Specification Guide for NDM-U Services

Version 1.0

November 12, 2001

Preface

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Abstract

The IP-based services discussed in the abstract in NDM-U [1] must be documented explicitly for each individual service supported by OSS/BSS products that implement NDM-U. The document that embodies the specification of a given service is known as an NDM-U Service Specification. This document serves as a guide for those authoring and using such Service Specifications.

Change History

1.0 Initial Draft	**November 12, 2001**
1.0 Ballot Draft	October 22, 2001
1.0	**November 12, 2001**

Table of Contents

1. Introduction

1.1 Purpose

This document, in conjunction with the referenced Service Definition documents, is intended to specify technical information that is sufficient for practical implementations of interchange of usage data among service elements participating in the delivery of IP-based services, either within a single enterprise or across multiple enterprises.

The IPDR organization intends to submit this specification to selected accredited organizations for consideration as an approved standard.

1.2 Scope

This document is limited to the discussion of issues as defined by the mission statement of IPDR.org, namely:

> The IPDR Organization (the "Organization") is organized and operates as a non-stock not for profit organization for the following purposes:

- To create and promote the adoption of interoperability standards for exchanging service usage and control information between IP network or hosting elements and operations or business support systems.
- To provide a standardized framework for the development of carrier-grade support systems that enable next-generation digital service providers to operate efficiently and cost effectively.

1.3 Compatibility

Future revisions are expected to make every attempt to preserve investments made by service providers and solution vendors by considering backward and forward compatibility whenever it is practical.

1.4 References

[1] NDM-U 3.0, IPDR.org, October ??, 2001.

[2] XML Schema Part 1: Structures, W3C Candidate Recommendation 24 October 2000. See http://www.w3.org/TR/xmlschema-0.

[3] XML Schema Part 2: Data Types, W3C Candidate Recommendation 24 October 2000.

[4] Application Service Provider Service Specification – ASP 3.0-A.0

[5] Voice over IP Service Specification – VoIP 3.0-A.0

[6] Electronic Mail Service Specification – E-mail 3.0-A.0

[7] Authentication and Authorization Service Specification – A&A 3.0-A.0

[8] Internet Access Service Specification – GPRS and WAP 3.0-A.0

[9] Wholesale Service Specification 3.0-A.0

[10] Streaming Media Service Specification – SM 3.0-A.0

[11] UML – Unified Modeling Language 1.4, Object Management Group, September 2001.

1.5 Overview

This balance of this document is divided into four major chapters:

- Service Specification Template – a high-level outline of the sections required in a Service Specification document, along with a brief description of the purpose of each.
- Use Case Guidelines—requirements and direction for the business model of the service specified.
- Data Definition Guidelines—requirements for the form and style of usage attribute data descriptions.
- XML Schema Guidelines—constraints on the use of the XML Schema notation and specific requirements for layout and style.

1.6 Terminology and Glossary

1.6.1 Terminology

Term	Definition
Accounting	The process of collecting and analyzing **service** and **resource usage** metrics for the purposes of capacity and trend analysis, cost allocation, auditing, and billing, etc. Accounting management requires that resource consumption be measured, rated, assigned, and communicated between appropriate business entities.
Mediation	In view of network reference model, Mediation refers to the combination of the logical entities IPDR recorder, IPDR transmitter, and IPDR store.
Resource	A quantifiable asset employed by a **Service Provider**, or on behalf of a **Service Provider** by another Service Provider, to fulfill a request of a **Service Consumer**. (Examples include: files, communications, goods, etc).
Roaming	Service usage initiated by a service consumer and provided by a service provider other than the one with which the service consumer have business relationship.
Service	Network and/or application operation that provides the **Service Consumer** with the requested **resource.**
Service Consumer	The beneficiary (human or system) of a **service**.
Service Element	Any element that is responsible for fulfilling a **Service Consumer** request. (Examples include: network equipment and system processes)
Service Provider	An enterprise that provides communications-based **services**.
Session	A set of related service usages; service usages may or may not be time based in the unit of measurement.
Usage	Consumption of **resources** and **services** by a **Service Consumer**.
Usage Attribute	A parameter whose value indicates some aspect of **usage** of a given **service** and/or **resource.**

Term	Definition
Usage Entry[1]	A **Service**-specific trigger resulting in the generation by a **Service Element** of a set of **Usage Attribute** values related to **Usage** specific to a given **Service Consumer**

[1] Because of legacy issues, a Usage Entry from a given Service Element will not initially conform to an IPDR specification or, in some cases, may never conform. To be considered a Usage Entry the information presented or made available by inference from the Service Element must minimally contain attributes from some of the general attribute categories.

