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ATN Accounting Management Requirements

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SUMMARY

STNA and Eurocontrol are in the process of producing documents that discuss and identify the potential Network Administrators requirements for the management of ATN Systems. The objective of this activity is to identify the minimum subset of information elements required to be implemented in the Management Information Base (MIB) of ATN Systems,. A first draft addressing fault management requirements has already been produced. This Information Paper addresses **ATN accounting management**.

The main objective of this paper is to define basic systems management capabilities to be implemented in the ATN systems for the purpose ATN usage accounting management.

This paper discusses potential requirements for ATN usage accounting management, and defines Management Information elements in the MIB of ATN systems that support the identified accounting management requirements.

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1 Introduction

1.1 Scope

STNA and Eurocontrol are in the process of producing documents that discuss and identify the potential Network Administrators requirements for the management of ATN Systems. The objective of this activity is to identify the minimum subset of information elements required to be implemented in the Management Information Base (MIB) of ATN Systems,. A first draft addressing fault management requirements has already been produced. This Information Paper addresses **ATN accounting management**.

1.2 Purpose

The main objective of this paper is to define basic systems management capabilities to be implemented in the ATN systems for the purpose ATN usage accounting management.

This paper discusses potential requirements for ATN usage accounting management, and defines Management Information elements in the MIB of ATN systems that support the identified accounting management requirements.

1.3 Limitations of the paper

The accounting management requirements are depending on the charging models adopted by the organizations providing ATN communication services. The definition of an ATN charging model, is however out of the scope of this paper (these are the organizations which individually or together will define the tariff principles). The only purpose of this paper is to define management capabilities that can be implemented within the ATN systems in support of the accounting process. In order to achieve this objective, this paper considers a number of different general charging models and draw the list of associated accounting management requirements. It then specifies management capabilities which satisfy these requirements.

The charging models in the ATN could be usage-sensitive, usage insensitive (flat-rate pricing), or a combination of the two.

In this document, the work concentrated on usage-based accounting management only. Usage-based accounting management is a process which requires collection, log, and collation of usage information pertinent to the cost of using or providing the ATN communication service. To perform these management tasks requires information on the activities of the managed systems, and this is typically obtained by monitoring/logging specific management information elements.

On the other hand, this document does not consider accounting management requirements associated with usage-insensitive charging policies. This could be the subject of a future paper.

Usage insensitive charging policies are by nature less-demanding in term of accounting management capabilities. Would charging policies of such type be adopted in the ATN, it would not be necessary to implement the usage-based accounting management related capabilities identified in this document.

1.4 Structure of the document

The document is organized as follows:

- Chapter 2 is an introductory section summarizing key notions about accounting management

- Chapter 3 discusses requirements for accounting management capabilities implemented within ATN systems
- Chapter 4 proposes Managed Information elements to be implemented in the MIB of ATN systems for usage-based accounting management purpose

2 About Usage Accounting Management

2.1 Motivation for Usage Accounting

The dominant motivations for usage accounting management are:

- Understanding/Influencing Behaviour.

  Usage reporting provides feedback for the subscriber on his use of network resources. The subscriber can better understand his network behaviour and measure the impact of modifications made to improve performance or reduce costs.

- Measuring Policy Compliance.

  From the perspective of the network provider, usage reports might show whether or not a subscriber is in compliance with the stated policies for quantity of network usage. Reporting alone is not sufficient to enforce compliance with policies, but reports indicate whether it is necessary to develop methods of enforcement.

- Rational Cost Allocation/Recovery.

  Implementation of the ATN will incur a considerable capital expenditure, and it will also have significant running costs. It will be necessary to charge the ATN users, so that the investment can be recovered, and the running costs funded. Where ATN development has been funded by commercial investment, it will also be necessary to provide a return on the investor' capital. Accounting can be used as the basis for billing.

The chief deterrent to accounting management is the cost of measuring usage, which includes:

- Reporting/collection overhead.

  This offers an additional source of computational load and network traffic due to the counting operations, managing the reporting system, collecting the reported data, and storing the resulting counts. Overhead increases with the accuracy and reliability of the accounting data.

- Post-processing overhead.

  Resources are required to maintain the post-processing tasks of maintaining the accounting database, generating reports, and, if appropriate, distributing bills, collecting revenue, servicing subscribers.

- Security overhead.

  The use of security mechanisms will increase the overall cost of accounting. Since accounting collects detailed information about subscriber behaviour on the network and since these counts may also represent a flow of money, it is necessary to have mechanisms to protect accounting information from unauthorised disclosure or manipulation.

The balance between cost and benefit is regulated by the GRANULARITY of accounting information collected. This balance is policy-dependent. To minimise costs and maximise benefit, accounting detail is limited to the minimum amount to provide the necessary information for the research and implementation of a particular policy.

2.2 Network policy and accounting

Accounting requirements are driven by policy. Conversely, policy is typically influenced by the available management/reporting tools and their cost. This section is NOT a recommendation for billing practices, but intended to provide additional background for understanding the problems involved in implementing a simple, adequate usage reporting system.

Determining an appropriate charge on each user is potentially a complex problem. The ATN will consist of networks of varying sizes and capacities, operated both by administrations and commercial organisations. Subsidies and funding mechanisms appropriate to non-profit organisations often restrict commercial use or require that "for profit" use be identified and billed separately from the non-profit use. Tax regulations may require verification of network usage. Some portions of the ATN will be distinctly "private", whereas other ATN segments will be treated as public, shared infrastructure. Each of the administrations may have different policies and by-laws about who may use an individual network, who pays for it, and how the payment is determined. Also, each administration will balance the OVERHEAD costs of accounting (metering, reporting, billing, collecting) against the benefits of identifying usage and allocating costs.

Different billing schemes may be employed. In certain cases a flat-fee, usage-insensitive model, similar to the monthly unlimited local service phone bill, could be sufficient and could be preferable for financial, technical, or other reasons. In other cases, usage-sensitive charges may be preferred or required by a local administration’s policy. The wishes of ATN users with low or intermittent traffic patterns may force the issue (note: flat fees are beneficial for heavy network users. Usage-sensitive charges generally benefit the low-volume user).

2.3 General interconnection scenarios

Referring to existing practice in commercial data communications, a number of basic principles can be identified regarding the interconnection network resources owned or operated by different parties:

1. Owner interconnection of network resources, requires a bilateral agreement between the operators of the RDs, identifying the technical and administrative aspects of the interconnection

2. A clear distinction is made between « retail » and « wholesale » interconnection. With a retail interconnection, one party makes the interconnection as a consumer of a service, and the other as a supplier. With a « wholesale » interconnection, both parties make the interconnection as part of the supply of service to customers.

3. A « retail » interconnection is between a Service Provider and a User, and the User is charged for the cost of the interconnection and for the value added service provided.

4. A « wholesale » interconnection is between two Service Providers and such an interconnection exists because it is in the business interest of both parties or required by a national law enforced by a regulator or some other statutory body.

