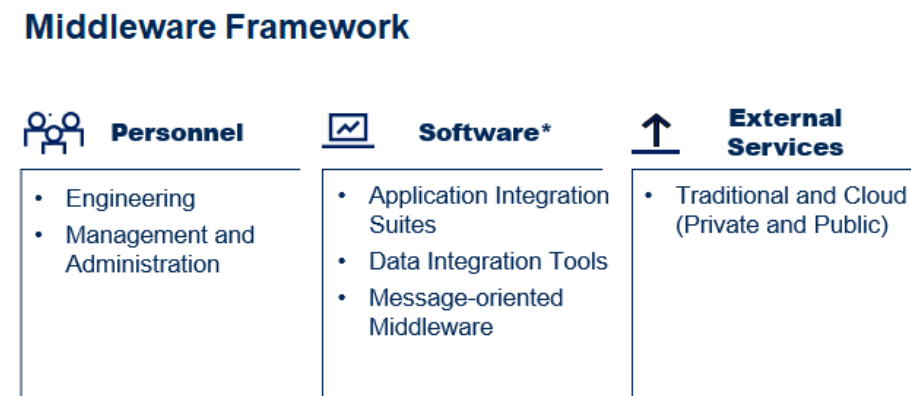
External Services

- Traditional Outsourcing
- Infrastructure as a Service

Middleware

Middleware is the software “glue” that helps programs and databases (which may be on different computers) work together. Its most basic function is to enable communication between different pieces of software. This includes Integration middleware and Platform middleware.

Figure 4: Middleware Framework



*Includes SaaS
Source: Gartner (2022)
ID: 779723

Personnel

Annual spending, as described in [general information](#), for staff functions providing second tier support of the middleware systems. Functions include:

- Engineering
 - Change and Release Management
 - Problem and Incident Management
 - Performance Management
 - Middleware Support

The scope of the middleware service is composed of both applications and infrastructure personnel functions including, but not limited to the following duties:

- Design, implement, develop, and maintain technical solutions
- Support overall middleware systems architecture requiring knowledge of all aspects of designing and constructing new and existing applications.
- Validate system requirements, both functional and non-functional with business analysts.
- Develop and author end-to-end middleware solutions for various projects and systems.
- Develop and document middleware software standards.
- Build and test interfaces for Service-Oriented Architecture (SOA) integrations
- Assess change requests, defects, trouble reports, and ad hoc database query requests and make recommendations on design approaches and alternatives.
- Plan, install, configure, tune for performance, monitor and support middleware products, systems software and operating systems, infrastructure and tools
- Ensure the products are tailored to maximize functionality
- Maintain support processes, identify issues, investigate and coordinate the resolution of complex service problems and collaborate with application teams on error resolution.
- Prepare and maintain operational documentation.
- Ensure that services and components meet all the agreed performance targets and service levels.

- Management and Administration

Software

Annual license and maintenance spending, as well as costs associated with new purchases and upgrades, for middleware software products.

