CLOUD COMPUTING AND CHARGEBACK MODELS

By Mitesh Soni
hargeback and metering refers to the ability of an IT organization to track and measure the IT expenses per business unit and charge them back accordingly. According to Role, chargeback includes different dimensions.
The idea of chargeback in the IT industry was developed in the mainframe era. Mainframes were very expensive, and buying a mainframe for small- to medium-sized business was a problem. So the businesses that had these mainframes began providing the computing services to the small businesses to cope with the operational costs and to better utilize the resources of these expensive mainframes.

The central idea is that computing resources and services are metered like electricity, so customers pay only for what they use. Internally, enterprises can charge back business units or at least use “showback” to educate managers about the costs of computing and strategic expenditures.

Traditionally, organizations funded server (and storage) acquisition as part of the new project process. But virtualization breaks this model; it is a method of making a physical entity act as multiple, independent logical entities (virtual machines). Thus chargeback needs to consider this dimension due to use of shared resources in virtualization.

In designing an accounting mechanism to support new technologies, two factors must be determined: 1) the resource metrics on which chargeback will be based, 2) How to account for the excess capacity required for supporting a dynamic, shared-usage model.

As newer technologies like de-duplication become more widely adopted, issues like whether to charge by logical (virtual) gigabyte or physical de-duplicated gigabyte and how to predict or plan for that. Accurate chargeback are instrumental in showing business units the direct benefits of virtualization.

![Figure 1: IT department provides services to internal departments](image1)

![Figure 2: IT department provides services to external departments as service providers.](image2)

![Figure 3: IT Production and Customers are consolidating servers that runs IT applications but still customized application on dedicated servers exists.](image3)
OVERVIEW OF THE CHARGEBACK MODEL

An IT chargeback system is a method of accounting for technology-related expenses that applies the costs of services, hardware and software to the business unit in which they are used. IT chargeback systems are sometimes called “responsibility accounting” because this sort of accounting demonstrates which departments or individuals are responsible for significant expenses.

Reporting systems that leverage IT chargeback provide end users with more transparency into which business decisions are creating expenses and help management identify how to achieve greater efficiency.

In the traditional chargeback model, an IT department might divide its budget for services by the total number of business units it serves. In the cloud, that scenario gets even more complex because IT needs to consider the rate and time of consumption.

Chargeback Goals:
- Provide Business Units with Information
- Identify Services Required
- Control or Influence Costs
- Use Resources More Effectively
- Improve Productivity

ARCHITECTURE AND IMPLEMENTATION

TECHNOLOGY STACK

A few key steps can help you implement this model and resolve some chargeback chores:

Implementation
- Evaluate the needs of the business
- Anticipate how the business units would benefit from a chargeback system
- Determine whether business units are just seeking more control over IT processes, whether divisions are trying to determine if projects are viable
- Anticipate cost to implement a chargeback model and business’ willingness to pay for it
- Evaluate software that will help with a chargeback program and help you implement the process.

Cost
- Materials and external costs—all the out-of-pocket costs associated with the project
- Creative and production, fully burdened labor
- Account management/project management/traffic, fully burdened labor
- Department management and administration
- Hardware and software costs
- Overhead (e.g., space and associated facility costs)
- Training and team events
Challenges

“Virtualization throws a very large wrench into IT chargeback as the connection between a virtual server and its physical home is not necessarily as clear. Almost any hypervisor offers the ability to extract the necessary data to do accurate chargeback of virtual machines. However, most of the platforms do not make this process very easy. Typically, a third-party tool or business intelligence reporting structure will need to be implemented to resolve this particular thorny issue.

In a chargeback program, it may be easy for the business units to start seeing the data center as just another utility service—one that exists solely for each business unit. This means it may become difficult to analyze technology trends, forecast services for the company, or even train staff adequately because there is no business unit willing to pay for that work.

Virtualization:

What will the customer base really use? Virtual CPU capacity, Disk IO, Network IO, or even Memory Loading? What if your cost model is based on just one or two capacities, but all your clients end up using more of one of the others you did not base your cost model on?