5. Both parties share the cost of a « wholesale » interconnection, and value added service charges are shared either on the basis of « sender keep all », or by an agreement providing financial compensation for traffic imbalances

Certain organizations (typically the ATSOs) will interconnect partly as independent users directly exchanging data and partly as service providers, providing a communications path between another organization and an aircraft, and possibly between two other organizations. The hybrid nature of the interconnection needs to be recognised, and the different natures of traffic (ground/ground vs air/ground) recognised, and separately accounted for.

2.4 Charging models

The above provides a common basis for interconnection. However, complications arise if Service Providers interconnect through another Service Provider. A typical example is a service provider in country « A », passes data for the delivery to destinations in country « C », to a service provider in country « B ». There are three possible charging models for this scenario:

1. « Sender keeps all »: this is the simplest model, in which the first service provider in the delivery chain keeps all the revenue and the others receive nothing. It is satisfactory when traffic flows are balanced and there is little opportunity for competition between the service providers.

2. « multiple bilateral agreements »: the first service provider in the delivery chain negotiates a separate bilateral agreement with each service provider en route, and shares the revenue according to that agreement. Typically a traffic balance is assumed as the normal situation, with financial compensation agreed in the event of imbalances during an accounting period. This approach is satisfactory provided the route can be computed in advance and does not vary dynamically.

3. « Incremental charging »': the bilateral interconnection agreement between service providers separately itemises the total cost of delivering packets to destinations not served directly by the service provider, including charges payable to other service providers en route. The charging arrangements are similar to a retail interconnection and it is up to each service provider to route the packets to their destination along the most appropriate route. The route may vary and does not have to be known in advance by the sender.

2.5 Meters

2.5.1 General

ISO 7498-4 (OSI Reference Model Part 4: Management Framework) defines a generalised accounting management activity which includes calculations, usage reporting to users and providers and enforcing various limits on the use of resources.

The OSI accounting model defines three basic entities:

1) the METER, which performs measurements and aggregates the results of those measurements;

2) the COLLECTOR, which is responsible for the integrity and security of METER data in short-term storage and transit; and

3) the APPLICATION, which processes/formats/stores METER data. APPLICATIONS implicitly manage METERS.

This paper is concerned with specifying the attributes of METERS and, with little concern at this time for COLLECTORS and APPLICATIONS

2.5.2 Purpose of the meters

A METER is a process which examines a stream of packets on a communications medium or between a pair of media. The meter records aggregate counts of packets belonging to FLOWs between communicating entities (hosts/processes or aggregations of communicating hosts (domains)). The assignment of packets to flows may be done by executing a series of rules. Meters can reasonably be implemented in any of three environments -- dedicated monitors, in routers or in general-purpose systems.

Meter location is a critical decision in accounting. An important criterion for selecting meter location is cost, i.e., REDUCING ACCOUNTING OVERHEAD and MINIMISING THE COST OF IMPLEMENTATION.

In the trade-off between overhead (cost of accounting) and detail, ACCURACY and RELIABILITY play a decisive role. Full accuracy and reliability for accounting purposes require that EVERY packet must be examined. However, if the requirement for accuracy and reliability is relaxed, statistical sampling may be more practical and sufficiently accurate, and DETAILED ACCOUNTING is not required at all. Accuracy and reliability requirements may be less stringent when the purpose of usage-reporting is solely to understand network behaviour, for network design and performance tuning, or when usage reporting is used to approximate cost allocations to users as a percentage of total fees.

Overhead costs are minimised by accounting at the coarsest acceptable GRANULARITY, i.e., using the greatest amount of AGGREGATION possible to limit the number of accounting records generated, their size, and the frequency with which they are transmitted across the network or otherwise stored.

The other cost factor lies in implementation. Implementation will necessitate the development and introduction of accounting software components into the ATN. It is important to design an architecture that tends to minimise the cost of these new components.

3 Usage accounting management requirements

3.1 Introduction

Although the exact requirements for internet usage accounting will vary from one organization to the next and will depend on policies and cost trade-offs, it is possible to characterise the problem in some broad terms and thereby bound it. Rather than try to solve the problem in exhaustive generality (providing for every imaginable set of accounting requirements), some assumptions about usage accounting are posited in order to make the problem tractable and to render implementations feasible. Since these assumptions form the basis for our architectural and design work, it is important to make them explicit from the outset and hold them up to the scrutiny of the ATN community.

In the following sections, the accounting requirements are being considered at different communication service levels, with the objective to identify the accounting management capabilities to be implemented within ATN Systems.

3.2 Subnetwork accounting management requirements

Subnetwork service accounting is primarily of a concern for the subnetwork service providers (SNSPs). Except in the particular case of the adoption of a usage incentive accounting policy (i.e. a flat fee approach), the subnetwork service providers needs to perform the measurement of the amount of service consumed by their subscribers. The requirement is generally to record for each subscriber the characteristics of every established subnetwork connection, the duration of these subnetwork connections and the number of packets and/or octets exchanged over these subnetwork connections. This is usually resolved by implementing a meter function at the point of attachment of the subscriber to the subnetwork. This functionality is generally implemented within the equipment providing the subscriber with access to the subnetwork service, or within a dedicated device located at the attachment point. This function is not implemented in an ATN system. Subnetwork accounting for an SNSP does therefore put any requirements for accounting capabilities within an ATN System.

Subnetwork accounting may also be of interest for the Subnetwork Service User (SNSU). For instance, an SNSU may be willing to perform subnetwork accounting in order to verify that the communication charges do correspond to the real consumption, or to control that the current consumption does not exceed a specified quota. In addition, the SNSU may wish to monitor how the subnetwork service is consumed and know which proportion of the subnetwork service consumption is to be associated to different upper level services or upper level services end users. Possibly this can be used to charge back the subnetwork service that is consumed in the provision of an upper level communication service. For instance, an organization operating an A/G BIS connected to a mobile subnetwork may wish to know which ATN Internetwork Service users are at the origin of the traffic observed on the mobile subnetwork.

An SNSU may therefore have the following 2 accounting management requirements:

- To know the amount of subnetwork service that is consumed

- To know the amount (or proportion) of subnetwork service consumed by individual upper level service or upper level service (end) users

These requirements can be satisfied with the implementation of a meter function implemented within the equipment connected to the subnetwork or within a dedicated device located at the attachment point.

When the equipment connected to the subnetwork are ATN ESs or ISs, it may be therefore desirable to the local organization that these ATN systems implement subnetwork accounting meter functions that meet the above 2 requirements.

The first requirement can usually be easily satisfied by implementing the appropriate counters within the SNAcP layer of the ATN system. The type of different counters to be implemented depend on the type of the connected subnetwork(s). A possible approach is to implement the same counters as the ones used by the SNSP in the construction of the tariff. The public subnetwork operators generally construct their tariff on the basis of a standard set of counters that is specified in an ITU-T Recommendation. For instance for X.25 subnetwork, ITU-T Recommendations D.10, D.11 and D.12 define the provisions of the tariff principles applying to international packet switched public data communication services.