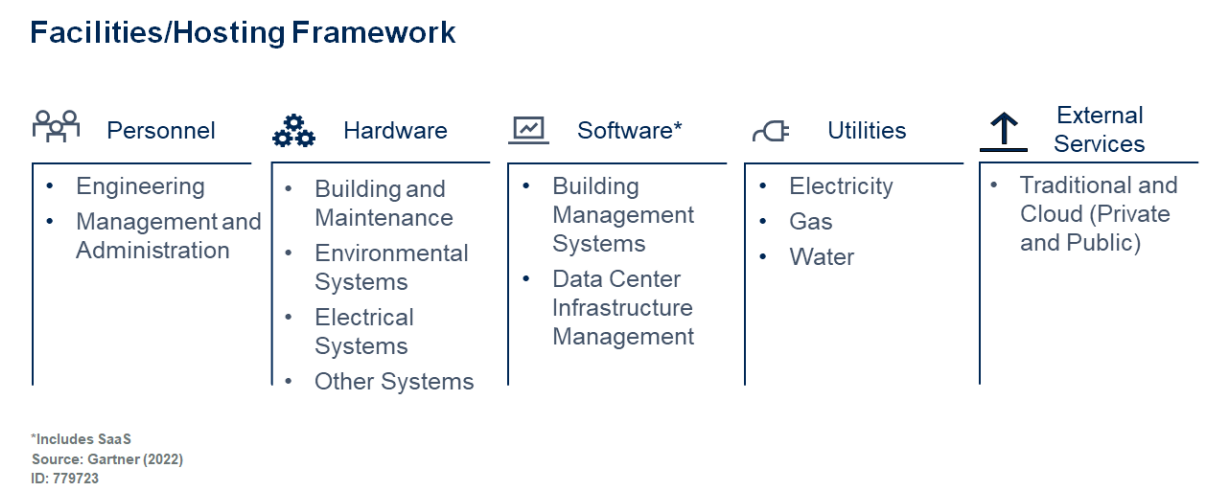
External Services

- Traditional Outsourcing
- Infrastructure as a Service

Facilities/Hosting

This includes the full life cycle management of the physical data center premises, and other facilities and services associated with the premises such as furniture, power supply, heat management, climatization services, access security, floor space, office space, design and consulting.

Figure 5: Facilities/Hosting Framework



Personnel

Annual spending, as described in [general information](#), for staff functions providing second tier support of facilities/hosting. Functions include:

- Engineering

Management of physical data center premises, and other facilities and services associated with the premises such as furniture, power supply, heat management, climatization services, access security, floor space, office space, design and consulting.

■ Management and Administration

Hardware

Annual capital and operational expense, maintenance, installation and taxes, as appropriate, for all hardware assets including:

Building and Maintenance: Walls, floors, ceilings, carpeting, and office area improvements. Include floor space costs for data center and network personnel who work within the confines of the data center. Exclude any co-located office space or other non-data center building costs.

Environmental Systems: Air conditioning (CRACs), chillers, humidifiers, fans and associated piping and ducting.

Electrical Systems: Power distribution units (PDUs), uninterruptible power supply (UPS), backup generators/batteries, cabling and electrical conduits.

Other Systems: Fire prevention and suppression, lighting, heating and physical/logical security systems.

Software

Annual license and maintenance spending, as well as capital costs associated with new purchases and upgrades, software including, but not limited to building management systems (BMS) and data center infrastructure management (DCIM) software.

Utilities

This includes annual spending for utilities for data center equipment including electricity, gas and water.

External Services

■ Traditional Outsourcing

Common Definitions

Certain activities and terms are common across all Data Center services. For the sake of avoiding repetition, the terms listed below apply to all services unless specified otherwise.

Engineering

Change and Release Management: This is designed for the efficient and effective handling of Changes — installations, add, moves and changes to the associated systems which is vital to the successful operation of any IT organization. This includes evaluation, installation, maintenance (e.g., fixes and upgrades) as well as removal of system software, security packages, systems utilities and database transaction packages as appr. Changes must be carefully managed throughout their entire life cycle from initiation and recording, through filtering, assessment, categorization, authorization, scheduling, building, testing, implementation and eventually their review and closure. The Release process takes a holistic view of Changes to IT services, considering all aspects of a Release both technical and non-technical. It is responsible for all legal and contractual obligations for all hardware and software in use within the organization.

Problem and Incident Management: This covers the second and third-line management of all system related Incidents from detection and recording through diagnosis to resolution and closure, but not the first-line IT Service Desk. The objective is to restore normal service as soon as possible, and with minimum disruption to the business, and to minimize the adverse impact of both Incidents and Problems on the business. It manages all major Incidents and Problems, while endeavoring to record all workarounds and “quick fixes” as Known Errors where appropriate, also raising Changes to implement permanent structural solutions wherever possible. Problem Management further analyses and trends Incidents to proactively prevent the occurrence of repeat or associated Incidents and Problems. Includes systems administrators/storage administrators as appropriate.

Cloud Engineering Activities:

- Applying or Developing Technical architecture for a workload’s use of IaaS and PaaS components
- Building operating system (OS) and application stack “golden images” for cloud environments
- Manually provisioning into the cloud environment
- Automating provisioning into the cloud environment
- Automating management of the cloud environment and its workloads

- Cloud-related problem management
- Cloud-capacity management
- Implementing technical controls for cloud governance
- Forecasting cloud spending
- Implementing cloud cost optimizations
- Implementing integrations between cloud and non-cloud infrastructure elements

Performance Management: Ensuring that the availability and response of each system meets or exceeds its targets, and is proactively managed on an ongoing basis. Specifically, this process establishes technical standards, takes key measures and reports, and reviews them against targets, to determine if actions are required to manage the service more compliantly. This involves tuning system performance. Measures include availability, reliability, maintainability, serviceability and security as appropriate.

