Network Accounting: An opportunity to control network-related expenses through IT Charge Manager™

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Abstract
For years, technological and cost constraints have held people back from implementing network accounting systems. With rapidly growing network usage due to such factors as Internet access, global communications, distributed client/server applications, as well as audio and video data transmission, network accounting has never been so critically important. Fortunately, new technologies and SAS Institute’s IT Charge Manager now make network accounting implementation not only feasible but also surprisingly affordable.

What is network accounting and why should I implement it?

Network accounting: A definition
Network accounting is the process of monitoring network traffic and associating it with the business units and applications that are generating it. This information is retained in a database, permitting tracking of application and network usage over time. The importance of network accounting cannot be over-emphasized. All too often, management has no idea who is using the network, or how the network is being used. If they are lucky and have implemented network management systems, they may at least know what the peak periods are on given portions of the network. However, this is not enough. Without network accounting providing a more detailed view, the situation is akin to receiving a monthly telephone bill showing a single lump charge. Perhaps the bill might also inform you that your peak telephone usage was during the daytime. Even this additional information is not very helpful in explaining the patterns or characteristics of your telephone usage. Who would accept a telephone bill like this? And yet, management often operates with equivalent or less information regarding network usage every day.

The corporate communications network: A cost free resource?
The costs associated with corporate communications networks have been steadily increasing. However, for a long time now, network access has been considered like air -- everyone has the right to breathe it and it is there for the taking. It is this legacy perception of the network resource, combined with technologies that are common in today’s applications, which has intensified the need to manage network expenses. Following are several examples:

• There is a general insensitivity to the cost of network resources. The design phase for client/server applications rarely considers the impact on network resources. If network bandwidth is regarded as free, there is little or no incentive to optimize applications. Therefore, it is common that new client/server applications make inefficient use of network resources.

• Data warehoused on mainframes is transmitted to servers in a global environment with little consideration of the impact that the increased load will have on the network. Moreover, extraneous data is frequently included in these transmissions, as opposed to sending only those fields or rows that require updating. Similarly, there is no incentive to utilize data compression as a standard for these transmissions when costs are not applied.
• Internet (including World Wide Web) activity places additional strain on the network. Unfortunately, access to the Web is also viewed as free and users behave accordingly. What is more, such activity is typically not mission-critical. In fact, it may not be business related at all.

• Users access data with little regard to where it is physically stored. Once again, since no cost is associated with it, they need not consider the load this may place on the network.

• Corporate networks are increasingly being utilized to transmit voice and video data. Users are unaware of the telecommunications resources required to support technologies such as digital sound and video, and the complexity that modern networks require to handle these and other client/server applications.

A network accounting database can readily identify the users of a given application and its level of network utilization. Network accounting not only keeps management informed, it helps to influence user behavior. People are motivated to consider their use of something when there is a cost associated with it. A usage-based accounting system identifies the resource consumers, thereby bringing the quantity and cost of consuming those resources directly to the attention of those users. This allows users to understand and therefore reduce their usage. For example, an organization could discourage the use of certain transactions or protocols by setting a comparatively high rate. The opposite tactic could be used to reward users for usage patterns that management would like to encourage. Network accounting is the only solution that makes users aware of their activity and charges them appropriately for it. There are other solutions that may limit activity, but these are typically heavy-handed “Big Brother” controls. In effect, with a well-implemented accounting system, users control their own activity.

**So why should I implement network accounting?**

• **To obtain critical management information regarding how network resources are being utilized.**
  There is an old computer measurement adage: "You can't manage what you don't measure". You can certainly try but it makes more sense to implement a system that allows you to determine not only who is using the network but also for what applications and protocols. With this information, efforts to manage the network can be prioritized appropriately.

• **To accurately measure and gauge levels of utilization throughout the network.**
  A by-product of implementing a network accounting system is that a baseline of the "normal" level of network utilization will be established. This information can be used to gauge activity to detect if traffic is increasing or decreasing and locate where in the network these fluctuations may occur. Information such as this can be invaluable for load balancing efforts.

**What can I achieve with network accounting?**

A network accounting system provides much more than basic usage-based billing information. Accumulated over time, the data stored in a network accounting repository has relevance to a broad scope of management disciplines directly influencing the cost and consumption of network resources. The accompanying data warehouse can be used for capacity management, baselining,
service level management, and more. Following is an overview of what can be accomplished in association with a network accounting system:

- **Manage IT as a business**
  The network accounting database contains all the information management needs to assess and manage the network as a critical corporate resource. Detailed knowledge of exactly how the network is being utilized enables informed planning and control. Business decisions can be made with a good idea of the impact on IT customers and corporate finances.

