Contributions to AAA Arch Work: Inter-domain Accounting

Business Model, Scenario, Actors and Use Cases

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Contributor(s):

Bharat Bhushan **GMD-FOKUS** **Kaiserin-Augusta-Allee 31** **D-10589 Berlin Germany** **Tel : +49-30-3463 7351** bhushan@fokus.gmd.de	**Eric Leray** **Telecommunications Software Systems Group** **WIT, Ireland** **Tel : +353-51-302412** eleray@tssg.wit.ie
Michael Tschichholz **GMD-FOKUS** **Kaiserin-Augusta-Allee 31** **D-10589 Berlin Germany** **Tel : +49-30-3463 7215** tschichholz@fokus.gmd.de	**William Donnelly** **Telecommunications Software Systems Group** **WIT, Ireland** **Tel: +353-51-302423** wdonnelly@tssg.wit.ie

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1 Introduction

In the Business-to-Business value chain, providing "e" services means much more than building web-front interfaces with fancy features to end customers. An e-Business value chain can be defined as commerce conducted between businesses over an Intranet, Extranet or Internet. While organisations in different countries move online at their own pace, their collective e-Commerce activities is estimated, by Forester Research Inc. to reach $6.8 trillion dollars, or 8.6% of the global sales of goods and services, in 2004.

A key aspect in successful e-Business operation is the optimisation of the e-Business value chains (i.e. management of business-2-business chains). A crucial element of successful e-Business operation is the ease and flexibility of *integrating and managing* inter-business interaction. Such e-Business requirements provide new opportunities and challenges for next generation Internet and Telecommunication service provider, which must offer dynamic, managed communication and inter-organisational application service management.

It is envisioned that today's ISPs and telecom operators will take up the IESP role. Current ISPs predominantly offer access services, which are becoming increasingly commoditised. Therefore ISPs are forced to move to value added services in the near future to discern themselves from their competitors. The market analysis with regard to the IESP does therefore focus on current ISPs and (units of) telecom operators that offer today's services for the Business-to-Business (B2B) market.

This contribution is the main result of work carried out in the market analysis and business modelling activity of the FORM project[1]. This document has the following objectives:

- To assist AAA Arch WG in developing a business model based on the inter-domain accounting environment, which identifies the actors, their responsibilities and obligations, the required inter-domain reference points as well as human roles.
- To establish an inter-domain accounting usage scenarios of billing.

The presentation and elaboration of the contribution is guided by methodology guidelines based on UML. This will allow an easy reuse of the results towards dissemination of the results of the FORM project to a wider research community.

Inter-Enterprise Service (IES) assumes a provider offering the application or communication service, which allow multiple customer organisations to co-operate. To support a range of customer configurations, the service must offer flexibility in the configuration of Service Level Agreements (SLAs) and the distribution of bills, where customers may take varying degrees of responsibility for negotiating SLAs and paying bill for the usage incurred by other customers.

The selected business scenarios are presented in order to capture more detailed requirements on the accounting and billing functionality.

An e-Business management provider is called the "***Inter Enterprise Service Provider***" (IESP). The services provided by an IESP are termed the "***Inter Enterprise Services***" (IES). Examples of IESs could include: dynamic, on-demand Virtual Private Network services; outsourced management of customer premises equipment, communications services and inter-organisation application services. The functional areas for this management would include Quality of Service monitoring and management. Security management, and Accounting management. This contribution takes up the **Accounting management** theme of the FORM project.

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[1] **FORM Full title: Engineering a Co-operative Inter-enterprise Management Framework, supporting dynamic Federated Organisations Management**

2 Inter-Enterprise Service Description

This section provides an outline definition of some of the terms and concepts underlying the Inter-Enterprise Service as well as a definition of the IES itself. Here we establish the interpretation of IES.

The Inter-Enterprise Service (IES), represents the requirements for application level service management and the complex requirements of communication service customers operating in groups or value chains. The IES comprises of management services supporting dynamic federated organisations performing businesses across IP based Intranet, Extranet or Internet, such as SMEs participating in business-to-business e-commerce or application service providers (ASPs) and their customers.

The following features define the IES:

a) The IES provides customer service with management capabilities in the following areas:

- SLA negotiation and the management of subscription settings
- Monitoring the level of adherence to SLAs
- Charging and billing of services.

b) The IES is a service for the flexible management of IP-based communication between members of a group of co-operating enterprises.

c) The IES supports communication between enterprise group members with guarantees on the level of end to end network QoS and security to be expected by users.

d) The IES supports outsourced management where required by a customer. This outsourced management may be of Customer Premises Equipment (CPE) where required by a customer and/or end application service management when necessary to achieve end-to-end guarantees on QoS and/or security.

e) The IES provider offers its services to customers connected via different ISP domains provided certain features are supported by the ISP concerned, related to the federation of security and IP QoS guarantees across ISP domains.

f) The IES can provide customers with on-line customer service management of the IES and of services provided by group members to each other via the IES.

