



**Business Solution Requirements –
Supplier/Partner Settlements
(S/PS)
For
Next Generation IP-Based Services**

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Preface

Abstract

This document defines the business requirements, information models, and the XML schema for inter-service provider wholesale usage settlement for IP-based services. The XML-based settlement record format defined in this specification is applicable in the context of enabling universal information exchange across a diversity of accounting, billing, and settlement infrastructures deployed by Service Providers.

Change History

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1.0 ID R2	September 9, 2002—Incorporation of comments and contributions
1.0 ID R3	August 5, 2003—Incorporation of comments and contributions
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1. Introduction

1.1 Purpose

This document, in conjunction with the referenced Service Specification documents, is intended to specify technical information that is sufficient for practical implementations of interchange of account settlement transactions among Business Support Systems (BSSs) of enterprises operating as suppliers and partners in the delivery of next generation IP-based services.

1.2 Scope

The focus of this specification is on the “E” interface of the IPDR Organization’s (IPDR.org) Reference Model (see section 2). While the relationship of this interface and its information model to the “D” interface and the “F” interface is relevant, a detailed discussion of those interfaces is outside the scope of this specification.

1.3 Compatibility

This specification is intended to be used in conjunction with other specifications produced by IPDR.org and associated Service Specifications. Additionally, certain existing industry standards and practices in this area (e.g., ETSI’s OSP, GSMA’s TAP3, OBF’s EMI and Cibernet’s CIBER) must be accounted for in certain interworking use cases.

1.4 Overview

Realizing the need for a solution to the problems of yesterday’s options, the members of IPDR.org, industry leaders from the service provider, mediation, billing, and clearinghouse segments, have crafted an open, flexible, and responsive technology to enable supplier/partner relationships to be practical and profitable.

Vendors and clearinghouse members have developed the specifications necessary to implement the settlement functions necessary to allow those relationships to exchange all of the usage and financial information necessary for accurate and reliable fund transfers among all supplier/partner pairs. Based on IPDR.org’s emerging worldwide choice for IP-based service usage measurement, the S/PS specification spans all transport technologies and all services with an extensible standards-based approach to settlement.

1.4.1 Document Structure

This specification is divided into three major chapters:

- S/PS Reference Model - a definition of the abstract and operational relationships between entities involved in the generation, recording, storage, transport, and processing of settlement transactions.
- Business Requirements - a definition of business requirements to be addressed by the protocol specification and specific scenarios for the major process flows anticipated in actual application.
- Protocol - the notation, data unit syntax, and dynamic procedures involved in the operation of the interfaces specified in the reference model.

The Protocol chapter represents the specific design produced through analysis of the Business Requirements chapter, consistent with the Reference Model chapter.

1.4.2 Revision Numbering Structure

The version number of this document is structured in the form M.m, where “M” is a major change in requirements and technology content, “m” is a minor change within the scope of the requirements and technology of the major release.

2. Reference Model

IPDR.org has adopted the TeleManagement Forum's (TMF) enhanced Telecommunications Operations Map (eTOM) for the purposes of motivating the functional role and interfaces of the IPDR.org specifications relative to Operations Support Systems/Business Support Systems (OSSs/BSSs). The eTOM was chosen because it is a well-known, industry-accepted organizational model of telecommunications operations business processes used by carriers and service providers today. The TMF Model is useful as a model of typical systems, and as motivation for design decisions. However, the TMF Model itself is not part of S/PS, and the data structures and interfaces of SPBS may be used in systems that vary substantially from the TMF Model. See references for more details.

2.1 S/PS and the TMF Model

The eTOM, shown in Figure 1, identifies the core operation support processes found in a production carrier business operation. The systems that implement the customer care, services development/operations and network/systems management processes each provide a well-defined set of services that enable a carrier to successfully deploy and manage telecommunications services. As the model shows, these systems are organized in a layered fashion. Thus, each component builds on the services provided at a lower layer (and possibly adjacent components) to deliver the required functionality. IPDR.org's charter is to facilitate the integration of IP-based network elements into billing, reporting, and assurance systems. In the eTOM, Supplier/Partner Settlements and Billing component defines the system-to-system mechanism for such purposes.

This specification purposely limits the scope of discussion to the settlements half of this component. The Supplier/Partner Billing component is outside the scope of this document.



Figure 1: Enhanced Telecommunications Operations Map (eTOM)

2.2 The S/PS Reference Model

S/PS applications are based on the overall reference model first defined in IPDR.org's Business Solution Requirements specification (see that specification for a more complete discussion of A, B, C, and D interfaces). The specification focused on the IT System to Business Support System "D" interface. S/PS is focused principally on the BSS to Settlement System "E" interface for Settlements in Figure 2 below.

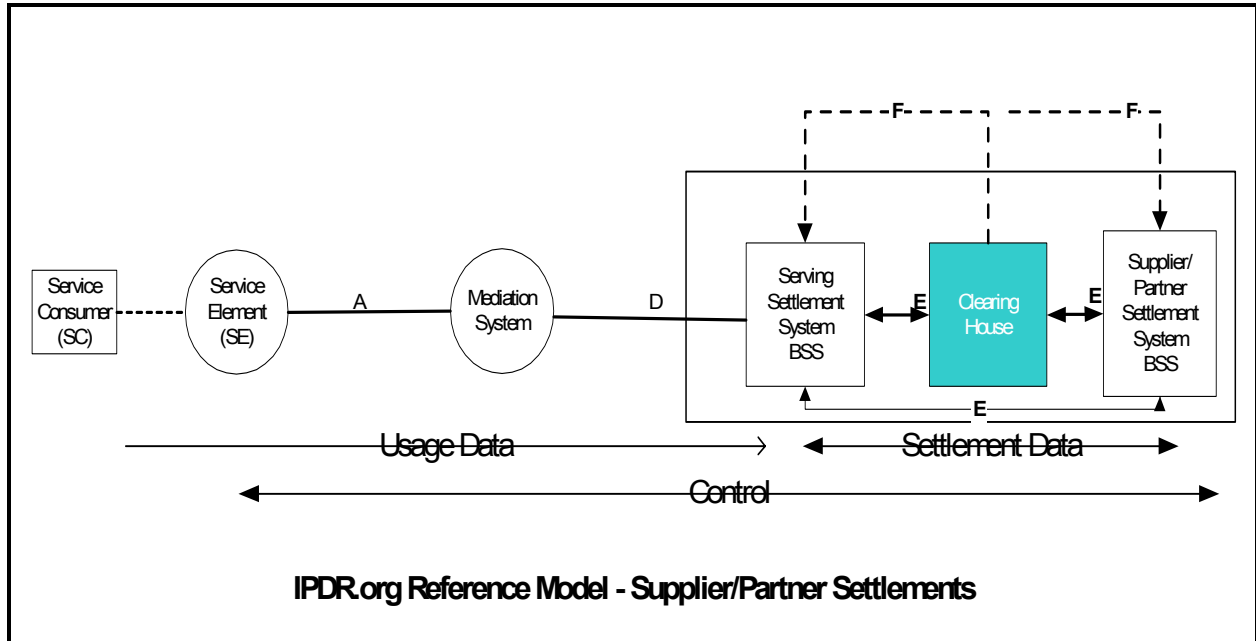


Figure 2: IPDR.org Reference Model – Supplier/Partner Settlements

The E interface, in the settlement context, delivers the settlement events/transactions between BSSs and/or clearinghouse systems and vice versa.

The main focus for specifying requirements is given to E, though there may be implied requirements for other interfaces.

2.3 S/PS Model Use Cases

2.3.1 Public WLAN Settlement Use Case

2.3.1.1 Settlement Reference Models

The specification assumes two reference models for settlement of Public WLAN (PWLAN) usage between service providers – one involving direct settlement between two service providers whereas the other assumes the existence of an intermediary (i.e., a clearinghouse) that performs multilateral settlement between two (or more) service providers.