The second requirement cannot easily be satisfied by implementing counters within the SNAcP layer of the ATN systems. It would require the accounting meter function to interpret the content of the data part of every exchanged subnetwork data packet , and to extract and use the upper level PDU fields that allow to identify the accountable upper level services or upper level services end users. This task can become particularly complex, when the upper level PDUs are compressed, as this may be the case in the ATN.

This second requirement can possibly be more easily achieved as part of the ATN internetwork service accounting process that is discussed in the next section.

3.3 ATN ICS usage accounting management requirements

3.3.1 Introduction

In the ATN, a number of involved organizations will provide ATN Internetworking services, i.e. services consisting in relaying and forwarding ATN CLNP packets on paths that allow the CLNP packets to reach or get closer to their destination.

It is assumed that some of these organizations will charge this ATN Internetworking service. Hence it can be assumed that some organizations will have an interest in ATN ICS accounting, for the purpose of either determining or verifying the charges.

This section examines the potential requirements of these organizations.

3.3.2 General

An organization providing or using ATN ICS service owns and operates some subset of the ATN. This subset is referred hereafter as its administrative domain. This administrative domain has well defined boundaries.

For accounting purpose, the network administrator may be interested in:

1. Traffic within the boundaries of the local administrative domain, and
2. Traffic crossing the boundaries of the local administrative domain

3.3.3 ATN ICS accounting requirements within an administrative domain

3.3.3.1 General

Accounting can be used within an Administrative domain in order to keep track of flows between individual ESs in the domain or between individual parts of the domains.

Accounting may also be used within an Administrative Domain, with the objective to apportion costs for the network management activity, to individual Ess or the departments that owns the Ess. Individual departments or Ess may then be charged internally for their own consumption of the communication resources. This case may introduce within an administrative domain a consumer-provider relationship between different departments and may create different accounting management requirements from the the consumer and provider perspectives

3.3.3.2 Provider perspective

A network administrator may be interested in knowing the contribution of individual departments on the total traffic handled by the communication resources. To simplify the discussion, we will assume here that individual departments form individual routing areas or routing domains within the administrative domain. The network administrator may then require to keep track, for internal accounting purpose, of the traffic that are exchanged between local routing areas(resp. domains) across an internal backbone network. This requirement can be satisfied with the following methods:

a) Accounting meters can be configured and placed on the backbone to keep track of the multiple individual ES to ES flows .The network administrator can then derive the contribution of individual routing areas/domains to the traffic of the backbone with a post-processing activity that compute, from the individual ES to ES flows records, the total traffic exchanged between each pair of areas (resp. domains)

b) In order to avoid post-processing activity and to alleviate the meters from the memory and CPU-cycles consumption required to keep track of flows between every pair of Ess, accounting meters can be placed on the backbone and configured to record only an aggregated account of packets that are exchanged between areas (resp. domains).

Approach a) provides a lot of details. Such details may not be of interest from a provider perspective (aggregate counts are sufficient for the charging of individual departments) but may be needed if detailed accounts are to be provided to the consumers. Approach a) brings a consequent overhead on the activity of the meters and of the network administrator (recording, reporting, collecting, post-processing). Furthermore, the implementation of detailed metering function at the level of the backbone may impact the performance of this backbone. It is therefore assumed that the approach b) would generally be preferred.

3.3.3.3 Consumer perspective

Certain departments of the local administrative domain might want to keep track of the communications of local individual Ess that use the service of the backbone, so that to know the contribution of these individual Ess to the total “outbound” traffic. If a detailed accounting service is not provided by the backbone service provider (approach a/ above is not implemented), it may then be desirable to implement locally meters that perform the necessary measurement: a meter can be placed in (or at) the router that connects the department to the backbone; alternatively, meters can be placed in the individual Ess or on the LANs.

3.3.3.4 Conclusion

Within an administrative domain, there might be different and various accounting management requirements ranging from the ES to ES accounting to accounting at a coarser granularities (e.g. aggregated counts of packets between local routing areas or routing domains).

More specifically, typical requirements are:

1. To log, for each individual local ES-to-ES flow, a separate record memorizing the 2 NSAP addresses and the number of packet/octets exchanged.

2. To log, for each individual local area-to-area (resp RD to RD) flow, a separate record memorizing the 2 area address prefixes (resp. the 2 RDIs) and the number of packet/octets exchanged.

3. To log, for each individual “outbound” flow, a separate record memorizing the NSAP address of the local ES, the address prefix of the “remote” source/destination area (or routing domain) and the number of packet/octets exchanged.

3.3.4 ATN ICS accounting requirements for cross domain traffic

3.3.4.1 General

ATN ICS accounting requirements for cross domain traffic depends for an organisation of the nature of the interconnections that this organisation may have with other organization (see section 2.3), and on the charging models in action over these interconnections (see section 2.4).

3.3.4.2 ICS Accounting requirements in the context of a retail interconnection

As introduced in section 2.3, a retail interconnection is between a service provider and a user, and the user is charged for the cost of the interconnection and for the communication over this interconnection.

In this context, the network administrator of the service provider is usually not interested in accounting for individual End Systems of the user organization. His primary concern is accounting to the level of the user organization. The usual scenario is therefore that the provider will send the user an aggregate bill (or other statement of accounting) for its use of his resources. When he receives an aggregate bill from the provider, if the user organization wishes to allocate the charges to end users or departments within its administrative domain, it is its own responsibility to collect accounting data about how they used the resources of the provider.

For the service provider, the basic requirement is therefore to implement a meter that allows to perform an aggregate count of packets sent and received to/from the user organisation without further information on which particular ESs (or departments) of the user organisation are involved in the communications. On the other hand, the service provider might require to examine the flow with a finer granularity when parameters of the packets have a direct effect on the tariff that is to be charged to the user. For instance, if the provider charges differently the packets function of the packet priority, traffic type, or remote source/destination address, the provider may require that the meter accounts separately packets with different priorities, traffic types, and remote source/destination address.

More specifically, the requirement is that the meter segregates the user traffic into individual flows on the basis of the remote source/destination address prefix, and possibly of the priority and traffic type, and then logs, for each of these individual flows, a separate record memorizing the user address prefix (typically the RDI), the remote source/destination address prefix, possibly the priority and the traffic type, and the number of packet/octets exchanged. The meter can be placed in (or at) the router (typically a BIS) that is interconnected with the user.

The service user might want to keep track of the communications of individual local Ess or departments that cross the domain boundaries. It might therefore be necessary for the service user to implement meters that record the consumption of individual cross-domain flows from/to every local ES or department. Accounted flows may have furthermore to be segregated according to the same parameters as the ones used by the provider in the construction of its tariff (e.g. recording separate accounts for flows of different priority, traffic type, or remote source/destination address, and for every local ESs or department).