Business-to-Business E-Commerce

Business-to-business is a general (marketing) term used for interaction between companies as opposed to interaction between a companies and consumers (business-to-consumer, B2C) or between a companies and government (Business-to government, B2G). The term B2B was used long before the Internet.

For the purpose of clarifying the term as used in the FORM project the following definition is adopted:

“Business-to-business [e-commerce] is defined as commerce conducted between businesses over an Intranet, Extranet or Internet (i.e. IP networks). This trade may be conducted between a business and its supply chain as well as between a business and other business end-customer” (Source: [durlacher])

Application Service Provider (ASP)

"An ASP is an independent third-party provider of software-based services which are delivered to customers across a wide area network". There are various types of ASPs operating in various sectors of IP-based and computing services market (Source: www.aspnews.com).

- **Business ASPs** mainly provide pre-packaged application services in wholesale to small or medium-sized enterprises.
- **Enterprise ASPs** typically deliver a select range of high-end business applications, supported by a significant degree of custom configuration and service.
- **Local/Regional ASPs** deliver a range of application services, and often the complete computing needs, of smaller businesses in their local geographic area.
- **Specialist ASPs** provide applications, which serve a specific professional or business activity, such as customer relationship management, human resources or Web site services.
- **Vertical Market ASPs** provide solutions tailored to the needs of a specific industry, such as the healthcare industry.

The following sections describe an accounting and billing business scenarios for **inter-domain accounting** management processes that operate within an IESP organisation. An **abstract business model** is defined that identifies **business roles** and **reference points** that may exist between them.

3 Accounting and Billing Business Model

This section presents some detailed usage scenarios in order to capture more detailed requirements on the inter-domain accounting. In scenario, a description of the business situation is presented, showing how the business processes, abstract business roles and reference points are applied to the scenario. A use case description of the scenario is then presented capturing the range of functionality the overall system implementing the scenario will offer to its users. In some cases the system is decomposed to expose requirements from actors imposing more technical requirements. In some cases the use cases are accompanied by an information model, which presents a more cohesive description of the informational requirements captured by the use cases.