Even worse, after you figure out some cost factor for Virtual CPU, Network, Disk, and Memory:

- Did you really pre-provision enough or each? (Decide what you need and when you need it in reference to infrastructure; pre-provision at least what you can for the first year if you can, this is a sunken cost.)
- What about the time factor?
- If network connectivity must be preconfigured, who gets that fixed cost per month until it is fully loaded?
- Shared storage: the same issue, but you have to have network and disk resources available before the virtual host is online. (Decide how or what you will charge against, again by virtual CPU, disk, memory, and/or network resources, include all costs for the period defined, site costs, infrastructure costs.)

Organizations first need to determine the capacity and power rating for each box in their data center. A unit-based measurement system provides a clearer picture of performance so that consolidation plans can be adjusted and adapted as the technology is implemented.

The benefits of measurement extend beyond a consolidation project to performance management. Detailed measures like cost per CPU second enable organizations to see how other changes in the environment impact efficiency and cost. While these systems require an investment in terms of time and sometimes, the help of a third-party, and the ability to track and measure the impact of significant changes in the data center is invaluable. A key performance indicator (KPI) such as cost per CPU second is the best way we have to indicate the unit cost of computing value delivered.

Factors to consider usage plan as per service models

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<thead>
<tr>
<th>Factors to consider</th>
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<th>IaaS usage Plan</th>
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</thead>
<tbody>
<tr>
<td>Functions and Module Availability</td>
<td></td>
<td>CDN Traffic</td>
<td></td>
<td>Message Queue Service</td>
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<td>Disc Space</td>
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<td>Storage Transaction</td>
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<td>Memory</td>
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<td>Number of Users</td>
<td></td>
<td>Storage Charges</td>
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<td>Bandwidth</td>
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Figure 5: Factors to consider usage plan as per service models
The following are important points related to chargeback in the context of virtualization:

- **Incentives are as important as cost recovery:** Chargeback methods also create incentives for the service provider. For example, a "one size fits all" VM price that assumes a certain average capacity will discourage the use of "large" VMs.

- **Infrastructure costs should be separate from service costs:** Most successful chargeback methods do not co-mingle the cost of data center capacity (CPU, Memory, Storage, and Facilities) with the labor and tools to manage individual application and OS instances. E.g. the difference between 10 VMs with 1 GB RAM each and 1 VM with 10 GB of RAM. Each has a total of 10 GB of RAM capacity, but 10 VMs are usually much more work to manage than a single, large VM.

- **Unit costs change over time:** Shared infrastructure is a combination of fixed costs and variable costs. As the environment grows, the proportion of fixed costs as a percentage of the whole will decrease. In a virtual environment, there is an entry cost that typically requires two or three hosts, access to shared storage and network fabric. Incremental capacity is less expensive for each additional VM. Chargeback methods need to account for the effect of decreasing marginal costs. (1) Revise the model over time, (2) assume a long-term average steady-state environment or (3) ignore the growth effect in the cost model, allowing cost reductions to improve margins over time.

- **Pricing should be tiered:** Chargeback for virtual infrastructure can be tiered on several dimensions. One dimension is on capacity: assuming the “slice” based model is used, then the capacity tiers are either divided into some form of small/medium/large slice, or as slices measured in discrete units (e.g., a slice defined as 1 GHz CPU and 1 GB RAM, and a larger VM requiring 4 GB of RAM is counted as four slices).

- **Bundling is a necessity:** In traditional IT environments, it is simple enough for the service provider to pass on the cost of network ports, storage, server hardware, power, and floor space. Virtualization abstracts the applications and operating systems from the physical infrastructure. Then, it moves everything into a shared infrastructure. Sending the customer a bill that shows usage of network ports, power (kWh) and cooling usage (BTU) is not only wrong, but it is also almost impossible to properly calculate (e.g. they could be using fractions of network ports and may be using portions of de-duplicated storage). When it comes to infrastructure costs, it is best to roll up the core infrastructure (floor space, power, cooling, network connectivity, etc.) into a bundled infrastructure rate, since the usage of those elements tend to be correlated with actual computing usage in a virtualized world.