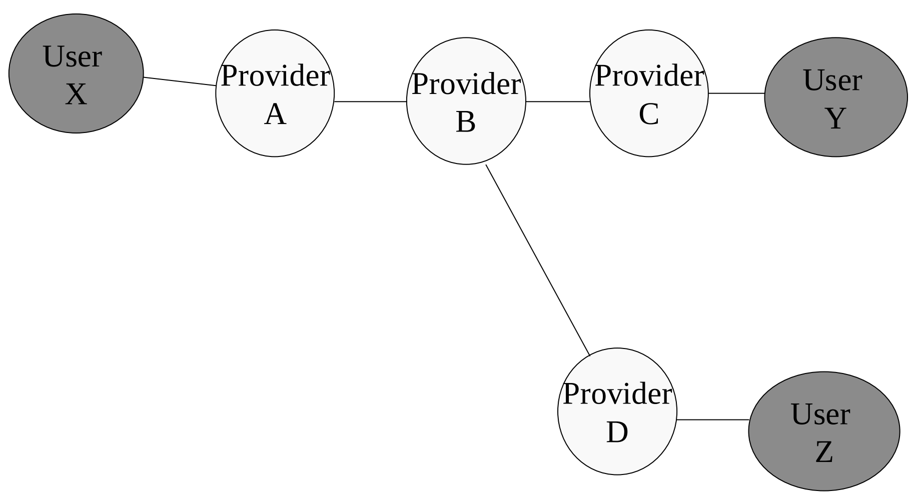
The user requirement is therefore to log, for each individual cross-domain flow, a separate record memorizing the NSAP address of the local ES (or the address prefix of the local area or RD), the remote source/destination address prefix, possibly the priority and the traffic type, and the number of packet/octets exchanged. This can be done with a meter placed in (or at) the router (typically a BIS) that is interconnected with the provider.

3.3.4.3 ICS Accounting requirements in the context of a wholesale interconnection

As introduced in section 2.3, a wholesale interconnection is between two service providers. In the context of such an interconnection, ATN ICS accounting requirements for cross domain traffic depends on the charging models that has been agreed between the two organizations.

When the “sender keeps all” charging model is used, both providers receive the revenue from their own direct customers only. There are no financial compensation exchanged between the two providers for traffic imbalances. There are therefore no accounting requirements related to the traffic exchanged between the two service providers.

When the “multiple bilateral agreements” charging model is used, the providers must redistribute



parts of the revenue received from its customers to every other providers that have contributed in the conveyance of packets originated from (or destined to) these customers. As an example, consider the figure below, representing the interconnection of a number of service users and providers.

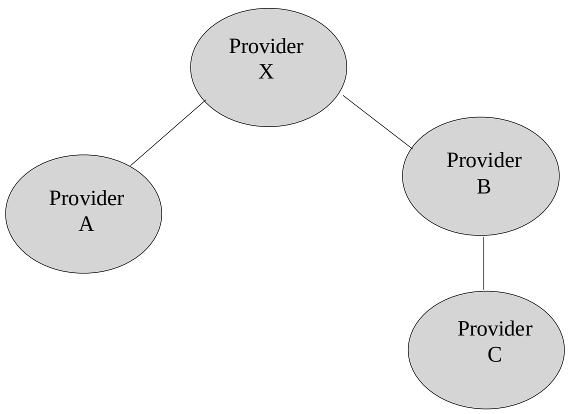
We assume that the Provider A receives a revenue from User X for the flows exchanged between Users X and Y. With the “multiple bilateral agreements” charging model, the Provider A would have to reverse part of this revenue to providers B and C, since these providers participate in the conveyance of packets from X to Y. In the same way, if Provider A receives a revenue from X for flows exchanged between X and Z, it would have to reverse part of this revenue to Providers B and D.

This charging model introduces the following accounting requirements:

- The first provider in a chain of providers needs to segregate the traffic of its customers on the basis of the remote destination/source address, and maintain separate accounts. This requirement was already identified in section 3.3.4.2. Assuming that this provider knows for every possible remote source/destination domain, the list of other providers on the path to this domain, post processing accounting activities may then allow to derive from the individual accounts, the revenue to be reversed to every other service provider.

- Providers that receive traffic from other providers may need to account this traffic in a way which allows them to verify that the other providers pay the due charges. These providers will then need to segregate the traffic received from other providers , into individual flows, on the basis of the address prefix of the remote end user that is being charged for the flow, and to maintain separate accounts. This can be done with a meter, placed in (or at) the routers that are interconnected with other providers. The meter must log, for each individual flow, a separate record memorizing the address prefix of the remote end user, possibly the priority and the traffic type, and the number of packet/octets exchanged. Assuming that the provider knows for every possible remote end user, the identity of the provider that charges this user, post processing accounting activities may then allow to derive from the individual accounts, the revenue to be perceived from every other service provider.

When the “incremental” charging model is used, the service providers establish, with their adjacent service providers, bilateral agreements that separately itemises the total cost of delivering packets to destinations not served directly by the service provider, including charges payable to other service providers en route.



Consider the viewpoint of the provider X in the figure above. The idea is that X will send each provider (i.e. A and B) a bill (or other statement of accounting) for its use of his resources and that the adjacent providers (i.e. A and B) will send him a bill for his use of its resources. When provider X receives an aggregate bill from Provider A, it will allocate these charges to its local customers that used the resources of Provider A. If the "user" is in fact the customer of another service provider, B, (on whose behalf X was using A's resources) the administrator for X just sends his counterpart in B a bill for the part of X's bill attributable to B's usage. If B was passing traffic for C, them B bills C for the appropriate portion X's charges, and so on, until the charges percolate back to the original end user, say G. Thus, the administrator for X does not have to account for G's usage; he only has to account for the usage of the providers directly adjacent to himself.

With this model, the charging arrangements between service providers are therefore similar to those for a retail interconnection. A difference is that the organisations takes both the role of user and provider over these "retail-like" interconnection. Another significant difference is that for flows crossing these interconnections, the organisations to be charged by the service provider is not the one referenced by the source or destination NSAP address prefix of the packets, but the directly adjacent organisation. The significance of the model is therefore that the accounting meters must be able to support accounting for adjacent organizations (rather than accounting on the basis of the packet NSAP address fields).

The need to support accounting for adjacent organization means that accounting will require information not present in CLNP PDU headers (these headers contain source and destination addresses of end-systems only). This information will come from lower layer protocols (SNAcP or link layer) in the form of the source/destination SNPA address.

The requirement is therefore that a meter segregates the adjacent provider traffic into individual flows on the basis of the remote source/destination address prefix, and possibly of the priority and traffic type, and then logs, for each of these individual flows, a separate record memorizing the SNPA address of the adjacent service provider, the remote source/destination address prefix, possibly the priority and the traffic type, and the number of packet/octets exchanged. The meter can be placed in (or at) the router (typically a BIS) that is interconnected with the adjacent organization.

3.3.4.4 ICS accounting requirements in the context of an hybrid interconnection

Hybrid interconnections are established between organizations that partly operate as independent users directly exchanging data and partly as service providers, providing a communication path for other organizations.

It can be assumed that in the context of hybrid interconnection, the accounting requirements will be a combination of those existing for retail and wholesale interconnections.

It may be noted that, in the context of hybrid interconnection, certain cross-domain flows will be direct user-to-user flows for which no accounting will be required. It may therefore be of interest to configure the accounting meters placed on these interconnections so that they ignore the user-to-user flows.