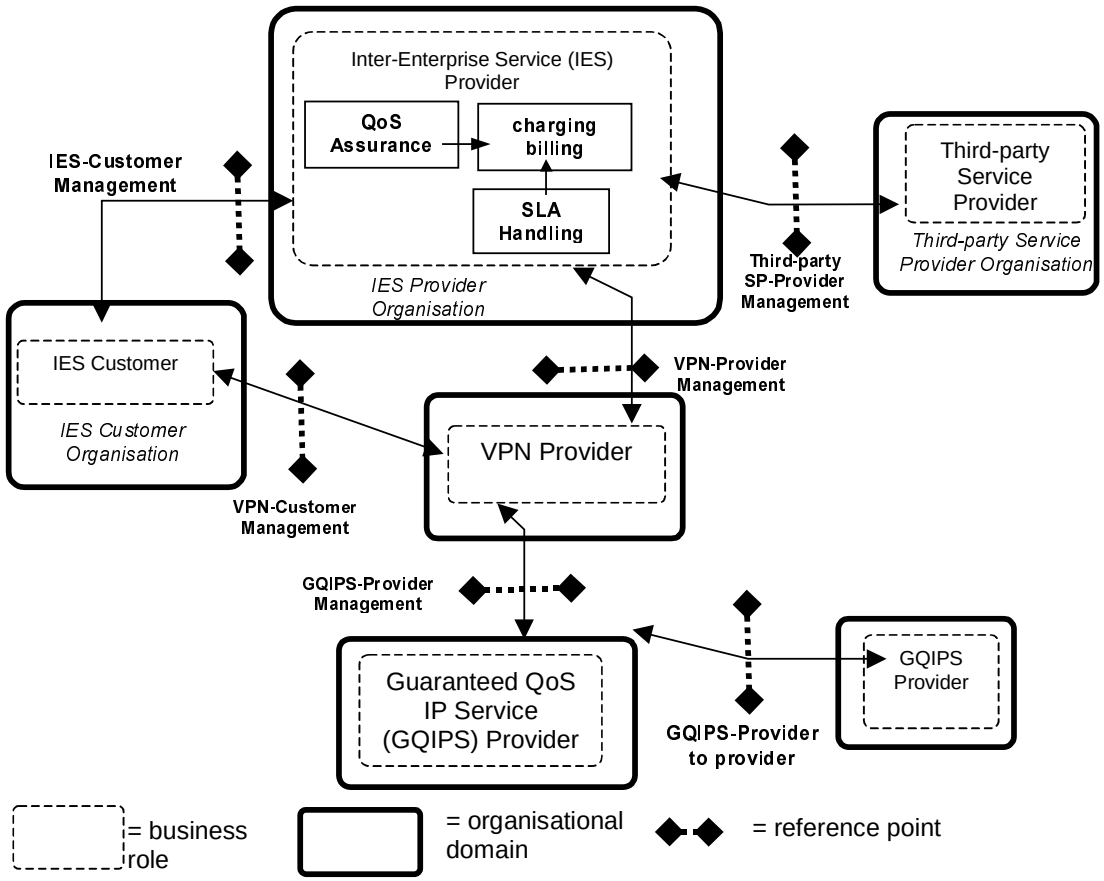

Figure 1: Business Model

The above figure 1 illustrates the model of business process, involving inter-domain accounting and billing. The main players are IES Customers, an IES Provider (IESP), a VPN Provider, a GQIPS (Guaranteed QoS IP Service) provider, and a third-party SP.

From the point of view of accounting and billing functionality, it must be noted that IESP, VPN Provider, GQIPS, and third-party SP may operate OSSs (Operation Support Systems) to carry out a range of tasks (from service negotiation and aggregated usage record generation, to full-fledged billing).

Third-party SP receives bills, as a part of account settlement for the accounting management services that it utilises from IESP. And, IES customer receives bills from IESP, and this bill includes the charges incurred from using application service. In this case, the role of IESP will be to:

- Negotiate between third-party SP and customer and maintaining SLAs.
- Receive bills; merge bills (if two third-party SPs are involved) into a consolidated bill. Forward consolidated bill to IES customer and bills to third-party SPs, VPN Provider, GQIPS, etc.

The SLA between third-party SP, VPN provider and IESP governs the settlement. The settlement indicates how the bill is proportioned among parties. I.e. which is to be paid by customer, which is to be kept by the IESP and which must be forwarded onto and paid by third-party SP and VPN Provider.

Third-party SP and VPN Provider may have their own OSSs and the functionality of such OSSs may range from service mediation (usage data collection, record production) to full-fledged bill processing. Hence, there can be various extents to which third-party SP and IESPs can co-operate. It will depend on many aspects such as:

(1) What level of information they can exchange

(2) Inter-operable interfaces

(3) Type of B2B relationship between third-party SP and IESP (specified in SLA).

The federated accounting in Form is based on the idea of inter-domain accounting in which two domains exchange SDRs (Service Detail Records) for service usage settlement. For example, an IESP (with its own domain) and a third-party SP (another domain with its own accounting system) settle their bills exchanging billing information.

This form of inter-domain accounting can be considered federated accounting, where federated accounting depends on the definition of the inter-operable interfaces and information (e.g., accounting data records) to be exchanged between IESP and third-party SP.

4 Use Case Descriptions

The main theme of the scenario that will demonstrate accounting management in the Form project is illustrated by the figure below. This gives an example of application services and customers who need accounting management services:

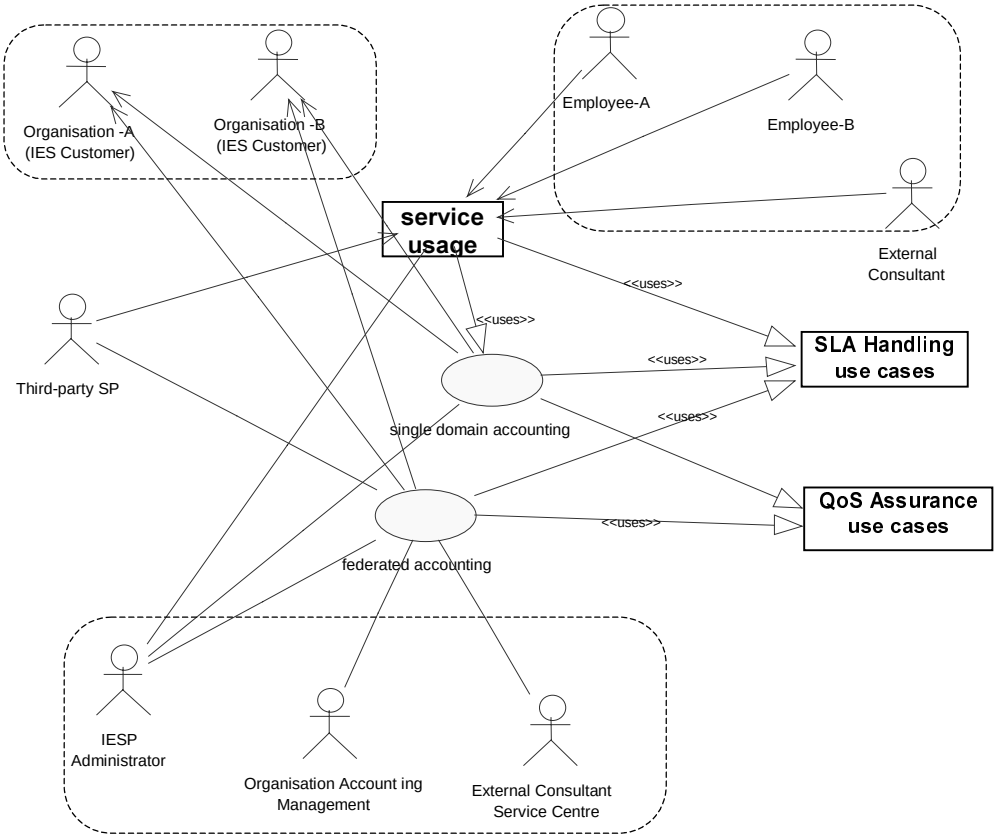

Figure 2: Accounting and Billing Use-Case Diagram

Employees of two organisations (Organisation-A and Organisation-B), which are IES Customers, want to use a communication service (e.g., Voice or Fax over IP) in order to communicate with each other. Employees of the two organisations may also at some point in time seek expert advice from **an External Consultant** and at the same time External Consultant may also want to seek advice of the employees of the two organisations. Organisations' employees and the External Consultant play the role of an **End-user**. Organisations contact **an IESP Administrator** that provides communication service, through a **Communication Service Provider (CSP),** (which is another organisation, playing role of third-party SP). There are two more "management" actors in this scenario: **Organisation Accounting Management**, who receives and pays bills on the behalf of these organisations; and an **External Consultant Service Centre**, who deals with the bills that are sent to External Consultant. IESP Administrator does the job of charging and billing of service usage and settles the accounts among.

Mapping of this scenario onto accounting and billing scenario is as follows:

Role	Actor
End-User	• **Employees (Employee-A and Employee-B) of Organisations:** User (a person) of the services provided by third-party SP. He/she works for organisations (organisation-A or organisation-B). • **External Consultant**: User (a person), of the service provided by third-party SP an expert. He/she is external to the Organisation and gives expert advice to (Employee-A and Employee-B) of Organisations.
End-Customer (IES-Customer)	• **Organisation-A and Organisation-B**: Organisations want to use the services provided by third-party SP (e.g., VoIP) in order to communicate with its Employees. An organisation may also want to set up a business-to-business partnership with other organisations and require application, QoS-supported Internet or VPN services to operate their businesses. • **Organisation Accounting Manager**: An administrator actor (a person) who receives and pays bills on the behalf of the Organisations. He/she validates, checks against the records, and controls the usage of service. • **Expert Consultant Service Centre**: An administrator actor (a person) who deals with the bills sent to External Consultant.
IESP	• **IESP Administrator**: Hospital contacts **an IESP Administrator** (a person) who provides communication, application, and information services, through third-party SPs. IESP Administrator does the job of charging and billing of service usage and settles the accounts among End-Customer and third-party SPs. IESP Administrator act as a service retailer and maintains contracts with third-party SPs (e.g., VPN providers or CSP). IESP Administrator also negotiate, finalise deals between customers and third-party SP, and do final settlement (final bills, etc).
Third-party SP (Service Provider)	• Communication Service Provider (CSP): This is an organisation, which provide the End-Customer with VoIP services and accessible by End-Users. • AVPN SP: They provide VPN services (a secure tunnel with certain level of QoS guarantees) and utilise accounting management services of IESP. End-Customers may also outsource management of their equipment to AVPN provider. • GQIPS Provider: The provide guaranteed QoS IP service. *A third-party SP can also provide such information or multimedia services as databases service, information search and retrieval, or video conferencing over Internet.*