1.6.2 Glossary:

ANI - Automatic Number Identification
ASP - Application Service Provider
BSS - Business Support Systems
CCI - Call Clarity Index
CRM - Customer Relationship Management
DSS - Decision Support Systems
DTD - Document Type Definition
DSL - Digital Subscriber Line
EP - End Point
ESN - Electronic Serial Number
ETSI - European Telecommunications Standardization Institute
FoIP - Fax over IP
GK - Gate Keeper
GPRS - General Packet Radio Service
GSM - Global System for Mobile Communications
IETF - Internet Engineering Task Force
IMSI - International Mobile Subscriber Identity
IP - Internet Protocol
IS - IPDR Store
ISDN - Integrated Services Digital Network
ISO - International Standardization Organization
ISP - Internet Service Provider
IT - IPDR Transmitter
ITU-T - International Telecommunications Union – Telecommunications Standardization Section
MOS - Mean Opinion Score
NDM - Network Data Management
NDM-U - Network Data Management - Usage
NSE - Network Service Element
OSS - Operations Support System
PLMN - Public Land Mobile Network
PSTN - Public Switched Telephone Network
QoS - Quality of Service
RADIUS – Remote Access Dial-In Usage Server
RAS - Remote Access Server
SC - Service Consumer
SCN - Switched Communications Network
SE - Service Element
SMS - Short Message Service
SP - Service Provider
TIPHON- Telecommunications and IP Harmonization over Networks
TMF - TeleManagement Forum
TOM - Telecommunications Operations Map
UA - Usage Aggregators
UC - Usage Collectors
VoIP - Voice over IP
VPN - Virtual Private Network
WAP - Wireless Application Protocol
xDSL - Digital Subscriber Line of type x
XML - eXtensible Markup Language

2. Service Specification Template

Service Specification documents shall conform to the following outline:

- Title Page – in the style of the title page of this document
- Preface – containing subsections contained in this document
- Introduction – containing subsections contained in this document, modified as appropriate to the specific service
- Use Case – a business process description of one or more service usage scenarios, as viewed from the perspective of the Service Consumer and Service Provider
- Data Definitions – a list of the usage attributes to be generated by an SE and recorded in an IPDR by an IR
- Service Definition – the annotated XML schema document implementing the packaging of the usage attributes in an NDM-U compliant IPDRDoc

3. Use Case Guidelines

The preferred representation of use cases for NDM-U Service Specification is UML. All components of UML that apply to the business scenario(s) described are encouraged to be used. The use cases should be expressed from the perspective of the Service Consumer, namely the events and metrics described should be in terms of those visible to the SC and of relevance to them with respect to service quality and units of usage. In cases where there are industry standards and practices describing a service, deference should be made to these sources. The NDM-U service definition is not intended to diverge from industry standards and practices, but rather focus on the unique aspect of defining the IPDR recorded by an IR from usage data generated by an SE.

4. Data Definition Guidelines

The data attributes documented in the Service Specification should be derived from analysis of the use case(s) presented in the prior section. Events and metrics generated by the SE, in response to the service consumed by the SC should be enumerated in a tabular representation as follows:

Category	Name	Type	Presence	Possible Values	Remarks
One of the choices from the high-level architecture model, namely: *Who* *When* *What* *Where* *Why*	*A unique name describing the attribute. The first source of names is the NDM-U data dictionary, (under construction). Every attempt should be made to reuse names from the data dictionary, thus promoting the use of common data formats and minimizing the casual proliferation of names.*	*One of the types specified in the following section.*	*One of the choice:* *Required-the IPDR is not complete without this attribute present* *Optional-the IPDR can be considered complete without this attribute present* *Conditional-this attribute is required to be present if another attribute is present (or attains a specified value) or this attribute must attain a specified value (or values) if another attribute takes on a specified value (or values).*	*An enumeration of specific values (if applicable) that the attribute may or must take on, possible under conditions specified in the prior column.*	*Supporting explanation of particular considerations that were borne in mind as a result of the analysis of the use case(s).*

5. Service Definition Guidelines

This section describes guidelines that should be followed when writing NDM-U service definitions in order to support the effective mapping to both the XML based encoding and compact encoding forms.

5.1 Schema Partitioning

A minimal NDM-U service definition involves at least three separate schema definition files:

IPDRTypes.xsd - the set of types and annotation elements used in all IPDR based definitions, specified in XML Schema format.
[Note: this is new for 3.0, it defines a small set of types, such as IPv4Addr and UUID, which are commonly used, but not specified as part of the base XML type set].

IPDRDocX.Y.xsd - defines the XML structure of an IPDR document in XML Schema format. [Note: X.Y denotes the major and minor revision levels of the NDM-U schema document defining the IPDRDoc structure.]