Figure 3 depicts the functional entities and accounting and settlement information flows associated with the direct exchange settlement model.

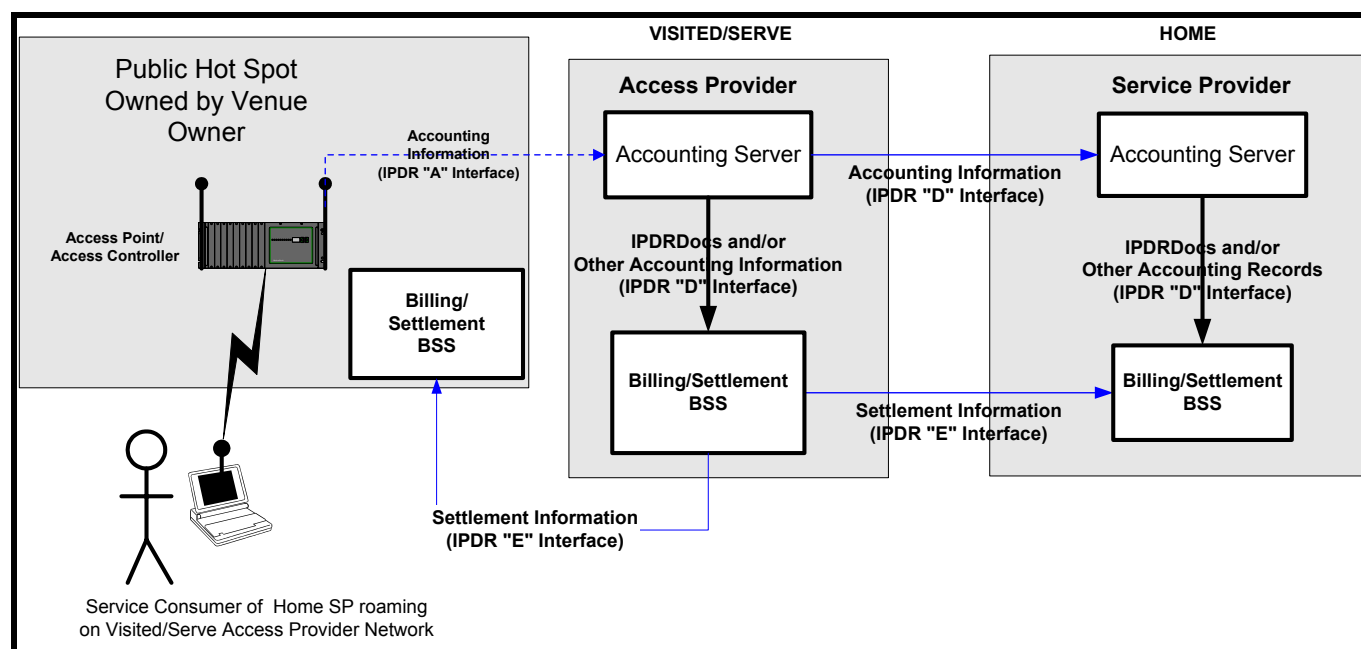


Figure 3 Direct Exchange Settlement Model

In Figure 3, the service consumer that has retail business relationship with home service provider roams on a PWLAN venue (“hotspot”) and is served by visited/serve access provider. The usage events of the PWLAN service are entered in the accounting information entries generated by the access controller and processed by the accounting server of the access provider. As per this settlement model, the Billing/Settlement BSS of the access provider exchanges the settlement information directly with the Billing/Settlement BSS of the home service provider. In the case where the venue owner is a separate entity from the access provider, settlement information may also be exchanged between the venue owner and the access provider. After the exchange of this settlement information between all parties, the Billing/Settlement BSS of the access provider also exchanges the financial net settlement information with the Billing/Settlement BSS of all

parties. The financial net settlement information exchange is outside the scope of this specification.

It may be noted that the Direct Exchange Model may imply settlement for bilateral business relationships. In such relationships, each party may act in dual roles (visited/serve access provider and home service provider), resulting in the exchange of usage and financial transactions flows in both directions. In the interest of simplicity, the flow in the Figure 4 depicts this flow only in a single direction – from the service consumer toward the home service provider.

Figure 4 depicts the functional entities and accounting and settlement information flows associated with the intermediary based settlement model.

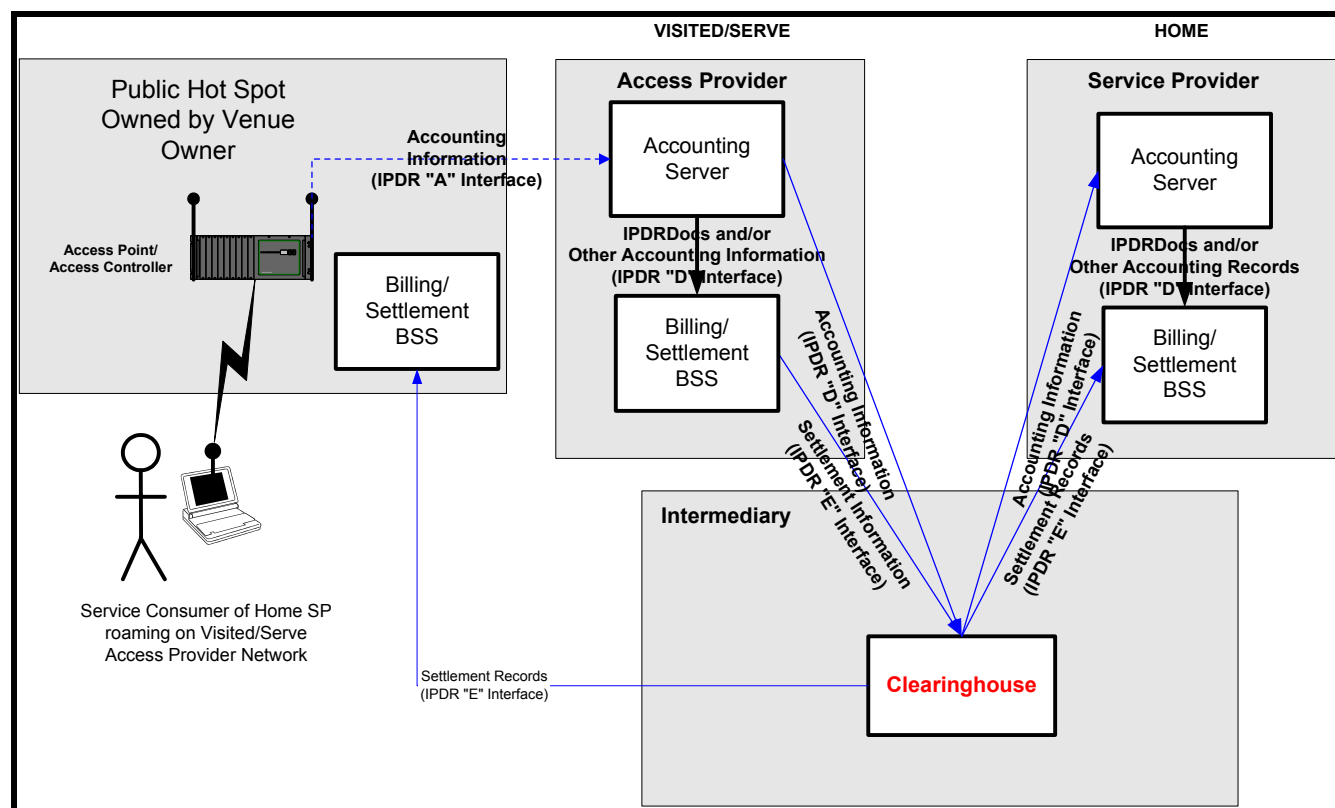


Figure 4 Intermediary Based Settlement Model

In Figure 4, the service consumer that has retail business relationship with home service provider roams on a PWLAN venue (“hotspot”) and is served by visited/serve access provider. The usage events of the PWLAN service are entered in the accounting information entries generated by the access controller and processed by the accounting server of the access provider. The BSS of the access provider then exchanges the settlement information with the clearinghouse function of an intermediary which, in turn, processes and forwards this information to the BSS of the home service provider. In the case where the venue owner is a separate entity from the access provider, settlement information may also be exchanged between the venue owner and the access provider. After the exchange of this settlement information between all parties, the intermediary

exchanges the financial net settlement information with the Billing/Settlement BSS of all parties. For purposes such as customer care, fraud abatement, and traffic engineering, Accounting Information may also be relayed from the Access Provider to the Service Provider via the Clearinghouse. The financial net settlement information exchange is outside the scope of this specification.