- **Achieve cost recovery**
  Since the network accounting database associates business units with their consumption of network resources, billing rates can be applied to utilization statistics so that expenses directly related to the network are distributed to those that use it. No longer will the corporate network be absorbed as an overhead of doing business; rather, the network’s "customers" will pay for it.

- **Informed management planning**
  By capturing and accumulating detailed utilization statistics, corporate management has the information they need for proper planning. This is most significant when justifying costs and planning upgrades or expansion of the corporate network.

- **Influence user behavior**
  By associating a cost with the consumption of network resources, users become sensitive to the expense that is associated with their activity. A full-functioned network accounting implementation will allow for variable per unit billing rates based upon user group or customer, time of day, application or protocol, and even the distance of the network "conversation". Manipulation of per unit billing rates can be an invaluable tool for influencing usage patterns.

- **Control and/or reduce costs**
  Network accounting has a direct relationship to reduction and control of cost. Once "customers" begin to receive bills for their network usage, their natural reactions will be 1) to discontinue unnecessary activity and 2) to make "expensive" applications more efficient. Similarly, usage of undesirable or obsolete applications can be discouraged and reduced by artificially raising per unit billing rates for them.

- **Assist with service level management**
  Service level management is a discipline that establishes contracts, or agreements, between IT and its "customers". These agreements indicate levels of service, in specific statistical measurements, that IT must deliver. A classic example of a service level statistic is application response time. Since network accounting and service level agreements are based upon the same raw measurement data and associate activity with IT customers, the two disciplines are very closely related. Furthermore, network accounting can generate billing credits when IT falls short of service level agreements.

- **Assist with capacity planning**
  Like service level management, capacity planning also makes use of resource utilization statistics in the context of applications and business units. Capacity
planning combines historical usage with forecasts of future usage by business unit and application to predict resource capacity requirements.

- **Bill external customers**
  A network accounting system enables service providers and outsourcers to capture resource usage activity by their customers. Afterward, reports and bills can be generated to recover not only costs but to generate real revenue for the corporation. The billing data, accumulated over time, can then also be used as a basis for periodic contract negotiation with existing clients. Or it may be used as a gauge when entering relationships with new customers.

- **Control network abuse**
  A well-constructed network accounting system allows IT management to view at a detail level exactly how corporate network resources are being used. Users abusing the network by running discouraged applications or accessing the Internet for non-business purposes can be quickly isolated and confronted.

**So how do you implement network accounting?**

There are a number of discrete high-level steps in implementing a usage-based network accounting system. These steps start with the identification of initial system objectives and conclude with back-end reporting and invoicing. Following are details for these steps as well as those in between.

**Site specific development of network accounting methodology**

The first step in the process of implementing a network accounting system is the same as with any new corporate application: system objectives must be clearly defined. A usage-based billing system is particularly sensitive to this initial step because each organization has its own site-specific reason for implementing it. As previously mentioned, there are many IT management disciplines that function in concert with usage-based billing. Thought must be given to determining which of them, if any, will also be implemented or affected by the network accounting implementation.

**Defining management objectives and basic system methodology**

What is management looking to achieve by implementing a network accounting system? Is the objective to generate corporate revenue or simply to recover network expense? If the objective is only to recover expenses, then exactly which expenses are to be included in the cost pool? Is it the costs associated with specific LANs, WAN links, or both? Is there an interest in issuing periodic fixed charges for desktop hardware and network access expense? These decisions are significant because they have a direct relationship to the infrastructure required for data collection as well as the actual unit(s) of measure selected for billing.

Will other management disciplines, such as capacity planning, utilize the network usage data? If so, how many levels of business unit must user identification methodologies derive? User identification is the site-specific process by which network measurement data is associated with the business unit(s) responsible for generating that data. For example, it may be determined that usage activity must be mapped to corporate departments, divisions, and external customers to achieve the desired invoicing and reporting. Network accounting and capacity planning have similar, but often somewhat different, requirements when it comes to the "business unit view" of the data. In fact, an organization may have a capacity planning implementation that correlates
resource consumption with entities such as corporate applications and products. Could requirements such as this be accommodated in the network accounting implementation?

There are also some usage-based billing techniques that can be applied to network accounting. These should be discussed for possible use in the overall methodology. For example, it is possible to bill using different rates based upon protocol or application or time of day. This would be an attempt by management to influence user behavior in a desired way. Similarly, network conversation data can be characterized by the "logical path" of the conversation and billed any applicable surcharges or discounts.