Table 1: Roles and actors

4.1 Service Usage Scenarios

Point to Point Automated Service Usage

Case No: 4.1 A	Point to Point Automated Service Usage
Actors	1. End-Customer (or, IES Customer): Organisations. 2. End-users: External Consultant and Organisation Employees 3. B2B co-operation between Organisations and External Consultant 4. GQIPS: Guaranteed QoS IP Service Provider 5. Third-party SP: An ASP providing communication service (e.g., VoIP)
Pre-conditions	Both customer organisations networks (Calling Party and Called Party) are configured to use the service. An SLA defines the customer service requirements The end-to-end connection can be supported by a single third party service provider. A single bill is generated which is presented to the calling party
Description	1. Employee-A of organisation-A dials the number of organisation-B

	and is connected to employee-B. 2. IES service monitoring system is notified of the connection and creates a service session id 3. IES service monitoring system monitors the service for performance against the service parameters as defined in the Service Level Agreement 4. The service is concluded and accounting information is forwarded from the service provider to the IES billing centre 5. A charge is generated against the customer account.
Post-condition	

Table 2: **Point to Point Automated Service Usage**

Point to Point Automated Service Usage with Performance/QoS problems

Case No: 4.1 B	**Point to Point Automated Service Usage with performance /QoS problems**
Actors	1. End-Customer (or, IES Customer): Organisations. 2. End-users: External Consultant and Organisation Employees 3. B2B co-operation between Organisations and External Consultant 4. GQIPS: Guaranteed QoS IP Service Provider 5. Third-party SP: An ASP providing communication service (e.g., VoIP)
Pre-conditions	Both customer organisations networks (Calling Party and Called Party) are configured to use the service. An SLA defines the customer service requirements The end-to-end connection can be supported by a single third party service provider. A single bill is generated which is presented to the calling party Step 1 to 3 in **Service Usage Use Case 4.1 A** has been carried out.
Description	1. The monitored service information indicates that the service performance is below the acceptable QoS parameter as defined in the SLA. 2. The IES monitoring system notifies the Service Provider OSS of the service violation. 3. The Service Provider is unable to rectify the QoS. 4. There are a number of service options at this stage. The correct one is dependent on the SLA that the IES has with the Customer and the SLA between the customer and the Service Provider. **(a)** The service provider pulls down the connection and establishes a new connection. **(b)** The service provider provides a best effort service and discounts the service in line with the IES/SP service level agreement . **(c)** The service is cancelled and the IES attempts to establish the connection with an alternative service provider.

	5. The call is concluded. 6. The service provider forwards the call charge /usage information to the IES accounting centre with appropriate discounts (as agreed through the SLA). 7. The IES Accounting centre generates a bill for the customer with the appropriate service discount[2].
Post-condition	None

Table 3: Point to Point Automated Service Usage with Performance/QoS problems

Point to Multi-point service usage

Case No: 4.1 C	**Point to Multi-point service usage**
Actors	1. End-Customer (or, IES Customer): Organisations. 2. End-users: External Consultant and Organisation Employees 3. B2B co-operation between Organisations and External Consultant 4. GQIPS: Guaranteed QoS IP Service Provider 5. Third-party SP: An ASP providing communication service (e.g., VoIP)
Pre-conditions	More than one service type is required. IES intervention is required to establish the second leg of the connection
Description	1. Employee-A of organisation-A dials the number of organisation-A and is connected to employee-B 2. IES service monitoring system is notified of the connection and creates a service session id. 3. IES service monitoring system monitors the service for performance against the service parameters as defined in the Service Level Agreement 4. After a period of time it is decided to extend the call to incorporate an additional person. The location of the person is outside of the coverage of the SP domain. 5. Employee-A requests the IES to extend the call to include the new participant. Details of the access number and service type is provided to the IES. 6. IES identifies the service provider and connects the third-party user (or external consultant in the accounting and billing use case diagram shown above). For example the initial connection made be via VoIP while the third-party user (or external consultant) may be connectable only via mobile. 7. IES monitors both connections. 8. The call is terminated and both calls are dropped.

[2] The discount received by the IES may not be the same as the discount provided to the customer as the former is defined by the IES/SP SLA and the later by the Customer/IES SLA

	9. The IES accounting centre received call accounting information from Service Provider 1 and Service Provider 2. 10. The accounting centre aggregates the call accounting information and allocates a single call charge to the customer.
Post-condition	None

Table 4: Point to Multi-point service usage

4.2 Single-Domain Accounting Use Cases

This use case involves accounting and billing management for a third-party SP (e.g., VoIP service provider). End-users use application service(s) of a single third-party SP and the End-Customer receives the bill. The End-Customer has a contract with the IESP Administrator. Settlement involves only a single third-party SP. Single domain accounting corresponds to **Service Usage Case 4.1 A** and **Service Usage Case 4.1 B** of **Service Usage Scenario** use cases.