2.3.1.2 Public WLAN Charging and Settlement Methods

This section is informational. The charging models in this section are guidelines to develop generic business requirements for IPDR settlement record format. The intended purpose of this section is to provide greater context against which the settlement format, parameters, and their proposed values may be validated.

2.3.1.2.1 Billed Entity

Charging models cannot be described without attributing resource usage to the billed entity. The specification assumes that a *billable account identifier* may be identified for all charging attributable to PWLAN access and associated services, as one of the following data types:

- **Service Consumer's Username or NAI** The accounting and settlement network may bill an end-user identifier for PWLAN access, independent of the terminal equipment identification used for PWLAN access. An example of this data type is the service consumer's email address.
- **Terminal Equipment Identifier**. The accounting and settlement network may bill a terminal equipment identifier for PWLAN access. Examples of terminal equipment identifier are the MAC address of the device, Mobile Serial Number (MSN) or International Mobile Equipment Identifier (IMEI).

The IPDR record format SHALL assume usage of one of the above methods to identify the billed entity.

Note: Non-IPDR protocols carrying accounting information (e.g., RADIUS) may carry additional information elements that ascribe greater granularity to a given information element that IPDR uses for generating the billed entity information. The specification of such finer granularity (or making assumptions about its availability) is beyond the scope of this specification.

2.3.1.2.2 Charging Models

This specification views *Charging Models* as network capabilities that enable specific type(s) of service agreements between the service provider and the service consumer. Instantiation of a charging model in the network assures the service provider that usage, measured by billable units applicable to that charging model, is accurately credited or debited to a billed entity. The conversion of billing units into currency units, while always necessary, is an aspect of billing that is independent of charging model definition. Based on the service agreement between the service consumer and the service provider, the charges to an account during a billing period may accrue from one charging model, or a combination of charging models.

Furthermore, the *payment method* for subscription to these charging models may vary independent of any of the above criteria. The charging models are independent of the end user payment method.

This specification derives some of the business requirements from the following three PWLAN access retail charging models:

1. Fixed Charging for PWLAN Access
2. Usage Based Charging for Metered PWLAN Access
3. Usage Based Charging for PWLAN Services

It is anticipated that these charging models cover all possible PWLAN retail charging scenarios.

Note 1: For any given charging model, the rate charged may vary based on multiple characteristics (such as the physical location of the user, time of access, etc.). Such cases, while within the scope of this specification, are treated as part of the rating process. Such considerations do not impact charging model definitions.

Note 2: More than one charging models may be related and/or simultaneously invoked. For example, fixed charging may be used for access to the WLAN while usage-based charging for WLAN services is used for content purchases.

2.3.1.2.2.1 Fixed Charging for Unlimited Public WLAN Access

Description

This charging model is based on a pre-set charge amount for unlimited usage of PWLAN access, until contract termination. Contract may be reinstated dynamically upon termination. Typical events that trigger contract termination are expiry of the time period or the number of allowed sessions.

Instances of this Charging Model in Service Agreements

This charging model MAY support the following types of Service Agreements:

- Charging on a per session basis
- Charging for a session with a maximum session time limit (e.g., PWLAN access authorized for the next 24 hours).
- Charging for a session with access for a specified time period (e.g., from noon today until noon tomorrow).
- Charging for a time period regardless of usage or number of sessions (e.g., a flat monthly charge).

Bundled service agreements that include one of the above instances of this charging model for PWLAN access as well as billing for non-PWLAN access services (e.g. fixed-line access) may

be offered to the service consumer. Service providers may also optionally bundle PWLAN access with free services such as local content or a “Walled Garden” or “Captive Portal” to offer access to content and services such as weather, news, information, etc. However, for the purpose of implementing this charging model in the network, such variations in packaging of this charging agreement offered by service providers are inconsequential.

2.3.1.2.2 Usage-Based Charging for Metered Public WLAN Access

Description

This charging model is based on a charge amount based on volume of usage. Three methods of metering volume of usage are:

- **Session Duration** - Time units between each authentication and user (or network) initiated log off.
- **Data Consumption** - Data/Application bytes transacted (received/transmitted) across the client-station and the PWLAN interface.
- **Number of Sessions** – A single charge amount based on a pre-set number of successful sessions established.

Instances of this Charging Model in Service Agreements

This charging model MAY support the following types of service agreements:

- Prepaid cards or charge cards that are based on volume of usage as measured by time, data bytes, or number of sessions.
- Limited access until usage reaches a certain volume threshold (e.g., free for first 2 hours etc.) after which different rates are applied (either raised or discounted).
- Service agreements such as discount cards while purchasing new access devices (laptops etc.) that offer free service with a service provider (or its roaming partners) for certain volume of usage.

2.3.1.2.3 Usage-Based Charging for Public WLAN Services

Description

This charging model facilitates charging for value-added services that may be provided by the service provider. The charging model may facilitate billing for three types of services:

- Subscription to a specific IP application (e.g., VoIP or VPN), a QoS/SLA guarantee, or a roaming plan that is part of the service agreement. A **roaming plan** is defined as a service agreement that enables the end user to use public WLAN access and/or services from multiple devices, locations, and access provider networks.
- Temporary, session-based subscription or purchased of the service provider owned content that is dynamically authorized by the network (e.g., VPN access during a session), and billed to the account, but that is not part of the service agreement.
- Third party content purchased during a session that is billed to the account and is not part of

the Service Agreement.

Instances of this Charging Model in Service Agreements

This charging model MAY support the following types of service agreements:

- VoIP calls over PWLAN
- Content purchased over PWLAN (such as music or a multimedia session)

2.3.1.3 Payment Methods

Two types of retail payment methods MAY be supported by each of the three charging models:

1. **Pre-Paid** services are provisioned as user accounts with a finite available balance. Payers purchase a known quantity of service from a payee prior to service initiation. The payer may pre-pay in a pre-defined account established with a service-provider or authorize an amount to charge to a credit or debit card through a portal at the site just prior to use. The payee will decrement the balance as service is used and terminate service when the balance reaches zero. Credit/debit cards are charged based on usage up to the amount authorized. Prepaid accounts may either be “throw away” after the balance has been depleted or prepaid vendors may elect an online “fill-up” to maintain a pre-existing balance on the prepaid card in case of a prepaid subscription such as a debit card. Prepaid cards are established as a promise of future services by the prepaid vendor for moneys paid at the point of sale.
2. **Post-paid** services are implemented via contract between a payor and payee. Post-paid accounts typically include a monthly fee for a device or user and often include additional charges for accumulated usage.