- **Be prepared for a dynamic environment:** Virtualization offers customers many more options for creating, cloning, powering on, and powering off of virtual systems. With that in mind, chargeback in this more dynamic environment must take into account three major themes:
  - More self-service tools for IT infrastructure; Provisioning and management tasks are automated
  - Capacity-based pricing must take into account capacity that is used on an on-demand basis
  - For non-automated functions, labor used for turn-on, turn-off, cloning, etc. should not be ignored (hence the need for some self-service automation such as VMware Lifecycle Manager when the business requires such a dynamic environment).

**FUNCTIONS, FEATURES, QUALITIES**

Chargeback is a way to put IT services in terms that businesspeople understand and value. When IT is bought and consumed like other services, IT can become a business within the business. And that is the path to true IT value.

**Functions**

Chargeback systems and procedures need to be user-oriented. There is a tendency to present billing information in terms of Number of I/Os, Processing Time or Memory Consumed. These units have little or no meaning to most users. A desired approach is to tie system resources to business entities. This way, users see charges by items such as Customers Processed or Accounts Updated. These are areas in which users can communicate and control usage of their processing resources.
Key chargeback functions can be grouped into the following areas:

- **Data Collection Functions**: For example, if a cost element is based on number of transactions, then the number of transactions executed each day will have to be collected.

- **Account Table Maintenance**: There will most likely be some form of account table that describes the various users and departments and how system data that is collected is to be allocated across these entities. Periodic maintenance will need to be done on this table to ensure that charges are being allocated correctly based on the most current requirements of the business.

- **Rate Setting**: Chargeback algorithms and rates may change over time due to increased costs for services or changes in user departments. These rates need to be fairly developed, agreed upon by key users and integrated into the current procedures and systems used to do chargeback.

- **Billing & Reporting**: Chargeback bills and reports will have to be produced on a periodic basis.

- **Administrative functions**:
  - » Budgeting Activities
  - » Pricing Decisions
  - » Usage Variance Analysis Request
  - » Business General Ledger & Accounting
  - » Cost Allocation Decisions
  - » Capacity Planning & Usage Trending Activities

**Features**

1. Maintains organizational alignment.
2. Involves a business stakeholder and make the business own facets of the problem.
3. Has a set of clearly defined roles and deliverables will be needed to clarify who owns what components.
4. Defines service-level agreements on data, availability, etc.,

Simple IT chargeback systems are little more than straight allocations of IT costs based on readily available information, such as user counts, application counts, or even subjective estimation. At a lesser degree of complexity, an organization trades some of the effectiveness of IT chargeback for a smaller burden, in terms of time and money required to perform the chargeback.

- **Chargeback Software Selection**: Key requirements are to determine the charging algorithm flexibility of the product chosen, accuracy of collection and reporting, and ease of maintenance and use.

- **Configuration versus Utilization Costing Strategies**: When developing cost algorithms, a key decision is whether to charge based on utilization of resources (incremental charges and measuring use of cost resources) or to charge directly related to the costs of the configuration (distributes costs to user departments).

- **Fixed versus Variable Cost Elements**: It must be determined whether charging algorithms are to be based on fixed charges (predictable usage) versus variable charges (unpredictable usage). Reporting and billing will then have to show how rates have been applied and what amounts of the variable elements have been recorded and charged for.

- **Unused or Idle Resources**: It should be determined how unused or idle resources will be covered by the chargeback system.

- **Overhead Resources**: It should be determined how overhead resources will be accounted for. These resources tend to be used by all users (such as the Operating System). If these types of resources are to be charged to users, a fair allocation strategy needs to be determined.

- **Shared Resources**: It should be determined how shared resources will be covered by the chargeback system.

- **Systems Software Customization**: Some customization efforts for systems software may be needed to adequately measure and collect usage statistics.

- **Scope of Processing Costs**: The scope of processing costs needs to be determined to understand the true costs of delivering services. These categories include:
  - **Equipment expenses**: Rental, lease, maintenance or depreciation on equipment.
  - **Communications expenses**: Costs for lines, wiring, transmission facilities and services.
  - **Salary expenses**: Costs for personnel used to support processing functions.
  - **Occupancy and facilities expenses**: Costs for building space and utilities.
  - **Supplies expenses**: Costs for supplies, forms and other non-equipment materials.
  - **Other allocated expenses**: Costs that have been allocated to operations from other activities within the business enterprise.
• Manual Services: Chargeback activities may need to include cost items for manual services such as data entry, tape mounts, etc.