**Selection of billing units**

Billing unit selection is one of the more critical steps in implementing a successful usage-based accounting system. Careful selection of the billable unit of measure ensures development of an accounting system that is user friendly, accurate, efficient, maintainable, and achieves the desired result. The classic criteria for the selection of billing units include:

- Usage reflects a consumable scarce resource
- The resource is associated with a determinable cost pool
- Resource measurement is simple and repeatable
- The cost of supplying the resource is significant
- The billing unit is understandable and controllable by users

Currently in a multi-protocol environment, the only viable data to use as input to network accounting is RMON2 conversation data. The typical unit of measure selected, as would be expected, is that of network traffic. However, because network data packets vary in size it is most meaningful, and equitable, for the unit of measure to be that of actual character traffic (in/out octets) as opposed to a simple packet count. Through an analysis of your network applications you may determine whether to bill for bytes-sent, bytes-received, or both. Some thought should also be given to a flat connection rate to cover the expense of an idle line and LAN usage.

**Establish a user identification methodology**

One of the biggest challenges for network accounting systems today is a general absence of IETF standards associated with user authentication. Therefore, site-specific methodologies must be developed to associate measured network activity with the business unit(s) to be billed. Network address is the data field best suited for use as the primary key in deriving the required level(s) of business unit detail. Network address values, such as IP and MAC addresses, have direct correlation with specific nodes on the network. However, they may also have a degree of variability that makes accurate mapping to a single business unit somewhat of a moving target. This dynamic aspect of network addressing is created by an automated IP address management technology called Dynamic Host Configuration Protocol (DHCP). DHCP removes the requirement for manual administration of IP addresses and allows network nodes to "lease" IP addresses for specified periods of time. For sites that do not make use of DHCP or utilize vendor software packages to help administer DHCP, a user identification methodology based upon network addressing may be entirely feasible, reliable, and accurate.
**Data Collection**

The best data source currently available for use as input to a network accounting system is RMON2 conversation matrix data. Conversation level data, collected by periodically polling intelligent agents, contains the source address, destination address, and application or protocol used by each conversation "pair". While this does represent the maximum level of possible detail, the data can be collected in a distributed configuration to ease operational and resource related issues. From the perspective of network accounting methodology, measurement data at this level of detail provides ultimate flexibility during the charge generation process.

The scope of the objectives for network accounting will dictate the location and extent to which intelligent agents must be distributed through the network. As intelligent agents are added to the data collection configuration, multiple agents may monitor individual conversations. This necessitates the insertion of logic to manipulate and filter duplicate records from the conversation data prior to processing into the network accounting repository.

The physical collection, or "polling", of the conversation data from the intelligent agents is a standard function of vendor supplied network management products. Care should be taken to ensure the network management platform supports the full RMON2 standard.

Although the cost of “instrumenting” the network with RMON probes ranges from 1-5% of the wide area network annual budget, frequently this expense is already carried by the network engineering or operations group for the purpose of troubleshooting.

**Physical network accounting system implementation**

Once the network accounting objectives have been established, and preliminary designs for user identification and data collection have been developed, it is time to put the pieces together as a fully functioning network accounting system. Some sites prefer to develop the application framework themselves. However, there are vendor-supplied solutions that provide usage-based accounting functionality. Depending upon site-specific requirements, usage-based billing systems may require some unique functionality. Typically, vendor-supplied products handle many requirements such as these.

Remember to implement a front-end filter to handle potential duplicates in the raw conversation data and initiate processing to populate a network accounting repository. At this time, begin to assess the degree to which user identification techniques are successfully producing the desired business unit associations. Make whatever changes necessary to tune the process. This preliminary validation of data will be an iterative process, culminating in a cost accounting exercise to compute the per unit billing rates used in the production application.

**Cost Accounting and Rate Development**

The cost accounting function identifies and categorizes all expenses (such as direct, indirect, or overhead, and depreciation costs) to be recovered by the billing system. This includes anticipated costs related to planned acquisitions and dispositions. The primary objective of this function is to identify and categorize the expected costs to be recovered for a specific period of time, usually a year. The process is similar to a budgeting process, but usually requires a finer granularity and a different categorization of the same cost data.

A document illustrating the broad scope of network accounting, in terms of how the underlying cost accounting methodologies support stated corporate objectives, is produced from an initial cost accounting study. This document specifies the guidelines to be used during implementation.
of network accounting. It includes detailed information regarding how the individual "cost pools" are populated as well as the specific measurements that will be used as the basis for recovering these expenses. The cost accounting document also serves as an ongoing reference, helping to ensure that the users and IT management are speaking the same language. It contains clearly stated goals, and might also state agreed-upon service levels.

Through the iterations of early system testing, the characteristics of your network traffic will begin to emerge. Remember that the primary function of the user identification process is to associate network activity with the business unit(s) or customers initiating network traffic. You will be able to assess the percentage of the network traffic that is associated with overhead or "non-billable" business units and customers. With this information known, final per unit rate setting can be done because you will be able to extrapolate the number of billable units that will be collected per fiscal or expense period.