2.3.1.4 Settlement Methods

This specification views *Settlement Methods* as network capabilities that facilitate different types of business agreements between access providers, service providers, and partners (e.g., content providers and venue owners). Support of different settlement methods in a network assures that the revenue collected by the service consumer’s home service provider is appropriately shared by all constituent business entities that facilitate the PWLAN service experience to the service consumer. The purpose of defining settlement models in this specification is to develop the information model based on which collection and distribution of appropriate information elements can be specified. Specification of different business processes that guide these settlement relationships between service providers are beyond the scope of this specification. It may be noted that these processes, well-defined in various non-PWLAN contexts (e.g. GSM or CDMA) in different network domains, may be applied or extended for PWLAN settlement.

The specification covers two types of settlement:

- Inter-Provider Settlement (e.g., between access provider and service provider)
- Provider-Partner Settlement (e.g., between access provider and partner)

2.3.1.5 Inter-Provider Settlement

Inter-provider settlement may be between two or more of the following types of entities: service providers and aggregators. The terms of settlement may be determined through bilateral or multilateral roaming agreements between the providers. Bilateral settlement may be supported by one or two mediation systems (BSS's) and done at the end of each settlement period. Multilateral settlement may be accomplished by a clearinghouse or a roaming aggregator. The charging models for inter-provider settlement are typically based upon fixed charging and/or usage-based charging for metered PWLAN access.

Examples of access providers include:

- Wireless ISPs (WISPs)
- Mobile operators or carriers that operate their own public WLAN hotspots
- Venue owners that operators their own public WLAN hotspot

Examples of service providers (those that maintain a billing relationship with the end-user) include:

- GSM Carriers
- CDMA Carriers
- Dialup & PWLAN Roaming Aggregators
- Wireline Carriers
- DOCSIS™ Cable Access MSOs
- Traditional ISPs
- Virtual WISPs

2.3.2 Content Delivery Use Case

The following use case provides the business problem context for which S/PS is a generic solution. It should be noted that, while the emphasis of this specification is on inter-enterprise use case scenarios, the specification could be equally applied to intra-enterprise scenarios where that makes good business sense.

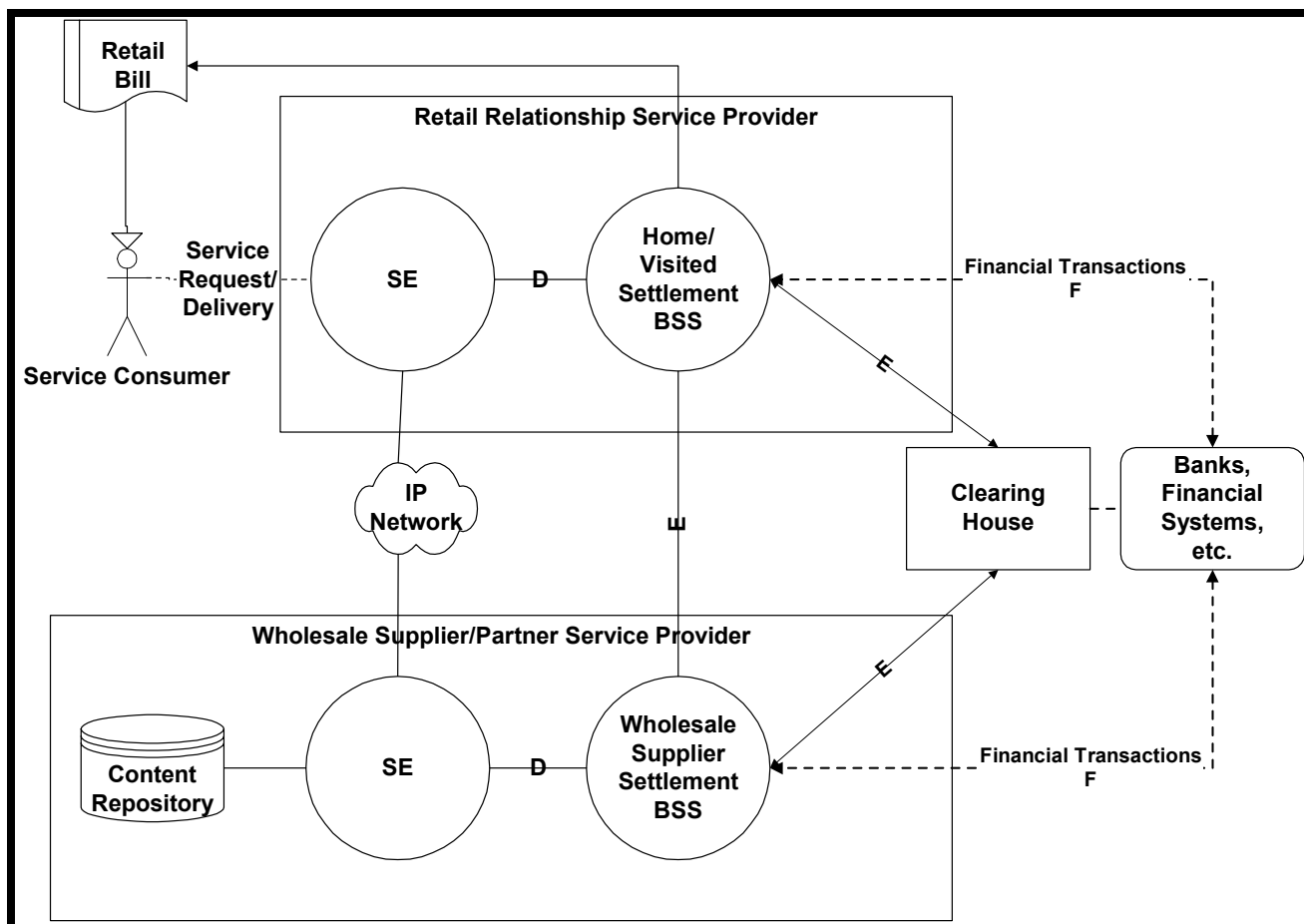


Figure 5 - Use Case Diagram

The business case under analysis is that of a service consumer that has a retail customer relationship to a retail service provider offering IP-based services. That retail service provider has a wholesale business relationship with a wholesale service provider which offers content delivery services. This wholesale service provider elects to have the retail service provider offer their content delivery services to the service consumer and leave to the retail service provider the responsibility for collection of the fees for delivery of the content. When the retail service provider collects the fees from the service consumer, they share the proceeds with the wholesale service provider under a prearranged commercial agreement. Since the retail service provider is assumed to have many such wholesale relationships, as does the wholesale service provider, they both elect to engage the services of a settlement company. Rather than send invoices and payments directly from each supplier/partner to each other, all the service providers send all of their transactions to the settlement system and the transactions are segregated by supplier/partner

relationship. At a predetermined interval, the settlement system calculates the amount due to/from each party and sends banking and financial transactions to the appropriate institutions and enterprises to effect the transfer of funds and to notify all parties as to the results.

The systems view of this business case is as follows:

1. The service consumer lodges a request for content delivery from the service element (SE) in the retail service provider's domain.
2. The retail service provider relays the request to the appropriate SE in the wholesale service provider's domain.
3. The wholesale service provider delivers the content as requested.
4. The retail SE creates one or more IPDRs on the D interface to its appropriate BSS.
5. The wholesale SE creates one or more IPDRs on the D interface to its appropriate BSS.
6. The retail service provider's BSS sends/receives one or more transactions on its E interface with the settlement system.
7. The wholesale service provider's BSS sends/receives one or more transactions on its E interface with the settlement system.

The purpose of the S/PS Specification is to identify the requirements for the "E" interfaces in this use case so that the Protocol Working Group can design a technical solution to meet the requirements. None of the other interfaces or interactions on the diagram is the direct subject of the S/PS and would be declared out of scope of the Specification, including the "F" interface, which is the one on which financial transactions (e.g., EDI, bank transfers, etc.) would flow to consummate the settlement transactions.