<service>.xsd - an XML schema description of the elements associated with a particular service and their type. In addition it specifies accounting record types indicating whether elements must appear in an IPDR record. A service should use the XML schema <include> or <import> mechanism on the previous two schema definitions.

As new services are defined by IPDR, new service definitions are defined in XML Schema format. Service definitions may be created within IPDR.org working groups or may be defined by third parties. Third party defined service definitions should use a different name space to clearly separate them from those defined by IPDR.org.

5.2 Element Specification

The service definitions must separate the element specification from the complex type definition that specifies the content of accounting records. Although this is not required by XML-Schema, it will aid in the processing of service definition files that are also utilized by the compact encoding format.

An example explicit element definition would appear as:

```
<element name="movieId" type="string">
  <annotation>
    <documentation>
     An identifier used to unique identify this movie.
    </documentation>
  </annotation>
```

```
</element>
```

Element definitions must not be present in complex type definitions. When describing the contents of an IPDR record, ref attributes must be used.

Correct:

```
<complexType name="Vod-IPDR">
 <extension base="ipdr:IPDR">
  <sequence>
   <element ref="movieId" minOccurs="1"/>
   <element ref="movieName" minOccurs="1"/>
    ...
```

Incorrect:

```
<complexType name="Vod-IPDR">
 <extension base="ipdr:IPDR">
  <sequence>
   <!-- name is used rather than ref -->
   <element name="movieId" type="string"/>
   <element ref="movieName" minOccurs="1"/>
    ...
```

Element definitions must not contain any attributes. Previous IPDR service specifications had some elements that used attributes to specify units of measure. The units are now considered fixed for a given element definition. And should be made explicit by using the "ipdr:units" application annotation mechanism described later.

5.3 Element Typing

Element specifications must all derive from the XML Simple types. Complex types are not allowed. This restriction is necessary to preserve the mapping to the compact format. Today all Service definitions utilize simple types.

The types allowed are further constrained to be the subset of base data types defined below, enumeration based restrictions of strings (which use the ipdr:enumid annotation) or the simple types defined as part of IPDRTypes.xsd.

The following XML-Schema simple data types are allowed in IPDR Service definitions:

- string - for non-numeric data which does have a more specific IPDR specialized type. The XML-Schema type string should be used. The compact format will encode this as an octet array containing the UTF-8 encoding of this string.

- integer or int - either type is acceptable, however int is prefered. In both cases the compact encoding will assume that this is a signed 32-bit integer quantity.

- long - this type should be used for integer quantities which may exceed 2^31 and are less than 2^63 (~9 quintillion). Values that may exceed this value or have a fractional component should be represented as a float or double.

- float - the compact encoding will represent this quantity as a 32-bit floating variable.

- double - the compact encoding will represent this quantity as a 64-bit floating variable.

- dateTime - the compact encoding will represent this quantity as a 32-bit integer representing the seconds since EPOCH (Jan 1, 1970 0:00 GMT). It is further constrained to always use the timezone designator "Z" indicating GMT.

The additional two base types are allowed but discouraged:

- unsignedInt - this type is allowed but discouraged. It is represented as value between 0 and 2^32. If the additional positive integers beyond that provided by the int type are to be used it is recommended to use the long type.

- unsignedLong - this type is allowed but discouraged. It only differs from long in its ability to represent values between 2^63 and 2^64 (9-18 quintillion). If these values are desired, the use of double is recommended.

In addition to these basic types, IPDR defines the following type extensions. Any additional types must be defined by IPDR, and will be added to the IPDRTypes.xsd schema definition.

- ipdr:dateTimeMsec - this type is supports time resolution at the millisecond level. Its compact representation uses a 64-bit integer quantity to represent the msec since EPOCH (Jan 1, 1970 0:00 GMT). It is further constrained to always use the timezone designator "Z" indicating GMT. Quantities of this type can optionally use 3 digits of fraction after the second to represent the milliseconds. If absent it is assumed the millisecond component is ".000".

- ipdr:ipV4Addr - an IP version 4 address in dotted notation decimal (e.g. 15.13.120.22). This is represented in the compact encoding as an unsigned 32-bit integer. This form is used rather than octet strings because it is expected to be common and requires 4 vs. 8 bytes to encode.

- ipdr:ipV6Addr - an IPv6 address in colon separated 2 byte block hexadecimal notation (e.g. FEDC:AB19:12FE:0234:98EF:1178:8891:CAFF). This is represented in the compact encoding as a 16 byte octet string.

- ipdr:UUID - a universal unique id in hex dash notation (e.g.f81d4fae-7dec-11d0-a765-00a0c91e6bf6). This is represented in the compact encoding as a 16 byte octet string.