The primary actors are the End-Users (Employee-A and Employee-B) who initiate a VoIP call to communicate with each other. The IESP is the secondary actor represented by the IESP Administrator, responding to the service usage request of the End-Users. The following figure 3 presents a graphical representation of the use-case. A textual description of the use-case is presented in following table 2.

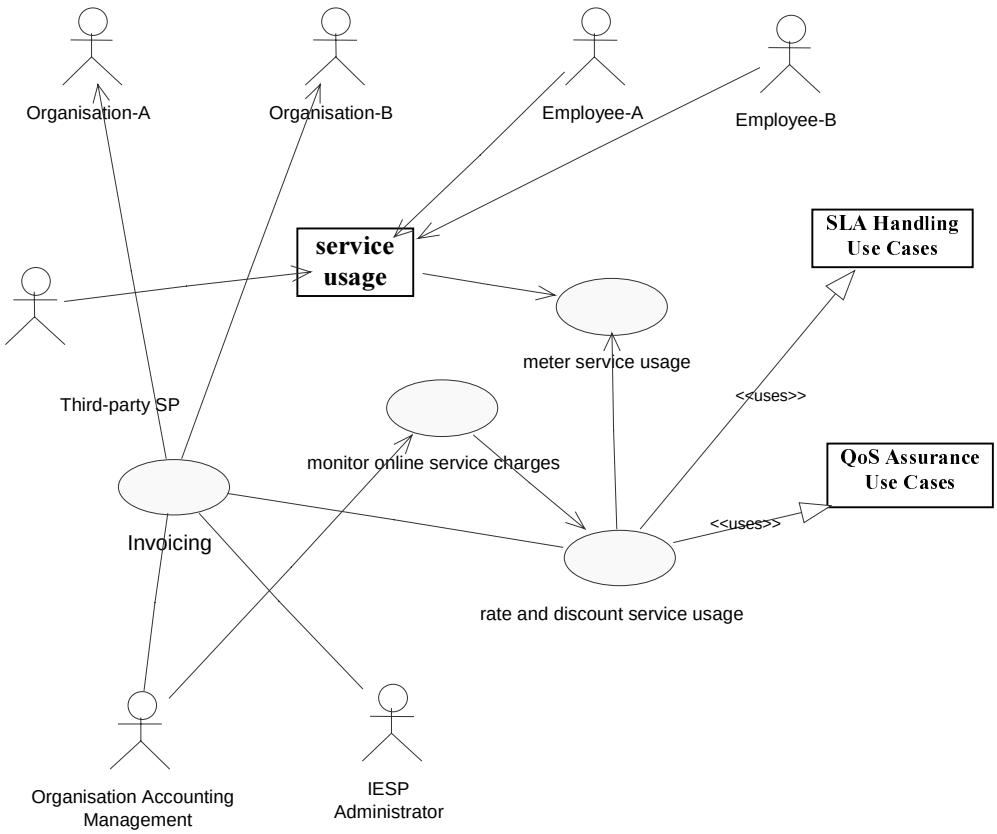

Figure 3: Single Domain Accounting Use-Case Diagram

Case No: 4.2	Single-Domain Accounting
Actors	1. **Primary**: End-User – Employees of Organisations. 2. **Secondary**: - IESP Administrator - Third-party SP (an ASP providing VoIP service) - Organisation Accounting Manager
Pre-conditions	End-Customers has accounts and Ids number. End-Users have successfully used the service. Both customer organisations networks (calling party and called party) are configured to use the service. An SLA defines the customer service requirements The end-to-end connection can be supported by a single third-party service provider.
Description	1. Meter Service Usage: SDR (Service Data Records) collection by IESP. The IESP will collect from third party SP all the SDR generated from the use of VoIP. These SDRs will be stored within the IESP accounting database system with a reference (e.g., session-ID) to the End-Customer and call type. 2. Rate and Discount Service Usage: Depending on the Service Configuration, rating and discounting are applied to the SDRs. 3. Invoicing: After successful completion of the rating process, the IESP prepares bills and forwards them to the End-Customers. 4. Monitoring of online service charges.
Post-condition	The End-Customers have been invoiced. The Organisation Accounting Manager can consult online the charges depending on management parameters (CUG, Services)

Table 5: Description of Single Domain Accounting Use Case

4.3 Inter-domain Accounting Use Cases

This use case involves accounting and billing management in an environment in which settlement involves two or more third-party SPs and an interaction takes place between IESP Administrator and two or more third-party SPs (operating two or more OSSs).

Federated accounting corresponds to **Service Usage Case 3.C** of the **Service Usage Scenario** use cases. End-Users (Employee-A and Employee-B) initiate a VoIP call to communicate with each other. After a period of time Employee-A and Employee-B request IESP to extend the call to include an additional person. At a later point in time during service usage, the third end-user (an External Consultant) joins in. The location of the person is outside of the coverage of the SP domain. Therefore the primary actors are Employee-A, Employee-B, and the External Consultant.