2.3.3 Problem Statement

A universal, extensible method to exchange settlement information allows a service consumer to roam across networks without the need to maintain retail account relationships with each Service Provider. Settlement for roaming revenues between service providers, faces the following barriers:

- Roaming services may be provided by a variety of service providers– namely Wireless Internet Service Providers (WISPs), Cellular Service Providers (GSM and CDMA), CableModem/DOCSIS™ Multi-cable System Operators (MSOs), and Wireline Service Providers (e.g., Local Exchange Carriers in the United States). Settlement between these diverse service provider networks requires a universal settlement standard, with defined interoperability criteria with the non-IPDR settlement methods that are prevalent in a given service provider network, where applicable.
- Roaming and retail charging plans and their user subscriptions differ for different service providers as well as for the same service provider in different geographic locations. A universal settlement method between service providers must universally support settlement for these charging models.
- Settlement models between different service provider pairs or service provider-clusters may be different. The settlement record format must have sufficient optional and conditional information elements to support these settlement models.
- The record format may either be used for bilateral settlement between two service providers or for multilateral settlement between more than two service providers. In the former case, these records may be exchanged by BSS of respective service providers. In the latter case, one or more roaming intermediary may broker the multilateral settlement between service providers. A universal settlement method must support both these settlement models.
- Finally, the universal settlement method must enable settlement between a service provider and its non-service provider business partners in the service value chain. Examples of these business partners include content vendors, venue owners, and potential vendors for IP-based services.

Figure 6 depicts the hierarchical accounting and settlement information flow, processes, and their inter-relationship.

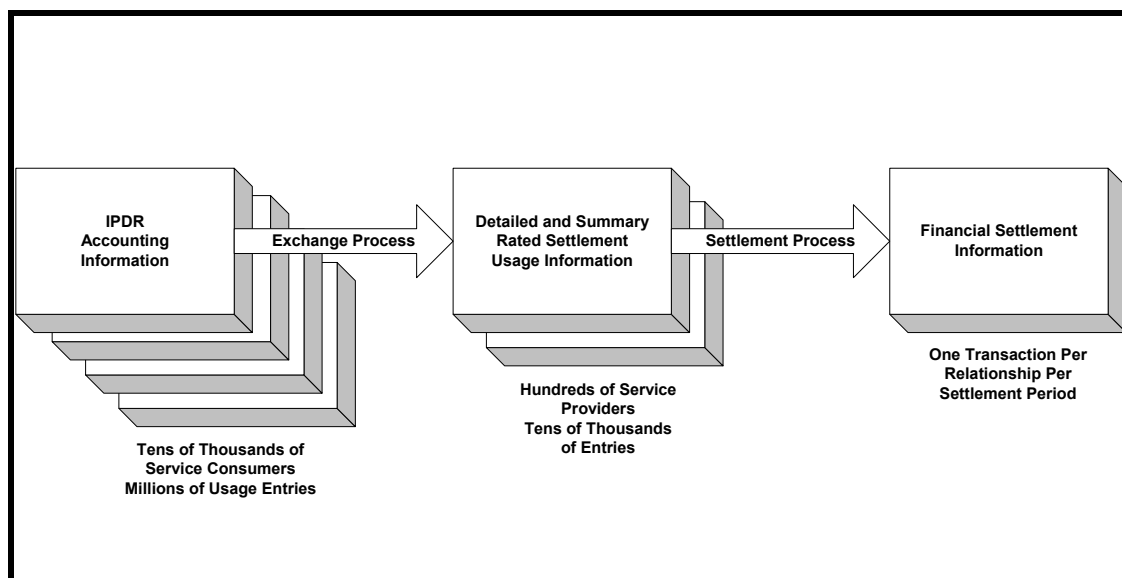


Figure 6: Data Hierarchy and Processes

2.4 S/PS “E” Interface

E-Interface

The E interface delivers IPDR documents from one BSSs to another BSS. Various scenarios of providing service can be anticipated which will involve a combination of transport technologies and multiple service providers. In such scenarios, the business relationships involved will require the exchange of usage data for a variety of process applications (e.g., net settlement, retail bill detail, customer service, and fraud abatement, marketing studies). The interface dedicated to such exchange is E interface. For IPDR-compliant service providers, the data exchanged may very well be IPDRDocs being delivered via some variant of the D interface protocol. In hybrid cases, the sending or receiving system may have to mediate the data format and protocol from or to the IPDR compliant form. Other industry standards and practices will require mappings with respect to IPDR for this to be implemented. The definition of the details of the E interface will address this requirement.

BSS/Settlement System

The Settlement system will interface with other BSSs for the purpose of exchanging relevant third party service provider rating and settlement related information.

All the events rated / re-rated by the retail billing system and relevant for settlement system are passed to the settlement system.

The settlement system may subsequently communicate with the retail billing system for all events (credit transactions) that are end user or service consumer related.

Settlement System/Other Systems

The settlement system will need to interface with various other Supplier/Partner BSSs including but not limited to financial systems for third party service provider's accounts receivable information, electronic invoice, and document management systems.

- Settlement system will interface with CRM system for point-of-sale service and /or order management for consumer events. CRM system can be an alternate BSS source to a settlement system other than retail billing system for data related to service consumer.
- Settlement system will interface with financial systems for third party service provider's accounts payable transaction information.
- Settlement system will interface with banks and any other financial agencies for EFT (electronic fund transfer) and exchange rates information.

In addition, settlement system may interface with other BSSs including, but not limited to the above mentioned BSS that can be source of input data for settlement solution.

While the current focus of this specification places these other interfaces and transactions outside its scope, at a minimum the existence and requirements of such other interfaces will be accounted for to ensure the practicality of this specification. If no other body of work on these other interfaces exists and it is considered necessary to discuss them in more detail, the scope of this specification could be expanded to include them, based on the decision of IPDR.org.

3. Business Requirements

3.1 Introduction

The following sections detail the business requirements imposed on the design of information models and protocols to realize the S/PS application. Various requirements call out constraints on data format, protocol, and systems, respectively.

This document, as it relates to these definitions of terms to describe the requirements of the S/PS specification, follows the conventions as outlined in [RFC2119]:

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” contained in this document are to be interpreted in the following manner:

REQUIRED – This word, or the terms “MUST” or “SHALL”, mean the definition is an absolute requirement to follow the S/PS recommendations.

MUST NOT – This phrase, or the phrase “SHALL NOT”, means the definition is an absolute prohibition to follow the S/PS recommendations.

RECOMMENDED – This word, or the adjective “SHOULD”, means there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.

NOT RECOMMENDED – This phrased, or the phrase “SHOULD NOT” means there may exist the valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.

OPTIONAL – This word, or the adjective “MAY”, means that an implementer may choose to include the item because a particular business objective requires it or because they feel that it enhances the service while other implementers may choose to omit the item. An implementation, which does not include a particular option, **MUST** be prepared to interoperate with another implementation that does include the option though with perhaps reduced functionality, and vice-versa.

3.2 Assumptions

1. A settlement system is a business support system that meets the requirements for facilitating financial payments between partners based on business-to-business (B2B) bilateral agreements.
2. This specification focuses on the wholesale information exchanged between business enterprises only.

3. Other BSSs, interfacing with settlement BSS, have the responsibility of filtering any service provider-private data and/or adding any settlement specific data prior to sending to the IPDRs.
4. Authentication of third parties in real-time and authorization of use of products and services requested is NOT in scope of this specification.
5. The technology of NDM-U shall be used to the greatest extent practical to implement these requirements, thus minimizing the need for new development prior to the deployment of S/PS solutions.

3.3 Generic Requirements

Based on charging and settlement models described in previous sections, the following business requirements for IPDR settlement record format are identified. These requirements are categorized into settlement requirements, business relationship data exchange requirements, and audit and revenue assurance data exchange requirements. The requirements below are numbered for reference.