Management and Administration

Management includes time spent by management personnel on supervisory, departmental administration, or strategy related tasks. These tasks include but are not limited to setting strategic direction, communications activities, hiring and firing of staff, personnel performance reviews, expense management, approving relevant documents, planning day to day personnel workload etc.

Administration includes direct administrative and clerical support to all organizations related to the service being studied. Typical positions include secretary, receptionist and administrative assistant. These individuals often work for high-level executives in the organization.

Each service covered by this framework includes its associated management and administration. When determining how high in the organization to represent management/administration personnel use the following guidelines to determine materiality:

- When analyzing a single service, it is not necessary to include management/administration time for any associate if the total time contribution related to the scope of the analysis of the individual (included non-management/administration activities) represents less than 15% of the individual's total hours.

- If multiple services are being analyzed, it is not necessary to include any management time for any associate if the total time contribution related to the scope of the analysis of the individual (including non-management activities) represents less than 30% of the individual's total hours.

External Services

Traditional Outsourcing: This includes the fees for outsource contracts in which outsource is defined as any situation in which the full operational responsibility for IT services is completely handed over to an external service provider.

Cloud Computing: Cloud computing is a style of computing where scalable and elastic IT-enabled capabilities are provided as a service to external customers using Internet technologies—i.e., public cloud computing uses cloud computing technologies to support customers that are external to the provider's organization. Using public cloud services generates the types of economies of scale and sharing of resources that can reduce costs and increase choices of technologies.

- Infrastructure as a service (IaaS) is a standardized, highly automated offering in which compute resources, complemented by storage and networking capabilities, are owned and hosted by a service provider and offered to the customer on demand. The resources are multitenant, metered, and operate in near-real time. Self-service interfaces are exposed directly to the customer, such as a web-based graphical user interface and API.
- Platform as a service (PaaS) is a type of cloud offering that delivers application infrastructure (middleware) capabilities as a service.

NOTE: Private cloud implementations are not included in this category. Third party offerings involving single tenant solutions should be included in the Traditional Outsourcing category. Internally maintained infrastructure cloud solutions are included in the Hardware and Software categories

Workload

Compute Workload Windows, Linux x86, UNIX

Includes all versions of Windows, Linux x86 and UNIX servers.

Physical Data Center

This is also known as “on-premises,” but it can involve fully outsourced and colocated environments. It does not include public cloud. It does include internally managed private cloud implementations.

Total Stand-Alone Servers: Include an annual weighted average of all physical devices used for production, hot spares, testing, monitoring and system management, which have not been virtualized. These servers run a single physical operating system

Total Virtual Server Hosts using Virtualization via OS: Include an annual weighted average of all physical devices used for production, hot spares, testing, monitoring and system management, which use the physical operating system to provide a virtualized environment. These servers can only run virtual machines using the same physical OS installed on the Server.

Total Virtual Server Hosts using Virtualization via Hypervisor: Include an annual weighted average of all physical devices used for production, hot spares, testing, monitoring and system management, which use a hypervisor to provide a virtualized environment. These servers run virtual machines using any operating system supported. These servers do not have a physical operating system installed.

Annualized Virtual Machines (VMs): This is a count of the VMs which were available across all virtual server hosts in each server category during the year. The number of VMs will exceed the number of virtual server hosts insofar as virtual OS environments have been created. VMs can be time bound and may not be in place for a whole year, since they can be installed on a server for only if they are needed. This total count of VMs will therefore need to reflect a concept of “VMs per annum” where partial VMs during the year are rounded up or down so that the total entered here reflects the average in place for the entire year.

Average Containers Active During the Year: Containers are an isolated, resource controlled, and portable runtime environment which runs on a host machine or virtual machine. An application or process which runs in a container is packaged with all the required dependencies and configuration files. It's given the illusion that there are no other processes running outside of its container. Containers can run on bare metal hosts, entirely removing the need for a hypervisor. Most enterprises today prefer to run containers inside virtual machines in order to leverage familiar and valuable management features. Only Windows and Linux x86 require container inputs.