3.3.5 Specific ATN ICS accounting requirements

The charging models discussed in the previous sections are suitable to communications taking place between fixed end users. These models may however be not totally suitable for mobile communications. Charging for mobile ATN ICS communications pauses indeed the following problem: for a ground end user, and for all but the last ICS providers on the path to an aircraft, the cost of the communications to the aircraft cannot be known in advance. This is due to the following facts:

- An end user or an ICS provider, cannot generally know in advance how far is an aircraft, and therefore how many ICS providers will participate in the conveyance of the packets toward/from the aircraft

- An end user or an ICS provider cannot generally know in advance through which type of mobile subnetwork will actually travel the packets exchanged with the aircraft. Depending on whether the packets are actually exchanged over an expensive mobile subnetwork (e.g. satellite) or a cheaper one (e.g. VDL Mode 2), the real cost of an air/ground communication between the same end users can vary significantly.

- The real cost of an air/ground communication may furthermore vary dynamically as the aircraft moves, and the interconnections of the aircraft with A/G service providers, and the type of available subnetworks change.

The definition of a charging model suitable for mobile communications is out of the scope of this paper (It is assumed that financial arrangements, solving the above issues, will be found between the different actors participating in ATN communications). The intent is to define the requirements for accounting management capabilities that would allow to support the mobile communication charging policy. As a way to proceed, it can be reasonably assumed that, whatever the mobile communication charging model, the following accounting management requirements may exist:

- For the purpose of verifying the charges that are paid, the airlines may wish to have within the aircraft a metering function that take the account of individual communications with organizations on the ground, and that also is able to segregate these flows so as to take an individual account of the packet sent/received over each adjacency with an A/G BIS and over each different mobile subnetwork sustaining this adjacency. Also it may be required that the meter accounts separately packets with different priorities and traffic types.

  The requirement is therefore that a meter segregates the air/ground traffic into individual flows on the basis of the remote ground source/destination address prefix, of the A/G ICS provider, of the mobile subnetwork type, and possibly of the priority and traffic type. The meter must then log, for each of these individual flows, a separate record memorizing the SNPA address of the adjacent A/G BIS, the mobile subnetwork identifier, the remote ground source/destination address prefix, possibly the priority and the traffic type, and the number of packet/octets exchanged. Such a meter would typically be implemented within the Airborne BIS.

- An ICS provider operating A/G BISs, may wish to take separate account of flows exchanged between individual aircraft (or aircraft of individual airlines) and individual ground end users, so as to be able to associate the related charge to the two potential accountable end user organizations the aircraft operator and the ground end user). Furthermore, as the tariff may be dependent on the type of mobile subnetwork used by the flow, the ICS provider may wish to segregate these flows so as to take an individual account of the packet sent/received over each different mobile subnetwork sustaining the adjacency with the aircraft. Also it may be required that the meter accounts separately packets with different priorities and traffic types.

  The requirement is therefore for a meter that would be able to segregate the flows and memorizes the packet/octets sent/received in individual records characterised by; the NSAP address prefixes (the RDI) of the aircraft and of the ground end user, the subnetwork used, the priority, the traffic type. Such a meter would typically be implemented within the A/G BIS

  The requirement is therefore that a meter segregates the air/ground traffic into individual flows on the basis of the remote ground source/destination address prefix, of the aircraft (or airline's aircraft) address prefix, of the mobile subnetwork type, and possibly of the priority and traffic type. The meter must then log, for each of these individual flows, a separate record memorizing the NSAP address prefix of the aircraft (or of the airline's aircraft), the mobile subnetwork identifier, the remote ground source/destination address prefix, possibly the priority and the traffic type, and the number of packet/octets exchanged. Such a meter would typically be implemented within the A/G BIS.

  It must be noted that the availability of such a meter could also resolve the second subnetwork accounting requirement identified in section 3.2 (that is to know the amount of subnetwork service individually consumed by ATN internetwork service end users)

- An ICS provider on the ground path to the aircraft may wish to take separate accounts of flows exchanged between individual ground end user, and aircraft of individual airlines, so as to be able to associate the related charge to the two potential accountable end user organizations. Alternatively, if the charging model for mobile communications is based on notions of propagation of charges between ICS provider (such as exposed for the "incremental charging" model above), it may be necessary to segregate the air/ground communication traffic on the basis of the adjacent ICS provider from/to which the flow is received. Finally, it may be required that the meter accounts separately packets with different priorities and traffic types.

  At the interconnection point with an adjacent ICS provider or user, there is therefore a potential requirement to implement a meter that segregates the traffic toward/from aircraft into individual flows on the basis of the address prefix of the airline's aircraft, of the address prefix of the ground end user, and possibly of the priority and traffic type. The meter must then log , for each of these individual flows, a separate record memorizing the address prefix of the airline's aircraft, the address prefix of the ground end user, the SNPA address of the adjacent provider's BIS, possibly the priority and the traffic type of the flow, and the number of packet/octets exchanged. Such a meter would typically be implemented in (or at) the BISs at the boundary of the ICS provider domain.

3.3.6 Conclusion

For the purpose of ATN ICS accounting, it has been necessary to define the concept of "traffic flows". A flow is a portion of traffic, delimited by a start and stop time, and the packets of which have certain common characteristics of interest for the network administrator. A traffic flow can be considered as an artificial logical equivalent to a connection; however, it is less restrictive than a connection, and refers more generally to a stream of packets with certain common parameters and passing across a node of the ATN.

For ATN ICS accounting management purpose, there are requirements to implement within ATN systems (IS and possibly ES) metering functions that allow to measure the flow. These metering functions should be configurable and provide for the following capabilities:

1. Filtering: to select based on certain criteria the subset of traffic for which accounting has to be performed

2. Segregation: to segregate the accountable traffic into individual flows that have to be accounted separately

3. Recording: to log for each of the individual flow a number of characteristics of the flow.

Different network administrators may have different requirements on which filtering criteria, segregation rules, and recorded information details have to be supported by the metering functions. However, a limited set of filtering, segregation and recording capabilities could allow the support of most accounting management requirements. The following paragraphs list the capabilities for which there might be a common interest.

Note: in the following paragraphs, the following definitions apply:

1. The "first end" is a term used to refer the source of packets on receipt and the destination of packets on transmission

2. The "second end" is a term used to refer the destination of packets on receipts and the source of packet on transmission

With respect to filtering capabilities, the following filtering criteria may be of interest for a network administrator:

- Select for accounting, the packets exchanged over a particular subnetwork interface of the ATN system
- Select for accounting, the packets exchanged with a particular adjacent system (i.e. packets received/sent from/to a particular remote SNPA address
- Select for accounting, the packets which “First End” NSAP address matches one particular NSAP address prefix
- Select for accounting, the packets which “Second End” NSAP address matches one particular NSAP address prefix
- Select for accounting, the packets which “First End” NSAP address does not match one particular NSAP address prefix
- Select for accounting, the packets which “Second End” NSAP address does not match one particular NSAP address prefix
- Select for accounting, the packets exchanged between two particular zones of the ATN (i.e. which “First End” and “Second End” NSAP addresses match a particular pair of NSAP address prefixes)
- Select for accounting the packets that have a particular traffic type
- Select for accounting the packets that have a particular priority

The network administrator might want to specify none, one or a combination of the above filters.