3.3.1 Settlement Requirements

Service providers must be able to pay for their service consumers that consumed resources on visited/serve (or foreign) service provider networks. Service providers must be able exchange (transmit and receive) detailed rated events for visiting service consumers with each other on a 1 to n ($n \geq 1$) business relationship basis. This exchange neither mandates nor precludes the use of roaming intermediary between service providers. It must be supported in near real-time (hourly or more).

[R1] The IPDR must be uniquely identifiable within a time period.

[R2] Rated IPDRs must contain the amount of the charge and the currency code of the charge.

[R3] The IPDR must be shared between service providers and partners or with the intermediary periodically. A mutually agreed periodicity for this purpose must be configurable by using the IPDR business relationship data exchange parameters. Typically a configured time period MAY be hourly (or more).

[R4] The IPDR exchange must support acknowledgement (or receipt) of rated usage events. This exchange must allow for retransmission of previously positively acknowledged rated usage event or upon request from the receiver.

Note 1: Receiver may not be able to request such retransmission beyond a specified time period since the rated usage event was first transmitted by the sender. This time period must be configurable by using the IPDR business relationship data exchange parameters. Typically a configured time period MAY range from 1 to 5 days. Such restriction SHALL apply to all rated usage event types (for example, rated usage, summary usage, settlement usage, net position usage, etc.).

[R5] The IPDR must support detailed exchange as well as summarized exchange of rated (or unrated) usage events. Summary of multiple rated usage events that occurred over a past time

period must be incorporated into summary parameters specified by the IPDR. The time period must be configurable by using the IPDR business relationship data exchange parameters. Typically a configured time period MAY range from 1 to 24 hours.

Note 2: This exchange MAY be done at any (Rated usage, summary, settlement or net position) levels based on a mutually agreed upon business relationship between one or more service providers.

[R6] The IPDR must support settlement reporting. This requires reporting net position between two or more service providers over a settlement period.

Note 3: The settlement period, Y (typically 30, 60 or 90 days), MAY vary and is assumed to be determined in the roaming agreement.

Note 4: Disputed IPDRs may be resolved between service providers using methods (e.g., return and reject processing) that are outside of the scope of this specification.

3.3.2 Business Relationship Data Exchange Requirements

[R7] The IPDR must enable service providers to exchange business relationship data with each other initially (set-up time) as well as periodically (weekly, monthly, or yearly) in order to set-up or maintain roaming agreements between them. Receipt of such IPDRs must be positively acknowledged by the receiving service provider. The IPDR must allow for exchange of the following parameters:

- Number of hours for Summary Exchange.
- Number of days for Settlement Exchange.
- Number of days for Net Position Exchange
- Identifiers (Sender and Receiver Id, Location Id, IP Address and FTP Location)
- Protocol of exchange (FTP in this release).
- Encoding of exchange (XML in this release).
- Dispute resolution process/parameters (Not supported in the current release of the specification).

3.3.3 Audits and Reconciliation Data Exchange Requirements

[R8] The IPDR must facilitate an audit of usage events between service providers periodically for revenue assurance and reconciliation purposes. Receipt of such IPDRs must be positively acknowledged by the receiving service provider. The IPDR must allow for exchange of the following audit parameters:

- Number of visiting service consumers by locations.
- Amount of resources (e.g., time, packets) used by date/time..

3.4 Generic Information Element Flows

Aside from exchange of settlement information, the XML-based schema includes coverage of:

- Information flows for audits/reconciliation between the BSSs. These information flows are an integral part of this specification.
- Information flows for setting up and maintaining business relationship parameters related to settlement (i.e., roaming agreements).

3.5 Audit/Reconciliation Information Element Flow

These information flows exchange auditing information between service providers for revenue assurance and reconciliation. While some of these information flows are accomplished using the IPDR documents, others are not. The information flows relevant to this specification are identified where applicable.

1. Two service providers agree on a periodic exchange of audit information.
2. At specified intervals, each service provider generates and exchanges the audit information with their partner service providers.

Each service provider must acknowledge receipt of audit information records.

Information Element Id	Category	Name	Presence (Required/ Optional/ Conditional) ¹	Format	Permitted Values (Enumerated/ Range/ Reference)	Remarks
A1	What	Audit-Record-Period-Start	Required	String	<range> 22 character alphanumeric string in the format “YYYY-MM-DDThh:mm:ssTZD”.	The universal GMT date and time the Audit-Record-Period-Start with the Service Consumer’s perceived time zone. See ISO 8601.
A2	What	Audit-Record-Period-End	Required	String	<range> 22 character alphanumeric string in the format “YYYY-MM-DDThh:mm:ssTZD”.	The universal GMT date and time the Audit-Record-Period-End with the Service Consumer’s perceived time zone. See ISO 8601.
A3	What	Home_Service_Provider_Type	Required	String	<enum> “DOMAIN” “PMN CODE” “SID/BID” “BRI”	Identifies how the home service provider is identified. For example, Domain Name, PMN code, SID/BID number, or BRI.
A4	Who	Home-Service-Provider	Required	String	<range> As assigned by home SP network authority. (Domain Name, PMN code, SID or BID number, or BRI)	The user’s Home Service Provider. May be derived from the NAI of the Username. This field, plus the type, will uniquely identify the provider by the same value that they are known in their industry.
A5	Who	Home Service Provider Name	Required	String		Human readable service provider name
A6	What	Access Provider Type	Required	String	<enum> “DOMAIN” “PMN CODE” “SID/BID” “BRI”	Identifies how the serve/visited service provider is identified. For example, Domain Name, PMN code, SID/BID number, or BRI. Need to identify the possible values.

¹ Required information elements must be present in all IPDRs. Optional Information Elements may be present, but are not required. Conditional Information Elements must be present when business rules agreed upon in roaming agreement between the Service Providers require them to be present. For all other cases, they are optional.

Information Element Id	Category	Name	Presence (Required/ Optional/ Conditional) ¹	Format	Permitted Values (Enumerated/ Range/ Reference)	Remarks
A7	Who	Access Provider	Required	String	<range> As assigned by home SP network authority. (Domain Name, PMN code, SID or BID number, or BRI)	The PWLAN operator providing network access. This field, plus the type, will uniquely identify the provider by the same value that they are known in their industry.
A8	Who	Access-Provider-Name	Required	String		Human Readable Access Provider Name.
A9	What	Number-of-Summary-Records-Exchanged	Required	Integer	<range>	Number of records exchanged in this period.
A10	What	Number-of-Settlement-Records-Exchanged	Required	Integer	<range>	Number of settlement records exchanged in this period.
A11	What	Resource-Type	Required	Enumeration (Integer)	<enum> “Bytes” “Seconds” “Minutes” “Hours” “Days” “Sessions”	Indicates the resource that is audited or reconciled. The enumerated list represents chargeable units. However, this field can be elaborated by the partners based on mutual agreement.
A12	What	Total-Resource-Used	Required	String	<range>	Number (Total of resources used for period)
A13	What	Number-of-Visitors	Required	String	<range>	Number (total of visitor sessions during the period)
A14	What	Resource Rate	Required	String	<range>	Rate for Resource Type
A15	What	Total-Charge	Required	String	<range>	Total charge for this period

Table 1: Audit and Reconciliation Information Elements

3.6 Specific Requirements

3.6.1 BSS

1. The BSS shall support both pulling and pushing for data transfer, so that the data transfer either by the consumer or autonomously.
2. The BSS shall support data transfer for both transaction-oriented (near real time) events and batches of events.
3. The BSS shall support retrieval of IPDR documents.
4. Service elements shall be uniquely identified within the scope of each terminating Service Provider.
5. Each IPDR shall have a unique event identifier within Service Provider.
6. The BSS shall support uniquely identifying IPDR documents for the purpose of gap and duplicate detection.

3.6.2 Format

This set of requirements pertains to the S/PS format.