At the end of VoIP call, the Organisation and External Consultant Service Centre are sent a consolidated bill. Charging information are collected at two end-points in the domains of two third-party SPs. Assumption here is that Employee-A and Employee-B use VoIP from an end-points in the domain of third-party SP-1 and External Consultant uses VoIP service in an end-point in the domain of third-party-2. Bills or usage records are exchanged with the IESP at the boundaries of all third-party SP providing end-to-end VoIP service.

- Bills are prepared and sent to the End-Customer (i.e., Organisations) and External Consultant Service Centre.
- Charging an End-Users for the service that they use
- Discounts incurred are mentioned, if the QoS falls below the level that is agreed in the SLA.

In this use case, the End-Customer has a contract with the IESP Administrator, who is the trusted party doing the final and equitable settlement for:

- The End-Customer by preparing a final consolidated bill for the services used; and
- The third-party SPs by preparing individual bills for the services that they provide

End-Customer and third-party SPs wish to have charges calculated and consolidated bills prepared. SLA and QoS use casess provide the IESP Administrator with End-Customer subscription and QoS information.

Combining charges from two third-party SPs in order to prepare a consolidated bill and then allocating costs among various sources and entities is another factor that distinguishes single domain accounting from federated accounting.

The total cost of usage can be allocated to two sources. That is, between two third-party SPs for VoIP service that they individually provided and the total charges are split up into two charges, one for third-party SPs-1 and the other for third-party SPs-2.

The total costs may also need to be allocated between partners in a venture or to among departments in a single firm. That is, among two entities (i.e., Organisation and External Consultant Service Centre).