Cloud Data Center

Annualized Virtual Machines (Cloud): Include an annual weighted average of cloud based virtual machines (VM) which are a software implementation of a hardware-like architecture, which executes predefined instructions in a fashion like a physical central processing unit (CPU). A VM can be used to create a cross-platform computing environment that loads and runs on computers independently of their underlying CPUs and operating systems.

Average Containers Active During the Year (Cloud): Containers sourced as Infrastructure as a Service

Compute Workload – Mainframe

General-Purpose MIPS: Enter the MIPS rating of the general-purpose engines in the mainframe. This comprises the general-purpose or “official” MIPS rating used typically for determining legacy software charges. If the MIPS have been upgraded part way through the year, this should be a weighted MIPS rating based on the number of days or months that each MIPS total was in place. General purpose MIPS can also be sourced through Infrastructure as a Service (Cloud).

Specialty Engine MIPS: Provide information on the MIPS ratings of the “specialty” engines (such as IBM zSeries zAAP, System z9’s zIIP, Linux integration (IFL) etc.) included the mainframe system. These MIPS will typically be the same as for general-purpose engines, but will not contribute to the “official” MIPS rating of the box used to determine legacy software charges. If these MIPS have been upgraded part way through the year, this should be a weighted MIPS rating based on the number of days or months that each MIPS total was in place. Specialty MIPS can also be sourced through Infrastructure as a Service (Cloud).

Storage Workload

Raw Configured Disk (TB): Amount of Raw Disk formatted for use.

While raw capacity may represent total storage under management, it should be considered within the context of business requirements (service levels), utilization levels, the enterprise storage portfolio and overall storage resource management strategy. This unit measure alone does not accurately represent cost related to the actual availability (usable configured after RAID, etc.) or utilization of resources, nor does it provide any insight into the cost associated with specific tiers of service levels. Service level dynamics such as availability, and recovery objectives, specific to the type of data storage, all need to be considered in tandem with factors such as the number and size of databases, as they are the primary drivers and fundamental context for a cost efficiency analysis. However, we find some organizations have difficulty taking inventory of the total cost structure alongside the usable configured capacity and utilized capacity within their enterprise; therefore this measure can be very useful in establishing a foundational baseline and framework to build from.

Facilities Workload

A data center is a facility used to house computer systems (mainframes and servers) and associated components, such as telecommunications and storage systems. It generally includes redundant or backup power supplies, redundant data communications connections, environmental controls (e.g., air conditioning, fire suppression), and special security devices.

Total Floor Space (Occupied and Spare):

- Raised Floor and/or Slab Using Overhead Cable Trays. Space required for operational devices such as servers, storage, network, mainframe, tape drives, consoles, network operations center, production control office space etc.
- Data Center Floor Space: Facilities Support. Space required for ancillary equipment such as UPS, air conditioning, power distribution, DR, etc.
- Data Center Floor Space: Office. Space required for Data Center staff not occupying the raised floor or slab but still within the data center facility.

Recommended by the Authors

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

[“IT Key Metrics Data 2023: Working with IT Budget and Comparison Tools”](#)

[“IT Key Metrics Data 2023: Infrastructure Measures — Windows Server Analysis”](#)

[“IT Key Metrics Data 2023: Infrastructure Measures — Linux x86 Server Analysis”](#)

[“IT Key Metrics Data 2023: Infrastructure Measures — UNIX Server Analysis”](#)

[“IT Key Metrics Data 2023: Infrastructure Measures — Mainframe Analysis”](#)

[“IT Key Metrics Data 2023: Infrastructure Measures — Storage Analysis”](#)

[“IT Score for Infrastructure and Operations”](#)

Evidence

This research contains the standard consensus model and IT performance measurement framework as defined by Gartner Benchmark Analytics. To learn more about [Gartner Benchmark Analytics](#) contact your account executive or [email](#) us.

Document Revision History

[IT Key Metrics Data 2022: Infrastructure Measures — Data Center Framework Definitions - 16 December 2021](#)

[IT Key Metrics Data 2021: Infrastructure Measures — Data Center Framework Definitions - 18 December 2020](#)

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