1. The S/PS format shall be extensible permitting the addition of any set of services and service specific usage attributes.
2. The S/PS format shall be able to self-describe its usage attributes.
3. The S/PS format shall capture sufficient information to identify an S/PS Service Consumer and Service Provider.
4. The S/PS format shall provide specified data types, so that various systems can interpret the data properly. Times in S/PS should be expressed per ISO 8601 format for the purpose of facilitating data exchange. The specific time precision requirements vary with applications (e.g. IP packet time as opposed to billing time) and are individually specified in the attribute list. For billing purpose, time stamp accuracy should be 1 second or better. Local time zone offset with reference to GMT should be provided and should reflect local time of calling party for correct billing.
5. The S/PS format shall support efficient encoding.
6. S/PS settlement data shall be contained in S/PS documents

3.6.3 Application Protocol

1. The S/PS protocol shall support encryption of S/PS documents.
2. The S/PS protocol shall use open protocols and description languages.
3. The S/PS protocol/format shall separate the record format and exchange protocol.
4. The S/PS protocol should support transfer capabilities negotiation.
5. The S/PS protocol shall support both individual and batch transfers of data
6. The S/PS protocol shall support resynchronization to a particular point in the order of delivery of S/PS documents.
7. The S/PS protocol shall support business process flow specification.
8. The business process flow specifications should be capable of negotiation between systems on a dynamic basis.

3.6.4 Usage Attributes

1. The S/PS format specification shall indicate, for all usage attributes, if the information is required, optional or conditional.
2. The S/PS format specification shall indicate usage attributes data type.
3. Where appropriate, a data type of value/unit shall be specified to denote the unit of measure of an associated attribute value.

3.6.5 Settlement

1. The S/PS format shall support roaming.
2. The S/PS format shall support mobile service consumer.
3. The S/PS protocol shall allow secure communications.
4. BSS will interface with other BSSs via E-Interface.
5. BSSs interfacing via E interface will have mechanism of acknowledgement for the S/PS documents sent/received.

4. Protocol

4.1 Data

4.1.1 IPDRSettlementDoc

The following figure presents the general structure of the IPDRSettlementDoc containing the accounting and settlement information for the use cases above:

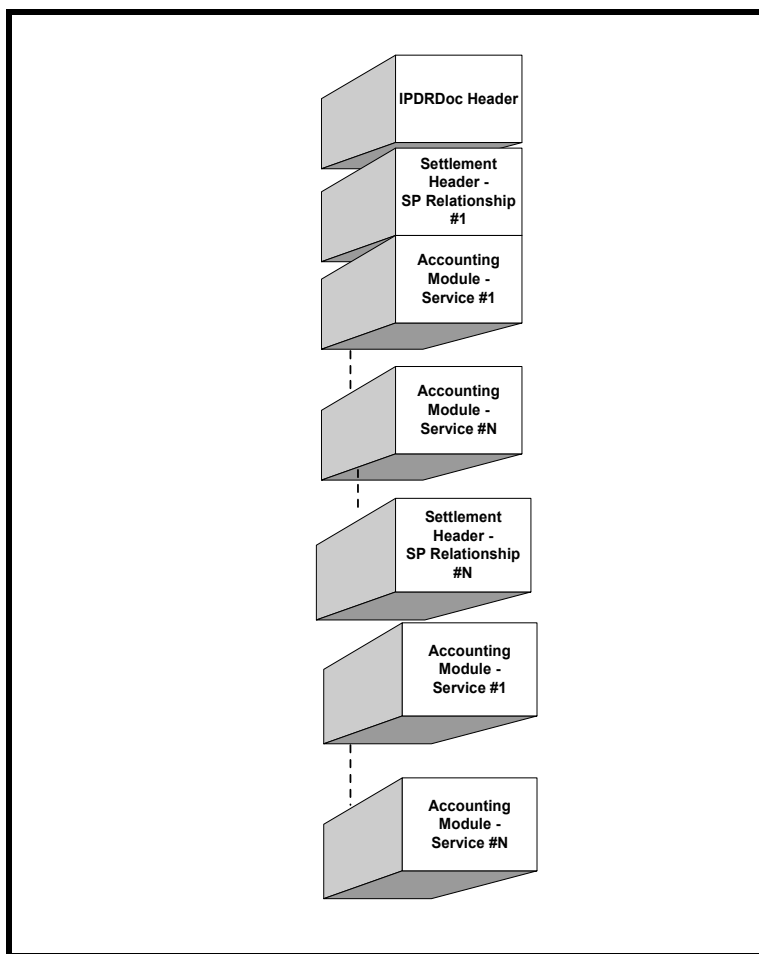


Figure 7 – IPDRSettlementDoc Model

Following the application-independent IPDRDoc Header information, one or more Settlement Headers follow, each associated with a given supplier/partner relationship. Following each of the Application Headers, one or more usage modules is present, each containing usage information for that usage of the visited/serve access provider's resources by service consumers of the respective supplier/partner/home service provider for the designated service.

The usage accounted for in the individual service's usage modules may be a combination of individual usage entries or an aggregated summary of usage across one or another dimension of aggregation. These are explicitly indicated in the following schemas.

In the most general case, there will be usage modules for every type of service defined by IPDR.org and used by service consumers on the visited service provider's access point. Thus, there will be IPDRs for PWLAN Access, streaming media content, VoIP phone calls, etc. all accounted for and exchanged for settlement purposes.