• Variable Charge Rates: It may be desirable to change charges depending on some criteria such as time of day, peak loads, priorities, etc.

• Variance Analysis: It may be desirable to compare budgeted processing expenses with those actually incurred by each user department.

• Charge Penalties: It may be desired to implement penalty costs for exceeding usage limits or processing certain types of functions at inconvenient times of the day.

**BENEFITS**

Charging back is not about creating a profit center or penalizing internal clients; it’s about running your creative services department in the most efficient manner to maximize your company’s profits. Benefits of implementing a chargeback system include:

- Increased awareness of how much it really costs to do those creative projects.
- Recognition of the value of an internal group compared to outside agencies—not just the cost, but things like brand knowledge and quick turnaround.
- Increased efficiencies by reducing those endless rounds of revision.
- Increase resource flexibility—to add staff to meet demand if you are billing for their costs.
- Transition from a cost center to a value center.
- Redefine the company as a service provider.
- Replace lengthy customized Service Level Agreements (SLAs) with a service catalog.
- Improve your cost strategy, provides the client with data for budgeting and gives your finance group the information they need to re-define their financial model.
- Better understanding of the complications and charges for requesting an IT service on the users’ part.

**APPLICATIONS, USE CASES, CUSTOMER CASE STUDIES**

Different models, with different classes of service, can be used to drive more cost-efficient consumption of IT and to achieve more effective matching of service to business need. Four basic methods for pricing IT value are described below.

**No chargeback**

The IT budget is a separate function approved as part of the organization’s planning process.

**Advantages:**
- Low-cost alternative.

**Disadvantages:**
- No accountability for demand and users do not necessarily understand the cost of the IT resources they are consuming.

**Non-IT-based chargeback**

IT costs are allocated to business units based on a non-IT allocation metric (e.g., % of revenue).

**Advantages:**
- Simple, low-cost approach to allocating IT costs.

**Disadvantages:**
- Cost allocations do not necessarily correlate to the cost of the service and consumption/demand cannot be allocated to the business unit using the service.
### IT-based chargeback

**Uses** IT measurements to allocate costs to user groups.

| Advantages: | • Correlates to the cost of the service. |
| Disadvantages: | • IT measurements (e.g., operating system instances) are difficult and costly to implement.  
• IT measurements can be difficult for users to understand and relate to business activities. |

### Direct Chargeback

**Allocates** specific costs for an entire service to a business unit.

| Advantages: | • Easy to implement. |
| Disadvantages: | • Not conducive to shared environments that can reduce costs for an organization. |

### Profit-Oriented Pricing

**Charges** a fee for service similar to an external service provider.

| Advantages: | • IT competes with external providers. |
| Disadvantages: | • Suboptimal decision making, as organizations may not invest internally to ensure long-term effectiveness. |

### Fixed Revenue

**Provides** fixed compensation for services.

| Advantages: | • Customer has greater predictability of Shared Service Center costs. |
| Disadvantages: | • Exposes Shared Service Center to risks of cost/volume increases that are beyond its control. |
Fixed Revenue Within Predefined Range

Provides fixed compensation for services, as long as resource utilization or transaction volumes stay within predefined range of activity. If activity goes above or below range, price will be adjusted accordingly.

Advantages:
- Favorable to Shared Service Center if it has cost advantage.
- Perceived to be fair to customers.
- Price is based on volume of transactions (i.e., usage).
- Addresses Shared Service Center risks exposure of uncontrollable cost/ volume increases.
- Customer doesn’t have to pay fixed revenues if volume is below predefined range.

Disadvantages:
- Customer may perceive that cost savings or efficiency improvements are not passed on.

Subscription Pricing

Enlists a pay-per-use model. The operational cost of the IT facilities is calculated and amortized across a subscription period (for example, one year) and then divided between all the users of the service.