Additional type definitions must be registered through IPDR.org, and will be reflected in updated versions of IPDRTypes.xsd. For all other types, string should be used. And the compact format will also encode as a string.

5.4 Enumerations

Enumerations are allowed in service definitions. They must derive from the base class of "string". In addition each enumeration item specified may contain an "ipdr:enumid" annotation element which provides the numeric equivalent.

If such an annotation is present, the compact representation will be represented as a 32-bit integer containing the appropriate numeric value. If the annotation is not present, then the compact format must use the string representation of the value.

Example:

```
<element name="completionCode">
 <simpleType>
  <restriction base="string">
   <enumeration value ="success">
    <annotation>
     <documentation>
      Indicates this operation completed successfully
     </documentation>
     <appinfo>
      <ipdr:enumid>1</ipdr:enumid>
     </appinfo>
    </annotation>
   </enumeration>
   <enumeration value="busy">
    <annotation>
     <documentation>
      Indicates the line was in use.
     </documentation>
     <appinfo>
      <ipdr:enumid>2</ipdr:enumid>
     </appinfo>
```

```
      </annotation>
    </enumeration>
    <enumeration value="no answer">
     <annotation>
      <documentation>
       Indicates the call was terminated without answer.
      </documentation>
      <appinfo>
       <ipdr:enumid>3</ipdr:enumid>
      </appinfo>
     </annotation>
    </enumeration>
   </restriction>
  </simpleType>
</element>
```

5.5 Annotations of element definitions

The XML-Schema document describing a service definition should constitute a standalone document. As such the use of annotations are critical in conveying the intent of each attribute defined for a service.

XML-Schema provides for documentation based annotation as well as application specific annotation that can consist of additional elements.

All elements defined as part of a service definition must provide a documentation element that describes the meaning of this element.

In addition to the textual documentation, the following application based annotation may appear:

- ipdr:units - defines the unit of measure associated with this element.
- ipdr:reference - specifies a URL which provides additional (human readable) information about this element.
- ipdr:status - takes on the value "current" or "deprecated".

Note that as service definitions are updated, elements should never be simply removed. If it is determined that they should not be used in future revisions, they should be marked as deprecated.

Example:

```
<element name="greenStampCount" type="integer">
```

```
  <annotation>
    <documentation>
     The number of Green Stamps earned for using this service.
     Note that green stamps are no longer issued, as of
     Jan. 30, 2001.
    </documentation>
    <appinfo>
      <ipdr:units>one stamp</ipdr:units>
      <ipdr:reference>http://www.greenstamps.com/stamps</ipdr:reference>
      <ipdr:status>deprecated</ipdr:status>
    </appinfo>
  </annotation>
</element>
```

5.6 Composition of schemas to create service definitions

An IPDR service definition that adds to the IPDR namespace will be constructed using the <include> mechanism of XML-Schema:

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
        xmlns:ipdr="http://www.ipdr.org/public/namespace"
        targetNamespace="http://www.ipdr.org/public/namespace">

<include schemaLocation="http://www.ipdr.org/public/ipdr30.xsd"/>
```

An IPDR service definition that is developed external to IPDR should use an alternate namespace to protect from naming collisions. In this case the service definition will specify a different target namespace in its initial declaration. To incorporate the appropriate IPDR base named types, the <import> mechanism of XML-Schema should be used as follows:

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
        xmlns:ipdr="http://www.ipdr.org/public/namespace"
        targetNamespace="http://www.foo.com/ipdr/namespace"
        xmlns:foo="http://www.foo.com/ipdr/namespace">


<import namespace="http://www.ipdr.org/public/namespace"
        schemaLocation="http://www.ipdr.org/public/ipdr30.xsd"/>
```

5.7 Schema references in IPDRDoc instance documents

When defining an instance document, the namespace and schemaLocation should be specified as follows:

```
<IPDRDoc xmlns="http://www.ipdr.org/public/namespace"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://www.ipdr.org/public/namespace
                        http://www.ipdr.org/public/service1.xsd">
```

If there were multiple services in a single document, then the header would appear as:

```
<IPDRDoc xmlns="http://www.ipdr.org/public/namespace"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://www.ipdr.org/public/namespace
                        http://www.ipdr.org/public/service1.xsd
                        http://www.ipdr.org/public/namespace
                        http://www.ipdr.org/public/service2.xsd">
```

If non-IPDR defined service definitions were used in the document, then the header would appear as:

```
<IPDRDoc xmlns="http://www.ipdr.org/public/namespace"
        xmlns:foo="http://www.foo.com/ipdr/namespace"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://www.foo.com/ipdr/namespace
                        http://www.foo.com/ipdr/fooService.xsd">
```