With respect to segregation capabilities, a network administrator might require that a meter be able to segregate the traffic into individual flows, on the basis of:

- The subnetwork interface over which the packets are exchanged (i.e. packets exchanged over different subnetwork interface, are considered to belong to different flows)
- The remote SNPA address of the adjacent system with which the packets are exchanged (i.e. packets exchanged with different adjacent system, are considered to belong to different flows)
- The “First End” NSAP address prefix (i.e. packets received from/sent to different zone of the ATN are considered to belong to different flows)
- The “Second End” NSAP address prefix (i.e. packets received from/sent to different zone of the ATN are considered to belong to different flows)
- The “First End” and the “Second End” NSAP address prefixes (i.e. packets exchanged between two different zones of the ATN are considered to belong to different flows)
- the traffic type (i.e. packets with different traffic types are considered to belong to different flows)
- the priority (i.e. packets with different priority are considered to belong to different flows)

The network administrator might want to specify none, one, or a combination of the above segregation rules.

With regard to the information to be recorded for each individual flow, the following might be of interest for a network administrator:

- The start and stop time

- The number of packets sent and received
- The number of octets sent and received
- The filters that were applied
- The information that characterizes the flow. This information is dependent on the segregation rule that has been applied. It may include:
  - The subnetwork interface identifier (if the flow was segregated on the basis of the Subnetwork interface)
  - The SNPA address of the adjacent system with which the flow was exchanged (if the flow was segregated on the basis of the adjacent system)
  - The “First End” NSAP address prefix of the flow (if the flow was segregated on the basis of the ‘First End” NSAP address prefix)
  - The “Second End” NSAP address prefix of the flow (if the flow was segregated on the basis of the ‘Second End” NSAP address prefix)
  - The priority of the flow (if the flow was segregated on the basis of the priority)
  - The traffic type associated to the flow (if the flow was segregated on the basis of the priority)

3.4 Other accounting management requirements

3.4.1 ES-IS accounting requirements

A portion of the traffic over mobile subnetworks will be the result of the operation of the ES-IS protocol. Although minimum (as compared to the CLNP traffic), there will be a cost associated with this ES-IS traffic. It might therefore be desirable for a network administrator operating A/G or airborne BISs to enter this traffic in the accounts.

The complete requirement for ES-IS accounting, would be to keep separate counts of the number of packets and octets of ISH PDU exchanged over each different mobile subnetwork adjacency (i.e. for each different adjacent BIS, over each different mobile subnetwork) .

Although ES-IS is a connectionless protocol, it is not a stateless protocol as is CLNP: a context is maintained by the ES-IS protocol for each IS adjacency over each different subnetwork. The above requirement can therefore be very easily satisfied by implementing counters of ISH PDUs and octets sent and received within this context and by logging the actual value of these counters when the context is released (i.e. when the adjacency is cleared).

3.4.2 IDRP accounting management requirements

A portion of the traffic over mobile and ground subnetworks will be the result of the operation of the IDRP protocol, and there will be a cost associated with this traffic. It might therefore be desirable for a network administrator operating Ground, A/G or airborne BISs to enter this traffic in the accounts.

Since IDRP uses the CLNS, it could be possible to perform IDRP accounting with accounting at CLNP level. For example a CLNP accounting meter could be used and configured to record the CLNP “System Management” traffic exchanged by a BIS at priority 14 with each of its adjacent BIS over each subnetwork interface.

If the IDRP traffic is to be systematically entered in the accounts, it may be simpler to implement PDUs/octets received/sent counters at IDRP level within each IDRP BIS-BIS connection context. The requirement could then be satisfied by logging the actual value of these counters at BIS-BIS connection clearing time. This approach is the preferred one. It must however be noted that it does not allow to get the individual amount of IDRP traffic spent on each subnetwork, and this might be a concern when IDRP is used over mobile subnetwork.

3.4.3 Transport and upper layers accounting requirements

Accounting at transport layer or above may be used by a network administrator in order to know the contribution of individual applications within an End System to the network traffic. Also, when an organisation is providing applications services to remote clients, accounting at transport or above level can be used to know the proportion of this service used by the individual remote clients.

If application specific accounting requirements have to be satisfied (e.g. to log the remote AE-title, to count the number of occurrences of a particular transaction), the application layer is the logical location to implement the required accounting mechanisms.

On the other hand, accounting at transport layer can provide generic accounting information associated with the different applications running on the system, without the need for the network administrator to scan the accounting logs of each individual application. The basic requirement is then to know the number of TPDUs and octets exchanged over each connection.

Accounting at transport layer and above is normally not an issue: contexts are generally created and associated with each individual connection/association. If required, counters can therefore be implemented within these contexts and their value logged at connection/association termination time.

The exception may be for the Connectionless transport and connectionless upper layers. This document gives this subject a miss.

3.4.4 Data compression and accounting issue

When accounting is used to pass the subnetwork charges on to individual ATN ICS end users, the reduction in volume of traffic obtained thanks to the compression mechanisms may have to be taken into account.

Ideally, within ATN systems that support compression mechanisms, the accounting information recorded for each individual ATN ICS flow should include the exact volume of data exchanged over the subnetwork i.e. taking into account the compression that have been applied to the flow.

Unfortunately, accounting at CLNP level cannot easily allow to meet this requirement. This is because CLNP is independent of the underlying subnetwork technology, and is not assumed to a priori know whether compression is used over the subnetwork, and how much each packet is compressed.

A solution is to record at SNDCF level, the volume of data to be exchanged over each Virtual Circuit (i.e. before compression is applied) and the volume of data effectively exchanged over each Virtual Circuit (i.e. after compression is applied). This allows to know the average compression ratio obtained over each Virtual Circuit and the proportion of traffic sent with this compression ratio. From this can be derived the average compression ratio obtained for each subnetwork adjacency. The network administrator is then able, as part of its post processing accounting activities, to take into account the average compression ratio relative to each individual ICS flow.

This solution is not totally satisfactory, because for ICS flows exchanged with a common subnetwork adjacency, a common average compression ratio is applied rather that the exact compression ratio that is effectively experienced by each individual ICS flow. This solution benefits therefore to ICS flows with a poor compression rate to the detriment of highly compressible ICS flows.

On the other hand, this solution is simple, and can be easily implemented. It is proposed as the basic solution for solving the issue. If the limitations of this solution are not acceptable to ICS end users, other solution will need to be defined.

4 Proposed Accounting Management Information Elements

4.1 Introduction

On the basis of the accounting management requirements identified in the previous sections, this chapter includes a proposal for accounting management information elements in the MIB of ATN systems.

Subnetwork accounting management requirements are not considered in this chapter. This is because subnetwork accounting is not an ATN specific issue and recommendations for the implementation of subnetwork accounting management information elements can be found in other documents.

This chapter focuses on the definition of a portion of the ATN system MIB, in support of ATN ICS accounting.