Advantages:
- Simple: If, for example, five lines of business were subscribing to a service that costs $60,000 per month to provide, the subscription charge (assuming a break-even business model) would be $60,000/5 = $12,000 per business unit per month.

Disadvantages:
- No usage monitoring or penalties: It assumes all parts of the business will use the service at the same level on a constant basis, with no penalties for excessive consumption or peak time usage.

Peak-Level Pricing

Adds a mechanism to the subscription model that monitors and records peak consumption. Consumers are billed according to their peak use, not according to their average use.

Advantages:
- Simple to meter: Only peak-level usage needs to be monitored and recorded.
- Easy to show when consumers are using more than the base-level resources.

Disadvantages:
- Penalizes variability: If there are just a few peaks of usage during a given period, the scheme can seem unfair. But shortening the analysis period—say from six months to one—and the measurement intervals—from weekly to daily, for example—can solve the problem.
User-Based Pricing

Meters IT by the person rather than the machine.

Advantages:
- Easy to implement: tracking the authentication of individual users to IT services is relatively simple, especially if a single sign-on system is in place.
- The authentication records provide the basis for cost justification.

Disadvantages:
- Ignores system load: If users make heavy demands on systems when they log on, this model shortchanges IT.

Ticket-Based Pricing

Meters and controls usage using electronic “tickets” that use a validity period (say four hours).

Advantages:
- Consumption regulation: ticket-based pricing lets IT control system load to a fine degree, helping eliminate usage peaks and ensure business continuity.
- Simple: all that is required to monitor ticket pricing is a low-latency (i.e., fast-responding) portal, most probably constructed as a Web service.
- Strongest cost justification.
- Pinpoint monitoring: tickets can be very specific, allowing both sides to monitor exact usage down to the specific application level.
- Network access could be offered under the ticket-based chargeback model at three price levels:
  - Varying degrees of bandwidth.
  - Service level guarantees.
  - Peak usage guarantees.

Disadvantages:
- Ticket hoarding: for the ticket-based model to operate effectively, it’s often necessary to implement “use-by” dates on tickets to avoid stockpiling.

Virtual Server Count-Based Pricing

Charges the departments based on the number of VMs they have on a particular host server. Host machine contains 10 VMs and two of them belong to the X department. X department will be charged 20% of the server’s overall operating costs (plus any applicable software licenses).

Advantages:
- Easy to implement & Simple to meter.

Disadvantages:
- It isn’t completely fair -- not all VMs consume equal hardware resources.
## Resource Consumption-Based Pricing

More common to find resource-based chargeback used to determine equitable cost allocations for the distributed systems.

There are sets of metering records for the various OSs but there are also metering data available to track and determine the cost of specialized environments such as Web servers, file servers, database servers.

For example, one department may operate a virtual Web server, which consumes sparse resources, while another department operates a SQL server that consumes nearly all of the host machine’s available CPU and memory resources. Being that some VMs consume more hardware resources than others, some organizations have begun basing their IT chargeback on the number of virtual CPUs that are allocated to each particular virtual server.

**Advantages:**
- Assuming the chargeback method is driven down to the business unit level, some control over demand, and behavior can be affected by “pay for what you use.”
- Perceived to be fair to customers.
- Price is based on usage of various resource factors.

**Disadvantages:**
- It is labor-intensive for IT to keep track of resources.
- Chargeback is less transparent since it is derived from multiple resource factors.

## Static Capacity-Based Pricing

Customer pays for a set amount of capacity, regardless of its consumption. This is best implemented as “slices.” Slices can be aggregated (a resource pool) or granular (individual VMs).

**Advantages:**
- Relatively easy to measure and bill for allocation of these slices.
- Customers are unlikely to be shocked by the bill at the end of the month.

**Disadvantages:**
- Chargeback is less transparent.

## Hardware-Based Pricing

Departments pay for their own hardware. For example, an organization’s marketing department needs to deploy a SharePoint server. SharePoint would be installed within a virtual machine running on the server. The department would own the server and would be free to deploy additional VMs without incurring any additional hardware-related chargebacks until the server has been filled to capacity.