4.1.2 Schema

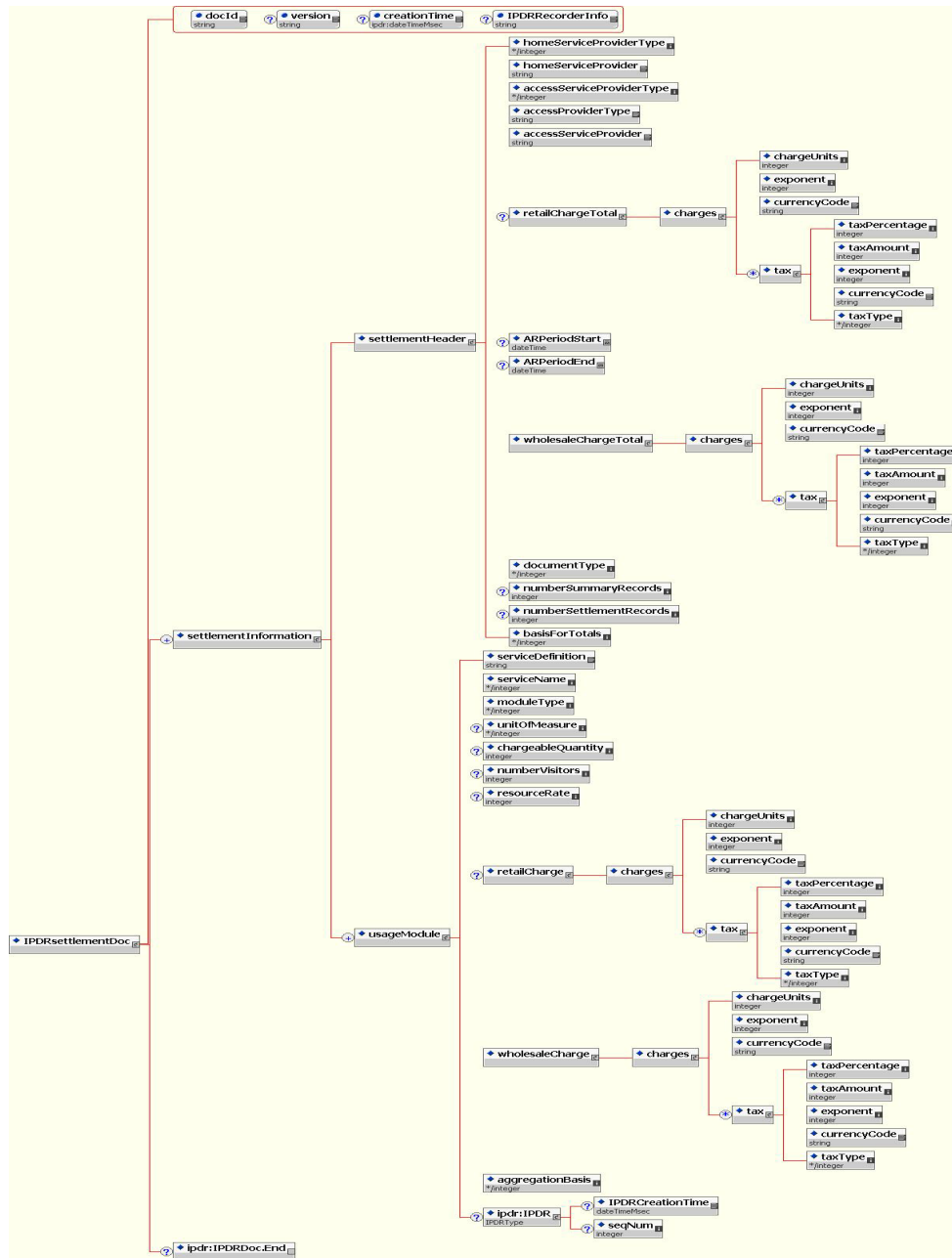


Figure 8 - IPDR Settlement Document Model

Visit the following hyperlink for the XML Schema source:
<http://www.ipdr.org/public/WLANAS/IPDRSettlementDoc3.5.1.xsd>

4.2 Automated Business Relationship Rules Exchange using IPDR Documents

4.2.1 Background

The exchange of business relationship parameters in many networks is manual and error-prone or is supported via proprietary interfaces without explicit Service Level Agreements (SLAs). The information elements specified in this document facilitate set-up and periodic update of business relationships (roaming agreements) among the IPDR compliant service providers. These are out of band exchanges.

4.2.2 Assumptions

- Business relationship and audit/reconciliation records exchange takes place among the interoperating settlement service providers at defined time intervals and/or as needed automated basis.
- This exchange is considered out of band (a.k.a. capability negotiation exchange – as per IPDR Streaming Interface) data and will not be included in Settlement exchange among the interoperating settlement service providers.
- This exchange is important for all IPDR compliant systems in order to go beyond current business practice and offer a new level of ease of operations.

4.2.3 Business Relationship Information Element Flow

These information flows establish the business relationship agreement between service providers. While some of these information flows are accomplished using the IPDR documents, others are not. The relevant information flows are identified where applicable.

1. Access provider or intermediary establishes a roaming agreement with the home service provider or intermediary and defines the terms of that agreement.
2. Each access provider, service provider, or intermediary generates IPDR Business Relationship information, identifying the parameters of the agreement, and shares them with each other.
3. Access provider, intermediary, and home service provider load the information into their operational system.
4. Access provider makes changes to their PWLAN network.
5. The service provider generates IPDR Business Relationship information, identifying the changes and sends them to the intermediary and/or the other home service provider(s).
6. The home service provider(s) loads the information into their operational system.

Name	Presence (Required/ Optional/ Conditional) ²	Format	Permitted Values (Enumerated/ Range/ Reference)	Remarks
Home_Service_Provider_Type	Required	Enum (Integer)	"DOMAIN" "PMN CODE" "SID/BID" "BRI"	Identifies how the home service provider is identified. For example, Domain Name, PMN code, SID/BID number, or BRI.
Home_Service_Provider	Required	String	As assigned by home SP network authority. (Domain Name, PMN code, SID or BID number, or BRI)	The user's Home Service Provider. May be derived from the NAI of the Username. This field, plus the type, will uniquely identify the provider by the same value that they are known in their industry.
Home_Service_Provider_Name	Required	String		Human readable service provider name
Access_Provider_Type	Required	Enum (Integer)	"DOMAIN" "PMN CODE" "SID/BID" "BRI"	Identifies how the serve/visited service provider is identified. For example, Domain Name, PMN code, SID/BID number, or BRI. Need to identify the possible values.
Access_Provider	Required	String	As assigned by home SP network authority. (Domain Name, PMN code, SID or BID number, or BRI)	The PWLAN operator providing network access. This field, plus the type, will uniquely identify the provider by the same value that they are known in their industry.
Access_Provider_Name	Required	String		Human Readable Access Provider Name.
Contract_Reference	Optional	String		Reference to specific clauses of an existing contract, if any.
Business_Relationship_ID	Required	String		Unique for each SP pair with format (SP_XXX_YYYYY) where XXX = 001 to 999 and YYYYY = 00001 to 99999

Name	Presence (Required/ Optional/ Conditional) ²	Format	Permitted Values (Enumerated/ Range/ Reference)	Remarks
Summary_Xchg_Hrs	Required	Integer		Typically 1 to 5 hours
Settlement_Xchg_Days	Required	Integer		Typically 1 to 7 days
NetPos_Xchg_Days	Required	Integer		Typically 30, 60, or 90
Effective_Date_Time	Required	String	22 character alphanumeric string in the format "YYYY-MM-DDThh:mm:ssTZD".	Time Stamp for making this BR record effective (typically 30 days due to pending/in-process data)
Response	Conditional	Enum (Integer)	"Not Supported" "Manual Intervention Needed"	Receiving Service Provider response (Accept or Reject) In case of Reject, reason code
Xchg_Protocol	Required	Enum (Integer)	"FTP over TCP/IP" "FFS"	
Xchg_SLA	Required	Enum (Integer)	"Strict Compliance to BR (with penalties)" "Best Effort"	
Xchg_Encoding	Required	Enum (Integer)	"XML" "Compact/Binary" "FFS"	
Dispute_Resolution	Required	Enum (Integer)	"Manual/Not Supported" "FFS"	
Location_Info	Required	String		FTP address for Xchg
BR_Contact_Name	Required	String		Name of the Business Relationship Contact for (sending) Service Provider

Name	Presence (Required/ Optional/ Conditional) ²	Format	Permitted Values (Enumerated/ Range/ Reference)	Remarks
Reject_Return	Required	Enum (integer)	"Manual/Not Supported" "FFS"	
Frequency_of_Audit/Reconciliation	Required	Integer		X hours.
Xchg_Currency_Type	Required	String		Standard Currency abbreviation from ISO
Unit of Measure	Required	Enum (Integer)	"Bytes" "KiloBytes" "Seconds" "Minutes" "Hours" "Days" "Sessions" "Per X Users"	Indicates what is being represented in chargeable units field
Chargeable_unit	Required	Enum (Integer)	"Incoming volume" "Outgoing volume" "Total volume" "Duration" "Event" "Fixed" "Content" "Bulk Users"	Indicates the type of charge
Rate Per Chargeable Unit	Required	Integer		Rate per type of charge measured by UOM
Rate Per Chargeable Unit Exponent	Required	Integer		Exponent portion of Rate Per Chargeable Unit
Clearing_Intermediary_Name	Conditional	String		Human Readable Clearing Intermediary Name of sending Service Provider. (Also known as ARP – Authorized Receipt Point)

Name	Presence (Required/ Optional/ Conditional) ²	Format	Permitted Values (Enumerated/ Range/ Reference)	Remarks
Billing_Intermediary_Name	Conditional	String		Human Readable Billing Intermediary Name of sending Service Provider.
Sending_Service_Provider_Disposition	Required	Enum (Integer)	“Serving” “Home”	
Last_Changed_Date_Time	Required	String	22 character alphanumeric string in the format “YYYY-MM-DDThh:mm:ssTZD”.	Last Changed Date of this BR.
File_Retention_Days	Required	Integer		Typically 45-90 days to enable re-transmission of missing files.

Table 2: Business Relationship Information Elements