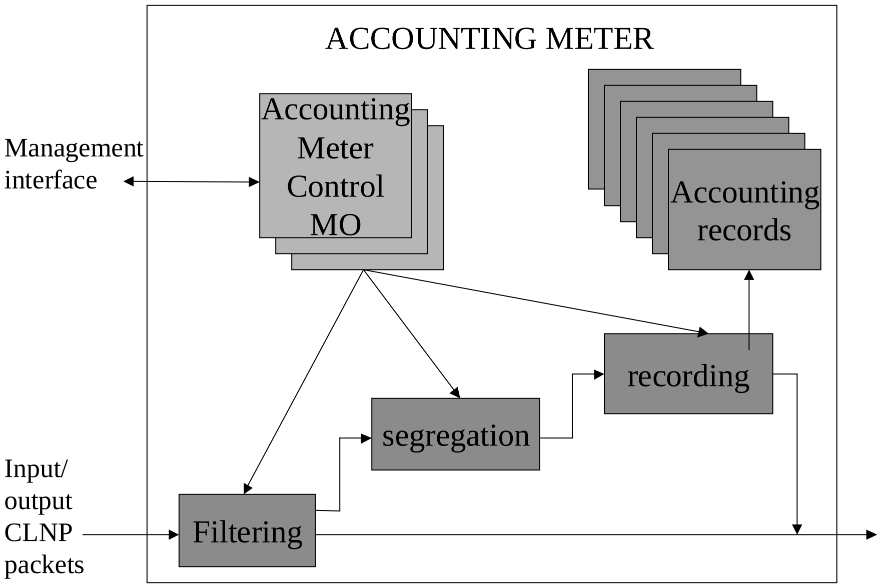
4.2 CLNP traffic Accounting Management

4.2.1 Overview of a CLNP meter function

ATN ICS accounting management requires the implementation of an accounting meter function within the CLNP entity of ATN systems. This section provides a brief overview of the possible structure or such a function.

The CLNP accounting meter is a function that is assumed to be invoked for each instance of CLNP packet received and sent (including forwarded) by the ATN system.

An outline of the structure of a CLNP Accounting meter is given in the following diagram.



Briefly, the meter works as follows:

– When invoked, the CLNP meter function first determines whether the packet is to be counted or ignored. This is assumed to be done by a filtering module.

– If the packet is to be counted, the attributes of the packets (i.e. the source and destination NSAP address, the next/previous hop SNPA address, the traffic type, etc…) are matched by a "segregation" module against rules that determine how the traffic has to be segregated into flows. As a result of this action, the meter must determine to which flow the packet being examined is related, and must find the accounting record associated with this flow; if a record does not yet exist for this flow, a new accounting record is created

– The count for the matching flow accounting record can then be updated (for instance by a recording module as represented in the figure).

The operation of the accounting meter is controlled by the network administrator via the creation of accounting meter control Managed Objects. Accounting meter control allows a managing system to:

– Collect accounting records, start and stop the accounting through management operation

– specify which usage data can be collected and under what circumstances they are updated and reported

The next section proposes a specification for the CLNP accounting meter control MO.

4.2.2 CLNP Accounting meter control MO

4.2.2.1 General accounting meter control functionality

No accounting can be done unless at least one CLNP Accounting meter control MO is created. CLNP Accounting meter control MOs can be created implicitly, or explicitly through the use of a system management CREATE operation.

Accounting meter control functionality must be started by directing a START action to the meter control MO. The effect of this action is to re-initialise the values of parameters accounting for usage which are under the control of that meter control MO, and identified in the START action parameter list.

Accounting is stopped by issuing a SUSPEND action on a meter control MO. The effect is that all recording of usage related to that meter control MO ceases. The related accounting records are left in the suspended condition (the usage counters are held constant at their current values). Accounting may be resumed in a running condition by directing a resume action to the meter control MO.

Upon creation, a meter control object must have values for:

- The filtering control attributes, which specify which packets are to be counted (and therefore which packets are to be ignored). The proposed accounting filters are discussed in section 4.2.2.2.

- The segregation control attributes, which specify which individual packets flows have to be considered by meter and separately accounted. The proposed segregation control attributes are discussed in section 4.2.2.3.

- The reporting triggers, which specify the occurrence of events that cause the meter control data to emit a notification reporting usage data. The reporting triggers are discussed in section 4.2.2.4.

4.2.2.2 Filtering control attributes

Within a meter control MO, accounting filters are specified as a set of MO attributes.

On the basis of the requirements identified in section 3.3.6, the following attributes are proposed:

LinkageFilter:	Boolean that specifies whether accounting is to be performed only for the CLNP traffic exchanged over the specific linkage designated by the **linkage** attribute
Linkage:	When **linkageFilter** is set to true, this attribute designates on which specific linkage, accounting of the CLNP traffic has to be performed for this control MO
SNPAfilter:	Boolean that specifies whether accounting is to be performed only for the CLNP traffic received/sent from/to the specific SNPA address designated by the **adjacentSNPA** attribute
AdjacentSNPA:	Specifies the SNPA address of an adjacent system. When **SNPAFilter** is set to true, packets that are not received/sent from/to that particular address must not be accounted in the usage records associated with this meter control MO.
NSAPprefixFilters:	Integer in the range 0..3. If set to 0, packets are not filtered on the basis of the source and destination address If set to 1, only packets which "First End" NSAP address matches the prefix designated by the **firstEndNSAPprefix** attribute must be selected for accounting If set to 2, only packets which "Second End" NSAP address

	matches the prefix designated by the **secondEndNSAPprefix** attribute must be selected for accounting If set to 3, only packets which “First End” NSAP address matches the prefix designated by the **firstEndNSAPprefix** attribute and which “Second End” NSAP address matches the prefix designated by the **secondEndNSAPprefix** attribute must be selected for accounting
FirstEndNSAPprefix:	(see description of the **NSAPprefixFilters** attribute)
SecondNSAPprefix:	(see description of the **NSAPprefixFilters** attribute)
NSAPprefixExcludeFilters:	Integer in the range 0..2. If set to 0, packets are not filtered on the basis of the source and destination address If set to 1, only packets which “First End” NSAP address does not match the prefix designated by the **ExcludeNSAPPrefix** attribute must be selected for accounting If set to 2, only packets which “second End” NSAP address does not match the prefix pair designated by the **ExcludeNSAPPrefix** attributes, must be selected for accounting
ExcludeNSAPPrefix:	(see description of the **NSAPprefixExcludeFilters** attribute)
PriorityFilter:	Boolean that specifies whether accounting is to be performed only for the CLNP traffic exchanged at the priority specified by the **priority** attribute
Priority:	Specify the priority of the CLNP traffic for which accounting is requested
TrafficTypeFilter:	Boolean that specifies whether accounting is to be performed only for the CLNP traffic of the type specified by the **trafficType** attribute
TrafficType:	Specify the type of the CLNP traffic for which accounting is requested

4.2.2.3 Segregation control attributes

Segregation capabilities of interest have been identified in section 3.3.6.