**Advantages:**
- Easy to implement & simple to meter.

**Disadvantages:**
- Need to establish guidelines as to what can be installed on a host server. For example, some organizations have security policies prohibiting Internet-facing VMs from being installed on the same host server as backend virtual servers.
- Departments are reluctant to blow their IT budgets on redundant hardware.
Flat-Rate Pricing

Works best in a virtual data center. Charges a flat rate for each server. Because some VMs consume more hardware resources than others, it’s possible to establish two different rates - basic and high capacity.

Advantages: • It does not force IT to use complex and time-consuming methods for determining each department’s monthly bill. • Makes it easy for the departments to stay on budget.

Disadvantages: • Chargeback is less transparent.

Transaction Ratio Funding

Starts with a fixed-operating budget. Then, based on the ratio of transactions, the single operating budget is divided. T1 hosts 20,000 transactions against their shared services, and T2 hosts 30,000 transactions, then T1 would get 40% of the operating budget.

Advantages: • Usage-based transparent chargeback.

Disadvantages: • Complex and time-consuming methods to keep track of transactions.

Activity-Based Pricing

Makes the cost-allocation fair, transparent, and predictable. Excellent for shared service chargeback. Also provides the basis for a clear and easy-to-understand invoice.

Advantages: • Helps shared service centers justify their costs. • Helps business units understand what their usage of shared services cost. • Provides shared service centers with better information for continuously improving internal efficiency and for benchmarking. • Perceived to be fair to customers. • Price is based on volume of transactions (i.e. usage) • Establish meaningful activity centers (cost pools). • Ensures that the cost drivers selected have a strong positive correlation with the resource cost. • Charges for resources that are expensive (material). • Data is easy and inexpensive to collect. • Provides sufficient detail to allow customers to influence the usage (cost). • Track information by service (application) and customer (company, division, cost center, etc.)

Disadvantages: • Revenues fluctuate according to demands.
TOOLS

- Open source web based service level management software
- VMware vCenter Chargeback Manager
- Utility Chargeback

EVALUATOR’S ANALYSIS, COMMENTS, AND RECOMMENDATIONS

Strengths

- IT needs to understand that the least costly way to run any IT operation of significant size is with a well-performing internal operation, and having a chargeback system in place that links costs to services is not going to make outsourcing more likely.
- The chargeback model also provides IT a more meaningful way of measuring the cost of their services in a way that makes sense to end-users. Improvements in processes will result in increased value of the service and/or reduced chargeback that will have a clear impact on the profitability of the business units. Business units appreciate the transparency and will tend to make fewer inaccurate assumptions about the value of their services.
- A chargeback model facilitates replacing multiple service-level agreements with a standard service catalog.
- Chargeback and other methods of demand management help organizations prioritize their IT projects.

Weaknesses

- Internal politics associated with implementing and maintaining IT chargeback systems to be daunting when combined with administrative costs and substantial accounting challenges.
- IT departments may also fear that linking actual costs to value delivered sets them up for comparisons to commercial service providers.
- A common problem with chargeback is that potential buyers start haggling with you or just go to a SaaS provider that is a few bucks cheaper.
- Chargeback can lead to bad decisions because managers become more concerned about reducing their individual costs than doing what is best for the enterprise.
- Chargeback adds overhead at a time when most organizations are being told to cut back.
- Internal customers have a hard time understanding all the costs required to support applications.

Recommendations

- Build a “best practices” chargeback process.
- Develop a chargeback requirements document.
- Evaluate and select chargeback software.
- Implement the chargeback software.
- Build a finance and chargeback support team dedicated to IT management.

CONCLUSION

IT chargeback can work, but it is important to plan the process, track using accounting principles, and then watch for any fallout that can occur with the chargeback program.
GLOSSARY

Operational Cost  | Operational costs may include expenditures for staffing, hardware maintenance, electricity, software procurement, storage rental, and security. Operational costs are usually calculated quarterly or annually.
Accounting  | Accounting is used for monitoring and controlling operational costs and can be used for capacity management and budgeting expenses.
Chargeback  | Chargeback is a general term that can be used to represent either charging of resource usage to different business units of the same company, or billing other companies based on their resource usage.
Billing  | Total Operational Cost + Gross Profit Margin.

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