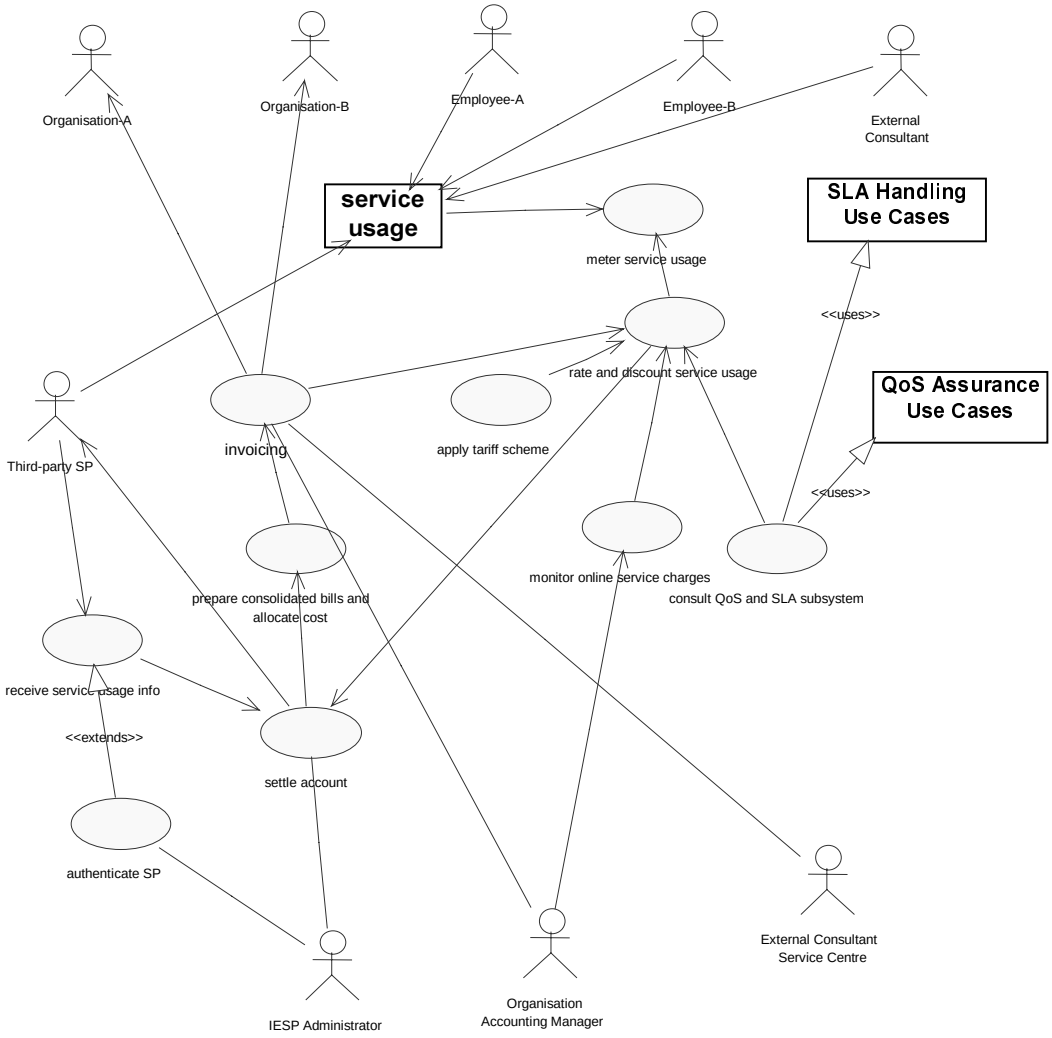

Figure 3: Inter-domain Accounting Use-Case Diagram

Case No: 4.3	**Federated Accounting**
Actors	**Primary**: 1. End-Users (Employee-A, Employee-B, and) **Secondary**: 2. IESP Administrator 3. Organisation Accounting Manager 4. End-Customers: Organisation-A and Organisation-B 5. third-party SPs (two ASP providing VoIP service) 6. External Consultant Service Centre 7. SLA and QoS Use Cases
Pre-conditions	Customer has an account and an ID number. Single Domain Accounting is up and running (hence, all the use case of Single Domain Accounting apply in Federated Accounting use cases). Third-party SPs need to charging information. Application and Connectivity Service Providers have provided the IESP Administrator with QoS information. More than one service type is required. IESP intervention is required to establish the second leg of connection (ie, connection between External Consultant, and Employee-A and Employee-B in **Service Usage Case 4.1 C** in Service Usage Scenario)
Description	1. **Receive service usage info**: Third-party SPs send usage or charging information, in one of the these formats: **(a)** SDR; **(b)** processed charges: I.e., contents for bill. This is sent to IESP Administrator who has to prepare bills first for the services two CSPs provided, so that settlement (between them can be done in the end of VoIP call); **(c)** processed bill of two Third-party SPs (to be consolidated). 2. **Authenticate Third-party SPs**: IESP Administrator identifies the Third-party SPs (based on the SLA between IESP- Third-party SPs) and collects usage information. The Third-party SPs here is include Third-party SPs-2 who is to provide VoIP service to External Consultant (the external party that joins in later on in **Service Usage Case 4.1 C** in **Service Usage Scenario**). 3. **Consult SLA and QoS use cases**: SLA use cases are consulted for subscription information and QoS use cases for QoS information. 4. **Apply tariffs**: Tariff schemes are consulted and applied to service usage. Tariffs vary with QoS provided to customer. Thus, QoS information is looked up. 5. **Settle accounts**: charges received from customer are split on equitable basis and forwarded to two Third-party SPs. 6. **Prepare consolidated bill and allocate cost**: Combine charges

	from two Third-party SPs and prepare a consolidated bill in the format that End-Customer has preferred. Allocate the total cost of usage to various sources (e.g., among VoIP, VPN and Email services) or among several entities (e.g., among various departments of organisations).
Post-condition	IESP Administrator processes the charges and prepares a consolidated bill. End-Customer receives a consolidated bill and accounts have been settled. Organisation Accounting Manager is able to view the charges incurred: (1) monthly; (b) on demand at a point after service usage; (c) during usage

Table 6: Description of the Inter-domain Accounting Use-Case

5 Conclusion

This deliverable has presented a business cases and usage examples for an inter-domain accounting management service.

6 List of Acronyms

ASP	Application Service Provider
B2B	Business-to-business
COTS	Commercial-Off-The-Shelf
CP	Customer Premises
CPN	Customer Premises Network
EBPP	Electronic Bill Presentment and Payment
EC	End-customer/End-consumer
ETSI	European Telecommunication Standards Institute
FORM	Engineering a Co-operative Inter-enterprise Management Framework, supporting dynamic Federated Organisations Management
GQIPS	Guaranteed QoS IP Service
IES	Inter-Enterprise Service
IESP	Inter-Enterprise Service Provider
IETF	Internet Engineering Task Force
ISP	Internet Service Provider
ITU-T	International Telecommunication Union
LAN	Local Area Network
OSS	Operation Systems Support
QoS	Quality of Service
SDR	Service Detail Record
SLA	Service Level Agreement
SLS	Service Level Specification
SME	Small and Medium Size Enterprises
UML	Unified Modelling Language
VoIP	Voice over IP
VPN	Virtual Private Network
VPNS	VPN Service

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