Within a meter control MO, segregation of the traffic into individual flows can be controlled with a set of MO attributes as follows:

1. Segregation of the traffic on the basis of the subnetwork interface over which the packets are exchanged: this can be configured simply with a boolean attribute that is set to true if packets exchanged over different interfaces have to be counted in separate records, and false otherwise. The proposed name for this attribute is:

    LinkageSegregation

2. Segregation of the traffic on the basis of the SNPA address of the adjacent system with which the packets are exchanged: this can be configured simply with a Boolean attribute that is set to true if packets exchanged with different adjacent systems have to be counted in separate records, and false otherwise. The proposed name for this attribute is:

   SNPAsegregation

3. Segregation of the basis of the “First End” NSAP address prefix: this can be configured simply with an integer attribute that specifies the prefix length that is used in the comparison of the “First End” NSAP address of packets. If a prefix length of 0 is configured, all packets will be considered as having the same “First End” NSAP address prefix and will therefore be associated to the same flow (provided that no other segregation attribute are activated). At the extreme opposite, If a prefix length of 20 is configured, only packets with the same “First End” complete NSAP address will be associated to the same flow. The proposed name for this attribute is:

   FirstEndSegregation

4. Segregation on the basis of the “Second End” NSAP address prefix can be configured using the same principle. The following attribute is proposed for this purpose:

   SecondEndSegregation

5. Segregation of the traffic on the basis of the traffic type: this can be configured simply with a boolean attribute that is set to true if packets with different traffic types have to be counted in separate records, and false otherwise. The proposed name for this attribute is:

   SecuritySegregation

6. Segregation of the traffic on the basis of the priority: this can be configured simply with a boolean attribute that is set to true if packets with different priority have to be counted in separate records, and false otherwise. The proposed name for this attribute is:

   prioritySegregation

4.2.2.4 Reporting triggers

The reporting triggers attribute specifies the occurrence which will cause accounting information to be reported by the meter. As a result of an internal event which matches one of the reporting situations listed in the reporting triggers attributes, an **acountingReport** notification is generated by the meter control MO.

Accounting Management relies upon the facilities of the Event Forwarding Discriminators implemented in the agent, in order to send the accountingReport notifications to specific destinations. One such destination can be a log on the ATN system.

The following reporting triggers attributes are proposed for the CLNP meter control MO:

flowIdleTimer:	This attribute specifies the duration after which an idle flow has to be considered terminated. On expiration of the flowIdleTimer, the meter must scan the current accounting records associated with the meter control MO. For each accounting records which counters have not been incremented since the last expiration of the timer and accountingReport notification carrying the actual value of the parameters and counters of the flow must be generated. The accounting record can then be deleted.

InterimReportTimer	Interim reporting is useful for flow with a long life time, in order to improve accounting reliability, and limit accounting data loss due to a reboot of the ATN system. On expiration of the interimReportTimer , the meter must scan the current accounting records associated with the meter control MO. For each accounting records which already existed at the previous expiration of the timer, an accountingReport notification carrying the current value of the parameters and counters of the flow must be generated. The accounting record must not deleted.

Additionally, accountingReport notifications may be issued at the deletion of a meter control MO.

4.2.3 CLNP accounting records

For the managing system, accounting records will be opaque objects implemented within the meter. It is not proposed to model individual accounting records as Managed Objects.

Accounting records should contain the descriptions of and values for one flow. The information to be recorded has been identified in section 3.3.6. When a reporting condition is encountered (see previous section) this information must be reported as parameters of the accountingReport notification .

4.2.4 Conclusion

CLNP accounting requirement can be satisfied with the implementation of a meter function within the CLNP entity of ATN system.

CLNP accounting management requirements are proposed to be resolved by the definition of a new Managed Object Class for the MIB of ATN systems: the “CLNP meter Control” MO class .

In the ATN system MIB containment tree this new class is proposed to be anchored below the aTNcLNS MO class.

As a summary of the previous sections, the CLNP meter control MO class is proposed to have the following characteristics:

Actions: CREATE
DELETE
SUSPEND
RESUME

Attributes: LinkageFilter
Linkage
SNPAfilter
AdjacentSNPA
NSAPprefixFilters
FirstEndNSAPprefix
SecondNSAPprefix
NSAPprefixExcludeFilters
ExcludeNSAPPrefix
PriorityFilter
Priority
TrafficTypeFilter
TrafficType
LinkageSegregation

SNPAsegregation
FirstEndSegregation
SecondEndSegregation
SecuritySegregation
PrioritySegregation
FlowIdleTimer
InterimReportTimer

Notifications ObjectCreation
ObjectDeletion
AccountingReport

4.3 ES-IS traffic accounting management

In section 3.4.1, it is observed that a network administrator may wish to keep a record of the individual amount of ES-IS traffic exchanged over every mobile subnetwork adjacency.

This can be achieved by adding specific counters within a Managed Object class of the ATN system MIB that represents a mobile subnetwork adjacency. The actual value of the counters can then be reported as parameters of the notification of the deletion of the Managed Object instances, and the network administrator can then rely upon the facilities of the Event Forwarding Discriminators implemented in the agent, for receiving or logging the notification.

In the current proposal for element of management information related to the ATN layer ([REF1]), the mobile subnetwork adjacencies are represented by the following MO class: aTNmobileAdjacency.

The proposal for ES-IS accounting management is then to add the following counters within the aTNmobileAdjacency MO class:

- ESISpdusReceived,
- ESISpdusSent,
- ESISoctetsSent
- ESISoctetsReceived

4.4 IDRP traffic accounting management

In section 3.4.2, it is observed that a network administrator may wish to keep a record of the individual amount of IDRP traffic exchanged with each adjacent BIS.

This can be achieved by adding specific counters within a Managed Object class of the ATN system MIB that represents BIS-BIS IDRP adjacency. The actual value of the counters can then be reported as parameters of the notification of the deletion of the Managed Object instances, and the network administrator can then rely upon the facilities of the Event Forwarding Discriminators implemented in the agent, for receiving or logging the notification.

In the current proposal for element of management information related to the ATN layer ([REF1]), the IDRP BIS-BIS adjacencies are represented by the following MO class: aTNadjacentBIS.

The proposal for IDRP accounting management is then to add the following counters within the aTNAdjacentBIS MO class:

- TotalBISPDUsIn,
- TotalBISPDUsOut

- iDRPoctetsSent
- iDRPoctetsReceived

4.5 Compression and accounting management

In section 3.4.4, it is observed that a network administrator may wish to keep a record of the volume, before and after compression, of the data exchanged over each mobile connection.

This can be achieved by adding specific counters within a Managed Object class of the ATN system MIB that represents, at SNDCF level, a mobile connection. The actual value of the counters can then be reported as parameters of the notification of the deletion of the Managed Object instances, and the network administrator can then rely upon the facilities of the Event Forwarding Discriminators implemented in the agent, for receiving or logging the notification.

In the current proposal for element of management information related to the ATN layer ([REF1]), the mobile connections are represented, at SNDCF level, by the following MO class: aTNmobileConnection.

The proposal is then to add the following counters within the aTNmobileConnection MO class:

- octetsReceivedCounter,
- octetsSentCounter,
- octetsReceivedCompressed
- octetsSentCompressed