**Reporting and invoicing**

As the operational procedures and underlying methodologies involved with populating the network accounting repository stabilize, the focus turns to reporting and invoicing. Since the generated billing information is stored in a single repository, and site-specific requirements for "business unit" fields are utilized, the flexibility for reporting is extensive. While high-level invoices can be generated to report charges to billable network customers, other more detailed reports can also be produced. Detailed reporting can, for example, illustrate a distribution of network usage by a hierarchy of business units, variances of actual usage from budgeted or expected activity, and basic trends over time to highlight increases or decreases in activity. These are just a few of the reporting capabilities that exist.

One of the more important aspects of reporting in a usage-based billing environment is the ability to substantiate charges at a detailed level. Legacy accounting systems typically supported this requirement by manually generating reports on an ad hoc basis. However, technology today can handle this much more efficiently by providing the user community with access to the charge audit data through a web-browser. By giving users the ability to answer their own questions, it is not only more effective but also minimizes the resource requirements for manual administration of the network accounting system.

**How does IT Charge Manager facilitate network accounting?**

Whatever your network accounting goals, IT Charge Manager can help you achieve them. Using the IT Charge Manager on-line panels, you can easily, say, set higher billing rates for transactions you seek to discourage and thus influence user behavior. Or you can recover costs by billing expenses directly back to network users. Moreover, IT Charge Manager allows you to use the accounting methodology that best fits your environment. Its interactive client/server interface reduces administrative effort dramatically from the effort typically required. The system is tailored via a series of on-line panels, which link to a relational structure of system tables. Syntax errors are flagged immediately upon entry, rather than at some later point in processing. These features make IT Charge Manager an invaluable and time-saving ally in the implementation of network accounting.

**What attributes and functionality does a successful network accounting system have?**

As previously mentioned, usage-based accounting systems require certain features and functionality that in many ways make them unique. Much of this scenario can be attributed to the
implementation of business oriented disciplines in a highly technical environment. In order for usage-based accounting systems to be well received by the user community, and therefore successful, there are a number of business issues that must be addressed.

- **Accountability** - A most important word in business today, and a word particularly relevant to usage-based accounting. Organizations want to track and control costs. It has long been proven that accounting systems provide the way for consumers of IT services to become accountable for their usage of these expensive resources.

- **Credibility** - To ensure accountability, the information that is provided to consumers of IT services must be credible, whether it is in the form of a report or an invoice. Additionally, information in these reports and invoices must be “defendable”.

- **Access** - Customers need easy access to detailed information concerning their own usage of IT services. A usage-based accounting system needs to provide this access in such a way that customers can check it themselves - at the end of the month, during the month - in time to make a difference.

- **Consolidated Reporting** - Organizations need reports that show all usage, no matter the source, from detailed to summary. Drill-downs, roll-ups, rotating columns, all the tools in today’s desktop environment should be available in accounting reports.

- **General Ledger Integration** - Usage-based accounting has a foot in both the technical and financial camps. But in the final analysis, organizations must be able to painlessly integrate this information with their general ledger.

There are a number of common mistakes people make in implementing usage-based accounting systems. A frequent misperception is that accounting systems require only the simple application of a per unit rate to a quantity. However, basic functionality such as user identification techniques, algorithms for computing resource consumption, and general interpretation of system measurement data all involve specialized and relatively complex pieces of programming logic.

Some other specific attributes of a successful network accounting system are:

- **Auditability** - An audit trail must be available to substantiate fiscal period charges.

- **Accountability** - Users of network resources are held accountable for their use of those resources.

- **Proration** - The system should offer the ability to prorate given activity. This could be a valid requirement for specific network hosts and/or protocols.

- **Error correction** - Errors, such as incorrectly attributed network nodes, should be correctable before billing.

- **Multiple rates** - A full-functioning network accounting system should offer the flexibility to apply different rates based upon customer, application, or time of day.

- **Change rates easily** - The network accounting system should be flexible enough to allow rate changes quickly and easily.
• *Fiscal, Gregorian, and Invoice calendars* - Fiscal calendars, Gregorian dates, and invoicing schedules should be defined independently of one another. In this way, periodic invoices may be generated on any basis the organization desires.

• *Billing unit flexibility* - The network accounting system should be able to issue charges for fixed or flat rate billing units as well as usage-based.

**Conclusion**

Even if an organization chooses not to implement network accounting this year or the next, it is essential to at least lay the groundwork for it. It is never too soon to begin constructing a network accounting methodology. As discussed above, the benefits of such a methodology are numerous. And, with the ever-rising costs of network activity, any delay in implementing a system to manage and understand the environment may be dangerously expensive.